



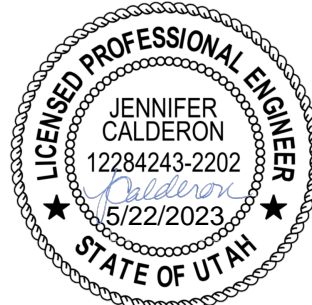
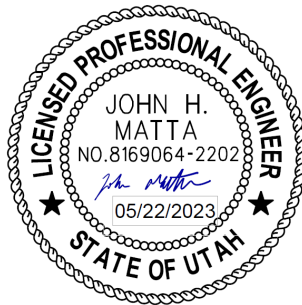
SOLIDS HOLDING TANK REFURBISHMENT PROJECT

CONTRACT DOCUMENTS

**BIDDING REQUIREMENTS, CONTRACT FORMS,
CONDITIONS OF THE CONTRACT,
TECHNICAL SPECIFICATIONS AND DRAWINGS**

Advertisement for Bids: May 18, 2023

Bid Documents Available: May 22, 2023



**Bids will be received at the office of South Valley Water Reclamation
Facility located at:**

7495 South 1300 West, West Jordan, Utah 84084

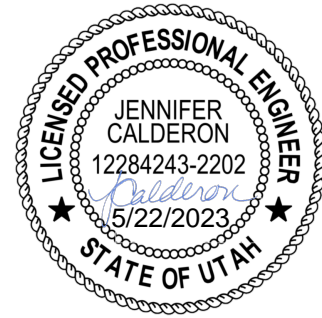
until Tuesday at 2:00 PM, June 13, 2023

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SECTION 00020

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CONDITIONS OF THE CONTRACT



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SECTION 00030

NOTICE INVITING BIDS

RECEIPT OF BIDS: Sealed Bids will be received at the office of the South Valley Water Reclamation Facility; OWNER of the WORK located at 7495 South 1300 West, West Jordan, Utah 84084, until 2:00 PM on Tuesday, June 13, 2023, for construction of South Valley Water Reclamation Facility's "Solids Holding Tank Refurbishment Project". Any Bids received after the specified time and date will not be considered.

OPENING OF BIDS: The Bids will be publicly opened and read at 2:00 PM, Tuesday, June 13, 2023, at the above-mentioned office of the OWNER.

COMPLETION OF WORK: The WORK shall be completed as described below:

- a) Contractor shall procure new equipment, demolish and remove existing equipment to be replaced, and install the new equipment. Contractor shall provide all materials required for the Work described. The Work shall be completed by October 31, 2023.

DESCRIPTION OF WORK: The project consists of the following Items:

- a) Deteriorated concrete at the existing Solids Holding Tank interior walls and ceiling slab is to be removed until rebar is exposed, and sound concrete is found. A new concrete slab shall be installed beneath the existing using holes cored through the existing slab to place the new concrete. New concrete will be placed at the walls to restore them to like new condition.
 - i. All piping, vents, and hatches in the existing elevated slab shall will be extended through the new elevated slab.
 - ii. The overflow, thickened sludge influent, and aeration air piping on the East wall of the structure will be removed and replaced at a lower elevation below the bottom of the new elevated slab. Replacement piping will be upgraded to 316L stainless steel.
 - iii. The refurbished walls and ceiling will be lined, and floors will be recoated to prevent corrosion due to sewer gases. Existing piping within the tank, and modified pipe on the East exterior wall to be repainted.
 - iv. The existing wall wash and spray foam systems will be removed and replaced below the new ceiling slab. The 4-inch wall wash piping will be upgraded to stainless steel. The 1.5-inch spray foam system will be reconstructed using schedule 80 PVC.
 - v. The existing aeration system will be removed and replaced with a similar system constructed of stainless steel.

SITE OF WORK: The site of the WORK is located at the OWNER's water reclamation facility at 7495 South 1300 West, West Jordan, Utah.

OBTAINING CONTRACT DOCUMENTS: The Contract Documents are entitled "South Valley Water Reclamation Facility – Solids Holding Tank Refurbishment Project".

The Contract Documents may be obtained by bidders, subcontractors and equipment suppliers at www.svwater.com under the engineering tab. Interested parties desiring emailed electronic files should contact Jenny Calderon, P.E., at Water Works Engineers, LLC at (385) 288-1465. There will be no charge for emailed bid documents.

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Notice Inviting Bids

Solids Holding Tank Refurbishment

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BID SECURITY: Each Bid shall be accompanied by a certified check or cashier's check or Bid Bond in the amount of 5 percent of the Total Bid Price payable to the OWNER as a guarantee that the Bidder, if its Bid is accepted, will promptly execute the Agreement. A bid shall not be considered unless one of the forms of Bidder's security is enclosed with it.

BIDS TO REMAIN OPEN: The Bidder shall guarantee the Total Bid Price for a period of 45 calendar days from the date of bid opening.

MANDATORY PRE-BID VISIT TO WORK SITE: For a bid to be considered complete, prospective bidders are **required** to attend a pre-bid walk through of the proposed work site which will be conducted by the OWNER at 10:00 AM on Wednesday, May 31, 2023. The object of the walk through is to acquaint bidders with the site conditions. The pre-bid visit will start at the office of the OWNER located at 7495 South 1300 West, West Jordan City, Utah. Follow-up visits by prospective bidders and subcontractors are available by appointment only. Contact Taigon Worthen, P.E. of the SVWRF for appointments.

PROJECT ADMINISTRATION: Technical communications relative to this WORK shall be directed to the ENGINEER prior to opening of the Bids. Communications relative to the purchase of Bid Documents shall be directed to the OWNER.

Water Works Engineers, LLC
1995 W. Grove Parkway #101
Pleasant Grove, UT 84062
Telephone: (801) 785-4105
e-mail: jennyc@wwengineers.com
Attention: Jenny Calderon, P.E.

SOUTH VALLEY WATER RECLAMATION FACILITY
7495 South 1300 West
West Jordan, Utah 84084
Telephone: 801-495-5469
e-mail: tworthen@svwater.com
Attention: Taigon Worthen, P.E.

OWNER'S RIGHTS RESERVED: The OWNER reserves the right to reject any or all bids, to waive any informality in a bid, and to make awards to the lowest responsive, responsible bidder as the OWNER in its sole discretion shall determine may best serve the interest of the OWNER.

++ END OF SECTION ++

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Notice Inviting Bids

Solids Holding Tank Refurbishment
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SECTION 00100

INSTRUCTIONS TO BIDDERS

1. **DEFINED TERMS.** Terms used in these Instructions to Bidders and the Notice Inviting Bids which are defined in the General Conditions have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to OWNER, as distinct from a sub-bidder, who submits a price or quote to a Bidder.
2. **INTERPRETATIONS AND ADDENDA.**
 - 2.1 All questions about the meaning or intent of the Contract Documents are to be directed to the ENGINEER. Additions, deletions, or revisions to the Contract Documents considered necessary by the ENGINEER in response to such questions will be issued by Addenda, mailed, emailed, or delivered to all parties recorded by the OWNER as having received the Contract Documents. Questions received less than 5 days prior to the date of Bids may not be answered. Only answers to such questions issued by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
 - 2.2 Addenda may also be issued to make other additions, deletions, or revisions to the Contract Documents.
 - 2.3 Bidders shall make no special interpretation or inference of intent from differing formats in the Technical Specifications.
3. **BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE.**
 - 3.1 It is the responsibility of each Bidder before submitting a Bid:
 - A. To examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical" data referred to below);
 - B. To visit the site to become familiar with local conditions that may affect cost, progress, or performance, of the WORK;
 - C. To consider federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the WORK;
 - D. To study and carefully correlate the Bidder's observations with the Contract Documents; and
 - E. To notify the OWNER of all conflicts, errors, ambiguities, or discrepancies in or between the Contract Documents and such other related data.
 - 3.2 (Not Used)
 - 3.3 It is also the responsibility of each Bidder before submitting a Bid to examine thoroughly those reports of physical conditions in or relating to existing surface and subsurface conditions (except underground utilities as defined in Article 1 of the General Conditions) which are at or adjacent to the site and which were utilized by the OWNER

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Instructions to Bidders

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility

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in the preparation of the Contract Documents. Copies of such report and drawings are available for information at the office of the OWNER.

- 3.4 Information and data reflected in the Contract Documents with respect to Underground Utilities at or contiguous to the site are based upon information and data furnished to the OWNER by the owners of such Underground Utilities or others, and the OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary General Conditions or Section 01530 - Protection of Existing Facilities.
- 3.5 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Utilities, and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions.
- 3.6 Before submitting a Bid, each Bidder will, at Bidder's 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 conditions (surface, subsurface, and Underground Utilities) at or contiguous to the site or otherwise which may affect cost, progress, or performance of the WORK and which the Bidder deems necessary to determine its Bid for performing the WORK in accordance with the time, price, and other terms and conditions of the Contract Documents.
- 3.7 On reasonable request in advance, the OWNER will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Bidder deems necessary for submission of a Bid. Location of any excavation or boring shall be subject to prior approval of OWNER and applicable agencies. Bidder shall fill all holes, restore all pavement to match existing structural section, and shall clean up and restore the site to its former condition upon completion of such explorations. OWNER reserves the right to require Bidder to execute an Access Agreement with the OWNER prior to accessing the site.
- 3.8 The lands upon which the WORK is to be performed, rights-of-way, and easements for access thereto and other lands designated for use by the CONTRACTOR in performing the WORK are identified in the Contract Documents. 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.
- 3.9 The submission of a Bid will constitute an absolute representation by the Bidder that the Bidder has complied with every requirement of this Paragraph 3 and the following:
 - A. That the Bid is premised upon performing the WORK required by the Contract Documents without exception and such means, methods, techniques, sequences, or procedures of construction (if any) as may be required by the Contract Documents;
 - B. That Bidder has given the OWNER written notice of all conflicts, errors, ambiguities, and discrepancies in the Contract Documents and the written resolution thereof by the OWNER is acceptable to the Bidder; and
 - C. That the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the WORK.

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Instructions to Bidders

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4. BID FORMS. The Bid shall be submitted on the Bid Forms bound herein. All blanks on the Bid Forms shall be completed in ink. All names must be printed below the signatures. The Bid shall be submitted in a sealed envelope which shall be plainly marked in the upper left hand corner with the name and address of the Bidder and shall bear the words "BID FORM" followed by the title of the Contract Documents for the WORK, the name of the OWNER, the address where Bids are to be delivered or mailed to, and the date and hour of opening of Bids.
5. CERTIFICATES.
 - 5.1 Bids by corporations must be executed in the corporate name by the president, a vice-president, or other corporate officer. Such Bid shall be accompanied by the enclosed Certificate of Authority to sign, attested by the secretary or assistant secretary, and with the corporate seal affixed. The corporate address and state of incorporation must appear below the signature.
 - 5.2 Bids by partnerships must be executed in the partnership name and be signed by a managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the partnership must appear below the signature.
 - 5.3 Bids by joint ventures must be executed in the joint venture name and be signed by a joint venture managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the joint venture must appear below the signature.
6. DISQUALIFICATION OF BIDDERS. More than one Bid from an individual, firm, partnership, corporation, or association under the same or different names will not be considered. If the OWNER believes that any Bidder has financial interest in more than one Bid for the WORK contemplated, all Bids in which such Bidder is interested will be rejected. If the OWNER reasonably believes that collusion exists among the Bidders, all Bids will be rejected. A party who has quoted prices to a Bidder is not hereby disqualified from quoting prices to other Bidders, but is disqualified from submitting a Bid directly for the WORK.
7. QUANTITIES OF WORK. The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the WORK; the OWNER does not expressly or by implication agree that the actual amount of work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit price item of the WORK by an amount up to and including 25 percent of any Bid item, without a change in the unit price, and shall include the right to delete any Bid item in its entirety, or to add additional Bid items up to and including an aggregate total amount not to exceed 25 percent of the Bid price.
8. COMPETENCY OF BIDDERS. Only qualified and E100 licensed CONTRACTORS specializing in mechanical construction may submit a bid for the performance of the WORK.
9. SUBMISSION OF BIDS. The Bid shall be delivered by the time and to the place stipulated in the Notice Inviting Bids. It is the Bidder's sole responsibility to see that its Bid is received in proper time and at the proper place.

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Instructions to Bidders

Solids Holding Tank Refurbishment

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Bid Documents

10. **BID SECURITY, BONDS, AND INSURANCE.** Each Bid shall be accompanied by a certified or cashier's check or approved Bid Bond in the amount stated in the Notice Inviting Bids. Said check or bond shall be made payable to the OWNER and shall be given as a guarantee that the Bidder, if awarded the WORK, will enter into an Agreement with the OWNER, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of said bonds to be in the amount stated in the Supplementary General Conditions. In case of refusal or failure to enter into said Agreement, the check or Bid Bond, as the case may be, shall be forfeited to the OWNER. If the Bidder elects to furnish a Bid Bond as its Bid security, the Bidder shall use the Bid Bond form bound herein, or one conforming substantially to it in form. Bid Bonds shall comply with the requirements applicable to payment and performance bonds in the General Conditions.
11. **DISCREPANCIES IN BIDS.** In the event there is more than one Bid item in a Bid Schedule, the Bidder shall furnish a price for all Bid items in the Schedule, and failure to do so will render the Bid non-responsive and shall cause its rejection. In the event there are unit price Bid items in a Bidding schedule and the amount indicated for a unit price Bid item does not equal the product of the unit price and quantity, the unit price shall govern and the amount will be corrected accordingly, and the BIDDER shall be bound by said correction. In the event there is more than one Bid item in a Bid Schedule and the total indicated for the Schedule does not agree with the sum of the prices Bid on the individual items, the prices Bid on the individual items shall govern and the total for the Schedule will be corrected accordingly, and the BIDDER shall be bound by said correction.
12. **MODIFICATIONS AND UNAUTHORIZED ALTERNATIVE BIDS.** Unauthorized conditions, limitations, or provisos attached to the Bid shall render it informal and may cause its rejection as being non-responsive. The Bid forms shall be completed without interlineations, alterations, or erasures in the printed text. Alternative Bids will not be considered unless called for. Oral, telegraphic, telephonic or electronic Bids or modifications will not be considered.
13. **WITHDRAWAL OF BID.** The Bid may be withdrawn by the Bidder by means of a written request, signed by the Bidder or its properly authorized representative. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of Bids prior to the scheduled closing time for receipt of Bids.
14. **AWARD OF CONTRACT.** Award of the contract, if awarded, will be made to the lowest responsive, responsible Bidder whose Bid complies with the requirements of the Contract Documents. Unless otherwise specified, any such award will be made within the period stated in the Notice Inviting Bids that the bids are to remain open. Unless otherwise indicated, a single award will be made for all the Bid items in an individual Bid Schedule.
15. **RETURN OF BID SECURITY.** Within 14 days after award of the contract, the OWNER will, if requested, return the Bid securities accompanying such Bids that are not being considered in making the award. All other Bid securities will be held until the Agreement has been finally executed. They will then be returned, if requested, to the respective Bidders whose Bids they accompany.
16. **EXECUTION OF AGREEMENT.** The Bidder to whom award is made shall execute a written Agreement with the OWNER on the form of agreement provided, shall secure all insurance, and shall furnish all certificates and bonds required by the Contract

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Instructions to Bidders

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Documents within 14 calendar days after receipt of the agreement forms from the OWNER. Failure or refusal to enter into an Agreement as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid security. If the lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the Contract to the second lowest responsive, responsible Bidder. If the second lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the contract to the third lowest responsive, responsible Bidder. On the failure or refusal of such second or third lowest Bidder to execute the Agreement, each such Bidder's Bid securities shall be likewise forfeited to the OWNER.

17. LIQUIDATED DAMAGES. Provisions for liquidated damages, if any, are set forth in the Agreement.
18. PREFERENCE FOR RESIDENT CONTRACTORS. The OWNER will apply the provisions of Utah Procurement Code 63G-6-405. titled Preference for Resident Contractors (Utah Code -- Title 63G -- Chapter 6) wherein it is stated "(2) (a) When awarding contracts for construction, a public procurement unit shall grant a resident contractor a reciprocal preference as against a nonresident contractor from any state that gives or requires a preference to contractors from that state. (b) The amount of the reciprocal preference shall be equal to the amount of the preference applied by the state of the nonresident contractor."

- END OF INSTRUCTIONS TO BIDDERS -

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Instructions to Bidders

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SECTION 00300

BID FORMS

BID

BID TO: South Valley Water Reclamation Facility

1. The undersigned Bidder proposes and agrees, if this Bid is accepted to enter into an Agreement with the OWNER in the form included in the Contract Documents to perform the WORK as specified or indicated in said Contract Documents entitled "South Valley Water Reclamation Facility – Pump Replacement Project".
2. Bidder accepts all of the terms and conditions of the Contract Documents, including without limitation those in the Notice Inviting Bids and Instructions to Bidders, dealing with the dispositions of the Bid security.
3. This Bid will remain open for the period stated in the "Notice Inviting Bids" unless otherwise required by law. Bidder will enter into an Agreement within the time and in the manner required in the "Notice Inviting Bids" and the "Instructions to Bidders", required by the Contract Documents.
4. Bidder has examined copies of all the Contract Documents including the following Addenda (receipt of all of which is hereby acknowledged):

Number_____	Date_____
_____	_____
_____	_____

Failure to acknowledge addenda shall render the bid non-responsive and shall be cause for its rejection.

5. Bidder has familiarized itself with the nature and extent of the Contract Documents, WORK, site, locality where the WORK is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules, and regulations), and the conditions affecting cost, progress or performance of the WORK and has made such independent investigations as Bidder deems necessary.

To all the foregoing, and including all Bid Forms contained in the Bid, said Bidder further agrees to complete the WORK required under the Contract Documents within the Contract Time stipulated in said Contract Documents, and to accept in full payment therefore the Contract Price based on the Total Bid Price(s) named in the aforementioned Bid forms.

Dated: _____ Bidder: _____

By: _____

Title: _____

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Bid Forms

Solids Holding Tank Refurbishment

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Bid Documents

BID CERTIFICATE

(if Corporation)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Board of Directors of the _____

a corporation existing under the laws of the State of _____,

held on _____, 20 _____, the following resolution was duly
passed and adopted:

"RESOLVED, that _____,

as _____ of this
Corporation, be and is hereby authorized to execute the Bid dated

_____, 20____, to the South Valley Water Reclamation Facility by this
Corporation and that his/her execution thereof, attested by the Secretary of this
Corporation, and with the Corporate Seal affixed, shall be the official act and deed of this
Corporation."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the
corporation this _____, day of _____, 20____.

Secretary

(SEAL)

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Bid Forms

Solids Holding Tank Refurbishment
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Bid Documents

BID CERTIFICATE

(if Partnership)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Partners of the _____

a partnership existing under the laws of the State of _____,

held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____,

as _____ of the

Partnership, be and is hereby authorized to execute the Bid dated _____,

20____, to the South Valley Water Reclamation Facility by this Partnership and that his/her

execution thereof, attested by the _____ shall be the official act and deed of this Partnership."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of _____, 20____.

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Bid Forms

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BID CERTIFICATE

(if Joint Venture)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Principals of the _____

a joint venture existing under the laws of the State of _____,

held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____,

as _____ of the

Joint Venture, be and is hereby authorized to execute the Bid dated _____,

20____, to the "South Valley Water Reclamation Facility by this Joint Venture and that

his/her execution thereof, attested by the _____ shall be the official act and deed of this Joint Venture."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the

corporation this _____, day of _____, 20____.

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Bid Forms

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Bid Documents

LIST OF SUBCONTRACTORS

The Bidder shall list below the name and the location of the place of business of each Subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a Subcontractor who, under subcontract to the prime contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of the prime contractor's total bid or ten thousand dollars (\$10,000), whichever is greater. The Bidder shall also list below the portion of the WORK which will be performed by each Subcontractor under its contract. The prime contractor shall list only one Subcontractor for each portion as is defined by the prime contractor in its bid. The prime contractor shall submit information (see next page) required of specialty subcontractors which are proposed to do Sheet Metal (HVAC) Work, Mechanical Work or Electrical Work, if any.

The Bidder's attention is directed to the provisions of Paragraph entitled "Subcontract Limitations," of the Supplementary General Conditions which stipulates the percent of the WORK to be performed with the Bidder's own forces. Failure to comply with this requirement will render the Bid non-responsive and may cause its rejection.

<u>Work to be Performed</u>	Subcontractor. <u>License Number</u>	<u>Percent of Total Bid</u>	<u>Subcontractor's Name and Address</u>
1. _____	_____	_____	_____ _____ _____ _____
2. _____	_____	_____	_____ _____ _____ _____

00300-5
Bid Forms

	<u>Work to be Performed</u>	<u>Subcontractor. License Number</u>	<u>Percent of Total Bid</u>	<u>Subcontractor's Name and Address</u>
3.	_____	_____	_____	_____ _____ _____ _____
4.	_____	_____	_____	_____ _____ _____ _____

Note: Attach additional sheets if required.

INFORMATION REQUIRED OF SPECIALTY SUBCONTRACTORS

The Bidder shall furnish the following information for each specialty subcontractor. Additional sheets shall be attached as required. Failure to complete Item Nos. 1, 2, and 3, will cause the Bid to be non-responsive and may cause its rejection.

(1) SPECIALTY SUBCONTRACTOR's name and address:

(2) SPECIALTY SUBCONTRACTOR's license:

Primary Classification

_____ State License No.

and Expiration Date _____ Specialty

classifications held, if any: _____ Name

of Licensee, if different from (1) above:

(3) ATTACH TO THIS BID a list of the 5 most recent construction contracts or subcontracts completed by the SPECIALTY SUBCONTRACTOR involving HVAC, Mechanical or Electrical Work of similar type and comparable value at Municipal Water Treatment Plants or Municipal Wastewater Treatment Plants.

The list shall include the following information as a minimum:

- Names, address, and telephone number of owner.
- Name of Project.
- Location of Project.
- Brief description of the work involved.
- Contract amount.
- Date of completion of the contract.
- Name, address, and telephone number of architect or engineer.
- Name of owner's project engineer.

00300-7
Bid Forms

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

INFORMATION REQUIRED OF BIDDER

The Bidder shall furnish the following information. Additional sheets shall be attached as required. Failure to complete Item Nos. 1, 3, and 6, will cause the Bid to be non-responsive and may cause its rejection.

(1) CONTRACTOR's name and address:

(2) CONTRACTOR'S telephone number:

(3) CONTRACTOR's fax number:

(4) CONTRACTOR's license: Primary Classification

_____ State License No. and Expiration Date

_____ Specialty classifications held, if any:

_____ Name of Licensee, if different

from (1) above: _____

(5) Name, address, and telephone number of surety company and agent who will provide the required bonds on this contract:

(6) ATTACH TO THIS BID a financial statement, references, and other information, sufficiently comprehensive to permit an appraisal of CONTRACTOR's current financial condition.

(7) ATTACH TO THIS BID a list of the 5 most recent construction contracts completed by the CONTRACTOR involving HVAC Work of similar type and comparable value at Municipal Water Treatment Plants or Municipal Wastewater Treatment Plants. The list shall include the following information as a minimum:

- Names, address, and telephone number of owner.
- Name of Project.
- Location of Project.
- Brief description of the work involved.
- Contract amount.
- Date of completion of the contract.
- Name, address, and telephone number of architect or engineer.
- Name of owner's project engineer.

00300-8
Bid Forms

**NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER
AND SUBMITTED WITH BID**

STATE OF)
) SS:
COUNTY OF)

_____, being first duly sworn, deposes and says that he or she is

_____ of _____ the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit or cost element of awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Signed: _____

Subscribed and sworn to before me

this _____ day of _____, 20____

Notary Public in and for the
County of _____
State of _____

(SEAL)

00300-9
Bid Forms

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

BID BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as Principal,
and _____ as Surety,
are held and firmly bound unto the South Valley Water Reclamation Facility hereinafter
called "OWNER," in the sum of

_____ dollars, for the
payment of which sum, well and truly to be made, we jointly and severally bind ourselves,
our heirs, executors, administrators, successors, and assigns firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required
under the bidding schedule(s) of the OWNER's Contract Documents entitled "South Valley
Water Reclamation Facility – Foul Air Fan VFD Replacement".

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the
time and in the manner required in the "Notice Inviting Bids" and the "Instruction to Bidder"
enters into a written Agreement on the form of agreement bound with said Contract
documents, furnishes the required certificates of insurance, and furnishes the required
Performance Bond and Payment Bond, and performs in all other respects the agreement
created by this bid, then this obligation shall be null and void, otherwise it shall remain in
full force and effect. The Surety stipulates and agrees that the obligation of said Surety
shall in no way be impaired or affected by an extension of the time within which the OWNER
may accept such bid and Surety further waives notice of any such extension. In the event
suit is brought upon this bond by said OWNER and OWNER prevails, said Principal and
Surety shall pay all costs incurred by said OWNER in such suit, including reasonable
attorney's fees and costs to be fixed by the court.

SIGNED AND SEALED, this _____ day of _____, 20____

(SEAL) (Principal) (SEAL) _____
(Surety)

By: _____ By: _____

(Signature) (Signature)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

00300-10
Bid Forms

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
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Bid Documents

- END OF BID FORMS -

00300-11
Bid Forms

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
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Bid Documents

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00300-12
Bid Forms

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
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Bid Documents

SECTION 00310

BID SCHEDULE

PART 1 – GENERAL

1.01 CONSTRUCTION CONTRACT

- A. Name of Project: South Valley Water Reclamation Facility – Solids Holding Tank Refurbishment

1.02 SCHEDULES TO BE ADDED TO THE AGREEMENT

- A. This Bid Schedule contains the schedules of prices which will be incorporated into the Agreement by reference.

1.03 TAXES

- A. The Bidder agrees that all sales, consumer, use, and other similar taxes are included in the stated bid prices for the WORK, unless provision is made herein for the Bidder to separately itemize the estimated amount of tax.

1.04 SCHEDULES OF PRICES

- A. Schedule A: Base Lump Sum Bid. This item includes all of the WORK for the project as specified and shown on the Contract Documents. Bidder shall complete Schedule A in its entirety (see next page).

00310-1
Bid Schedule

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

SCHEDULE A
SVWRF Pump Replacement Project

Item No.	Area	Description	Quantity Unit	Material & Equipment Cost¹	Installation Cost²	Total Cost³
1	Aeration System	Remove and Replace Tank Agitation Mixing System	1 Each	\$	\$	\$
2	Solids Holding Tank Concrete Restoration	Remove Damaged Concrete on Solids Holding Tank ceiling. Sandblast rebar to remove all rust. Coat with a rust inhibitor. Pour new elevated slab below existing	1 Lump Sum	\$	\$	\$
		Remove all damaged concrete from top half of Solids Holding Tank walls (approximately 1000 square feet). Sandblast rebar to remove all rust, coat with a rust inhibitor, and replace concrete as shown in Structural Detail 1: Wall Repair Detail.	1 Lump Sum	\$	\$	\$
3	Refurbish Thickened Sludge Suction Line	Replace nuts, bolts, washers, and gaskets on Interior Thickened Sludge suction line. Repaint pipe	1 Lump Sum	\$	\$	\$
4	Paint Existing Exterior Piping	Paint existing influent thickened sludge, overflow, and aeration piping at exterior East wall of the Solids Holding Tank.	1 Lump Sum	\$	\$	\$
5	Coatings	Prepare floors and coat with epoxy coating system	1 Lump Sum	\$	\$	\$
6	PVC Lining System	Line underside of new elevated slab and walls from finished floor using specified co-liner system	1 Lump Sum	\$	\$	\$
7	Foam and Wall Spray System	Remove and replace Wall Spray and Foam Mitigation Spray System	1 Lump Sum	\$	\$	\$

00310-2
Bid Schedule

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

Item No.	Area	Description	Quantity Unit	Material & Equipment Cost ¹	Installation Cost ²	Total Cost ³
8	Piping and supports	Thickened sludge, aeration, and overflow piping to be removed and replaced as shown on drawings. Includes all fittings, pipe supports, etc. Insulate piping as existing piping is insulated. Extend all pipes and vents through new elevated concrete slab.	1 Lump Sum	\$	\$	\$
9	Other Work	Extend Access hatch through new elevated concrete slab, Relocate pipes as indicated, and all other work not listed in bid schedule.	1 Each	\$	\$	\$
Bid Schedule Total (Sum of Total Costs of Items 1-9)				\$		
A	UNIT COST FOR ADDITIONAL CONCRETE REPAIR: Unit Cost for Repair of Walls	Provide a square footage cost for repair of deteriorated concrete for areas not included in Item No. 2 as shown in Structural Detail 1: Wall Repair Detail	sf	\$ /sf	\$ /sf	Unit Cost \$ /sf
B	UNIT COST FOR ADDITIONAL CONCRETE REPAIR: Unit Cost for Repair of Reinforcement	Provide a square footage cost for repair of broken or deteriorated reinforcement and concrete as shown in Structural Detail 2: Wall Repair Detail at Broken or Deteriorated Reinforcement	sf	\$ /sf	\$ /sf	Unit Cost \$ /sf

Continued on following page...

00310-3
Bid Schedule

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
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Bid Documents

Bid Schedule Total In Words:

¹Add sales taxes and other appropriate fees as required.

²The Total Cost is the sum of the equipment, material, and installation costs. All Unit Costs and Total Costs shall include all labor, equipment, tools, supplies, insurance, taxes, overhead, markups, applicable fees and all other costs associated with performing the Work. These costs shall be distributed fairly among the Bid Items according to their relative amounts and not weighted or unbalanced.

- END OF BID SCHEDULES -

00310-4
Bid Schedule

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

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Bid Documents

SECTION 00500

AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____ in the year 2023 by and between South Valley Water Reclamation Facility (hereinafter called OWNER) and _____ (Hereinafter called CONTRACTOR).

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

ARTICLE 1. WORK.

CONTRACTOR shall complete the WORK as specified or indicated in the OWNER's Contract Documents entitled "South Valley Water Reclamation Facility – Solids Holding Tank Refurbishment Project". The WORK is generally described as follows and as listed in Schedule A:

- a) Deteriorated concrete at the existing Solids Holding Tank interior walls and ceiling slab is to be removed until rebar is exposed, and sound concrete is found. A new concrete slab shall be installed beneath the existing using holes cored through the existing slab to place the new concrete. New concrete will be placed at the walls to restore them to like new condition. A unit price shall be supplied for repair of deteriorated rebar as required.
 - i. All piping, vents, and hatches in the existing elevated slab shall will be extended through the new elevated slab.
 - ii. The overflow, thickened sludge influent, and aeration air piping on the East wall of the structure will be removed and replaced at a lower elevation below the bottom of the new elevated slab. Replacement piping will be upgraded to 316L stainless steel.
 - iii. The refurbished walls and ceiling will be lined, and floors will be recoated to prevent corrosion due to sewer gases. Existing interior piping and piping on the exterior East wall shall be repainted.
 - iv. The existing wall wash and spray foam systems will be removed and replaced below the new ceiling slab. The 4-inch wall wash piping will be upgraded to stainless steel. The 1.5-inch spray foam system will be reconstructed using schedule 80 PVC.
 - v. The existing aeration system will be removed and replaced with a similar system constructed of stainless steel.

ARTICLE 2. CONTRACT TIMES

COMPLETION OF WORK: The WORK shall be completed as follows:

00500-1
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
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May 18, 2023
Bid Documents

1. Contractor shall begin WORK as soon as the Notice to Proceed is issued following award of WORK. Notice to Proceed is planned for June 17, 2023. Work shall be complete by October 31, 2023.

ARTICLE 3. LIQUIDATED DAMAGES

OWNER and the CONTRACTOR recognize that time is of the essence of this Agreement and that the OWNER will suffer financial loss if the WORK is not completed within the time specified

in Article 2 herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving in a legal proceeding the actual loss suffered by the OWNER if the WORK is not completed on time. Accordingly, instead of requiring any such proof, the OWNER and the CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) the CONTRACTOR shall pay the OWNER \$500.00 for each day that expires after the deadlines specified in Article 2 herein.

ARTICLE 4. CONTRACT PRICE

OWNER shall pay CONTRACTOR for completion of the WORK in accordance with the Contract Documents in current funds the amount set forth in the Bid Schedule(s).

ARTICLE 5. PAYMENT PROCEDURES

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by OWNER as provided in the General Conditions.

ARTICLE 6. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK consist of this Agreement (pages 00500-1 to 00500-8, inclusive) and the following attachments to this Agreement:

- o Notice Inviting Bids (pages 00030-1 to 00030-2, inclusive).
- o Instructions to Bidders (pages 00100-1 to 00100-6, inclusive).
- o Bid Forms including the Bid, Bid Schedule, information required of Bidder, Bid Bond, and all required certificates and affidavits (pages 00300-1 to 00300-12 and 00310-1 to 00310-4, inclusive).
- o Performance Bond (pages 00610-1 to 00610-2, inclusive).
- o Payment Bond (pages 00620-1 to 00620-2, inclusive).
- o General Conditions (pages 00700-1 to 00700-39, inclusive).
- o Supplementary General Conditions (pages 00800-1 to 00800-8, inclusive).

00500-2
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
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May 18, 2023
Bid Documents

- Supplementary General Conditions (Utah) (pages 00810-1 to 00810-4, inclusive).
- Technical Specifications consisting of Divisions and pages, as listed in the Table of Contents.
- Drawings consisting of 20 sheets, as listed in the Table of Contents/List of Drawings.
- Addenda numbers to, inclusive.
- Notice to Proceed.
- Change Orders which may be delivered or issued after Effective Date of this Agreement and are not attached hereto.

There are no Contract Documents other than those listed in this Article 6. The Contract Documents may only be amended by Change Order as provided in Paragraph 3.03 of the General Conditions.

ARTICLE 7. ASSIGNMENTS

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

OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have caused this Agreement to be executed the day and year first above written.

OWNER:
South Valley Water Reclamation Facility
By

South Valley Water Reclamation Facility
7495 South 1300 West
West Jordan, Utah 84084

(Jerry Knight, Board Chairman)

Attest

Approved as to Form:

Address for giving notices: _____

00500-3
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
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May 18, 2023
Bid Documents

(Signature)

(Facility Attorney)

CONTRACTOR:

By _____

[CORPORATE SEAL]

Attest _____

Address for giving notices:

Agent for service of process:

Telephone No. for Agent

00500-4
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

AGREEMENT CERTIFICATE

(if Corporation)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Board of Directors of the _____

_____ a corporation existing under the laws of the State of _____,
held on _____, 20 _____,
the following resolution was duly passed and adopted:

"RESOLVED, that _____,
as _____ of this
Corporation, be and is hereby authorized to execute the Agreement dated
_____, 20____, to the South Valley Water Reclamation Facility by this
Corporation and that his/her execution thereof, attested by the Secretary of this
Corporation, and with the Corporate Seal affixed, shall be the official act and deed of this
Corporation."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the
corporation this _____, day of _____, 20____.

Secretary

(SEAL)

00500-5
Agreement

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
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May 18, 2023
Bid Documents

AGREEMENT CERTIFICATE

(if Partnership)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Partners of the _____

a partnership existing under the laws of the State of _____,
held on _____, 20 _____, the following resolution was duly passed and
adopted:

"RESOLVED, that _____,

as _____ of the
Partnership, be and is hereby authorized to execute the Agreement

dated _____, 20____, by and between this Partnership and South Valley Water
Reclamation Facility by this Partnership and that his/her execution thereof, attested by the
_____ shall be the official act and deed of this Partnership."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of
_____, 20____.

00500-6
Agreement

Solids Holding Tank Refurbishment
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Bid Documents

AGREEMENT CERTIFICATE

(if Joint Venture)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Principals of the _____

a joint venture existing under the laws of the State of _____,

held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____,

as _____ of the
Joint Venture, be and is hereby authorized to execute the Agreement

dated _____, 20____, by and between this Joint Venture and South Valley
Water Reclamation Facility and that his/her execution thereof, attested by the

_____ shall be the official act and deed of this Joint Venture."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of

_____, 20____.

00500-7
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

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Bid Documents

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00500-8
Agreement

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

SECTION 00610
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as CONTRACTOR,
and _____ as

Surety,

are held and firmly bound unto South Valley Water Reclamation Facility hereinafter called "OWNER," in the sum of _____ dollars, 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 CONDITIONS OF THIS OBLIGATION ARE SUCH that said CONTRACTOR has been awarded and is about to enter into the annexed Agreement with said OWNER to perform the WORK as specified or indicated in the Contract Documents entitled "South Valley Water Reclamation Facility – Solids Tank Refurbishment Project".

NOW THEREFORE, if said CONTRACTOR shall perform all the requirements of said Contract Documents required to be performed on its part, at the times and in the manner specified therein, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

PROVIDED, that any alterations in the WORK to be done or the materials to be furnished, or changes in the time of completion, which may be made pursuant to the terms of said Contract Documents, shall not in any way release said CONTRACTOR or said Surety hereunder, nor shall any extensions of time granted under the provisions of said Contract Documents, release either said CONTRACTOR or said Surety, and notice of such alterations or extensions of the Agreement is hereby waived by said Surety.

IN WITNESS WHEREOF, we have hereunder set our hands this day of _____, 20____.

(SEAL)

(SEAL)

(CONTRACTOR)

(Surety)

By: _____
(Signature and SEAL)

By: _____
(Signature and SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

00610 - 1
Performance Bond

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
WWE Project: 22-097

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Bid Documents

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00610 - 2
Performance Bond

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
WWE Project: 22-097

May 18, 2023
Bid Documents

SECTION 00620

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as DESIGN-BUILDER,
and _____ as Surety,
are held and firmly bound unto South Valley Water Reclamation Facility hereinafter called
"OWNER," in the sum of _____ dollars, 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 CONDITIONS OF THIS OBLIGATION ARE SUCH that said DESIGN-BUILDER has been
awarded and is about to enter into the annexed Agreement with said OWNER to perform the
WORK as specified or indicated in the Contract Documents entitled "South Valley Water
Reclamation Facility – Solids Holding Tank Refurbishment Project".

NOW THEREFORE, if said DESIGN-BUILDER, or subcontractor, fails to pay for any materials,
equipment, or other supplies, or for rental of same, used in connection with the performance
of work contracted to be done, or for amounts due under applicable State law for any work or
labor thereon, said Surety will pay for the same in an amount not exceeding the sum specified
above, and, in the event suit is brought upon this bond, reasonable attorney's fees to be fixed
by the court. This bond shall inure to the benefit of any persons, companies, or corporations
entitled to file claims under applicable State law so as to give a right of action to them or their
assigns in any suit brought upon this bond.

PROVIDED, that any alterations in the WORK to be done or the materials to be furnished, or
changes in the time of completion, which may be made pursuant to the terms of said Contract
Documents, shall not in any way release said DESIGN-BUILDER or said Surety thereunder,
nor shall any extensions of time granted under the provisions of said Contract Documents
release either said DESIGN-BUILDER or said Surety, and notice of such alterations or
extensions of the Agreement is hereby waived by said Surety.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of
_____, 20____.

_____(SEAL) _____(SEAL)
(DESIGN-BUILDER) (Surety)

By: _____ By: _____
(Signature) (Signature and SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

- END OF BID FORMS -

00620 - 2
Payment Bond

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
WWE Project 22-097

May 18, 2023
Bid Documents

SECTION 00700

GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents and printed with initial or all capital letters, the following terms have the meanings indicated:

Addenda – Written or graphic instruments issued prior to the opening of Bids which make additions, deletions, or revisions to the Contract Documents.

Agreement – The written contract between the OWNER and the CONTRACTOR for the performance of the WORK pursuant to the Contract Documents. Documents incorporated into the contract by reference become part of the contract and of the Agreement.

Application for Payment – The form furnished by the ENGINEER and completed by the CONTRACTOR to request progress or final payment including supporting documentation to substantiate the amounts for which payment is requested.

Bid – The offer or proposal of a Bidder, submitted on the prescribed form, setting forth the price or prices for the WORK to be performed.

Bidder – Any person, firm or corporation submitting a Bid for the WORK.

Bonds – Bid, Performance and Payment Bonds and other instruments which protect the OWNER against loss due to inability or refusal of the CONTRACTOR to perform pursuant to the Contract Documents.

Change Order – A document recommended by the OWNER’S REPRESENTATIVE, which is signed by the CONTRACTOR and the OWNER and authorizes an addition, deletion, or revision in the WORK, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents – The documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK, consisting of the Drawings, Technical Specifications, General Conditions, Supplementary General Conditions, Notice Inviting Bids, Instructions to Bidders, Addenda, CONTRACTOR's Bid, Information Required of Bidder, Agreement, Performance Bond, Payment Bond, Notice To Proceed and Change Orders. Only printed or hard copies of the documents listed above are Contract Documents.

Contract Price – The total monies payable by the OWNER to the CONTRACTOR for completion of the WORK under the terms and conditions of the Contract Documents.

Contract Time – The number of successive Days or the date stated in the Contract Documents for Substantial Completion of the WORK. The Contract Time begins to run on the date specified in the Notice to Proceed.

CONTRACTOR – The person, firm, or corporation with whom the OWNER has executed the Agreement.

Day – A calendar day of 24 hours measured from midnight to the next midnight.

Defective Work – Work that: is unsatisfactory, faulty, or deficient; does not conform to the Contract Documents; does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; has been damaged prior to the ENGINEER's recommendation of final payment.

Drawings – The drawings, plans, maps, profiles, diagrams, and other graphic representations which show the character, location, nature, extent, and scope of the WORK.

Effective Date of the Agreement – The date indicated in the Agreement on which it was executed.

ENGINEER – The person, firm or corporation named as such in the Contract Documents.

Field Order – A written order issued by the OWNER which requires minor changes in the WORK, but which does not involve a change in the Contract Price or Contract Time.

General Requirements – Division 1 of the Technical Specifications.

Laws and Regulations; Laws or Regulations – Includes any and all applicable state, federal and local statutes, common law, rules, regulations, ordinances, codes, and/or orders.

Notice of Award – The OWNER's written notice to the apparent successful Bidder stating that upon compliance with the conditions precedent enumerated therein by the apparent successful Bidder within the time specified, the OWNER will enter into the Agreement.

Notice to Proceed – The OWNER's written notice to the CONTRACTOR authorizing the CONTRACTOR to proceed with the work and establishing the date of commencement of the Contract Time.

OWNER – SOUTH VALLEY WATER RECLAMATION FACILITY.

OWNER'S REPRESENTATIVE – The authorized representative of the OWNER who is assigned to the site or any part thereof.

Partial Utilization – Placing a portion of the WORK in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion of the WORK.

Project – A unit of total construction of which the WORK to be provided under the Contract Documents, may be the whole, or a part thereof.

Shop Drawings – All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the CONTRACTOR to illustrate some portion of WORK and all illustrations, brochures, standard schedules, performance charts, instruction, and diagrams to illustrate material or equipment for some portion of the WORK.

Specifications – (Same definition as for Technical Specifications hereinafter).

Subcontractor – An individual, firm, or corporation having a direct contract with the CONTRACTOR or with any other Subcontractor for the performance of a part of the WORK.

Substantial Completion – That state of construction when the WORK has progressed to the point where, in the opinion of the OWNER as evidenced by the Notice of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the WORK can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to any work refer to substantial completion thereof.

Supplementary General Conditions – The part of the Contract Documents which makes additions, deletions, or revisions to these General Conditions.

Supplier – A manufacturer, fabricator, supplier, distributor, materialman, or vendor.

Technical Data – The factual information contained in reports describing physical conditions, including: exploration method, plans, logs, laboratory test methods and factual data. Technical Data does not include conclusions, interpretations, interpolations, extrapolations or opinions contained in reports or reached by the CONTRACTOR.

Technical Specifications – Those portions of the Contract Documents consisting of the General Requirements and written technical descriptions of products and execution of the WORK.

Underground Utilities – All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and any encasements containing such facilities which have been installed under ground to furnish any of the following services or materials: water, sewage and drainage removal, electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, traffic, or other control systems.

WORK – The entire construction required to be furnished under the Contract Documents. WORK is the result of performing services, furnishing labor and supervision, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 DELIVERY OF BONDS/INSURANCE CERTIFICATES

- A. The CONTRACTOR shall deliver to the OWNER the Bonds and insurance certificates required by the Contract Documents within ten (10) days after receiving the Notice of Award from the OWNER.

2.02 COPIES OF DOCUMENTS

- A. The OWNER shall furnish the CONTRACTOR with a USB drive with electronic copies of the Contract Documents (Specifications and Drawings) in .pdf format. Printed copies of the Contract Documents will be furnished at reproduction cost.

2.03 STARTING THE PROJECT

- A. The CONTRACTOR shall begin construction of the WORK within 10 days after the commencement date stated in the Notice to Proceed but shall not commence construction prior to the commencement date.

2.04 BEFORE STARTING CONSTRUCTION

- A. Before undertaking each part of the WORK, the CONTRACTOR shall carefully study and compare the Contract Documents to check and verify pertinent figures and dimensions shown thereon with all applicable field measurements. The CONTRACTOR shall promptly report in writing to the OWNER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the OWNER before proceeding with any work affected thereby.
- B. The CONTRACTOR shall submit to the OWNER for review those documents called for under the Section entitled "Contractor Submittals" in the General Requirements.

2.05 PRECONSTRUCTION CONFERENCE

- A. The CONTRACTOR shall attend a preconstruction conference with the OWNER, the ENGINEER and others as appropriate to discuss the construction of the WORK in accordance with the Contract Documents.

2.06 FINALIZING SCHEDULES

- A. At least 7 days before the CONTRACTOR's submittal of its first Application for Payment, the CONTRACTOR, the OWNER, and others as appropriate will meet to finalize the schedules submitted in accordance with the General Requirements.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 INTENT

- A. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK. The Contract Documents are complementary, what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.
- B. It is the intent of the Contract Documents to describe the WORK, as completely as possible and in a functional manner. The WORK is intended to be constructed in accordance with the Contract Documents. All work, materials, or equipment that may be reasonably inferred from the Contract Documents as being required to produce the completed work shall be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe work, materials, or equipment such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals, or codes or any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, the CONTRACTOR, or the ENGINEER or any of their consultants, agents, or employees from those set forth in the Contract Documents.
- C. If, during the performance of the WORK, the CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, the CONTRACTOR shall immediately report it to the OWNER in writing and before proceeding with the work affected thereby. The OWNER shall then make a written interpretation, clarification, or correction.

3.02 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

- A. In resolving issues resulting from conflicts, errors, or discrepancies in any of the Contract Documents, or the order of precedence shall be as follows:
 - 1. Change Orders
 - 2. Agreement
 - 3. Addenda
 - 4. Supplementary General Conditions
 - 5. General Conditions
 - 6. Technical Specifications
 - 7. Referenced Standard Specifications
 - 8. Drawings

9. Contractor's Bid (Bid Form).
- B. With reference to the Drawings the order of precedence is as follows:
1. Figures govern over scaled dimensions
 2. Detail drawings govern over general drawings
 3. Addenda/change order drawings govern over general drawings
 4. Contract Drawings govern over standard drawings.

3.03 AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS

- A. The Contract Documents may be amended by a Change Order (pursuant to Article 10) to provide for additions, deletions or revisions in the WORK or to modify terms and conditions.

3.04 REUSE OF DOCUMENTS

- A. Neither the CONTRACTOR, Subcontractor, Supplier, nor any other person or organization performing any of the WORK under a contract with the OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Technical Specifications, or other documents used on the WORK, and they shall not reuse any of them on the extensions of the Project or any other project without the written consent of the OWNER and the ENGINEER.

ARTICLE 4 – AVAILABILITY OF LANDS: PHYSICAL CONDITIONS, REFERENCE POINTS

4.01 AVAILABILITY OF LANDS

- A. The OWNER shall furnish the lands, rights-of-way and easements upon which the WORK is to be performed and for access thereto, together with other lands designated for the use of the CONTRACTOR in the Contract Documents. Easements for permanent structures or permanent changes in existing major facilities will be obtained and paid for by the OWNER, unless otherwise provided in the Contract Documents. Nothing contained in the Contract Documents shall be interpreted as giving the CONTRACTOR exclusive occupancy of the lands or rights-of-way provided. The CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment. The CONTRACTOR shall not enter upon nor use any property not under the control of the OWNER until a written temporary construction easement agreement has been executed by the CONTRACTOR and the property owner, and a copy of the easement furnished to the ENGINEER prior to its use. Neither the OWNER nor the ENGINEER shall be liable for any claims or damages resulting from the CONTRACTOR's unauthorized trespass or use of any properties.

4.02 PHYSICAL CONDITIONS – SUBSURFACE AND EXISTING STRUCTURES

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- A. Explorations and Reports: The Supplementary General Conditions may identify exploration reports and subsurface conditions tests at the site that have been utilized by the OWNER in the preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the Technical Data contained in these reports. The CONTRACTOR is responsible for the interpretation, extrapolation or interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.
- B. Existing Structures: The Supplementary General Conditions identify the drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Utilities referred to in Paragraph 4.04 herein) which are at or contiguous to the site that have been utilized by the OWNER in the preparation of the Contract Documents. The CONTRACTOR is responsible for the interpretation, extrapolation or interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.

4.03 DIFFERING SITE CONDITIONS

- A. The CONTRACTOR shall notify the OWNER upon encountering any of the following unforeseen conditions, hereinafter called "differing site conditions," during the prosecution of the WORK. The CONTRACTOR's notice to the OWNER shall be in writing and delivered before the differing site conditions are disturbed, but in no event later than 14 days after their discovery.
 - 1. Subsurface or latent physical conditions at the site of the WORK which could not reasonably have been discovered through diligent inspection by CONTRACTOR before his Bid was submitted which differs materially from those indicated, described, or delineated in the Contract Documents including those reports and documents discussed in Paragraph 4.02; and
 - 2. Physical conditions at the site of the WORK of an unusual nature which could not reasonably have been discovered through diligent inspection by CONTRACTOR before his Bid was submitted and which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents including those reports and documents discussed in Paragraph 4.02.
- B. The OWNER will review the alleged differing site conditions; determine the necessity of obtaining additional explorations or tests with respect to verifying their existence and extent.
- C. If the OWNER concludes that because of newly discovered conditions a change in the Contract Documents is required, a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the differing site conditions.
- D. In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to the differing site conditions. If the OWNER and

the CONTRACTOR are unable to agree as to the amount or length of the Change Order, a claim may be made as provided in Articles 11 and 12.

- E. The CONTRACTOR's failure to give written notice of differing site conditions within 14 days of their discovery and before they are disturbed shall constitute a waiver of all claims in connection therewith, whether direct or consequential in nature.

4.04 PHYSICAL CONDITIONS – UNDERGROUND UTILITIES

- A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Utilities at or contiguous to the site are based on information and data furnished to the OWNER by the owners of Underground Utilities or by others. Unless it is expressly provided in the Supplementary General Conditions, the OWNER and the ENGINEER shall not be responsible for the accuracy or completeness of any Underground Utilities information or data. The CONTRACTOR's responsibility relating to underground utilities are: review and check all information and data, locate all Underground Utilities shown or indicated in the Contract Documents, coordinate the WORK with the owners of Underground Utilities during construction, safeguard and protect the Underground Utilities, and repair any damage to Underground Utilities resulting from the WORK. The cost of all these activities will be considered as having been included in the Contract Price.
- B. Not Shown or Indicated: If an Underground Utility not shown or indicated in the Contract Documents is uncovered or revealed at or contiguous to the site and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall identify the owner of the Underground Utility, give written notice of the location to that owner and notify the OWNER.

4.05 REFERENCE POINTS

- A. The OWNER will provide one bench mark, near or on the site of the WORK, and will provide two points near or on the site to establish a base line for use by the CONTRACTOR in laying out the WORK. Unless otherwise specified in the General Requirements, the CONTRACTOR shall furnish all other lines, grades, and bench marks required for proper execution of the WORK.
- B. The CONTRACTOR shall preserve all bench marks, stakes, and other survey marks. In case of their removal or destruction by its own employees or by its subcontractor's employees, the CONTRACTOR shall be responsible for the accurate replacement of reference points by professionally qualified personnel at no additional cost to the OWNER.

ARTICLE 5 – BONDS AND INSURANCE

5.01 PERFORMANCE, PAYMENT AND OTHER BONDS

- A. The CONTRACTOR shall furnish Performance and Payment Bonds, each in the amount of 100% of the Contract Price as security for the faithful performance and payment of all the CONTRACTOR's obligations under the Contract Documents. The Performance

Bond shall remain in effect at least until one year after the date of Notice of Completion, except as otherwise provided by Law or Regulation or by the Contract Documents. After the OWNER issues the Notice of Completion, the amount of the Performance Bond may be reduced to 10 percent of the Contract Price, or \$1,000, whichever is greater. The CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary General Conditions. The OWNER, at its sole discretion, may waive bond requirements for work not exceeding \$50,000.

- B. If the surety on any Bond furnished by the CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the WORK is located, the CONTRACTOR shall within 7 days after written approval by the OWNER of a substitute Bond and Surety substitute the approved Bond and Surety.

5.02 INSURANCE

- A. The CONTRACTOR shall purchase and maintain the insurance required under this paragraph. This insurance shall include the specific coverages set out herein and be written for not less than the limits of liability and coverages provided in the Supplementary General Conditions, or required by law, whichever is greater. The CONTRACTOR's liabilities under the Agreement shall not be deemed limited in any way to the insurance coverage required.
- B. The CONTRACTOR shall furnish the OWNER with certificates indicating the type, amount, class of operations covered, effective dates and expiration dates of all policies. All insurance policies purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days' prior written notice has been given to the OWNER by certified mail. Contract or certificate terms which state that reasonable efforts will be made to notify the OWNER prior to cancellation, change or renewal of the policy are not acceptable. All insurance shall remain in effect until the OWNER issues the Notice of Final Completion and at all times thereafter when the CONTRACTOR may be correcting, removing, or replacing defective work in accordance with Paragraph 13.01B or completing punch list items required by the Notice of Substantial Completion. In addition, the insurance required herein (except for Worker's Compensation and Employer's Liability) shall name the OWNER, the ENGINEER, and their officers, agents, and employees as "additional insured" under the policies. All liability insurance policies shall be occurrence and not claims made policies.
 - 1. Workers' Compensation and Employer's Liability: This insurance shall protect the CONTRACTOR against all claims under applicable state workers' compensation laws. The CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workers' compensation law. This policy shall include an "all states" endorsement. The CONTRACTOR shall require each subcontractor similarly to provide Workers' Compensation Insurance for all of

the latter's employees to be engaged in the WORK unless its employees are covered by the protection afforded by the CONTRACTOR's Workers' Compensation Insurance. In the event a class of employees is not protected under the Workers' Compensation Statute, the CONTRACTOR or Subcontractor, as the case may be, shall provide adequate employer's liability insurance for the protection of its employees not protected under the statute.

2. Comprehensive General Liability: This insurance shall be written in comprehensive form and shall protect the CONTRACTOR against all claims arising from injuries to persons other than its employees and damage to property of the OWNER or others arising out of any act or omission of the CONTRACTOR or its agents, employees or subcontractors. The policy shall include the following endorsements: (1) Protective Liability endorsement to insure the contractual liability assumed by the CONTRACTOR under the indemnification provisions in these General Conditions; (2) Broad Form Property Damage endorsement; (3) Personal Injury endorsement to cover personal injury liability for intangible harm. The Comprehensive General Liability coverage shall contain no exclusion relative to blasting, explosion, collapse of building, or damage to underground structures.
3. Comprehensive Automobile Liability: This insurance shall be written in comprehensive form. The policy shall protect the CONTRACTOR against all claims for injuries to employees, members of the public and damage to property of others arising from the use of CONTRACTOR's motor vehicles, whether they are owned, non-owned, or hired, and whether used or operated on or off the site. The motor vehicle insurance required under this paragraph shall include: (a) motor vehicle liability coverage; (b) personal injury protection coverage and benefits; (c) uninsured motor vehicle coverage; and (d) underinsured motor vehicle coverage.
4. Subcontractor's Insurance: The CONTRACTOR shall require each of its subcontractors to procure and to maintain Comprehensive General Liability Insurance and Comprehensive Automobile Liability Insurance of the type and in the amounts specified in the Supplementary General Conditions or insure the activities of its subcontractors in the CONTRACTOR's own policy, in like amount.
5. Builder's Risk: This insurance shall be of the "all risk" type, shall be written in completed value form, and shall protect the CONTRACTOR, the OWNER, and the ENGINEER against damage to buildings, structures, materials and equipment. The amount of this insurance shall not be less than the insurable value of the WORK at completion. Builder's risk insurance shall provide for losses to be payable to the CONTRACTOR, the OWNER, and the ENGINEER as their interests may appear. The policy shall contain a provision that in the event of payment for any loss under the coverage provided, the insurance company shall have no rights of recovery against the CONTRACTOR, the OWNER, or the ENGINEER. The Builder's Risk policy shall insure against all risks of direct physical loss or damage to property from any external cause including flood and earthquake. Allowable exclusions, if any, shall be as specified in the Supplementary General Conditions.

ARTICLE 6 – CONTRACTOR RESPONSIBILITIES

6.01 SUPERVISION AND SUPERINTENDENCE

- A. The CONTRACTOR shall supervise and direct the WORK competently and efficiently, devoting the attention and applying the skills and expertise necessary to perform the WORK in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incidental thereto. The CONTRACTOR shall be responsible to see that the finished WORK complies accurately with the Contract Documents.
- B. The CONTRACTOR shall employ the superintendent named in "Information Required of Bidder" on the work site at all times during the progress of the WORK. The superintendent shall not be replaced without the OWNER's written consent. The superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR. The CONTRACTOR shall issue all its communications to the OWNER.
- C. The CONTRACTOR's superintendent, or OWNER approved representative shall be present at the site of the WORK at all times while work is in progress. Failure to observe this requirement shall be considered suspension of the WORK by the CONTRACTOR until the superintendent is again present at the site.

6.02 LABOR, MATERIALS, AND EQUIPMENT

- A. The CONTRACTOR shall provide skilled, competent and suitably qualified personnel to survey and lay out the WORK and perform construction as required by the Contract Documents. The CONTRACTOR shall at all times maintain good discipline and order at the site.
- B. Except in connection with the safety or protection of persons at the WORK, or property at the site or adjacent thereto, all work at the site shall be performed during regular working hours (7:00 a.m. – 6:00 p.m., Monday through Friday), and the CONTRACTOR will not permit overtime work or the performance of work on Saturday, Sunday or any legal holiday observed by the OWNER without the OWNER's written consent given after prior written notice to the OWNER. Except as otherwise provided in this Paragraph, the CONTRACTOR shall receive no additional compensation for overtime work, i.e., work in excess of 8 hours in any one calendar day or 40 hours in any one calendar week, even though such overtime work may be required under emergency conditions and may be ordered by the OWNER in writing. Additional compensation will be paid the CONTRACTOR for overtime work in the event extra work is ordered by the OWNER and the Change Order specifically authorizes the use of overtime work, but only to the extent that the CONTRACTOR pays overtime wages on a regular basis being paid (>40 hours per week) for overtime work of a similar nature in the same locality.
- C. All costs of inspection and testing performed during overtime work approved solely for the convenience of the CONTRACTOR shall be borne by the CONTRACTOR. The OWNER

shall have the authority to deduct the costs of all inspection and testing from any partial payments otherwise due to the CONTRACTOR.

- D. Unless otherwise specified in the Contract Documents, the CONTRACTOR shall furnish, erect, maintain and remove the construction plant, and temporary works and assume full responsibility for all materials, equipment, labor, transportation, construction equipment, machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities and all other facilities and incidentals necessary for the furnishing, performance testing, start-up and completion of the WORK.
- E. All materials and equipment incorporated into the WORK shall be of new and good quality, except as otherwise provided in the Contract Documents. If required by the OWNER, the CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. The CONTRACTOR shall apply, install, connect, erect, use, clean, and condition all material and equipment in accordance with the instructions of the manufacturer and Supplier except as otherwise provided in the Contract Documents.

6.03 ADJUSTING PROGRESS SCHEDULE

- A. The CONTRACTOR shall submit any adjustments in the progress schedule to the OWNER for acceptance in accordance with the provisions for "Contractor Submittals" in the General Requirements.

6.04 SUBSTITUTES AND "OR-EQUAL" ITEMS

- A. The CONTRACTOR shall submit proposed substitutes and "or-equal" items in accordance with the provisions for "Contractor Submittals" in the General Requirements.

6.05 SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- A. The CONTRACTOR shall be responsible to the OWNER and the ENGINEER for the acts and omissions of its subcontractors and their employees to the same extent as the CONTRACTOR is responsible for the acts and omissions of its own employees. Nothing contained in this paragraph shall create any contractual relationship between any subcontractor and the OWNER or the ENGINEER nor relieve the CONTRACTOR of any liability or obligation under the Agreement.

6.06 PERMITS

- A. Unless otherwise provided in the Supplementary General Conditions, the CONTRACTOR shall obtain and pay for all construction permits and licenses from the agencies having jurisdiction, including furnishing the insurance and bonds required by such agencies. The costs incurred by the CONTRACTOR in compliance with this paragraph shall not be made the basis for claims for additional compensation. The OWNER shall assist the CONTRACTOR, when necessary, in obtaining such permits and licenses. The CONTRACTOR shall pay all governmental charges and inspection fees

necessary for the prosecution of the WORK, which are applicable at the time of opening of Bids, including all utility connection charges for utilities required by the WORK.

- B. The CONTRACTOR shall pay all license fees and royalties and assume all costs when any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others when issued in the construction of the WORK or incorporated into the WORK. If a particular invention, design, process, product, or device is specified in the Contract Documents for incorporation into or use in the construction of the WORK and if to the actual knowledge of the OWNER or the ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of these rights shall be disclosed by the OWNER in the Contract Documents. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER and the ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees and court costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the WORK or resulting from the incorporation in the WORK of any invention, design, process, product, or device not specified in the Contract Documents.

6.07 LAWS AND REGULATIONS

- A. The CONTRACTOR shall observe and comply with all Laws and Regulations which in any manner affect those engaged or employed on the WORK, the materials used in the WORK, or the conduct of the WORK. If any discrepancy or inconsistency should be discovered in the Contract Documents in relation to any Laws or Regulations, the CONTRACTOR shall report the same in writing to the OWNER. Notwithstanding any immunity otherwise provided by applicable workers' compensation statutes, the CONTRACTOR shall indemnify, defend and hold harmless the OWNER, the ENGINEER and their officers, agents, and employees against all claims arising from violation of any Laws or Regulations, by CONTRACTOR or by its employees or subcontractors. This indemnity provision is intended to provide the greatest protection of the OWNER and ENGINEER allowed by law. Any particular law or regulation specified or referred to elsewhere in the Contract Documents shall not in any way limit the obligation of the CONTRACTOR to comply with all other provisions of federal, state, and local laws and regulations.

6.08 EQUAL OPPORTUNITY

- A. The CONTRACTOR agrees not to discriminate against anyone because of race, national origin, ancestry, color, religion, sex, age, or disability. The CONTRACTOR agrees to abide by all applicable civil rights Laws and Regulations.

6.09 TAXES

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

6.10 USE OF PREMISES

- A. The CONTRACTOR shall confine construction equipment, stored materials and equipment, and other operations of workers to (1) the Project site, (2) the land and areas identified for the CONTRACTOR's use in the Contract Documents, and (3) other lands whose use is acquired by Laws and Regulations, rights-of-way, permits, and easements. The CONTRACTOR shall be fully responsible to the owner and occupant of such lands for any damage to the lands or areas contiguous thereto, resulting from the performance of the WORK or otherwise. Should any claim be made against the OWNER or the ENGINEER by owner or occupant of lands because of the performance of the WORK, the CONTRACTOR shall promptly settle the claim by agreement, or resolve the claim through litigation. The CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify, defend, and hold the OWNER and the ENGINEER harmless from and against all claims, damages, losses, and expenses (including, but not limited to, fees of engineers, architects, attorneys, and other professionals and court costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any owner or occupant of land against the OWNER or the ENGINEER to the extent the claim is based or arises out of the CONTRACTOR's performance of the WORK.

6.11 SAFETY AND PROTECTION

- A. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
1. All persons on or near the work site and other persons and organizations who may be affected by activities on or near the work site.
 2. All the WORK and materials and equipment to be incorporated therein, whether in storage on or off the site; and
 3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- B. The CONTRACTOR shall comply with all applicable Laws and Regulations (whether referred to herein or not) of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the WORK may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Unless the CONTRACTOR otherwise designates in writing a different individual as the responsible individual, the CONTRACTOR's superintendent shall be CONTRACTOR's representative at the site whose duties shall include providing all persons on the work site with a reasonably safe environment and the prevention of accidents.

6.12 SHOP DRAWINGS AND SAMPLES

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WWE Project 22-097

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- A. After checking and verifying all field measurements and after complying with the applicable procedures specified in the General Requirements, the CONTRACTOR shall submit all shop drawings to the OWNER for review and approval in accordance with the approved schedule for shop drawing submittals specified in the General Requirements.
- B. The CONTRACTOR shall also submit to the OWNER for review and approval all samples in accordance with the approved schedule of sample submittals specified in the General Requirements.
- C. Before submitting shop drawings or samples, the CONTRACTOR shall determine and verify all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and review or coordinate each shop drawing or sample with other shop drawings and samples and with the requirements of the WORK and the Contract Documents. The CONTRACTOR shall stamp each shop drawing, certifying his review. If the same shop drawings require re-submittal more than two times, the CONTRACTOR shall pay for the costs of ENGINEER's and OWNER's subsequent review(s).

6.13 CONTINUING THE WORK

- A. The CONTRACTOR shall carry on the WORK and adhere to the progress schedule during all disputes or disagreements with the OWNER. No work shall be delayed or postponed pending resolution of any dispute or disagreement, except as the CONTRACTOR and the OWNER may otherwise mutually agree in writing.

6.14 INDEMNIFICATION

- A. To the fullest extent permitted by Laws and Regulations, and notwithstanding any immunity the CONTRACTOR might otherwise have under applicable workers' compensation statutes, the CONTRACTOR shall indemnify, defend, and hold harmless the OWNER, the ENGINEER, and their officers, agents, and employees, against and from all claims and liability arising under or by reason of, or claimed by others to arise under or by reason of, the Agreement or any performance of the WORK, but not from the sole negligence or willful misconduct of the OWNER and/or the ENGINEER. Such indemnification by the CONTRACTOR shall include but not be limited to the following:
 - 1. Liability or claims resulting in whole or in part, directly or indirectly from, or claimed by others to result in whole or in part, directly or indirectly from, the negligence, carelessness or other fault of the CONTRACTOR or its employees, Subcontractors, Suppliers or agents in the performance of the WORK, or in guarding or maintaining the same, or from any improper materials, implements, or appliances used in its construction;
 - 2. Liability or claims arising in whole or in part, directly or indirectly, from or based on, or claimed by others to arise in whole or in part, directly or indirectly, from or based on, the violation of any Laws or Regulations by the CONTRACTOR or its employees, Subcontractors, Suppliers or agents;

3. Liability or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the use or manufacture by the CONTRACTOR, or its Subcontractors, Suppliers or agents in the performance of this Agreement of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, article, or appliance, unless otherwise specifically stipulated in this Agreement.
 4. Liability or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the breach of any warranties, whether express or implied, made by the CONTRACTOR or its Subcontractors, Suppliers or agents;
 5. Liabilities or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the willful misconduct of the CONTRACTOR or its Subcontractors, Suppliers or agents; and,
 6. Liabilities or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, any breach of the obligations assumed herein by the CONTRACTOR or its Subcontractors, Suppliers or agents.
 7. If for any reason the OWNER is required to pay damages in proportion to the fault of the OWNER notwithstanding the above indemnity provisions, CONTRACTOR shall, notwithstanding any workers' compensation immunity, indemnify and hold OWNER harmless from the payment of any increased damages OWNER is required to pay which result from a reapportionment of the fault of the CONTRACTOR, or any of its employees, Subcontractors or Suppliers pursuant to Utah Code Annotated section 78b-5-818, Comparative negligence.
- B. The CONTRACTOR shall reimburse the OWNER, and the ENGINEER for all costs and expense, (including but not limited to fees and charges of engineers, architects, attorneys, and other professional and court costs) incurred by the OWNER, and the ENGINEER in enforcing the provisions of this Paragraph.
- C. The indemnification obligation under this Paragraph shall not be limited in any way by any limitation of the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR or any such subcontractor or other person or organization under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- 6.15 CONTRACTOR'S DAILY REPORTS
- A. The CONTRACTOR shall complete a daily report indicating manpower, major equipment, subcontractors, weather conditions, etc., involved in the performance of the WORK. The daily report shall be completed on forms prepared by the CONTRACTOR and acceptable to the OWNER, and shall be submitted to the OWNER at the conclusion of each workday.

6.16 ASSIGNMENT OF CONTRACT

- A. The CONTRACTOR shall not assign, sublet, sell, transfer, or otherwise dispose of the Agreement or any portion thereof, or its right, title, or interest therein, or obligations thereunder, without the written consent of the OWNER except as imposed by law. If the CONTRACTOR violates this provision, the Agreement may be terminated at the option of the OWNER. In such event, the OWNER shall be relieved of all liability and obligations to the CONTRACTOR and to its assignee or transferee, growing out of such termination.

ARTICLE 7 – OTHER WORK

7.01 RELATED WORK

- A. The OWNER may perform other work related to the Project at the site by the OWNER's own forces, have other work performed by utility owners, or let other direct contracts for the performance of the other work which may contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents written notice thereof will be given to the CONTRACTOR prior to commencing any other work.
- B. The CONTRACTOR shall afford each utility owner and other contractor who is a party to a direct contract (or the OWNER, if the OWNER is performing the additional work with the OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of the other work. The CONTRACTOR shall properly connect and coordinate the WORK with the other work. The CONTRACTOR shall do all cutting, fitting, and patching of the WORK that may be required to make its several parts come together properly and integrate with the other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and shall only cut or alter their work with the written consent of the OWNER and the others whose work will be affected.
- C. If the proper execution or results of any part of the CONTRACTOR's work depends upon the integration of work with the completion of other work by any other contractor or utility owner (or the OWNER), the CONTRACTOR shall inspect and report to the OWNER in writing all delays, defects, or deficiencies in the other work that renders it unavailable or unsuitable for proper integration with the CONTRACTOR's work. Except for the results or effects of material latent defects and deficiencies in the other work which could not reasonably have been discovered by the CONTRACTOR, the CONTRACTOR's failure to report will constitute an acceptance of the other work as fit and proper for integration with the CONTRACTOR's work and as a waiver of any claim for additional time or compensation associated with the integration of the CONTRACTOR's work with the other work.

7.02 COORDINATION

- A. If the OWNER contracts with others for the performance of other work on the Project at the site, a coordinator will be identified to the extent that the coordinator can be

identified at this time, in the Supplementary General Conditions and delegated the authority and responsibility for coordination of the activities among the various contractors. The specific matters over which the coordinator has authority and the extent of the coordinator's authority and responsibility will be itemized in the Supplementary General Conditions or in a notice to the CONTRACTOR at such time as the identity of the coordinator is determined.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 COMMUNICATIONS

- A. The OWNER shall issue all its communications directly to the CONTRACTOR.

8.02 PAYMENTS

- A. The OWNER shall make payments to the CONTRACTOR as provided in Article 14.

8.03 LANDS, EASEMENTS, AND SURVEYS

- A. The OWNER's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. The OWNER shall identify and make available to the CONTRACTOR copies of exploration reports and subsurface conditions tests at the site and in existing structures which have been utilized in preparing the Drawings and Technical Specifications as set forth in Paragraph 4.02

8.04 CHANGE ORDERS

- A. The OWNER shall execute approved Change Orders for the conditions described in Paragraph 10.01D.
- B. When funds are not budgeted to support continuation of performance in a subsequent fiscal period, the contract shall be canceled and the contractor shall be reimbursed for the reasonable value of any non-recurring costs incurred but not amortized in the price of the supplies or services delivered under the contract.

8.05 INSPECTIONS AND TESTS

- A. The OWNER's responsibility with respect to inspection, tests, and approvals is set forth in Paragraph 13.03B.

8.06 SUSPENSION OF WORK

- A. In connection with the OWNER's right to stop work or suspend work, see Paragraphs 13.04 and 15.01, Paragraphs 15.02 and 15.03 deal with the OWNER's right to terminate services of the CONTRACTOR under certain circumstances.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S REPRESENTATIVE

- A. The OWNER will designate a representative during the construction period. The duties, responsibilities and the limitations of authority of the OWNER's representative during construction are summarized hereafter.

9.02 VISITS TO SITE

- A. The ENGINEER will make visits to the site during construction to observe and inspect the progress and quality of the WORK and to determine, in general if the WORK is proceeding in accordance with the Contract Documents.

9.03 PROJECT REPRESENTATIVE

- A. The OWNER'S Representative will observe and inspect the performance of the WORK. The Owner's Representative and/or other authorized agents of the OWNER shall serve as the primary contact(s) with the Contractor during the construction phase. All submittals shall be delivered to, and communications between the OWNER and the CONTRACTOR shall be handled by, the Owner's Representative and/or other authorized agents. The Owner's Representative shall be the primary authorized representative of the OWNER in all on-site relations with the CONTRACTOR.

9.04 CLARIFICATIONS AND INTERPRETATIONS

- A. The OWNER will issue, with reasonable promptness written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as the OWNER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

9.05 AUTHORIZED VARIATIONS IN WORK

- A. The OWNER may authorize minor variations in the WORK as described in the Contract Documents when such variations do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These variations shall be accomplished by issuing a Field Order. The issuance of a Field Order requires the CONTRACTOR to perform the work described in the order promptly. If the CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, the CONTRACTOR may make a claim therefor as provided in Article 11 and 12.

9.06 REJECTION OF DEFECTIVE WORK

- A. The OWNER is authorized to reject work which the OWNER believes to be defective and require special inspection or testing of the WORK as provided in Paragraph 13.03G, whether or not the WORK is fabricated, installed, or completed.

9.07 CONTRACTOR SUBMITTALS, CHANGE ORDERS, AND PAYMENTS

- A. The OWNER will review for approval all CONTRACTOR submittals, including shop drawings, samples, substitutes, and "or equal" items, etc., in accordance with the procedures set forth in the General Requirements.
- B. In connection with the OWNER'S REPRESENTATIVE responsibilities as to Change Orders, see Articles 10, 11, and 12.
- C. In connection with the OWNER responsibilities as to Applications for Payment, see Article 14.

9.08 DISPUTES, CLAIMS AND OTHER MATTERS

- A. All claims, disputes, and other matters concerning the acceptability of the WORK, the interpretation of the requirements of the Contract Documents pertaining to the performance of the WORK, and claims for changes in the Contract Price or Contract Time under Articles 11 and 12 will be referred to the OWNER in writing with a request for formal decision in accordance with this paragraph. The OWNER will render a decision in writing within 30 days of receipt of the request. Written notice of each claim, dispute, or other matter will be delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event. Written supporting data will be submitted to the OWNER with the written claim unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim.
- B. When reviewing the claim or dispute, the OWNER'S REPRESENTATIVE will not show partiality to the OWNER or the CONTRACTOR and will incur no liability in connection with any interpretation or decision rendered in good faith. The OWNER'S REPRESENTATIVE rendering of a decision with respect to any claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 14.12) shall be a condition precedent to the OWNER's or the CONTRACTOR's exercise of their rights or remedies under the Contract Documents or by Law or Regulations with respect to the claim, dispute, or other matter.

9.09 LIMITATION ON ENGINEER'S RESPONSIBILITIES

- A. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as reviewed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review, or judgment of the OWNER as to the WORK, it is intended that such requirement, direction, review, or judgment will be solely to evaluate the WORK for compliance with the Contract Documents, unless there is a specific statement indicating otherwise. The use of any such term or adjective shall not be effective to assign to the OWNER any duty or authority to supervise or direct the performance of the WORK.

- B. Neither the OWNER nor the ENGINEER will be responsible for the CONTRACTOR's means, methods, techniques, sequences, or procedures of construction not specified in the Contract Documents. Neither the OWNER nor the ENGINEER shall have any responsibility for safety precautions or programs on site or for the safety of CONTRACTOR'S employees, Subcontractors, employees of Subcontractors, Suppliers, employees of Suppliers or others on site.
- C. Neither the OWNER nor the ENGINEER will be responsible for the acts or omissions of the CONTRACTOR nor of any Subcontractor, Supplier, or any other person or organization performing any of the WORK to the extent that such acts or omissions are not reasonably discoverable considering the level of observation and inspection required by the ENGINEER's agreement with the OWNER.

ARTICLE 10 – CHANGES IN THE WORK

10.01 GENERAL

- A. Without invalidating the Agreement and without notice to any surety, the OWNER may at any time or from time to time, order additions, deletions, or revisions in the WORK; these will be authorized by a written Field Order and/or a Change Order issued by the OWNER. Upon receipt of any of these documents, the CONTRACTOR shall promptly proceed with the work involved pursuant to the applicable conditions of the Contract Documents.
- B. If the OWNER and the CONTRACTOR are unable to agree upon the increase or decrease in the Contract Price or an extension or shortening of the Contract Time, if any, that should be allowed as a result of a Field Order, a claim may be made therefor as provided in Articles 11 and 12.
- C. The CONTRACTOR shall not be entitled to an increase in the Contract Price nor an extension of the Contract Time with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented by Change Order, except in the case of an emergency and except in the case of uncovering work provided in the Paragraph 13.03G.
- D. The OWNER and the CONTRACTOR shall execute appropriate Change Orders covering:
 - 1. Changes in the WORK which are ordered by the OWNER pursuant to Paragraph 10.01A;
 - 2. Changes required because of acceptance of defective work under Paragraph 13.06;
 - 3. Changes in the Contract Price or Contract Time which are agreed to by the parties; or
 - 4. Any other changes agreed to by the parties.

5. Any construction contract change order which increases the contract amount shall have the prior written certification of the District's controller that the expenditure of the change order amount is properly authorized by the District's board of trustees consistent with the District's budget and financial management policies and the instructions of the board of trustees.
- E. If the provisions of any Bond require notice of any change to be given to a surety, the giving of these notices will be the CONTRACTOR's responsibility. The CONTRACTOR shall provide for the amount of each applicable Bond to be adjusted accordingly.

10.02 ALLOWABLE QUANTITY VARIATIONS

- A. Whenever a unit price and quantity have been established for a bid item in the Contract Documents, the quantity stated may be increased or decreased to a maximum of 25 percent with no change in the unit price. An adjustment in the quantity in excess of 25 percent will be sufficient to justify a change in the unit price. All changes in the quantities of bid items shall be documented by Change Order.
- B. In the event a part of the WORK is to be entirely eliminated and no lump sum or unit price is named in the Contract Documents to cover the eliminated work, the price of the eliminated work shall be agreed upon in writing by the OWNER and the CONTRACTOR. If the OWNER and the CONTRACTOR fail to agree upon the price of the eliminated work, the price shall be determined in accordance with the provisions of Article 11.

ARTICLE 11 – CHANGE OF CONTRACT PRICE

11.01 GENERAL

- A. The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the WORK. Except as directed by Change Orders, all duties, responsibilities, and obligations assigned to or undertaken by the CONTRACTOR shall be at its expense without change in the Contract Price.
- B. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered with the claim, unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the CONTRACTOR's written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR is entitled as a result of the occurrence of the event. If the OWNER and the CONTRACTOR cannot otherwise agree on the amount involved, all claims for adjustment in the Contract Price shall be determined by the OWNER in accordance with Paragraph 9.08A. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph.

- C. The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:
1. Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.
 2. Mutual acceptance of a lump sum, which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.
 3. On the basis of the cost of work (determined as provided in Paragraphs 11.02 and 11.03) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.04).

11.02 COST OF WORK (BASED ON TIME AND MATERIALS)

- A. General: The term "cost of work" means the sum of all costs necessarily incurred and paid by the CONTRACTOR for labor, materials, and equipment in the proper performance of work. Except as otherwise may be agreed to in writing by the OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project.
- B. Labor: The cost of labor used in performing work by the CONTRACTOR, a Subcontractor, or other forces will be the sum of the following:
1. The actual wages paid plus any employer payments to, or on behalf of workers for fringe benefits including health and welfare, pension, vacation, and similar purposes. The cost of labor may include the rates paid to foremen when determined by the OWNER that the services of foremen do not constitute a part of the overhead allowance.
 2. All payments imposed by state and federal laws including, but not limited to, compensation insurance, and social security payments.
 3. The amount paid for subsistence and travel required by collective bargaining agreements, or in accordance with the regular practice of the employer.
 4. At the beginning of the extra work and as later requested by the OWNER, the CONTRACTOR shall furnish the OWNER proof of labor compensation rates being paid.
- C. Materials: The cost of materials used in performing work will be the cost to the purchaser, whether CONTRACTOR or Subcontractor, from the Supplier thereof, except as the following are applicable:
1. Trade discounts available to the purchase shall be credited to the OWNER notwithstanding the fact that such discounts may not have been taken by the CONTRACTOR.

2. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual Supplier as determined by the OWNER. Markup except for actual costs incurred in the handling of such materials will not be allowed.
 3. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from these sources on extra work items or current wholesale price for the materials delivered to the work site, whichever is lower.
 4. If, in the opinion of the OWNER, the cost of material is excessive, or the CONTRACTOR does not furnish satisfactory evidence of the cost of the material, then the cost shall be deemed to be the lowest current wholesale price for the quantity concerned, delivered to the work site less trade discount. The OWNER reserves the right to furnish materials for the extra work and no claim shall be made by the CONTRACTOR for costs and profit on such materials.
- D. Equipment: The CONTRACTOR will be paid for the use of equipment at the rental rate listed for the equipment specified in the Rental Rate Blue Book published by Dataquest, Inc. The rental rate will be used to compute payments for equipment whether the equipment is under the CONTRACTOR's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate resulting in the least total cost to the Owner for the total period of use.
1. All equipment shall, in the opinion of the OWNER, be in good working condition and suitable for the purpose for which the equipment is to be used.
 2. Before construction equipment is used on the extra work, the CONTRACTOR shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the OWNER, in duplicate, a description of the equipment and its identifying number.
 3. Unless otherwise specified, manufacturers' ratings and manufacturer-approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.
 4. Individual pieces of equipment or tools having a replacement value of \$100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefore.
 5. Rental time will not be allowed while equipment is inoperative due to breakdowns.
- E. Equipment on the Work: The rental time to be paid for equipment used on the WORK shall be the time the equipment is in productive operation on the extra work being performed and, in addition, shall include the time required to move the equipment to

the location of the extra work and return it to the original location or to another location that requires no more moving time than that required to return it to its original location. Moving time will not be paid if the equipment is used on other than the extra work, even though located at the site of the extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power. However, no payment will be made for loading and transporting costs when the equipment is used on other than the extra work even though located at the site of the extra work. The following shall be used in computing the rental time of equipment on the WORK.

1. When hourly rates are listed, any part of an hour less than 30 minutes of operation shall be considered to be 1/2-hour of operation, and any part of an hour in excess of 30 minutes will be considered one hour of operation.
2. When daily rates are listed, any part of a day less than 4 hours operation shall be considered to be 1/2-day of operation. When owner-operated equipment is used to perform extra work to be paid for on a time and materials basis, the CONTRACTOR will be paid for the equipment and operator, as set forth in Paragraph (3), (4), and (5), following.
3. Payment for the equipment will be made in accordance with the provisions in Paragraph 11.02D, herein.
4. Payment for the cost of labor and subsistence or travel allowance will be made at the rates paid by the CONTRACTOR to other workers operating similar equipment already on the WORK, or in the absence of such labor, established by collective bargaining agreements for the type of workmen and location of the extra work, whether or not the operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein in accordance with the provisions of Paragraph 11.02B, herein, which surcharge shall constitute full compensation for payments imposed by state and federal laws and all payments made to on behalf of workers other than actual wages.
5. To the direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Paragraph 11.04, herein.

11.03 SPECIAL SERVICES

- A. Special work or services are defined as that work characterized by extraordinary complexity, sophistication, or innovation or a combination of the foregoing attributes which are unique to the construction industry. The following may be considered by the OWNER in making estimates for payment for special services:
 1. When the OWNER and the CONTRACTOR, by agreement, determine that a special service or work is required which cannot be performed by the forces of the CONTRACTOR or those of any of its Subcontractors, the special service or work may be performed by an entity especially skilled in the work to be

performed. After validation of invoices and determination of market values by the OWNER, invoices for special services or work based upon the current fair market value thereof may be accepted without complete itemization of labor, material, and equipment rental cost.

2. When the CONTRACTOR is required to perform work necessitating special fabrication or machining process in a fabrication or a machine shop facility away from the job site, the charges for that portion of the work performed at the off-site facility may by agreement, be accepted as a special service and accordingly, the invoices from the work may be accepted without detailed itemization.
 3. All invoices for special services will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of the allowances for overhead and profit specified in Paragraph 11.04, herein, an allowance of 5 percent will be added to invoices for special services.
- B. All work performed hereunder shall be subject to all of the provisions of the Contract Documents and the CONTRACTOR's sureties shall be bound with reference hereto as under the original Agreement. Copies of all amendments to surety bonds or supplemental surety bonds shall be submitted to the OWNER for review prior to the performance of any work hereunder.

11.04 CONTRACTOR'S FEE

- A. Work ordered on the basis of time and materials will be paid for at the actual necessary cost as determined by the OWNER, plus allowances for overhead and profit. For extra work involving a combination of increases and decreases in the WORK, the actual necessary cost will be the arithmetic sum of the additive and deductive costs. The allowance for overhead and profit shall include full compensation for superintendence, bond and insurance premiums, taxes, office expenses, and all other items of expense or cost not included in the cost of labor, materials, or equipment provided for under Paragraphs 11.02B, C, and D herein, including extended overhead and home office overhead. The allowance for overhead and profit will be made in accordance with the following schedule:

OVERHEAD AND PROFIT ALLOWANCE

Labor	10 percent
Materials	10 percent
Equipment	10 percent

- B. It is understood that labor, materials, and equipment may be furnished by the CONTRACTOR or by a Subcontractor, and that the allowance specified herein shall be applied to the labor, materials, and equipment costs of the Subcontractor, to which the CONTRACTOR may add five percent of the Subcontractor's total cost of work. Regardless of the number of hierarchical tiers of Subcontractors, the five-percent markup may be applied one time only for each separate work transaction.

ARTICLE 12 – CHANGE OF CONTRACT TIME

12.01 GENERAL

- A. The Contract Time may only be changed by a Change Order. Any claim for an extension of the Contract time shall be based on written notice delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within 30 days after such occurrence (unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR's written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. Claims for adjustment in the Contract Time shall be determined by the OWNER in accordance with Paragraph 9.08 if the OWNER's representative and the CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph.
- B. The Contract Time will be extended in an amount equal to time lost if the CONTRACTOR makes a claim as provided in Paragraph 12.01A and the OWNER determines that the delay was caused by events beyond the control of the CONTRACTOR. Examples of events beyond the control of the CONTRACTOR include acts or neglect by the OWNER or others performing additional work as contemplated by Article 7, or by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, sabotage, or freight embargoes.
- C. All time limits stated in the Contract Documents are of the essence.
- D. None of the aforesaid time extensions shall entitle the CONTRACTOR to any adjustment in the Contract Price or any damages for delay. Furthermore, the CONTRACTOR hereby indemnifies and holds harmless the OWNER and ENGINEER, their officers, agents and employees from and against all claims, damages, losses and expenses (including lost property and attorney's fees) arising out of or resulting from the temporary suspension of work whether for the OWNER's convenience as defined in Article 15.01A or for whatever other reasons including the stoppage of work by the OWNER for the CONTRACTOR's failure to comply with any order issued by the OWNER.

12.02 EXTENSIONS OF THE TIME FOR DELAY DUE TO INCLEMENT WEATHER

- A. "Inclement weather" is any weather condition or conditions resulting immediately therefrom, causing the CONTRACTOR to suspend construction operations or preventing the CONTRACTOR from proceeding with at least 75 percent of the normal labor and equipment force engaged on the WORK.
- B. Should the CONTRACTOR prepare to begin work at the regular starting time at the beginning of any regular work shift on any day on which inclement weather, or its effects on the condition of the WORK prevents work from beginning at the usual starting time and the crew is dismissed as a result thereof, the CONTRACTOR will not

be charged for a working day whether or not conditions change thereafter during the day and the major portion of the day could be considered to be suitable for construction operations.

- C. The CONTRACTOR shall base its construction schedule upon the inclusion of the number of days of inclement weather specified in the Supplementary General Conditions. No extension of the Contract Time due to inclement weather will be considered until after the stated number of days of inclement weather has been reached. However, no reduction in Contract Time will be made if the number of inclement weather days is not reached.

12.03 EXTENSIONS OF TIME FOR OTHER DELAYS

- A. If the CONTRACTOR is delayed in completion of the WORK beyond the Contract Time, by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, industry-wide shortage of raw materials, sabotage or freight embargoes, the CONTRACTOR shall be entitled to an adjustment in the Contract Time. No such adjustment will be made unless the CONTRACTOR shall notify the OWNER in writing of the causes of delay within 15 calendar days from the beginning of any such delay. The OWNER shall ascertain the facts and the extent of the delay. No adjustment in time shall be made for delays resulting from noncompliance with the Contract Documents, accidents, failure on the part of the CONTRACTOR to carry out the provisions of the Contract Documents including failure to provide materials, equipment or workmanship meeting the requirements of the Contract Documents; the occurrence of such events shall not relieve the CONTRACTOR from the necessity of maintaining the required progress.
- B. If the CONTRACTOR is delayed in completing the WORK beyond the Contract Time by reason of shortages of raw materials required for CONTRACTOR-furnished items, the CONTRACTOR shall be entitled to an adjustment in the Contract Time in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER; provided, however, that the CONTRACTOR shall furnish documentation acceptable to the OWNER that he placed or attempted to place firm orders with Suppliers at a reasonable time in advance of the required date of delivery of the items in question, that such shortages shall have developed following the date such orders were placed or attempts made to place same, that said shortages are general throughout the affected industry, that said shortages are shortages of raw materials required to manufacture CONTRACTOR furnished items and not simply failure of CONTRACTOR's Suppliers to manufacture, assemble or ship items on time, and that the CONTRACTOR shall, to the degree possible, have made revisions in the sequence of his operations, within the terms of the Contract Documents, to offset the expected delay. The CONTRACTOR shall notify the OWNER, in writing, concerning the cause of delay, within 15 calendar days of the beginning of such delay. The validity of any claim by the CONTRACTOR to an adjustment in the Contract Time shall be determined by the OWNER, and his findings thereon shall be based on the OWNER's knowledge and observations of the events involved and documentation submitted by the CONTRACTOR, showing all applicable facts relative to the foregoing provisions. Only the physical shortage of raw materials will be considered under these provisions as a cause for adjustment of time and no consideration will be given to any claim that items

could not be obtained at a reasonable, practical, or economical cost or price, unless it is shown to the satisfaction of the OWNER that such items could have been obtained only at exorbitant prices entirely out of line with current rates taking into account the quantities involved and the usual practices in obtaining such quantities.

- C. If the CONTRACTOR is delayed in completion of the WORK by any act of the OWNER not authorized by the Contract Documents, an adjustment in the Contract Time will be made by the OWNER in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER. In the event of such delay, the CONTRACTOR shall notify the OWNER in writing of the causes of delay within 15 calendar days from the beginning of any such delay.

ARTICLE 13 – WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

13.01 WARRANTY, GUARANTEE AND CORRECTION PERIOD

- A. The CONTRACTOR warrants and guarantees to the OWNER and the ENGINEER that all work, equipment, materials and workmanship are in accordance with the Contract Documents and are not defective. Reasonably prompt notice of defects discovered by the OWNER or ENGINEER shall be given to the CONTRACTOR. All defective work, whether or not in place, may be rejected, corrected, or accepted as provided in this Article 13.
- B. If within one (1) year after the date of final completion, as set by the Contractor's Certificate of Final Completion, or a longer period of time prescribed by Laws or Regulations or by the terms of any applicable special guarantee or specific provisions of the Contract Documents, any part of the WORK is found to be defective, the OWNER shall notify the CONTRACTOR in writing and the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with the OWNER's written notification, either correct the defective work, or, if it has been rejected by the OWNER, remove it from the site and replace it with non-defective work. In the event the CONTRACTOR does not promptly comply with the notification, or in an emergency where delay would cause serious risk of loss or damage, the OWNER may have the defective work corrected or rejected work removed and replaced. All direct, indirect, and consequential costs of the removal and replacement including but not limited to fees and charges of engineers, architects, attorneys and other professionals will be paid by the CONTRACTOR. This paragraph shall not be construed to limit nor diminish the CONTRACTOR's absolute guarantee to complete the WORK in accordance with the Contract Documents.

13.02 ACCESS TO WORK

- A. The ENGINEER, other representatives of the OWNER, testing agencies, and governmental agencies with jurisdictional interests shall have access to the work at reasonable times for their observation, inspections, and testing. The CONTRACTOR shall provide proper and safe conditions for their access.

13.03 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall give the OWNER timely notice of readiness of the WORK for all required inspections, tests, or approvals.
- B. If Laws or Regulations of any public body other than the OWNER, with jurisdiction over the WORK require any work to be specifically inspected, tested, or approved, the CONTRACTOR shall pay all costs in connection therewith. The CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with the OWNER's acceptance of a Supplier of materials or equipment proposed as a substitution or "or-equal" to be incorporated in the WORK and of materials or equipment submitted for review prior to the CONTRACTOR's purchase for incorporation in the WORK. The cost of all inspections, tests, and approvals, with the exception of the above which are required by the Contract Documents, shall be paid by the OWNER (unless otherwise specified).
- C. The OWNER will make, or have made, such inspections and tests as the OWNER deems necessary to see that the WORK is being accomplished in accordance with the Contract Documents. The CONTRACTOR, without additional cost to the OWNER, shall provide the labor and equipment necessary to make the WORK available for inspections. Unless otherwise specified in the Supplementary General Conditions, all other costs of inspection and testing will be borne by the OWNER. In the event the inspections or tests reveal non-compliance with the requirements of the Contract Documents, the CONTRACTOR shall bear the cost of corrective measures deemed necessary by the OWNER, as well as the cost of subsequent re-inspection and retesting. Neither observations by the OWNER nor inspections, tests, or approvals by others shall relieve the CONTRACTOR from the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.
- D. All inspections, tests, or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by properly licensed organizations selected by the OWNER.
- E. If any work (including the work of others) that is to be inspected, tested, or approved is covered without the OWNER's written authorization, it must, if requested by the OWNER, be uncovered for testing, inspection, and observation. The uncovering shall be at the CONTRACTOR's expense unless the CONTRACTOR timely notified the OWNER of the CONTRACTOR's intention to cover the same and the OWNER failed to act with reasonable promptness in response to the notice.
- F. If any work is covered contrary to the written request of the OWNER, it must, if requested by the OWNER, be uncovered for the OWNER's observation at the CONTRACTOR's expense.
- G. If the OWNER considers it necessary or advisable that covered work be observed, inspected or tested by the OWNER or others, the OWNER shall direct the CONTRACTOR to uncover, expose, or otherwise make available for observation, inspection, or testing that portion of the work in question. The CONTRACTOR shall comply with the OWNER's direction and furnish all necessary labor, material, and equipment. If the work is

defective, the CONTRACTOR shall bear all direct, indirect and consequential costs of uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction of the work, including, but not limited to, fees and charges for engineers, architects, attorneys, and other professionals. However, if the work is not defective, the CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both. The increase in Contract Time and Contract Price shall be the CONTRACTOR's actual time and costs directly attributable to uncovering and exposing the work. If the parties are unable to agree as to the amount or extent of the changes, the CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

13.04 OWNER MAY STOP THE WORK

- A. If the WORK is defective, or the CONTRACTOR fails to perform work in such a way that the completed WORK will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the WORK, or any portion thereof, until the cause for the order has been eliminated. This right of the OWNER to stop the WORK shall not give rise to any duty on the part of the OWNER to exercise this right for the benefit of the CONTRACTOR or any other party.

13.05 CORRECTION OR REMOVAL OF DEFECTIVE WORK

- A. When directed by the OWNER, the CONTRACTOR shall promptly correct all defective work, whether or not fabricated, installed, or completed, or, if the work has been rejected by the OWNER, remove it from the site and replace it with non-defective work. The CONTRACTOR shall bear all direct, indirect and consequential costs of correction or removal, including but not limited to fees and charges of engineers, architects, attorneys, and other professionals made necessary thereby. If the CONTRACTOR does not correct the defective work within 30 days, the OWNER may correct the WORK and charge the CONTRACTOR for the cost of correcting the defective WORK.

13.06 ACCEPTANCE OF DEFECTIVE WORK

- A. If, instead of requiring correction or removal and replacement of defective work, the OWNER prefers to accept the work, the OWNER may do so. The CONTRACTOR shall bear all direct, indirect, and consequential costs attributable to the OWNER's evaluation of and determination to accept the defective work. If any acceptance of defective work occurs prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the WORK, and the OWNER shall be entitled to an appropriate decrease in the Contract Price.

ARTICLE 14 – PAYMENTS TO CONTRACTOR, LIQUIDATED DAMAGES AND COMPLETION

14.01 LUMP SUM BID

- A. A schedule of values or lump sum price breakdown will serve as the basis for progress payments for a lump sum Bid and will be incorporated into the form of Application for Payment included in the Contract Documents.

14.02 UNIT PRICE BID

- A. Progress payments for a unit price Bid will be based on the number of units completed.

14.03 APPLICATION FOR PROGRESS PAYMENT

- A. Unless otherwise prescribed by the OWNER, on the 25th of each month, the CONTRACTOR shall submit to the OWNER for review and approval, an Application for Payment completed and signed by the CONTRACTOR covering the WORK completed as of the date of the Application and accompanied by such supporting documentation as required by the Contract Documents.
- B. The Application for Payment shall identify, as a sub-total, the amount of the CONTRACTOR's Total Earnings to Date, plus the Net Value of Materials On-site which have not yet been incorporated in the WORK.
- C. The Net Payment Due to the CONTRACTOR shall be the above-mentioned sub-total, from which shall be deducted the retainage amount and the total amount of all previous payments made to the CONTRACTOR.
- D. The OWNER may retain five percent of the amount otherwise due to the Contractor as retainage. Monies retained shall be placed in an interest-bearing account for the benefit of the CONTRACTOR.
- E. Except as otherwise provided in the Supplementary General Conditions, the value of materials stored at the site shall be valued at 95 percent of the value of the materials. This amount shall be based upon the value of all acceptable materials and equipment stored at the site or at another location agreed to in writing by the OWNER; provided, each individual item has a value of more than \$5000 and will become a permanent part of the WORK. The Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that the CONTRACTOR has received the materials and equipment free and clear of all liens, charges, security interests, and encumbrances (which are hereinafter referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the OWNER's interest therein, all of which will be satisfactory to the OWNER.

14.04 CONTRACTOR'S WARRANTY OF TITLE

- A. The CONTRACTOR warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the WORK or not, will pass to the OWNER no later than the time of final payment, free and clear of all liens.

14.05 REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

- A. The OWNER will, within 7 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to the OWNER, or return the Application to the CONTRACTOR indicating in writing the OWNER's reasons for refusing to recommend payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the Application. Thirty days after presentation of the Application for Payment with the OWNER's REPRESENTATIVE recommendation, the amount recommended will (subject to the provisions of Paragraph 14.05B) become due and when due will be paid by the OWNER to the CONTRACTOR.
- B. The OWNER may refuse to make payment of the full amount recommended by the OWNER's REPRESENTATIVE to compensate for claims made by the OWNER on account of the CONTRACTOR's performance of the WORK or other items entitling the OWNER to a credit against the amount recommended, but the OWNER must give the CONTRACTOR written notice within 7 days stating the reasons for such action.

14.06 PARTIAL UTILIZATION

- A. The OWNER may utilize or place into service any item of equipment or other usable portion of the WORK at any time prior to completion of the WORK. The OWNER shall notify the CONTRACTOR in writing of its intent to exercise this right. The notice will identify the equipment or specific portion or portions of the WORK to be utilized or otherwise placed into service.
- B. It shall be understood by the CONTRACTOR that until such written notification is issued, all responsibility for care and maintenance of all items or portions of the WORK to be partially utilized shall be borne by the CONTRACTOR. Upon the issuance of a notice of partial utilization, the OWNER's REPRESENTATIVE will deliver to the OWNER and the CONTRACTOR a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance.
- C. The CONTRACTOR shall retain full responsibility for satisfactory completion of the WORK, regardless of whether a portion thereof has been partially utilized by the OWNER, and the CONTRACTOR's one-year correction period shall commence only after the date of Final Completion for the WORK.

14.07 DAMAGES

- A. The CONTRACTOR shall pay to the OWNER the amount specified in the Supplementary General Conditions, not as a penalty but as liquidated damages, if he fails to complete the WORK or specified parts of the WORK within the Contract Time. The periods for which these damages shall be paid shall be the number of Days from the Contract Time as contained in the Agreement, or from the date of termination of any extension of time approved by the OWNER, to the date or dates on which the OWNER issues the Notice of Substantial Completion as provided in Article 14.08, herein. The OWNER may deduct the amount of said damages from any monies due or to become due the CONTRACTOR. After Substantial Completion, if the CONTRACTOR fails to complete the remaining WORK within 45 days or any proper extension thereof granted by OWNER,

CONTRACTOR shall pay OWNER the amount stated in the Supplementary General Conditions as liquidated damages for each day that expires after the 45 days, until readiness for final payment.

- B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would sustain; and said amount is agreed to be the amount of damages which the OWNER would sustain.
- C. If actual damages are assessed, they will include all costs incurred by the OWNER as a result of a delay in the completion time of the work beyond the contract time.
- D. All times specified in the Contract Documents are hereby declared to be of the essence.

14.08 SUBSTANTIAL COMPLETION

- A. When the CONTRACTOR considers the WORK ready for its intended use, the CONTRACTOR will notify the OWNER in writing that the WORK is Substantially Complete. Within a reasonable time thereafter, the OWNER and the CONTRACTOR, shall make an inspection of the WORK to determine the status of completion. If the OWNER does not consider the WORK Substantially Complete, the OWNER will notify the CONTRACTOR in writing giving the reasons therefor. If the OWNER considers the WORK Substantially Complete, the OWNER will execute the Notice of Substantial Completion signed by the CONTRACTOR, which shall fix the date of Substantial Completion.
- B. The Notice of Substantial Completion shall be a release by the CONTRACTOR of the OWNER and its agents from all claims and liability to the CONTRACTOR for anything done or furnished for, or relating to, the WORK or for any act or neglect of the OWNER or of any person relating to or affecting the WORK, to the date of Substantial Completion, except demands against the OWNER for the remainder of the amounts kept or retained from progress payments and excepting pending, unresolved claims filed in writing prior to the date of Substantial Completion. At the time of delivery of the Notice of Substantial Completion, the OWNER's REPRESENTATIVE will deliver to the OWNER and the CONTRACTOR, if applicable, a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance. Upon the OWNER's acceptance of these recommendations, the recommendation will be binding on the OWNER and the CONTRACTOR until final payment.
- C. The OWNER, upon written notice to the CONTRACTOR, shall have the right to exclude the CONTRACTOR from the WORK after the date of Substantial Completion, and complete all or portions of the WORK at the CONTRACTOR's expense.

14.09 COMPLETION AND FINAL PAYMENT

- A. Upon written certification from the CONTRACTOR that the WORK is complete (if a Notice of Substantial Completion has been issued this certification must occur within 45 days of that date), the OWNER will make a final inspection with the

CONTRACTOR. If the OWNER does not consider the WORK complete, the OWNER will notify the CONTRACTOR in writing of all particulars in which this inspection reveals that the WORK is incomplete or defective. The CONTRACTOR shall immediately take the measures necessary to remedy these deficiencies. If the OWNER considers the WORK complete, the CONTRACTOR may proceed to file its application for final payment pursuant to this Article. At the request of the CONTRACTOR, the OWNER's REPRESENTATIVE may recommend to the OWNER that certain minor deficiencies in the WORK that do not prevent the entire WORK from being used by the OWNER for its intended use, and the completion of which will be unavoidably delayed due to no fault of the CONTRACTOR, be exempted from being completed prerequisite to final payment. These outstanding items of pickup work, or "punch list items", shall be listed on the Notice of Substantial Completion, together with the recommended time limits for their completion, and extended warranty requirements for those items and the value of such items.

- B. After the issuance of the Notice of Completion and after the CONTRACTOR has completed corrections that have not been exempted to the satisfaction of the OWNER and delivered to the OWNER all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, marked-up record documents and other documents, all as required by the Contract Documents; and after the OWNER has indicated that the WORK is acceptable, the CONTRACTOR may make application for final payment following the procedure for progress payments. The final application for payment shall be accompanied by all documentation called for in the Contract Documents and other data and schedules as the OWNER may reasonably require, including an affidavit of the CONTRACTOR that all labor, services, material, equipment and other indebtedness connected with the WORK for which the OWNER or his property might in any way be responsible, have been paid or otherwise satisfied, and a consent of the payment bond surety to final payment, all in forms approved by the OWNER.

14.10 FINAL APPLICATION FOR PAYMENT

- A. If, on the basis of the OWNER's observation of the WORK during construction and final inspection, and the OWNER's review of the final application for payment and accompanying documentation, all as required by the Contract Documents, the OWNER is satisfied that the WORK has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, the OWNER's REPRESENTATIVE will, within ten days after receipt of the final application for payment, indicate in writing his recommendation of payment and present the application to the OWNER for payment. Thereupon, the OWNER's REPRESENTATIVE will give written notice to the OWNER and the CONTRACTOR that the WORK is acceptable by executing the Notice of Completion. Otherwise, the OWNER will return the application to the CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case the CONTRACTOR shall make the necessary corrections and resubmit the application.
- B. Within 45 calendar days after the Notice of Completion, the OWNER will make final payment including all deducted retainage and interest to the CONTRACTOR. The OWNER's remittance of final payment shall be the OWNER's acceptance of the WORK if formal acceptance of the WORK is not indicated otherwise. The final payment shall

be that amount remaining after deducting all prior payments and all amounts to be kept or retained under the provisions of the Contract, including the following items:

1. Liquidated or actual damages, as applicable.
2. Two times the value of any outstanding items of pickup work or "punch list items", indicated on the OWNER's Notice of Completion as being yet uncompleted.

14.11 CONTRACTOR'S CONTINUING OBLIGATIONS

- A. The CONTRACTOR's obligation to perform and complete the WORK in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the OWNER, nor the issuance of a Notice of Substantial Completion or Notice of Completion, nor payment by the OWNER to the CONTRACTOR under the Contract Documents, nor any use or occupancy of the WORK or any part thereof by the OWNER, nor any act of acceptance by the OWNER nor any failure to do so, nor any review of a shop drawing or sample submittal, will constitute an acceptance of work or materials not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

14.12 FINAL PAYMENT TERMINATES LIABILITY OF OWNER

- A. Final payment is defined as the last progress payment made to the CONTRACTOR for earned funds, less deductions listed in Paragraph 14.10B herein. The acceptance by the CONTRACTOR of the final payment referred to in Paragraph 14.10 herein, shall be a release of the OWNER and its agents from all claims of liability to the CONTRACTOR for anything done or furnished for, or relating to, the work or for any act or neglect of the OWNER or of any person relating to or affecting the work, except demands against the OWNER for the remainder, if any, of the amounts kept or retained under the provisions of Paragraph 14.10 herein; and excepting pending, unresolved claims filed prior to the date of the Notice of Substantial Completion.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 SUSPENSION OF WORK BY OWNER

- A. The OWNER may, by written notice to the Contractor, temporarily suspend the WORK, in whole or in part, for a period or periods of time, but not to exceed 90 days, for the convenience and benefit of the OWNER upon the occurrence of any one or more of the following: (1) unsuitable weather; (2) delay in delivery of OWNER- furnished equipment or materials, or such other conditions as are considered unfavorable for prosecution of the work; (3) Shortfall in construction funds; (4) Constraints imposed by public entities, public utilities, property owners or legal proceedings; (5) Failure or delay in acquisition of easements or right-of-way by the OWNER; or (6) Other conditions which, in the opinion of the OWNER, warrant a delay in the WORK. Suspended WORK shall be resumed by the CONTRACTOR within 10 calendar days of receipt from the OWNER of written notice to resume work. Whenever the OWNER

temporarily suspends work for any conditions enumerated in this Article, the CONTRACTOR shall be entitled to an adjustment in the Contract Time as specified in Article 12.03 C.

- B. The suspension of work shall be effective upon receipt by the CONTRACTOR of a written order suspending the work and shall be terminated upon receipt by the Contractor of a written order terminating the suspension.
- C. The CONTRACTOR hereby indemnifies and holds harmless the OWNER, their officers, agents and employees, from and against all claims, damages, losses and expenses, including lost profits and attorney's fees, arising out of or resulting from the temporary suspension of the WORK, whether for the OWNER's convenience described in this Article or for whatever other reasons, including the stoppage of work by the OWNER for the CONTRACTOR's failure to comply with any order issued by the OWNER.

15.02 TERMINATION OF AGREEMENT BY OWNER (CONTRACTOR DEFAULT)

- A. In the event of default by the CONTRACTOR, the OWNER may give written notice to the CONTRACTOR of OWNER's intent to terminate the Agreement. The notice shall state the event of default and the time allowed to remedy the default. It shall be considered a default by the CONTRACTOR whenever the CONTRACTOR shall: (1) declare bankruptcy, become insolvent, or assign its assets for the benefit of its creditors; (2) fail to provide materials or workmanship meeting the requirements of the Contract Documents; (3) disregard or violate provisions of the Contract Documents or OWNER's instructions; (4) fail to prosecute the WORK according to the approved progress schedule; or, (5) fail to provide a qualified superintendent, competent workmen, or materials or equipment meeting the requirements of the Contract Documents. If the CONTRACTOR fails to remedy the conditions constituting default within the time allowed, the OWNER may then issue a Notice of Termination.
- B. In the event the Agreement is terminated in accordance with Paragraph 15.02A, the OWNER may take possession of the WORK and may complete the WORK by whatever method or means the OWNER may select. The cost of completing the WORK shall be deducted from the balance which would have been due the CONTRACTOR had the Agreement not been terminated and the WORK completed in accordance with the Contract Documents. If such cost exceeds the balance which would have been due, the CONTRACTOR shall pay the excess amount to the OWNER. If such cost is less than the balance which would have been due, the CONTRACTOR shall have no claim to the difference.

15.03 TERMINATION OF AGREEMENT BY OWNER (FOR CONVENIENCE)

- A. The OWNER may terminate the Agreement at any time if it is found that reasons beyond the control of either the OWNER or CONTRACTOR make it impossible or against the OWNER's interests to complete the WORK. In such a case, the CONTRACTOR shall have no claims against the OWNER except: (1) for the value of the work, as determined by the OWNER, performed by the Contractor up to the date the Agreement is terminated; and, (2) for the cost of materials and equipment on hand, in transit, or on definite commitment, as of the date the Agreement is terminated, which would be

needed in the WORK and which meet the requirements of the Contract Documents. The value of work performed and the cost of materials and equipment delivered to the site, as mentioned above, shall be determined by the OWNER in accordance with the procedure prescribed from making the final application for payment and final payment under Paragraphs 14.09 and 14.10.

15.04 TERMINATION OF AGREEMENT BY CONTRACTOR

- A. The CONTRACTOR may terminate the Agreement upon 10 days written notice to the OWNER, whenever: (1) the WORK has been suspended under the provisions of Paragraph 15.01, for more than 90 consecutive days through no fault or negligence of the CONTRACTOR, and notice to resume work or to terminate the agreement has not been received from the OWNER within this time period; or, (2) the OWNER should fail to pay the CONTRACTOR any monies due him in accordance with the terms of the Contract Documents and within 60 days after presentation to the OWNER by the CONTRACTOR of a request therefore, unless within said 10-day period the OWNER shall have remedied the condition upon which the payment delay was based. In the event of such termination, the CONTRACTOR shall have no claims against the OWNER except for those claims specifically enumerated in Paragraph 15.03, and as determined in accordance with the requirements of that paragraph.

ARTICLE 16 – NOTICE

16.01 GIVING NOTICE

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

16.02 TITLE TO MATERIALS FOUND ON THE WORK

- A. The OWNER reserves the right to retain title to all soils, stone, sand, gravel, and other materials developed and obtained from excavations and other operations connected with the WORK. Unless otherwise specified in the Contract Documents, neither the CONTRACTOR nor any Subcontractor shall have any right, title, or interest in or to any such materials. The CONTRACTOR will be permitted to use in the WORK, without charge, any such materials which meet the requirements of the Contract Documents.

16.03 RIGHT TO AUDIT

- A. If the CONTRACTOR submits a claim to the OWNER for additional compensation, the OWNER shall have the right, as a condition to considering the claim, and as a basis for evaluation of the claim, and until the claim has been settled, to audit the CONTRACTOR's books. This right shall include the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to discover and verify all direct and indirect costs of whatever nature claimed to have been incurred or anticipated to be incurred and for which the claim has been submitted.

The right to audit shall include the right to inspect the CONTRACTOR's plants, or such parts thereof, as may be or have been engaged in the performance of the WORK. The CONTRACTOR further agrees that the right to audit encompasses all subcontracts and is binding upon subcontractors. The right to examine and inspect herein provided for shall be exercisable through such representatives as the OWNER deems desirable during the CONTRACTOR's normal business hours at the office of the CONTRACTOR. The CONTRACTOR shall make available to the OWNER for auditing, all relevant accounting records and documents, and other financial data, and upon request, shall submit true copies of requested records to the OWNER.

16.04 HAZARDOUS MATERIALS

- A. If the CONTRACTOR during the course of work observes the existence of hazardous material, the CONTRACTOR shall promptly notify the OWNER. The OWNER shall consult with others regarding removal or encapsulation of the hazardous material and the CONTRACTOR shall not perform any work pertinent to the hazardous material prior to receipt or special instruction from the OWNER.

ARTICLE 17 – SUBCONTRACT LIMITATIONS

17.01 SUBCONTRACT LIMITATIONS

- A. In addition to the provisions of Paragraph 6.05 of the General Conditions, the CONTRACTOR shall perform not less than 30 percent of the WORK with its own forces (i.e., without subcontracting). The 30 percent requirement shall be understood to refer to the WORK, the value of which totals not less than 30 percent of the Contract Price.

ARTICLE 18 – PATENTS AND COPYRIGHTS

18.01 PATENTS AND COPYRIGHTS

- A. The CONTRACTOR shall indemnify and save harmless the OWNER, the ENGINEER, and their officers, agents, and employees, against all claims or liability arising from the use of any patented or copyrighted design, device, material, or process by the CONTRACTOR or any of his subcontractors in the performance of the WORK.

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00700 - 40
General Conditions

Solids Holding Tank Refurbishment
South Valley Water Reclamation Facility
WWE Project 22-097

May 18, 2023
Bid Documents

SECTION 00800

SUPPLEMENTARY GENERAL CONDITION

PART 1 – GENERAL

These Supplementary General Conditions make additions, deletions, or revisions to the General Conditions as indicated herein. All provisions which are not so added, deleted, or revised remain in full force and effect. Terms used in these Supplementary General Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

SGC-1 DEFINITIONS

Add the following definitions to Article 1:

OWNER – The OWNER is further defined as South Valley Water Reclamation Facility, 7495 South 1300 West, West Jordan, Utah 84084. Telephone No.: (801) 566-7711.

OWNER'S REPRESENTATIVE – The OWNER'S REPRESENTATIVE is defined in SGC – 9.03 on page 00800-5. The OWNER'S REPRESENTATIVE for this project shall be Taigon Worthen.

BIDDER – The person, firm, or corporation, partnership or joint venture or LLC submitting a Bid for the Work.

CONTRACTOR – The person, firm, or corporation, partnership or joint venture or LLC with whom the OWNER has executed the Agreement.

ENGINEER – Defined as the firm of Water Works Engineers, LLC, located at 1995 W. Grove Parkway Suite 101, Pleasant Grove, UT 84062

SGC-2.02 COPIES OF DOCUMENTS

The OWNER shall furnish to the CONTRACTOR 5 copies of the Contract Documents which may include bound reduced drawings, if any, together with 2 sets of full-scale Drawings if requested. Additional quantities of the Contract Documents will be furnished at reproduction cost plus mailing costs if copies are mailed.

SGC-4.02 REPORTS OF PHYSICAL CONDITIONS

In the preparation of the Contract Documents, the OWNER has relied upon:

- A. The following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground utilities) which are at or contiguous to the site of the WORK.
 - 1. None

- B. Copies of these drawings may be examined at the office of the OWNER, during regular business hours. As provided in Paragraph 4.02 of the General Conditions and as identified and established above, the CONTRACTOR may rely upon the accuracy of the technical data contained in such reports and drawings, except for such physical dimensions that can be field verified; however, the interpretation of such technical data, including any interpolation or extrapolation thereof, and opinions contained in such reports and drawings are not to be relied on by the CONTRACTOR.

SGC-5.01 BONDS

Delete the first sentence of Paragraph 5.1A and add the following:

The CONTRACTOR shall furnish a satisfactory Performance Bond in the amount of 100 percent of the Contract Price and a satisfactory Payment Bond in the amount of 100 percent of the Contract Price as security for the faithful performance and payment of all the CONTRACTOR's obligations under the Contract Documents.

SGC-5.02 INSURANCE

- A. Substitute for Paragraph 5.02.B. the following:

All insurance required by the Contract Documents to be purchased and maintained by the CONTRACTOR shall be obtained from insurance companies that are duly licensed, admitted, and authorized to issue insurance policies for the limits and coverage so required in the State in which the Project is located. Such insurance companies shall have a current Best's Rating of at least an "A" (Excellent) general policy holder's rating and a Class VIII financial size category and shall also meet such additional requirements and qualifications as may be provided in the Supplementary General Conditions.

- B. Add the following to Paragraph 5.02.B.5:

If the OWNER finds it necessary to occupy or use a portion or portions of the project prior to Substantial Completion, the OWNER shall provide notice of occupancy without the need for mutual agreement between the OWNER and the CONTRACTOR and to which the insurance company providing the Builder's Risk Insurance has consented by endorsement to the policy or policies.

- C. The limits of liability for the insurance required by Paragraph 5.2 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations. Limits may be provided by a combination of primary and excess liability policies or through a single policy. If the limits are provided by a combination of primary and excess liability policies, then the excess or umbrella liability coverages shall include commercial general, comprehensive automobile, and employer's liability and shall provide coverage at least as broad as the underlying policies.

1. Workers' Compensation:

- | | | |
|----|-----------------------------------|-------------|
| a. | State: | Statutory |
| b. | Applicable Federal (e.g. USHL&H): | Statutory |
| c. | Employer's Liability: | \$1,000,000 |
2. Comprehensive or Commercial General Liability:
- Combined Single Limit:
- | | | |
|----|---|------------------|
| a. | Premises/operations | |
| | \$ 1,000,000 | Each Occurrence |
| | \$ 2,000,000 | Annual Aggregate |
| b. | Products/completed operations | |
| | \$ 1,000,000 | Each Occurrence |
| | \$ 2,000,000 | Annual Aggregate |
| c. | Personal Injury | |
| | \$ 1,000,000 | Each Occurrence |
| | \$ 2,000,000 | Annual Aggregate |
| d. | Policies shall include premises/operations, products, completed operations, independent contractors, owners' and contractors' protective, explosion, collapse, underground hazards, broad form contractual, personal injury with employment contractual exclusions deleted, and broad form property damage. | |
| e. | If policies are written on a Commercial General Liability form, the General Aggregate shall be at least two times the each occurrence limit or be written on a "per project" basis. | |
| f. | All policies shall be written on an occurrence basis. If the CONTRACTOR would like to substitute any "claims made" liability policies, then these must be pre-approved in writing according to the terms and conditions they may impose. | |
| g. | If policies are written for split limits, limits shall be equal for bodily injury and property damage liability. | |
3. Comprehensive Automobile Liability (including owned, hired, and non-owned vehicles):
- Combined Single Limit:
- | | |
|----|--|
| a. | Bodily Injury and Property Damage: \$2,000,000 each accident |
| b. | If policies are written for split limits, limits shall be equal for bodily |

injury per person, bodily injury per accident and property damage.

4. Excess Liability Insurance:
 - a. \$4,000,000 over all underlying coverage lines
5. Builder's Risk Insurance:
 - a. In an amount equal to the replacement cost of the completed value of the project or \$4,000,000 whichever is greater.
 - b. Any deductibles of self-insured retentions shall be as agreed to by the OWNER and CONTRACTOR.
 - c. The CONTRACTOR shall include flood and earthquake coverage in the Builder's Risk Insurance requirements under Paragraph 5.02.B.5 of the General Conditions, with a minimum limit of \$4,000,000 per event or occurrence.
- D. All policies shall provide that the CONTRACTOR agrees to waive all rights of subrogation against the OWNER, the ENGINEER, and their subconsultants, employees, officers and directors, for WORK performed under the Agreement. Endorsements shall be provided with certificates of insurance.
- E. All policies shall also specify that the insurance provided by the CONTRACTOR will be considered primary and not contributory to another insurance available to the OWNER or ENGINEER.
- F. All policies except Workers' Compensation and Builders Risk shall name the OWNER, including their officers, directors or board members, employees agents or any others associated with the management or operations of South Valley Water Reclamation Facility; Engineer, their consultants, subconsultants, shall be additional insureds on the Auto Liability and Commercial General Liability policies. The Builders Risk insurance shall name the CONTRACTOR, OWNER, and ENGINEER as named insureds and subcontractors and additional insureds. The Workers' Compensation policy shall name the OWNER as additional insured by means of an alternative employer endorsement, with respect to the employer's liability coverage only.
- G. All policies shall provide for 60 days notice prior to any cancellation, reduction in coverage or nonrenewal.
- H. The deductible or self-insured retention on Comprehensive or Commercial General Liability shall not be greater than \$25,000. All deductibles are the responsibility of the CONTRACTOR.

SGC-6.05 SUBCONTRACT LIMITATIONS

Add the following as paragraph 6.05.B of the General Conditions

- B. The CONTRACTOR shall perform not less than 30 percent of the WORK with its own forces (i.e., without subcontracting). The 30 percent requirement shall be understood to refer to the WORK, the value of which totals not less than 30 percent of the Contract Price.

SGC-6.06 PERMITS

- A. The CONTRACTOR shall acquire and comply with the following permits if applicable:
1. State permits to construct and/or operate sources of air pollution.
 2. Certificates and permits are required for sources such as, but not limited to, the following:
 - a. Fuel burning equipment
 - b. Gasoline and petroleum distillate storage containers
 - c. Land disturbing activities
 - d. Processing equipment (sand, gravel, concrete batch plant, etc.)
 - e. Odors.
 3. Permit-Required Confined Space: The workspace in which the WORK is to be performed may contain permit-required confined spaces (permit spaces) as defined in 29 CFR 1910.146. Permit space entry is allowed in such spaces only through compliance with a confined space entry program meeting the requirements of 29 CFR 1910.146.
 4. Encroachment Permit
- B. The CONTRACTOR shall comply with OWNER requirements for a "Hot Work Permit" as described in Section 01520 – Security/Process Safety Management.

SGC-9.03 PROJECT REPRESENTATION

- A. The OWNER's Representative, will act as directed by and under the supervision of the OWNER and will confer with the OWNER regarding its actions. The OWNER's REPRESENTATIVE dealings in matters pertaining to the WORK shall, in general, be only with the OWNER and the CONTRACTOR, and dealings with Subcontractors shall only be through or with the full knowledge of the CONTRACTOR.
- B. The OWNER's REPRESENTATIVE shall have the duties and responsibilities set forth in this paragraph.
1. Review the progress schedule of Shop Drawing submittals and schedule of values prepared by the CONTRACTOR and consult with the ENGINEER concerning their acceptability, as applicable.
 2. Attend preconstruction conferences. Arrange a schedule of progress meetings and other job conferences as required and notify in advance those expected

to attend.
Attend meetings and maintain and circulate copies of minutes thereof.

3. Serve as the OWNER's liaison with the CONTRACTOR, working principally through the CONTRACTOR's superintendent and assist said superintendent in understanding the intent of the Contract Documents.
4. Receive Shop Drawings and samples furnished by the CONTRACTOR.
5. Conduct on-site observations of the WORK in progress to assist the OWNER in determining if the WORK is proceeding in accordance with the Contract Documents.
6. Transmit to the CONTRACTOR the OWNER's or ENGINEER's clarifications and interpretations of the Contract Documents.
7. Consider and evaluate the CONTRACTOR's suggestions for modifications in the Contract Documents and report them with recommendations to the OWNER.
8. Review applications for payment with the CONTRACTOR for compliance with the established procedure for their submittal and forward them with recommendations to the OWNER, noting particularly their relation to the schedule of values, work completed, and materials and equipment delivered at the Site but not incorporated in the WORK.
9. During the course of the WORK, verify that certificates, maintenance and operation manuals, and other data required to be assembled and furnished by the CONTRACTOR are applicable to the items actually installed.
10. Before the OWNER prepares a Notice of Completion, as applicable, submit to the CONTRACTOR a list of observed items requiring completion or correction.
11. Conduct final inspection in the company of the ENGINEER, the OWNER, and the CONTRACTOR, and prepare a punch list of items to be completed or corrected.
12. Verify that all items on the punch list have been completed or corrected and make recommendations concerning acceptance.

SGC-11.03D EQUIPMENT

The CONTRACTOR will be paid for the use of equipment at the rental rate listed for such equipment specified in the current edition of the following reference publication:

- A. "Rental Rate Blue Book for Construction Machinery" as published by the Machinery Information Division of the K-III Directory Corporation, telephone number (800) 669-3282.

SGC-12.02 WEATHER DELAYS

The CONTRACTOR's construction schedule shall anticipate 30 days of delay due to unusually severe weather.

SGC-14.03C AMOUNT OF RETENTION

Add the following to Paragraph 14.03C of the General Conditions:

Unless otherwise prescribed by law, the OWNER may retain a portion of the amount otherwise due to the CONTRACTOR, as follows:

1. Retention of 5 percent of each approved progress payment until the WORK is certified as having reached substantial completion.

SGC-14.03D VALUE OF MATERIALS STORED AT THE SITE

Unless otherwise prescribed by law or prescribed in Assigned Purchase Order Agreements, the value of materials stored at the SVWRF shall be 95 percent of the value of such materials.

SGC-14.05.A REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

Replace the last sentence with the following: "Forty-Five days after presentation of the Application for Payment with the ENGINEER'S recommendation, the amount recommended will (subject to the provisions of Paragraph 14.05B) become due and when due will be paid by the OWNER to the CONTRACTOR."

SGC-14.07.A DAMAGES

The amount of liquidated damages shall be \$500 per calendar day."

-END OF SECTION-

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Supplementary General Conditions

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility
WWE Project 22-097

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Bid Documents

SECTION 00810

SUPPLEMENTARY GENERAL CONDITIONS (UTAH)

SGC-18 UTAH STATE REQUIREMENTS

- A. Retainage of Compensation to CONTRACTOR: Pursuant to Utah Code Ann. 13-8-5, any retainage of CONTRACTOR's compensation hereunder shall be placed in an interest-bearing escrow account and the interest which accrues thereon shall do so for the benefit of CONTRACTOR and Subcontractors. Release of the retainage shall be as contemplated by the General Conditions and Supplementary General Conditions, Article 14 – Payments to Contractor, Liquidated Damages and Completion. Any interest which has accrued on the retainage and which is released to the CONTRACTOR shall be promptly disbursed by CONTRACTOR to itself and/or to Subcontractors on a pro rata basis.
- B. Certification of Change Orders: Pursuant to Utah Code Ann. Section 63G-6-602, no change order shall be authorized without a written certification, signed by an official representative of the OWNER responsible for monitoring and reporting the status of the costs of the total Project or the contract budget, stating that funds are available for the subject change order.
- C. Adjustments in Price: Pursuant to Utah Code Ann. Section 63G-6-601, any adjustment in compensation due CONTRACTOR under this agreement shall be computed in one or more of the following ways:
1. By agreement on a fixed-price adjustment before commencement of the pertinent performance or as soon as practicable;
 2. By unit prices specified in the contract or subsequently agreed upon;
 3. By the costs attributable to the events or situations with adjustment of profit or fee, all as specified in the contract or subsequently agreed upon;
 4. In any other manner as OWNER and CONTRACTOR may mutually agree;
 5. In the absence of agreement between CONTRACTOR and OWNER, by a unilateral determination by OWNER of the costs attributable to the events or situations with adjustment of profit or fee, all as computed by the OWNER in accordance with Utah Code Ann. Section 63G-6-415 and/or the rules and regulations promulgated thereunder.
- D. Cost Principles: CONTRACTOR shall comply in all respects with applicable provisions of Utah Code Ann. Section 63G-6-415, and the rules and regulations promulgated thereunder. To the extent that such provisions are inconsistent with the other terms and conditions of this agreement, the former shall prevail. OWNER may, at reasonable times and places, audit the books and records of CONTRACTOR, any Subcontractor, or any other person who has submitted cost or pricing data pursuant to said section. The books and records of CONTRACTOR

shall be maintained for 3 years following the end of the fiscal year in which final payment is made under the Contract. The books and records of the Subcontractor and all other persons shall be maintained for 3 years following the end of the fiscal year in which final payment is made under the subcontract and/or to the person, unless a shorter period is otherwise authorized in writing.

- E. Project Safety: CONTRACTOR shall comply in all respects with the Utah Occupational Safety and Health Act, Utah Code Ann. Sections 34A-6-101 et seq., and the rules, regulations and standards promulgated thereunder by the Utah State Industrial Commission, as such act, rules, regulations or standards now exist or may be amended during the term of this agreement. Specifically, but not in limitation, CONTRACTOR shall comply with Construction Standards, Rules and Regulations, promulgated by the Utah Occupation and Safety and Health Division, Utah State Industrial Commission.
- F. Protection of Underground Utility Facilities: CONTRACTOR shall comply in all respects with Utah Code Ann. Section 54 Chapter 8a et seq. and the rules and regulations promulgated thereunder, as it now exists or may be amended during the term of this agreement, with regard to the protection of underground utility facilities. Specifically, but not in limitation, CONTRACTOR shall notify the appropriate public utility(s) when making an excavation with power equipment. CONTRACTOR shall further refrain from proceeding with excavation until such time as the appropriate public utility(s) have advised CONTRACTOR of the location of any underground facilities in the area proposed for excavation by marking such facilities with stakes, paint, or other customary way, indicating horizontal location within 24 inches of the outside dimensions of both sides of the underground facility.
- G. Review of Construction by OWNER: OWNER may, at its option, assign a field representative to review the construction of the Project in progress. Said representative will cooperate with the ENGINEER/OWNER in attempting to note deviations from, or necessary adjustments to, the Contract Documents or deficiencies or defects in the construction. Said representative's presence on the Project, however, shall in no way relieve CONTRACTOR of its primary responsibility for construction of the Project in accordance with the Contract Documents.
- H. OWNER Inspection: Pursuant to Utah Code Ann. Section 63G-6-418, OWNER may, at reasonable times, inspect the plant or place of business of the CONTRACTOR or any Subcontractor which is related to the performance of this contract or any subcontract entered into hereunder.
- I. Code Requirements: The provisions of the latest editions of the International Building Code, National Electric Code, and Utah Plumbing Code, as adopted or followed in Utah, including standards adopted in relation thereto, as supplemented or amended, shall apply to the Project except as specific variances may be expressly authorized by the OWNER. If the Contract Documents fail to meet the minimum standards of the referenced codes, CONTRACTOR shall be responsible to bring such information to the attention of the architect/OWNER

associated with the Project. Subcontractors shall also inform CONTRACTOR of any infractions of the above-referenced codes regarding their own particular trades. In the event that workmanship or incidental materials are not specified or indicated, they shall at least conform to the above-referenced codes and shall be incorporated into the Work without any additional cost to the OWNER. If the Contract Documents call for items or workmanship which exceed code requirements, the Contract Documents shall take precedence over such requirements.

- J. Workers Compensation: CONTRACTOR shall comply in all respects with Utah Code Ann. Section 34A-2-101, et seq. and the rules and regulations promulgated thereunder by the Utah State Industrial Commission, as such law, rules or regulations now exist or may be amended during the term of this agreement.
- K. Archaeological, Anthropological, or Paleontological Findings: CONTRACTOR shall comply with Utah Code Ann. Section 9-8-301 et seq., with respect to the discovery of archaeological, anthropological, or paleontological findings at or on the Project site. Specifically, but not in limitation, CONTRACTOR shall promptly notify the Utah Division of State History of any such findings.
- L. Nondiscrimination Equal Employment Opportunity: CONTRACTOR shall comply in all respects with the Utah Anti-Discrimination Act of 1965, Utah Code Ann. Section 34A-5-101 et seq., and the rules and regulations promulgated thereunder by the Utah State Industrial Commission and/or its Anti-Discrimination Division, as such act, rules or regulations now exist or may be amended during the term of this agreement, specifically:
 - 1. CONTRACTOR shall not discriminate against any employee or applicant for employment because of race, color, sex, religion, ancestry or national origin.
 - 2. In all solicitations or advertisements for employees, CONTRACTOR shall state that all qualified applicants shall receive consideration without regard to race, color, sex, religion, ancestry or national origin.
 - 3. CONTRACTOR shall send to each labor union or worker's representative notices to be provided, stating the CONTRACTOR's responsibilities under the statute.
 - 4. CONTRACTOR shall furnish such information or reports as are requested by the Utah State Industrial Commission and/or its Anti-Discrimination Division, for the purpose of determining compliance with the statute.
 - 5. CONTRACTOR shall include the provisions of paragraphs 1 through 4 above in all subcontracts for this Project.
 - 6. Failure of the CONTRACTOR to comply with the statute, the rules and regulations promulgated thereunder, and this provision, shall be deemed a

breach of contract entitling OWNER, in its discretion, to cancel, terminate, or suspend this agreement in whole or in part.

- M. Affirmative Action: CONTRACTOR shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex or national origin. Such action shall include, but shall not be limited to: employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layout or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

At its discretion, OWNER may perform a compliance review at CONTRACTOR's place of business and/or the Project site to verify CONTRACTOR's compliance with this provision. Such compliance verifications may be conducted with such frequency as is needed to assure CONTRACTOR's compliance with this provision.

- N. Citizens Preferred: Pursuant to Utah Code Ann. Section 34-30-1, CONTRACTOR shall give preference in hiring to citizens of the United States or those having declared their intention to become citizens; failure to comply may render this contract null and void at the discretion of OWNER.
- O. Veterans' Preference: Pursuant to Utah Code Ann. Section 71-10-2, CONTRACTOR shall give preference in hiring to honorable discharged veterans who have served in the Armed Forces of the United States during a period of conflict, war, or other national emergencies as defined by Congress, and to any un-remarried surviving spouse of an honorably discharged veteran, if they possess qualifications for that employment and if the honorably discharged veteran is or, if deceased, was a resident of the State of Utah.
- P. Specific OWNER Requirements: CONTRACTOR shall comply with the specific rules and regulations promulgated by OWNER pursuant to authority granted or retained under the Utah Procurement Code, Utah Code Ann. Section 63G-6-101, et seq.

-END OF SECTION-

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The WORK to be performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all WORK, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all WORK, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete, safe and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of the rehabilitation of the "South Valley Water Reclamation Facility – Solids Holding Tank Refurbishment", complete and operational per the Project Drawings and Specifications including:
1. South Valley Water Reclamation Facility operates a Solids Holding Tank (SHT) that collects and stores Thickened WAS from the Dissolved Air Floatation Facility. Retention time for solids is generally 1-4 days.
 2. The SHT is to be refurbished as follows:
 - a. Concrete is to be removed until undamaged concrete is fully exposed.
 - b. Exposed rebar is to be sandblasted to remove all rust and coated with a rust inhibitor that is compatible with the coatings to be installed.
 - c. An elevated slab is to be poured beneath the existing elevated slab as shown in the Drawings to provide structural support for the equipment installed on the existing elevated slab.
 - 1) Existing slab shall be core drilled to allow placement of concrete. Existing elevated slab shall be examined using non-destructive means such as x-rays or ground penetrating radar to locate rebar, conduits, etc. A coring plan shall be submitted for approval prior to beginning core drilling work.
 - 2) Pipes, vents, and hatches installed in the existing elevated slab shall be extended through the new slab using similar materials.
 - 3) The existing Foam mitigation and Wall Wash Spray systems shall be demolished prior to pouring the elevated slab, and reconstructed after the elevated slab is complete in accordance with the Drawings and specifications. Attachments shall be done in accordance with the Drawings, Specifications, and the requirements of the applicable liner manufacturer.

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Summary of Work

Solids Holding Tank Refurbishment

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- d. Walls shall be repaired per the requirements of the Drawings and the Division 03, Concrete Specifications.
- e. Existing pipe penetrations at the top of walls shall be demolished and moved down as shown in the drawings such that they are below the new concrete slab. The influent sludge, overflow, and aeration lines shall be constructed of stainless steel as shown in the Drawings and Section 40 05 10.01, Pipe Schedule.
- f. To mitigate concrete corrosion, a PVC lining system shall be installed on the walls and ceiling of the SHT per the requirements of Section 03 15 03, PVC Liner for Concrete Structures.
- g. To mitigate concrete corrosion, an epoxy coating system shall be applied to the floors of the SHT per the requirements of Section 09 97 23, Coatings for Wastewater Structures.
- h. The existing aeration system shall be demolished and replaced with a new system. All piping, headers and nozzle assemblies shall be constructed of Stainless Steel to prevent corrosion.

1.3 CONTRACT METHOD

- A. The WORK hereunder will be constructed under a single lump sum contract.

1.4 WORK BY OTHERS

- A. There may be two or more contracts being performed at one time on the same Site or adjacent land in such a manner that work under one contract may interfere with work under another. The OWNER will determine the sequence and order of the WORK in either or both contracts. When the Site of one contract is the necessary or convenient means of access for performance of work under another, the OWNER may grant privilege of access or other reasonable privilege to the CONTRACTOR so desiring, to the extent, amount, and in manner and at time that the OWNER may determine. No OWNER determination of method or time or sequence or order of the work or access privilege shall be the basis for a claim for delay or damage except under provisions of the General Conditions for temporary suspensions of the work. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the work of such other contractors, and shall cooperate fully with such contractors to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.

1.5 WORK SEQUENCE AND SCHEDULING CONSTRAINTS

- A. WORK sequence and scheduling constraints are described in Section 01030 – Special Project Constraints.
 - 1. If Schedule A is awarded, the CONTRACTOR may deliver equipment and materials required for that Work as early as possible following the Notice to Proceed.
 - 2. The remainder of the Work, including demolishing shall not proceed beyond the point that it affects operation until all materials are on site.
 - 3. The Work shall be complete by October 31, 2023.

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1.6 CONTRACTOR USE OF PROJECT SITE

- A. The CONTRACTOR's use of the project Site shall be limited to its construction operations, including on-site storage of materials and on-site fabrication facilities. The CONTRACTOR's use of the Facility will be limited by the OWNER. After the preconstruction meeting, the CONTRACTOR shall be expected to submit a "Request for Use of Area Plan For Construction Activities. CONTRACTOR'S use of the site will be limited so as not to interfere with operations of the OWNER.

1.7 OWNER USE OF THE PROJECT SITE

- A. The OWNER may utilize all or part of the existing facilities during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate and coordinate with the OWNER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed safe access to the Site during the period of construction.

1.8 PARTIAL UTILIZATION OF THE WORK BY OWNER (NOT USED.)

1.9 OUTAGE PLAN AND REQUESTS

- A. Outage Plans are discussed in Section 1030 – Special Project Constraints

1.10 PROJECT MEETINGS

- A. Preconstruction Conference
 - 1. Prior to the commencement of WORK at the Site, a preconstruction conference will be held at a mutually agreed time and place. The CONTRACTOR'S Project Manager, its Superintendent, its Safety Representative, and its Subcontractors shall attend the conference as the CONTRACTOR deems appropriate. Other attendees will be:
 - a. ENGINEER;
 - b. Representatives of OWNER;
 - c. Governmental representatives as appropriate;
 - d. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
 - 2. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with Section 01300 – Contractor Submittals.
 - 3. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. However, CONTRACTOR should be prepared to discuss all of the items listed below.
 - a. Status of CONTRACTOR's insurance and bonds.
 - b. CONTRACTOR's tentative schedules.
 - c. Transmittal, review, and distribution of CONTRACTOR's submittals.
 - d. Processing applications for payment.
 - e. Maintaining record documents.
 - f. Critical WORK sequencing.

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Summary of Work

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- g. Field decisions and Change Orders.
 - h. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
 - i. Major equipment deliveries and priorities.
 - j. CONTRACTOR's assignments for safety and first aid.
 - k. Contract authority and channels of communication.
 - l. Utilities required for construction.
 - m. CONTRACTOR's preliminary schedule.
 - n. Establishment of emergency contacts.
- 4. The OWNER will preside at the preconstruction conference and will arrange for keeping and distributing the minutes to all persons in attendance.
 - 5. The CONTRACTOR and its Subcontractors should plan on the conference taking no less than one half working day.

B. Progress Meetings

- 1. The CONTRACTOR shall schedule and hold regular on-site progress meetings at times requested by OWNER or as required by progress of the WORK. The CONTRACTOR, OWNER and all Subcontractors active on the Site must attend each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.
- 2. The OWNER will preside at the progress meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR shall present any issues which may impact its progress with a view to resolving these issues expeditiously.

1.11 SURVEY CONTROL AND REQUIREMENTS (NOT APPLICABLE)

1.12 BUILDING PERMIT (NOT APPLICABLE)

1.13 DEFINITIONS APPLICABLE TO TECHNICAL SPECIFICATIONS

A. The following words shall have the defined meaning in the Technical Portions of the WORK:

Indicated	is a word used to direct the CONTRACTOR to information contained on the Drawings or in the Specifications. Terms such as "shown," "noted," "scheduled," and "specified" also may be used to assist in locating information, but no limitation of location is implied or intended.
Furnish	means to supply and deliver to the site, to unload and unpack ready for assembly, installation, testing, and startup.
Install	defines operations at the site including assembly, erection, placing, anchoring, applying, shaping to dimension, finishing, curing, protecting, and cleaning, ready for the OWNER's use.

Provide	is defined as furnish and install, test, adjust, program, and demonstrate proper operation if required by the specification, ready for the intended use.
Installer	a person or firm engaged by the CONTRACTOR or its subcontract or any subcontractor for the performance of installation, erection, or application work at the site. Installers must be expert in the operations they are engaged to perform.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

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Summary of Work

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 SCOPE

- A. Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies and manufactured articles, and for all labor, operations and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the WORK, all in accordance with the requirements of the Contract Documents, including appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U. S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule(s), and all costs therefore shall be included in the prices named in the Bid Schedule(s) for the various appurtenant items of work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

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SECTION 01030

SPECIAL PROJECT CONSTRAINTS

PART 1 – WORK INVOLVED WITH EXISTING PLANT

1.1 GENERAL

- A. The WORK shall be executed while the existing wastewater treatment plant is in operation. Operation of the existing plant shall not be jeopardized nor shall the efficiency of wastewater treatment be reduced as a result of the execution of the WORK.
- B. Access to the Solids Holding Tank must be accomplished via a 30" manway on the North wall of the tank, or via a 42" x 42" Hatch located in the upper deck at the middle of the tank's East Wall.
- C. To minimize the amount of time the Solids Holding Tank is offline, no WORK may begin until all materials are on site.
- D. The solids processing building, at which the Solids Holding Tank is located, has daily operational and maintenance traffic occurring intermittently 24 hours a day. Access to the facility may not be disrupted.
- E. Critical events in the sequence of construction are described in this Section and shall be utilized by the CONTRACTOR as a guideline. The construction constraints presented are intended to describe the sequence of critical events necessary to minimize disruption to the ongoing treatment plant processes. It shall be understood and agreed by the CONTRACTOR that the critical events described are not all inclusive and that additional items of work not described may be required to minimize disruption and ensure compliance.

1.2 The construction constraints described herein shall be incorporated into the CONTRACTOR's schedule as described in Section 01 32 13 – Progress Schedule.

- A. Operational functions or shutdown of portions of the existing plant required to facilitate CONTRACTOR's operation will be done by the plant personnel only.
- B. The plant operation and maintenance personnel will cooperate in every way that is practical in order to facilitate CONTRACTOR's operation.
- C. If it is necessary for the proper operation or maintenance of portions of the plant, the OWNER may require the CONTRACTOR to reschedule an approved shutdown. The CONTRACTOR shall then reschedule his operations so there shall be no conflict with necessary operations or maintenance of the plant.

1.3 COMPLIANCE WITH UPDES PERMIT

- A. Operations by the CONTRACTOR shall not impair in anyway the OWNER's responsibility to comply with the facility's UPDES permit requirements.

1.4 OUTAGE PLANS

- A. It is the CONTRACTOR's responsibility to coordinate and plan their construction activities in detail and provide such to the OWNER on an as needed or as requested basis by the OWNER or the ENGINEER. Outage plans shall be complete, concise, and provided two week in advance to the OWNER for review.

1.5 SCHEDULE CONSTRAINTS

- A. It is the CONTRACTOR's responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall WORK.

1.6 CONSTRUCTION SEQUENCING

- A. Solids Holding Tank Refurbishment: SVWRF will have the tank isolated and bypassed during the construction period. SVWRF will have sole control of turning on or closing off the thickened WAS feed to the Solids Holding Tank as needed and will apply lock out and tag out locks. CONTRACTOR to verify and apply Lock Out Tag Out locks to all valves on inlets and outlets from the Solids Holding Tank. Work to proceed as outlined in the Summary of Work.

1.7 LIQUIDATED DAMAGES AND INCENTIVES

- A. OWNER and CONTRACTOR recognize that time is of the essence for this Agreement and that the OWNER will suffer financial loss if the WORK is not completed by the listed milestones, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by the OWNER if the WORK is not completed on time. Accordingly, instead of requiring any such proof, the OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), the CONTRACTOR shall pay the OWNER \$500.00 for each calendar day thereafter, until the WORK is ready for use.

1.8 SAFETY PLAN

- A. At the Preconstruction Conference, the CONTRACTOR shall submit a Safety, Health and Environmental Action Plan (SHEAP). SVWRF will review the SHEAP to ensure its compatibility with the safety policies of SVWRF. The CONTRACTOR shall address the topics provided on the SVWRF-SHEAP outline (outline is included in appendix to specifications).
- B. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all health safety and environmental issues for his or her employees, including all aspects of on-site construction, operation and activities associated with the contract.
- C. The CONTRACTOR shall provide the following insurance and safety data, for each of the past three years including the current year to date. See form entitled "Job Related Accident Reports" (form is included in appendix to specification)
- D. The CONTRACTOR shall provide a list of employees including employees of subcontractors that will be coming to the SVWRF. Include names, positions and

length of service. CONTRACTOR agrees to provide valid photo identifications of all employees and employees of subcontractors that will be coming to the SVWRF and further agrees to allow SVWRF to copy said photo IDs for security and safety use at SVWRF.

1.9 GENERAL REQUIREMENTS FOR ALL WORK

- A. During all rehabilitation, modification and demolition work, safe working conditions for the OWNER's and CONTRACTOR's personnel shall be maintained at all times. The foregoing includes, but is not limited to, proper trench excavation, the provision of temporary equipment guards, supports, warning signs, walkways, covers over openings, hand-railing and protection of electrical equipment and power supply. All temporary facilities shall be constructed in accordance with applicable codes and regulations so that they operate safely and properly. Valves to be temporarily shut off during the WORK shall be tagged as such and shall be wired shut with a crimped lead seal and padlocked. Electrical and mechanical equipment shall be similarly shut down.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

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Special Project Constraints

Solids Holding Tank Refurbishment

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SECTION 01070

ABBREVIATIONS OF INSTITUTIONS

PART 1 – GENERAL

1.1 GENERAL

Wherever in the Contract Documents references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the reader, the following acronyms or abbreviations which may appear in the Contract Documents shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association

AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLPCA	California Lathing and Plastering Contractors Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ICEA	Insulated Power Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
ITU	International Telecommunications Union
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration

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Abbreviations of Institutions

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PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industry Association
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

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Abbreviations of Institutions

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SECTION 01090

REFERENCE STANDARDS

PART 1 – GENERAL

1.1 GENERAL

- A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.
- B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.
- C. Specialists, Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with the CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents.
- B. References herein to "Building Code" or "International Building Code" shall mean International Building Code of the International Conference of Building Officials (ICBO). Similarly, references to "Mechanical Code" or "International Mechanical Code," "Plumbing Code" or "International Plumbing Code," "Fire Code" or "International Fire Code," shall mean International Mechanical Code, International Plumbing Code and International Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the

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Reference Standards

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local agency as of the date that the Work is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

- C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or furnishing labor. The CONTRACTOR shall bid for the most stringent requirements.
- D. The CONTRACTOR shall construct the Work indicated herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.
- E. Applicable Standard Specifications: References in the Contract Documents to the "Standard Specifications" shall mean the Uniform Standard Specifications for Public Works Construction Off-Site Improvements, Salt Lake County Area, latest version.
- F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- H. References herein to "UDOT Standards" shall mean Standard Specifications for Road and Bridge Construction.
- I. References herein to "MSHA Standards" shall mean Mine Safety and Health Administration, latest version.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

- A. The CONTRACTOR is responsible that all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.
- B. Where no specific regulations exist, all chemical, hazardous, and petroleum product piping and storage in underground locations must be installed with double containment piping and tanks, or in separate concrete trenches and vaults, or with an approved lining which cannot be penetrated by the chemicals, unless waived in writing by the OWNER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

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Reference Standards

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SECTION 01300
CONTRACTOR SUBMITTALS

PART 1 – GENERAL

1.1 GENERAL

- A. CONTRACTOR "Submittals" may be Shop Drawings, schedules, surveys, reports, samples, plans, lists, drawings, documents, findings, programs, manuals, data, or any other item or information required by the Contract Documents to be submitted or offered by the CONTRACTOR in accomplishing the Work.
- B. Wherever Submittals are required hereunder, all such documents shall be furnished to the OWNER.
- C. The CONTRACTOR shall be responsible for the accuracy, completeness, and coordination of all Submittals. The CONTRACTOR shall not delegate this responsibility in whole or in part to any Subcontractor. Submittals may be prepared by the CONTRACTOR, Subcontractor, or Supplier, but the CONTRACTOR shall ascertain that each Submittal meets the requirements of the Contract and the Project. The CONTRACTOR shall ensure that there is no conflict with other Submittals and shall notify the OWNER in each case where its Submittal may affect the work of another Contractor or the OWNER. The CONTRACTOR shall ensure coordination of Submittals of related crafts and Subcontractors.

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

- A. At the preconstruction conference referred to in Section 01010 - Summary of Work, submit the following items for review:
 - 1. A project overview bar chart in accordance with Section 01 32 13 – Progress Schedule.
 - 2. The names and qualifications of Designated Safety Representative and Designated Competent Persons.
 - 3. At the Preconstruction Conference, the Contractor shall submit a Safety, Health and Environmental Action Plan (SHEAP). SVWRF will review the SHEAP to ensure its compatibility with the safety policies of SVWRF.

1.3 SHOP DRAWINGS

- A. Wherever called for in the Proposal Documents, or where required by the OWNER, the CONTRACTOR shall furnish to the OWNER for review, 5 copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part

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Contractor Submittals

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of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.

- B. Except as may otherwise be indicated herein, the OWNER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 20 working days following their receipt by the OWNER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the OWNER by the second submission of a submittal item. The OWNER reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the OWNER's review beyond the second submittal.
- C. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.
- D. If a submittal is returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.
- E. If a submittal is returned to the CONTRACTOR marked "AMEND-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the OWNER.
- F. If a submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the OWNER.
- G. Fabrication of an item shall be commenced only after the OWNER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Proposal Documents and shall not be taken as the basis for changes to the proposal requirements.
- H. All CONTRACTOR shop drawings submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the OWNER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Proposal Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the OWNER of any CONTRACTOR submittals will be made for any items that have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the OWNER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.
- I. The OWNER's review of CONTRACTOR shop drawings submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.4 OWNER'S MANUAL

- A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. It shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.
- B. The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "Part." "Parts" shall conform to the following (as applicable):

- 1. Part 1 - Equipment Summary:

- a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - b. Form: The OWNER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

- 2. Part 2 - Operational Procedures:

- a. Procedures: CONTRACTOR-recommended procedures on the following shall be included in Part 2:

- Installation
 - Adjustment
 - Startup
 - Location of controls, special tools, equipment required, or related instrumentation needed for operation
 - Operation procedures
 - Load changes
 - Calibration
 - Shutdown
 - Troubleshooting
 - Disassembly
 - Reassembly
 - Realignment
 - Testing to determine performance efficiency
 - Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices
 - List of all electrical relay settings including alarm and contact settings

- 3. Part 3 - Preventive Maintenance Procedures:

- a. Procedures: Preventive maintenance procedures shall include all CONTRACTOR-recommended procedures to be performed on a periodic basis

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is, both by removing and replacing the equipment or component, and by leaving the equipment in place.

- b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

4. Part 4 - Parts List:

- a. Parts List: A complete parts list shall be furnished, including a generic description and CONTRACTOR's and original manufacturer's identification numbers for each part. Addresses and telephone numbers of the nearest CONTRACTOR and parts warehouse shall be included.
- b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

5. Part 5 - Wiring Diagrams:

- a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Part 6 - Shop Drawings:

- a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

7. Part 7 - Safety:

- a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation:

- a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

C. The CONTRACTOR shall furnish to the OWNER 3 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be bound in a ITOYA Spring-Post Binder, 3-post, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder paper capacity shall not exceed 4 inches. Multiple binders may be required to form a set. Binders shall be sized appropriately. A table of contents indicating all equipment in the manuals shall be prepared.

D. OWNER'S MANUALS shall be submitted in final form to the OWNER not later than the date of shipment of equipment. The CONTRACTOR shall correct all discrepancies found by the OWNER in the technical manuals within 30 days from the date of written notification by the OWNER.

- E. Incomplete or unacceptable OWNER'S MANUALS shall constitute sufficient justification to withhold 5-percent of the total price of the equipment due to the CONTRACTOR until the OWNER'S MANUAL is completed.

1.5 SPARE PARTS LIST

- A. The CONTRACTOR shall furnish to the OWNER 3 identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each CONTRACTOR recommends be maintained by the OWNER in inventory at the plant site. Each CONTRACTOR shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Proposal Documents and shall include the original manufacturer. The spare parts lists shall be bound in the OWNER'S MANUAL.

1.6 CONTRACTOR'S SCHEDULE

- A. The CONTRACTOR's construction schedules and reports shall be prepared and submitted to the OWNER in accordance with the provisions of Section 01311 – Scheduling and Reporting.

1.7 WEEKLY FORCE REPORT

- A. The CONTRACTOR and each Subcontractor shall submit to the OWNER, or designee, a weekly force report. Deliver report not later than 9:00 A.M. of the Monday following the report date and include the following:
 - 1. Days of week, date, CONTRACTOR name and Report number.
 - 2. Summary of work in process (segregated by CONTRACTOR and Subcontractor).
 - 3. Details of work accomplished including quantities of work installed.
 - 4. Summary of equipment working and where working.
 - 5. Summary of manpower by work element and Subcontractor.
 - 6. Receipt of major equipment or materials.
 - 7. All required testing performed and, if available, documented results.

1.8 REQUESTS FOR INFORMATION

- A. In the event that the CONTRACTOR, Subcontractor or supplier, at any tier, determines that some portion of the drawings, specifications, or other Contract

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Documents requires clarification or interpretation by the OWNER, the CONTRACTOR shall submit a Request for Information in writing to the OWNER. Requests for Information may only be submitted by the CONTRACTOR and shall only be submitted on the Request for Information form provided by the OWNER. The CONTRACTOR shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the OWNER. In the Request for Information the CONTRACTOR shall set forth their own interpretation or understanding of the requirement along with reasons why they have reached such an understanding.

- B. The OWNER will review all Requests for Information to determine whether they are Requests for Information within the meaning of this term. If the OWNER determines that the document is not a Request for Information it will be returned to the CONTRACTOR, unreviewed as to content, for resubmittal on the proper form and in the proper manner.
- C. Responses from the OWNER will not change any requirement of the Contract Documents unless so noted by the OWNER in the response to the Request for Information. In the event the CONTRACTOR believes that a response to a Request for Information will cause a change to the requirements of the Contract Documents the CONTRACTOR shall immediately give written notice to the OWNER stating that the CONTRACTOR considers the response to be a Change Order. Failure to give such written notice immediately shall waive the CONTRACTOR's right to seek additional time or cost under the Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01301
SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 GENERAL

- A. This Section defines the process whereby the Schedule of Values shall be developed and incorporated into the cost loading function of the CPM Construction Schedule as specified in Section 01311 – CPM Construction Schedule. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.
- B. The Schedule of Values shall be developed independent but simultaneous with the development of the CPM schedule activities and logic.

1.2 PRELIMINARY SCHEDULE OF VALUES

- A. The CONTRACTOR shall submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with Section 01010 – Summary of Work. The Schedule of Values shall be at least as detailed as the bid schedule. Contractor may submit more detail on each line item in the Schedule of Values for consideration by the ENGINEER and OWNER. Payment will only be made for equipment and materials that have arrived on site and are in acceptable condition for install.
- B. The CONTRACTOR and RESIDENT PROJECT REPRESENTATIVE (RPR) shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the RPR, these are necessary to establish fair and reasonable allocation of values for the major WORK components. Front end loading will not be permitted. The RPR may require reallocation of major WORK components from items in the above listing if in the opinion of the RPR such reallocation is necessary. This review and any necessary revisions shall be completed within 15 days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES

- A. The CONTRACTOR shall add the additional items so identified by the RPR within 21 days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major WORK components. Because the ultimate requirement is to develop a detailed Schedule of values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The RPR shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the RPR, a greater number of Schedule of Values items than proposed by the CONTRACTOR is necessary, the CONTRACTOR shall add the additional items so identified by the RPR.

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Schedule of Values

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1. The minimum detail of breakdown of the major WORK components is indicated below. Greater detail shall be provided as directed by the RPR. It is generally intended that a break down for each major facility and/or WORK element be provided per the bid schedule.
 - a. Mobilization – no break down required.
 - b. Demobilization
 - c. Equipment for each line item
 - d. Material for each line item
 - e. Installation for each line item
 - f. Unit Costs for Alternates
2. The CONTRACTOR and RPR shall meet and jointly review the detailed Schedule of Values within 35 days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to allow acceptable cost loading of the CPM Schedule activities. Any adjustment deemed necessary to the value allocation or level of detail shall be made by the CONTRACTOR and a revised detailed Schedule of Values shall be submitted within 40 days from the date of Notice to Proceed.
3. Following acceptance of the detailed Schedule of Values, the CONTRACTOR shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the CONTRACTOR shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS REFERENCE LISTING

- A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the CONTRACTOR shall provide a Cross Reference Listing which shall be furnished in two parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for the valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

- B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Section 01311 – Scheduling and Reporting.
- C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.5 CHANGES TO SCHEDULE OF VALUES

- A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the RPR. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the RPR.
- B. In the event that the CONTRACTOR and RPR agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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Schedule of Values

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SECTION 01311

PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRE-CONSTRUCTION CONFERENCE

- A. Upon receipt of the Notice to Proceed, or at an earlier time if mutually agreeable, the ENGINEER will arrange a preconstruction conference to be attended by the CONTRACTOR's superintendent or other project representative authorized to commit on the behalf of the CONTRACTOR and to direct the performance of the work by others, the OWNER, the ENGINEER or ENGINEER's representative, and representatives of utilities, major subcontractors, and others involved in the execution of the work.
- B. The purpose of this conference will be to establish a working relationship and understanding between the parties and to discuss subjects as may be pertinent for the execution of the work.
- C. CONTRACTOR shall be prepared to discuss the following subjects, as a minimum:
 - 1. Required schedules.
 - 2. Status of Bonds and insurance.
 - 3. Sequencing of critical path work items.
 - 4. Progress payment procedures.
 - 5. Project changes and clarification procedures.
 - 6. Use of site, access, office and storage areas, security and temporary facilities.
 - 7. Major product delivery and priorities.
 - 8. CONTRACTOR's safety plan and representative.

1.2 PROGRESS MEETINGS

- A. The ENGINEER will arrange and conduct progress meetings. The ENGINEER will prepare and circulate a draft agenda of each meeting. The CONTRACTOR may add items as appropriate to the draft agenda.
- B. Progress meetings will be conducted on a regular basis, at such frequency as the OWNER and CONTRACTOR may mutually agree. Progress meetings shall be attended by the ENGINEER, OWNER Operations personnel, CONTRACTOR's superintendent or other project representative, and representatives of all subcontractors involved in the work at the time of the meeting, required by the CONTRACTOR, or requested by the OWNER.
- C. The purpose of the meetings will be to facilitate the work of the CONTRACTOR and any subcontractor or other organization that is not up to schedule, resolve conflicts, identify and resolve any potential delays or necessary changes in the work and in general, coordinate and facilitate the execution of the work.
- D. The agenda of progress meetings shall include review of work progress, the latest Construction Schedule submittal (monthly), potential project delays, the status of key shop drawings, submittal reviews, information requests, safety concerns, record drawings, and extra work items.

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Project Meetings

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1.3 CONSTRUCTION SCHEDULE REVIEW

- A. The Construction Schedule will be reviewed monthly during an agreed upon progress meeting to verify at a minimum:
 - 1. Actual start and finish dates of completed activities since the last progress meeting.
 - 2. Durations and progress of all activities not completed.
 - 3. Critical submittals/materials delivery problems.
 - 4. Potential project delays.
 - 5. Any activity behind schedule and CONTRACTOR's plan to bring it back on schedule.
 - 6. Reason, logic, time, and cost data for Change Order work that is to be incorporated into the Construction Schedule or payment request form.
 - 7. Payment due to the CONTRACTOR based on percentage complete of items in the submittal payment request form.
- B. At the progress meeting, the CONTRACTOR shall provide an update of the Construction Schedule as described in Section 01321, Progress Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01321

PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work specified in this Section includes the CONTRACTOR's preparation, submittal, maintenance and use of a computerized Critical Path Method (CPM) Construction Schedule to plan and monitor construction progress for the project.
- B. The computerized CPM schedule shall be completed using Microsoft Project for Windows or another software package acceptable to the ENGINEER.
- C. The requirements specified under Section 01300, Contractor Submittals, also apply to the Construction Schedule initial submittal(s) and subsequent updates and revisions.

1.2 PREPARATION AND SUBMITTAL PROCEDURE

- A. Schedule Preparation and Submittal:
 - 1. The CONTRACTOR's on-site construction supervisor (superintendent, project manager, etc.) shall be directly involved in preparation of the Construction Schedule.
 - 2. The Construction Schedule shall be completed and submitted to the ENGINEER within 30 days after Notice to Proceed.
 - a. By preparing and submitting the Construction Schedule the CONTRACTOR represents that the CONTRACTOR can and intends to execute the work and portions thereof within the specified times and constraints and that the CONTRACTOR's bid covers the costs associated with the execution of work in accordance with the Construction Schedule.
 - 3. At the time of submittal of the Construction Schedule, CONTRACTOR's on-site construction supervisor shall review the schedule with ENGINEER's construction project representative.
 - 4. If the initial Construction Schedule submittal is not acceptable to the ENGINEER, it shall be revised in coordination with observations and comments from the ENGINEER and resubmitted within 7 days of the return of the schedule to the CONTRACTOR.

1.3 CONSTRUCTION SCHEDULE CONTENT

- A. The Construction Schedule shall be calendar-based, time-scaled, and show the durations of and relationships between the various work activities.
- B. Work activities shall be selected which reflect actual work to be performed for this specific project. No generic work activities shall be allowed.
 - 1. Work activities shall include non-construction activities such as submittal preparation and review, manufacturing, equipment delivery, mobilization, preparation of Contract Record Drawings, etc. for a complete picture of the CONTRACTOR's plan for project execution.
 - 2. Information on each activity shall include:

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Project Schedule

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- a. Concise description of the activity.
 - b. Duration in working days.
 - c. The dates for the beginning and completion of each activity.
 - d. The relationship of each activity to other activities.
 - 3. No work activity shall be longer than 10 working days.
 - a. Work tasks which will take longer than 10 working days shall be broken down into several work activities which are no longer than 10 working days.
 - b. Each work activity must be defined clearly and measurable. For example, a series of work activities such as "Building 1, east wall piping; Building 1, west wall piping; Building 1, north and south wall piping", each with a duration less than 10 days would be acceptable. A series of work activities all labeled "Building 1 Piping", even if each had a duration less than 10 days, would not be acceptable because the tasks are not defined clearly or measurable.
 - 4. Provide a monthly activity for preparation of Contract Record Drawings, in accordance with Section 01300, Contractor Submittals, with a minimum monthly cost of \$2,500.
- C. The schedule shall be referenced to calendar dates, and the beginning of the contract time shall be the date of receipt of the Notice to Proceed.
- D. Failure to include an activity required for the execution of the work shall not excuse the CONTRACTOR from completing the work and portions thereof within the specified times and at the price specified in the Agreement, and from meeting the constraints specified for sequence of work and control dates.

1.4 UPDATING THE CONSTRUCTION SCHEDULE

- A. The CONTRACTOR shall review and discuss the project progress relative to the most up to date Construction Schedule (updated monthly) at the weekly progress meetings, as specified in Section 01311, Project Meetings.
- B. The schedule update shall reflect progress to date. The schedule update shall incorporate all revisions to logic and duration.

1.5 ADJUSTMENT OF THE CONTRACT TIME AND CHANGE ORDERS

- A. Adjustments of the contract time due to delays, additional work, or any other cause will only be issued through a contract change order in accordance with the General Conditions.
 - 1. The CONTRACTOR shall include, as part of each change order proposal for which the CONTRACTOR is requesting an adjustment in the contract duration, a proposed revised Construction Schedule.
 - 2. The proposed revised Construction Schedule shall be compared to the most recent Construction Schedule to assess overall schedule impact.
 - 3. If a Change Order is issued by the OWNER, the CONTRACTOR shall incorporate the Change Order into the Construction Schedule.

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Project Schedule

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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Project Schedule

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Project Schedule

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SECTION 01 45 03

QUALITY CONTROL

PART 1 - GENERAL

1.1 OBSERVATION AND SUPERVISION

- A. The ENGINEER or ENGINEER's appointed representative will review the Work and the CONTRACTOR shall provide facilities and access to the Work at all times as required to facilitate this review.
- B. Responsibility:
 - 1. The CONTRACTOR shall be solely responsible to supervise and direct the entire Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to complete the Work in accordance with the Contract Documents.
 - 2. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, quality control, and procedures of construction and safety precautions and programs incidental thereto.
 - 3. The foregoing includes work performed by the CONTRACTOR's Subcontractors.
 - 4. The CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.
- C. Superintendent:
 - 1. The CONTRACTOR shall designate in writing and keep on the work site at all times during its progress a technically qualified, English-speaking superintendent, who shall not be replaced without written acceptance of the ENGINEER.
 - 2. The superintendent shall be the CONTRACTOR's representative at the job site and shall have authority to act on behalf of the CONTRACTOR.
 - 3. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.
 - 4. The CONTRACTOR's superintendent shall be present at the site of the Work at all times while work is in progress. Failure to observe this requirement shall be considered as suspension of the Work by the CONTRACTOR until such time as such superintendent is again present at the site.

1.2 RESPONSIBILITY

- A. The CONTRACTOR is responsible for conducting all testing and inspection specifically required by the Specifications and otherwise necessary to ensure compliance with the Contract Documents.
 - 1. Approval of Testing Laboratories:
 - a. All laboratory work under this contract shall be performed by a laboratory approved by the ENGINEER, whether the laboratory is employed by the CONTRACTOR, or is owned and operated by the CONTRACTOR.
 - b. The basis of approval includes the following:
 - 1) Testing laboratories performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E 329 and ASTM D 3666, respectively.

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- 2) Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and non-destructive testing shall comply with ASTM E 548.
- B. The ENGINEER may conduct periodic independent testing and inspection to verify compliance with the Contract Documents.
- C. Retesting:
 1. The OWNER reserves the right to back-charge the CONTRACTOR for retesting of deficient or defective work or products upon written notification.
 2. Compensation for retesting on behalf of the OWNER will be made through deductions from the Progress Payments.
- D. The CONTRACTOR is responsible for correcting all defective work discovered prior to final acceptance of the Contract, despite the failure of the Inspector(s) to discover it.

1.3 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall be responsible for scheduling all inspections and tests required.
 1. The ENGINEER shall be given a minimum 48 business hours notice prior to any inspections or tests.
- B. The CONTRACTOR shall pay for all tests including, but not limited to:
 1. Inspections and tests necessary to comply with laws, ordinances, rules, regulations and orders of public authorities pursuant to General Conditions.
 2. Mix designs, including tests of trial batches, on concrete mixes.
 3. Tests of materials, inspections, and certifications required by the Specifications.
 4. Testing, adjusting, and balancing of equipment and systems required by the Specifications.
 5. One tension and elongation test for each 5 tons of steel or fractional part thereof for each size will be required, unless the steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports. Commercial stock may be used, subject to approval of the ENGINEER.
 6. Any testing performed by the CONTRACTOR for their own quality control (e.g., compaction tests).
 7. Retests or re-inspections by the OWNER, if required, and tests or inspections required due to CONTRACTOR error or lack of required identifications of material.
 8. Any and all water used by the CONTRACTOR in any testing.
- C. Two copies of the agency or laboratory report of each test or inspection shall be provided to the ENGINEER. All tests of materials shall be made in accordance with the commonly recognized standards of national technical organizations, and such other special methods and tests as are prescribed in the Contract Documents.
- D. Purchase Orders:
 1. One copy of each of the CONTRACTOR's purchase orders for materials forming a portion of the work shall be furnished to the ENGINEER, if requested.
 2. Each such purchase order shall contain a statement that the materials included in the order are subject to inspection by the OWNER.
 3. Materials purchased locally will be inspected at the point of manufacture or supply, and materials supplied from points more than 50 miles from the job site will be

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inspected upon arrival at the job, except when other inspection requirements are provided for specific materials in other Sections of this Specification.

E. Samples:

1. The CONTRACTOR shall furnish samples of materials as are required by the ENGINEER, without charge.
2. No material shall be used until the ENGINEER has had the opportunity to test or examine such materials.
3. Samples will be secured and tested whenever necessary to determine the quality of the material.
4. Samples and test specimens prepared at the job site, such as concrete test cylinders, shall be taken or prepared by the ENGINEER in the presence and with the assistance of the CONTRACTOR.

1.4 AUTHORITY AND DUTIES OF INSPECTOR

- A. Inspectors employed by the OWNER shall be authorized to inspect all work done and materials and equipment furnished to complement the CONTRACTOR furnished independent inspector.
1. Such inspection may extend to all or any part of the work, and to the preparation, fabrication, or manufacture of the materials and equipment to be used.
 2. The Inspector will not alter or waive the provisions of the Contract Documents.
 3. The Inspector will keep the ENGINEER informed as to the progress of the work and the manner in which it is being done.
 4. The Inspector will call the CONTRACTOR's attention to nonconformance with the Contract Documents that the Inspector may have observed.
 5. The Inspector will not be responsible for the adequacy or correctness of the CONTRACTOR's means, methods, techniques, sequences, or procedures for construction.
 6. The Inspector will not approve or accept any portion of the work, issue instructions contrary to the Contract Documents, or act as foreman for the CONTRACTOR.
 7. The Inspector may reject defective materials, equipment, or work when it is not in compliance with the Contract Documents.
 8. The Inspector will not be responsible for:
 - a. The CONTRACTOR's quality control program.
 - b. The CONTRACTOR's safety program.
 - c. Coordinating the work or activities of the CONTRACTOR or their Subcontractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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Quality Control

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SECTION 01505

MOBILIZATION

PART 1 – GENERAL

1.1 GENERAL

- A. Mobilization shall include the obtaining of all permits; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; implementing security requirements; all as required for the proper performance and completion of the WORK. Mobilization shall include the following principal items.
1. Providing all required insurance certificates and bonds.
 2. Moving on to the site, or portion of site as available, of all the CONTRACTOR's plant and equipment required for first month operations including office and storage trailers.
 3. Providing on-site sanitary facilities and potable water facilities.
 4. Constructing and implementing security features and requirements complying with Section 01520 – Security and Process Safety Management.
 5. Obtaining all required permits.
 6. Posting all OSHA required notices and establishment of safety programs.
 7. Submitting initial submittals.

1.2 PAYMENT FOR MOBILIZATION

- A. The CONTRACTOR shall include mobilization as an item on the Schedule of Values (Lump Sum Price breakdown). No payment for mobilization, or any part thereof, will be made until all mobilization items listed above have been completed as specified.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

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Mobilization

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SECTION 01510
TEMPORARY UTILITIES

PART 1 – GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide temporary utilities as required to provide the Work and perform the services, complete, in accordance with the Contract Documents.
- B. Types: The types of utility services required for general temporary use at the project site include the following:

- Water service (potable for certain uses)
 - Storm sewer
 - Sanitary sewer
 - Electric power service

1.2 JOB CONDITIONS

- A. Scheduled Uses: In conjunction with establishment of the job progress schedule, establish a schedule for implementation and termination of service for each temporary utility or facility; at earliest feasible time, and when acceptable to OWNER, change over from use of temporary utility service to permanent service.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. The CONTRACTOR shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where a portion of temporary utility is provided by a utility company, the CONTRACTOR shall provide the remaining portion with matching and compatible materials and equipment and shall comply with recommendations of utility company.

PART 3 – EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

- A. General: Wherever feasible, engage the utility company to install temporary service to project, or as a minimum, to make connection to existing utility service; locate services where they will not interfere with total project construction Work, including installation of permanent utility services; and maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate total project construction Work.

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Temporary Utilities

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- B. Approval of Electrical Connections: All temporary connections for electricity shall be subject to approval of the ENGINEER and the power company representative, and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the Work.
- C. Separation of Circuits: Unless otherwise permitted by the ENGINEER, circuits separate from lighting circuits shall be used for all power purposes.
- D. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

3.2 INSTALLATION OF POWER DISTRIBUTION SYSTEM

- A. Power: Provide all necessary power required for its operations under the Contract, and provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.
- B. Temporary Power Distribution: Provide a weatherproof, grounded, temporary power distribution system sufficient to accommodate performance of entire Work of project, including temporary electrical heating where indicated, operation of test equipment and test operation of building equipment and systems which cannot be delayed until permanent power connections are operable, temporary operation of other temporary facilities, including permanent equipment and systems which must be placed in operation prior to use of permanent power connections (pumps, HVAC equipment, elevators, and similar equipment), and power for temporary operation of existing facilities (if any) at the site during change-over to new permanent power system. Provide circuits of adequate size and proper power characteristics for each use; run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations, and result in least interference with performance of the Work; provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks, or other recognized exposures to damage or abuse. All temporary construction power wiring shall be on a Ground Fault Installation System.

3.3 INSTALLATION OF LIGHTING

- A. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper Work and to afford adequate facilities for inspection and safe working conditions.
- B. Temporary Lighting: The CONTRACTOR shall provide a general, weatherproof, grounded temporary lighting system in every area of construction work, as soon as overhead floor/roof deck structure has been installed; and provide sufficient illumination for safe work and traffic conditions; and run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible

damage from construction operations on grade, floors, decks, or other recognized areas of possible damage or abuse.

3.4 WATER SUPPLY

- A. The CONTRACTOR shall connect to the potable water pipe located at the southwest corner of Blower Building No. 3 for water of a quality suitable for domestic service. A valve or corp stop shall be provided to isolate the CONTRACTOR'S water system. The CONTRACTOR shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from use of the same, including discharge or waste of water therefrom. The cost for domestic water will be paid by the OWNER.
- B. Water Connections: The CONTRACTOR shall not make connection to or draw water from any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use of said fire hydrant or pipeline and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.

3.5 INSTALLATION OF SANITARY FACILITIES

- A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever needed for the use of CONTRACTOR's employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.
- B. Sanitary and Other Organic Wastes: The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the Site in a manner satisfactory to the ENGINEER and in accordance with all laws and regulations pertaining thereto.

3.6 INSTALLATION OF GAS SERVICE

- A. Gas service: If the CONTRACTOR requires natural gas at its construction trailers, gas may be obtained from the pipe located at the southwest corner of Blower Building No. 3. Installation costs are the responsibility of the CONTRACTOR. Installation shall conform to the requirements of the natural gas supplier.

3.7 INSTALLATION OF COMMUNICATIONS

- A. Telephone Services: The CONTRACTOR shall provide and maintain at all times during the progress of the WORK not less than one telephone and one fax machine in good working order at its own field construction office at or near the Site. Each such telephone and fax machine shall have a separate connection to an established exchange for toll service.

- B. Telephone Use: The CONTRACTOR shall permit the ENGINEER, the OWNER, or their authorized representatives or employees free and unlimited use of said telephone facilities for all calls that do not involve published toll charges. Calls originated by the ENGINEER, the OWNER, their authorized representatives or employees which involve toll or message unit charges shall be billed to the OWNER by the CONTRACTOR at the rates charged by the telephone company.

3.8 OPERATIONS AND TERMINATIONS

- A. Inspections: Prior to placing temporary utility services into use, the CONTRACTOR shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.
- B. Protection: The CONTRACTOR shall maintain distinct markers for underground lines, and protect from damage during excavating operations.
- C. Termination and Removal: When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the CONTRACTOR shall promptly remove installation unless requested by ENGINEER to retain it for a longer period. The CONTRACTOR shall complete and restore WORK which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.
- D. Removal of Utility Connections: Before final acceptance of the WORK on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to original condition or better, to the satisfaction of the RPR and to the agency owning the affected utility.

END OF SECTION

SECTION 01520

SECURITY AND PROCESS SAFETY MANAGEMENT

PART 1 – GENERAL

1.1 SECURITY PROGRAM

A. The CONTRACTOR shall:

1. Protect WORK, existing premises and OWNER's operations from theft, vandalism, and unauthorized entry.
2. Maintain program throughout construction period.
3. Require that the workers employed by the CONTRACTOR, his Subcontractors and his Vendors shall obey all Rules and Ordinances enacted by the SVWRF regarding the existence of firearms on SVWRF property. The CONTRACTOR shall immediately suspend any such worker who disobeys said Rules and Ordinances and remove such worker from the SVWRF property.

1.2 ENTRY CONTROL

A. The CONTRACTOR shall:

1. Limit entry of persons and vehicles into project site.
2. Allow entry only to authorized persons.
3. Require that all personal vehicles of the workers employed by the CONTRACTOR, his Subcontractors and his Vendors shall park their cars outside of the SVWRF property enclosed by SVWRF gates and fencing. At his option, the CONTRACTOR may construct a temporary parking facility on the OWNER'S property southwest of the main SVWRF entry gate to be used by the workers.
4. Entry to the SVWRF facility by the workers of the CONTRACTOR, his Subcontractors and his Vendors may be by walking through the front gate or by official shuttle bus operated by the CONTRACTOR.

B. OWNER will control entrance of persons and vehicles related to OWNER's operations.

C. The CONTRACTOR's and all Subcontractor's personnel shall report at the Lower Maintenance Building at the start and the end of the work day. Each person shall sign the daily roll log and indicate the time of sign-in and sign-out. The RPR will copy the daily roll log and submit to the OWNER's designated person to monitor for Process Safety Management purposes.

1.3 PERSONNEL IDENTIFICATION

A. The CONTRACTOR shall:

1. Maintain a list of authorized persons and submit copy to OWNER on request.
2. Require that an identifying badge shall be worn by each of the workers of the CONTRACTOR, his subcontractors and Vendors on the front of their construction hard hats. Further, the CONTRACTOR shall collect the Driver's License of each worker as he first comes on-site and submit them to the RPR. The RPR will oversee the production of the badges and will return the Driver's Licenses with Badges to the CONTRACTOR's Project Superintendent.

1.4 PROCESS SAFETY MANAGEMENT PLAN

- A. The CONTRACTOR shall conform to the OWNER's Process Safety Management Plan which is available for review from the Owner's designated Safety officer.
- B. Hot Work Permit. The CONTRACTOR's personnel shall obtain a Hot Work Permit when conducting work on any existing electrical equipment. Hot Work permits shall be completed daily by each employee and counter-signed by the OWNER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.1 GENERAL

- A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation.

1.2 RIGHTS-OF-WAY

- A. The CONTRACTOR shall not do any WORK that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electrical transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified that the OWNER has secured authority therefore from the proper party.
- B. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin WORK, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.
- C. Some of the SVWRF facilities are located on Rocky Mountain Power (RMP) Rights-of-Way as shown on the Drawings. SVWRF has permanent easements to install remove, repair or replace sewer pipelines and other facilities on these easements. Copies of the easements and conditions for their use may be examined at the office of the SVWRF during regular business hours. The CONTRACTOR shall comply with the conditions of each easement. The CONTRACTOR shall maintain the minimum clearance mandated by RMP or 6-feet, whichever is greater, between the lowest conductor on the RMP power lines and maximum vertical reach of the equipment booms operated by the CONTRACTOR.
- D. When two or more contracts are being executed at one time of the same or adjacent land in such manner the WORK on one contract may interfere with that on another, the OWNER shall determine the sequence and order of the WORK. When the territory of one contract is necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the OWNER to CONTRACTOR so desiring, to the extent, amount, in the manner, and at the times permitted, No such decision as to the method or time of conducting the WORK or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the WORK in Article o the General Conditions of the Contract.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by the CONTRACTOR shall be accurately restored after street or roadway resurfacing has been complete.

1.4 RESTORATION OF PAVEMENT

- A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements which are subject to partial removal shall be neatly saw cut in straight lines.
- B. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.
- C. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, the CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition until the final restoration thereof has been made.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

- A. General: The CONTRACTOR shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the utilities are indicated on the Drawings. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
- B. Except where the Drawings indicate utilities have been field located during design or certain utility locations shall be exposed as part of the WORK, the CONTRACTOR shall be responsible for exploratory excavations as it deems

necessary to determine the exact locations and depths of utilities which may interfere with its work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's progress. When such exploratory excavations show the utility location as shown on the Drawings to be in error, the CONTRACTOR shall so notify the RESIDENT PROJECT REPRESENTATIVE (RPR).

- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.
- D. Utilities to be Moved: In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the CONTRACTOR, be notified by the OWNER to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the RPR a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- E. Utilities to be Removed: Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which I indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the RPR and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal. Permanent relocation of any utility shall be noted on the CONTRACTOR's record drawings.
- F. OWNER's Right of Access: The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.
- G. Underground utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and if damaged, shall be immediately repaired or replaced by the CONTRACTOR, unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, the CONTRACTOR shall reimburse said owner for the costs of repair.
- H. Underground Utilities Not Indicated: In the event that the CONTRACTOR damages existing utility lines that are not indicated or the locations of which are not made know to the CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to the RPR and a written report thereof

shall be made promptly thereafter. The RPR will immediately notify the owner of the damaged utility. If the RPR is not immediately available, the CONTRACTOR shall notify the utility owner of the damage. If directed by the RPR, repairs shall be made by the CONTRACTOR under the provisions for changes and extra work contained in the General Conditions.

- I. Costs of locating and repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the WORK which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such work will be paid for as extra work in accordance with the provisions of Articles, 10, 11, and 12 of the General Conditions.
- J. Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.
- K. Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the RPR are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or it not discovered until after completion of the backfilling.

1.6 TREES OR SHURBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

- A. General: Except where trees or shrubs are indicated to be removed, the CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or the OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.
- B. Trimming: Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive,

and elastic, and free from kerosenes, coal tar, creosote, or other materials injurious to the life of the tree.

- C. Replacement: The CONTRACTOR shall immediately notify the jurisdictional agency and/or the OWNER if any tree or shrub is damaged by the CONTRACTOR's operations. If, in the opinion of said agency or the OWNER, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, the CONTRACTOR shall pay to the owner of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height. Planting of replacement trees and shrubs shall be in accordance with the recommendations of the nursery furnishing the plants. Unless otherwise indicated, the CONTRACTOR shall water and maintain the replacements trees and shrubs for 6 months after planting.

1.7 LAWN AREAS

- A. Lawn or landscaped areas and irrigation systems damaged during construction shall be repaired to match the pre-construction condition to the satisfaction of the OWNER. The damaged lawn shall be replaced with sod on top of an adequate layer of topsoil. Damaged sprinkler heads shall be replaced with identical heads. Installation details for sprinkler system and sprinkler heads shall match existing.

1.8 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire. The CONTRACTOR shall notify RMP three days prior to mobilizing any machinery or equipment within reach of any overhead power lines and shall comply with RMP requirements regarding the operation of such machinery or equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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Protection of Existing Facilities

Solids Holding Tank Refurbishment

South Valley Water Reclamation Facility

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Protection of Existing Facilities

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SECTION 01550

SITE ACCESS AND STORAGE

PART 1 – GENERAL

1.1 HIGHWAY LIMITATIONS

- A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK. It shall be the CONTRACTOR's responsibility to construct and maintain any haul roads required for its construction operations.

1.2 TEMPORARY CROSSINGS

- A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants and parking lots. The CONTRACTOR shall cooperate with parties involved in removal of trash, garbage and screenings so as to maintain existing schedules for such services.
- B. Temporary Bridges: Wherever necessary, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation.
- C. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. Where excavation is being performed in streets, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

- A. The OWNER will designate and arrange for the CONTRACTOR's use, a portion of the property near to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations relative to this Contract. Security at the CONTRACTOR's work and storage area is the responsibility of the CONTRACTOR. At completion of WORK, the CONTRACTOR shall return this area to its original condition, including grading and landscaping.
- B. The CONTRACTOR shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the WORK.

- C. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.
1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.
 2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.
 3. The CONTRACTOR shall develop and submit to the RPR a plan for storing and disposing of the materials above.
 4. The CONTRACTOR shall obtain and submit to the RPR a single EPA number for wastes generated at the Site.
 5. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials.
 6. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

1.4 PARKING

A. The CONTRACTOR shall:

1. Park official company vehicles and equipment in areas as directed by the RPR.
2. Traffic and parking areas shall be maintained in a sound condition, free of excavated materials, construction equipment, mud, and construction materials. The CONTRACTOR shall repair breaks, potholes, low areas which collect standing water, and other deficiencies.
3. See Section 01520 – Security and Process Safety Management for parking of personal vehicles.

1.5 VEHICLE CLEANING

- A. All vehicles leaving the site shall be cleaned to prevent the carrying of mud, gravel or other debris onto the Plant access road system or 1300 West Street. CONTRACTOR

shall install and maintain a "Contractor's Entrance" per City of West Jordan Standard 5105.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

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Site Access and Storage

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SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.1 EXPLOSIVES AND BLASTING

- A. Use of explosives on the work is not permitted.

1.2 DUST ABATEMENT

- A. The CONTRACTOR shall prevent its operation from producing dust in amounts damaging to property, cultivated vegetation or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for any damage resulting from dust originating from its operations. The dust abatement measures shall be continued throughout all phases of construction, including suspension of work, until final acceptance. The CONTRACTOR shall abate dust nuisance by cleaning, sweeping and sprinkling with water, or other means necessary. Use of water resulting in mud on access areas used by the public or OWNER will not be permitted as a substitute for sweeping or other methods.

1.3 RUBBISH CONTROL

- A. During progress of the WORK, the CONTRACTOR shall keep the Site and other areas used by it in a neat and clean condition, free from accumulation of rubbish. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the Site, and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.4 CHEMICALS

- A. All chemicals used during project construction or furnished for project operations, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or other classification shall show approval of either the USEPA or the USDA. Use of such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer(s). In addition, see the requirements set forth in the General Conditions.

1.5 AIR POLLUTION CONTROL

- A. The CONTRACTOR shall not discharge smoke, dust or any other air contaminants into the atmosphere in such quantity as may violate the regulations of any legally constituted authority having jurisdiction.

1.6 WATER POLLUTION CONTROL

- A. The CONTRACTOR shall exercise every reasonable precaution to protect plant facilities, drainage channels and storm facilities from pollution. It shall avoid muddying and silting of said channels. Water pollution control work shall consist of constructing those facilities which may be required to provide prevention, control and abatement of water pollution.
- B. SVWRF Storm Water Pollution Prevention Plan Requirements for Contractors – South Valley WRF has an active Storm Water Discharge Permit. CONTRACTORS working at either of our facilities are required to take actions to minimize the potential of storm water contamination that come from their work activities. At our main facility, precipitation that falls on paved or packed dirt parking areas is collected and discharged directly into the Jordan River. Currently, the storm water receives no additional treatment, which requires SVWRF to be proactive in controlling potential pollution sources on site. As part of the SVWRF Storm Water Pollution Prevention Plan, CONTRACTORS are required under our Good Housekeeping Policy to take the necessary actions to minimize potential negative impacts on storm water. Following are some of situations and the expected actions to be taken by the CONTRACTOR to control possible storm water contamination. This is not meant to be a comprehensive list, but only a few examples of situations that might develop during construction. Included are the corrective actions required by SVWRF if a spill or leak occurs. Any spills or leaks on the construction site **must be reported immediately** to the Resident Project Representative, who in turn will report to the SVWRF Storm Water Pollution Prevention Plan Coordinator, Lee Rawlings, and/or the Safety Coordinator, Chuck McStotts.

Item	Pollution Source	Required Action
Road and Parking Areas	Dirt, gravel, sand, etc., tracked onto roads by CONTRACTOR's equipment.	Remove immediately. Ongoing hauling /excavation may require scheduled hourly cleaning.
CONTRACTOR Equipment	Leaking oil, hydraulic fluid, antifreeze, routine maintenance, etc.	Contain the spill immediately to minimize contamination. Clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Vehicle Fueling Area	Fuel spilled	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Chemicals and Other Hazardous Materials	Outside storage	Must be kept completely covered. Hazardous materials must be removed from site ASAP after using it for its intended purpose.

	Spills and leaks	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Above Ground Storage Tanks	Leakage and/or spills	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Ground Water	Pumping to clear an excavation	Control measures must be in place to minimize silt, gravel, etc., from entering the storm water collection system. Only discharge of uncontaminated ground water is allowed by the SVWRF permit. Additional testing may be required before pumping begins.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

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Temporary Environmental Controls

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SECTION 01600

PRODUCTS, MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DEFINITIONS

- A. The word "Products," as used herein, is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the WORK.

1.2 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible for each unit of work, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

- A. The CONTRACTOR shall deliver and store the WORK in accordance with methods and means that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the CONTRACTOR'S facility and the OWNER'S site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times.

1.4 TRANSPORTATION AND HANDLING

- A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition.

- B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment, by methods to prevent soiling and damage while the equipment is in the CONTRACTOR'S control.
- C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
- D. The CONTRACTOR shall be responsible to deliver the equipment to the job site. The CONTRACTOR will also be responsible for unloading, storing, protecting and installing the equipment at the job site. The CONTRACTOR shall notify the OWNER (14) calendar days prior to delivery of equipment.

1.5 STORAGE AND PROTECTION PRIOR TO SHIPMENT

- A. Products shall be stored in accordance with component manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.
- B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.
- C. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.
- D. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF STORAGE

- A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.
- B. The CONTRACTOR shall maintain manufacturer-required environmental conditions continually.
- C. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.
- D. For mechanical and electrical components, the CONTRACTOR shall provide a copy of the component manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.
- E. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to acceptance by the OWNER in accordance with the Proposal Documents.

PART 2 - PRODUCTS (NOT USED)

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Products, Materials, and Equipment

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PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

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Products, Materials, and Equipment

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Products, Materials, and Equipment

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SECTION 01640

DEMOLITION AND RECONSTRUCTION

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall demolish and reconstruct existing civil, landscaping, structural, architectural, and mechanical, HVAC, electrical, and instrumentation facilities as indicated, in accordance with the Contract Documents.

1.2 COORDINATION

- A. The CONTRACTOR shall carefully coordinate the work in areas where existing facilities are interconnected with new facilities. Existing facilities shall remain operational during all phases of demolition and construction. The CONTRACTOR shall schedule all demolition and reconstruction to minimize equipment 'down-time'. If necessary, the CONTRACTOR shall provide a sufficient number of temporary lights to maintain a well-lighted and safe environment.
- B. The WORK indicated in the Contract Documents is not all inclusive and the CONTRACTOR shall be responsible to perform the reconstruction indicated plus that which can be reasonably inferred from the Contract Documents as necessary to complete the Project. The Specifications and Drawings identify the major facilities that shall be demolished and reconstructed, but auxiliary utilities such as water, air, chemicals, drainage, lubrication, fluid power, electrical wiring, controls, and instrumentation are not necessarily shown. The CONTRACTOR shall comply with sequencing requirements in Section 01030 – Special Project Constraints.
- C. The CONTRACTOR shall note that the Drawings used to indicate demolition and reconstruction are based on record drawings of the existing facilities, which have been reproduced to show existing conditions and to clarify the scope of work as much as possible. Prior to bidding, the CONTRACTOR shall conduct a comprehensive survey at the Site to verify the correctness and exactness of the Drawings, the scope of work, and the extent of auxiliary utilities. A complete set of record drawings is available for review at the South Valley Water Reclamation Facility (SVWRF) during regular business hours.
- D. While demolition and reconstruction are being performed the CONTRACTOR shall provide adequate access for the continued operation and maintenance of equipment and treatment processes. The CONTRACTOR shall erect and maintain fences, warning signs, barricades, and other devices around the reconstruction as required for the protection of the CONTRACTOR's employees and the OWNER's personnel at

the plant. The CONTRACTOR shall remove all such protection when reconstruction activities are complete, or as work progresses, or when directed by the OWNER.

E. Coordination with ENGINEER:

1. Only materials specified herein, shown on the Demolition Photographs or the Drawings, or approved by ENGINEER in the field shall be demolished, salvaged, removed, relocated, or abandoned.
2. Verify materials scheduled to be demolished, salvaged, removed, relocated, or abandoned with ENGINEER prior to performing Work.
3. Do not remove materials without prior approval of ENGINEER.
4. Provide at least 3 working days' notice to ENGINEER prior to start of Work.
5. Notify ENGINEER to turn off affected services or facilities before starting Work.
6. Provide temporary services during interruptions to affected services or facilities as acceptable to ENGINEER.
7. ENGINEER will indicate limits of Work if not clearly shown.

F. Coordination with OWNER:

1. Notify OWNER to turn off affected services or facilities before starting Work. Submit request to OWNER one week in advance of desired start date for shutdown of OWNER's facilities. Request to include identification of all items to be shutdown.
2. After review and acceptance of shutdown plan by ENGINEER and OWNER, provide not less than 72 hours notice to OWNER prior to shutdown, unless otherwise agreed upon. Confirm shutdown with OWNER 24 hours in advance of the day and time of the approved shutdown.
3. Provide temporary services during interruptions to affected services or facilities as acceptable to OWNER.

1.3 SUBMITTALS

A. ACTION SUBMITTALS:

1. Product Information: Grout, sealants, and bonding agents to be used for patching.
2. Core drilling plan, including results from non-destructive examination of existing suspended showing the location of rebar, conduits and other embedments, and proposed core drilling plan to avoid the same.
3. Shutdown and Outage request plan.

B. INFORMATIONAL SUBMITTALS:

1. Plan and schedule phased demolition, including limits of demolition, as part of and consistent with the Progress Schedule.
2. Methods of demolition and equipment proposed to demolish materials.
3. Copies of any authorizations and permits required to perform Work.
4. Copies of Hazardous Materials Inspection Reports.
5. Repair procedures for demolition of materials beyond limits shown on Drawings.

1.4 CUTTING, DRILLING, & CORE-DRILLING

- A. Perform cutting operations in a manner that will not damage or weaken structures or the Work.
- B. CONTRACTOR shall layout locations of cuts, core-drills, and other drilling and shall notify OWNER for inspection prior to beginning Work. Non-destructive examination such as x-rays, ground penetrating radar, or other means and methods shall be used to determine the location of reinforcing steel, electrical conduits, etc. CONTRACTOR shall submit a coring plan showing the location of proposed coring such that cutting or damage reinforcing steel, electrical conduits, etc. are avoided.
- C. Patched concrete and asphalt surfaces will be keyed into remaining Work.
- D. Interior concrete removal will be accomplished in a manner to minimize the spread of dust, i.e. wet cutting, vacuum at point of dust creation, work area enclosed. Remove all cuttings from Owner's property and legally dispose of cuttings and other debris resulting from these operations.
- E. Do not allow dust and dirt to accumulate in work areas. Clean up at end of each shift and leave areas free from accumulation of materials and equipment so no interference results to plant operations.

1.5 REHABILITATION

- A. Damage to existing civil, landscaping, structural, architectural, mechanical, HVAC electrical, and instrumentation work due to reconstruction activities shall be repaired and rehabilitated.
- B. Damaged items shall be repaired or replaced with new items to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage.
- C. In all demolition where electrical installation exists, remove the wiring and conduit back to the respective panel or remaining connection point. Where conduit can

continue in service, remove old conductors back to the panel and run new conductors. Keep track of remaining circuits by labeling, coding, etc.

1.6 DISPOSAL

- A. The CONTRACTOR shall be responsible for the offsite disposal of debris resulting from demolition and reconstruction in compliance with local, state, and federal codes and requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings are based on available information. The Work may differ slightly from what is shown. CONTRACTOR shall be responsible for determining the work required by inspecting the site.

3.2 SAFETY REQUIREMENTS

- A. All Work shall be done in conformance with all applicable rules and regulations pertaining to safety.
- B. Hazardous Materials:
 - 1. See General Conditions.
 - 2. Existing facilities, or portions thereof, to be demolished may contain hazardous materials such as asbestos cement piping, residual chemicals in existing or abandoned piping, lead-based paint, mercury seals, or other unknown hazardous materials.

3.3 SEQUENCE

- A. The CONTRACTOR will be responsible for the sequence of Work.
- B. Conform to constraints as specified in Section 01130, SPECIAL PROJECT CONSTRAINTS as applicable.

3.4 LIMITS

- A. Drawings define minimum portions of materials to be demolished. Unless otherwise shown, rough cuts or breaks may be made to limits of demolition shown. If rough cuts or breaks are made exceeding limits shown, CONTRACTOR shall repair the cuts or breaks back to the dimensions shown on Drawings at CONTRACTOR's expense.

- B. If limits are not clear on the Drawings or Demolition Photographs, limits shall be as directed by ENGINEER.
- C. All areas not within the limits of demolition Work shown on the Drawings, or as specified herein, shall be left undisturbed, unless necessary for demolition of materials.

3.5 DEMOLITION

A. General:

1. Inspect condition of materials to be demolished prior to bidding to assess potential for salvage value.
2. Remove all materials associated with existing equipment that is to be demolished.
3. Materials within limits of demolition will become the property of CONTRACTOR.
4. All materials from the demolition process shall be removed safely from the project site as soon as possible. They shall be disposed of in accordance with applicable federal, state, and city regulations. CONTRACTOR is responsible for determining these regulations and shall bear all costs associated with disposal of the materials.

B. Concrete, CMU, and Reinforcing:

1. In areas where concrete or CMU portions are to be removed from a structure, the edge of removal shall be cut with a concrete saw to leave a perpendicular edge or by core-drilling where a circular hole is required.
2. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
3. Depth of removal shall be as determined by ENGINEER unless otherwise shown or specified.
4. Reinforcing shall be cut and removed unless otherwise shown or instructed by ENGINEER.
5. Spalled edges may be required to be resawn at the discretion of the ENGINEER.
6. Protect adjacent structures and equipment from damage during Work.
7. Exposed surfaces following demolition activities shall be repaired and finished to provide a uniform, smooth, and level transition between adjacent surfaces.
8. Remove and repair designated cracked and damaged concrete areas shown in accordance with this section and Section 0330003 30 03, CAST-IN-PLACE CONCRETECast-in Place Concrete.

C. Concrete Embedded Items:

1. Except for core drills, demolish anchor bolts, reinforcing steel, conduit, and other materials that are concrete embedded to a minimum of 1 inch below final finished

surface. For core drills, see note for exposed reinforcement in the drawings. coat rebar exposed by core drilling in accordance with Section 09900, PAINTING.09 91 03, Painting.

2. Plug empty pipes and conduits with fireproof sealant to maintain fire ratings for floors or walls.
3. Patching:
 - a. Demolish damaged concrete. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
 - b. Coat with approved bonding agent.
 - c. Patch with nonshrink, nonmetallic grout.

D. Piping:

1. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
2. Gravity Services: Install concrete plugs, 5 foot minimum length.

E. Utilities:

1. Support or relocate utility lines exposed by Work.

F. Electrical:

1. Remove conduits and wiring from materials to be demolished back to nearest junction box.
2. For existing circuits to remain operational, intercept existing conduit at the most convenient location, or as shown, and splice and extend conduit to new location. Install new conductors as required to accomplish intended results. New conductors shall be continuous without splices between junction boxes.
3. For existing circuits no longer needed, demolish conductors from conduits.
4. Demolish all surface-mounted conduit which is no longer needed.
5. For conduit below grade or concealed within walls, cap and abandon in place.

3.6 REPAIR AND REPLACEMENT

- A. Any damaged materials scheduled to be salvaged or relocated shall be repaired by the CONTRACTOR to the satisfaction of ENGINEER or replaced at the CONTRACTOR's expense.
- B. Any damage to areas not within the limits of demolition Work shown on the Demolition Photographs, Drawings, or as specified herein shall be repaired or replaced to original precontract conditions at the CONTRACTOR's sole expense.

3.7 DISPOSAL

- A. Dispose of materials offsite in licensed landfills and in accordance with all local, state, and federal regulations. CONTRACTOR is responsible for obtaining any and all necessary permits for disposal.

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Demolition and Reconstruction

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SECTION 01642

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SECTION REQUIREMENTS

- A. Unless otherwise indicated, demolished materials become CONTRACTOR's property and are to be removed from the project site at the CONTRACTOR's expense.
- B. Items indicated to be removed and salvaged remain OWNER's property. Remove, clean, and deliver to OWNER's designated storage area.
- C. Comply with EPA regulations and disposal regulations of authorities having jurisdiction.
- D. Conduct demolition without disrupting OWNER's use of the facility.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 DEMOLITION

- A. Maintain and protect existing utilities to remain in service before proceeding with demolition, providing bypass connections as necessary to maintain service.
- B. Locate, identify, shut off, disconnect, and cap off utility services to be demolished.
- C. Conduct demolition operations and remove debris to prevent injury to people and damage to adjacent buildings and site improvements.
- D. Provide and maintain shoring, bracing, or structural support to preserve building stability and prevent movement, settlement, or collapse.
- E. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
- F. Promptly patch and repair holes and damaged surfaces of building caused by demolition. Restore exposed finishes of patched areas and extend finish restoration into remaining adjoining construction.
- G. Promptly remove demolished materials from OWNER's property and legally dispose of them. Do not burn demolished materials.

++ END OF SECTION ++

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Selective Demolition

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Selective Demolition

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SECTION 01700
PROJECT CLOSEOUT

PART 1 – GENERAL

1.1 FINAL CLEANUP

- A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, construction equipment, and temporary facilities used during construction. Final acceptance of the WORK by the OWNER will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

1.2 CLOSEOUT TIMETABLE

- A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the OWNER, the ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.3 TECHNICAL MANUAL SUBMITTAL

- A. No portion of the project will be accepted for partial utilization until approved Technical Manual(s) for each piece of mechanical equipment within that portion is submitted.
- C. Approved Technical Manuals shall be submitted prior to shipment of individual pieces of equipment. Money claimed by the CONTRACTOR for stored materials related to the receipt of equipment will be withheld until approved Technical Manuals are submitted.

1.4 FINAL SUBMITTALS

- A. The CONTRACTOR, prior to requesting final payment, obtain and submit the following items to the ENGINEER for transmittal to the OWNER:
1. Written guarantees, where required.
 2. Technical Manuals and Instructions.
 3. Maintenance stock items; spare parts; special tools.
 4. Completed record drawings.
 5. Release from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of the law.

1.5 MAINTENANCE AND GUARANTEE

- A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the General Conditions.
- B. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the OWNER. If the CONTRACTOR fails to make such repairs or replacements promptly, the OWNER reserves the right to do the Work and the CONTRACTOR and his surety shall be liable to the OWNER for the cost thereof.

1.6 BONDS

- A. The CONTRACTOR shall provide bonds as required by the General Conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01740

CLEANING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers the work necessary for cleaning during construction and final cleaning on completion of the Work.

1.2 GENERAL

- A. At all times maintain areas covered by the Contract and public properties free from accumulations of waste, debris, and rubbish caused by construction operations.
- B. Pollution Control:
 - 1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 2. Do not burn or bury rubbish and waste materials on project site.
 - 3. Volatile wastes shall be properly stored in covered metal containers and removed daily.
 - 4. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 5. Do not dispose of wastes into streams or waterways.
- C. Construction materials such as concrete forms and scaffolding shall be neatly stacked by the CONTRACTOR when not in use. The CONTRACTOR shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
- D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- E. Use cleaning materials only on surfaces recommended by cleaning material manufacturers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEANING DURING CONSTRUCTION

- A. During execution of Work, clean site and public properties and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

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- C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. Empty containers within one day after they are full.
- D. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed and semi-exposed surfaces.
- E. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.
- F. Vacuum clean all interior spaces, including inside cabinets. Broom clean paved surfaces, rake clean other surfaces of grounds.
- G. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- H. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- I. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

3.2 FINAL CLEANING

- A. Refer to the requirements of the General Conditions, Section 00700 in addition to the requirements of this Section.
- B. See Section 01770, Project Closeout, for additional requirements.
- C. At the completion of Work on all Contracts and immediately prior to final inspection, cleaning of the entire Project will be accomplished according to the following provisions:
 - 1. The CONTRACTOR shall thoroughly clean, sweep, wash, and polish all work and equipment, including finishes. The cleaning shall leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.
 - 2. Should the CONTRACTOR not remove rubbish or debris or not clean the building and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
 - 3. Employ professional cleaners for final cleaning.
 - 4. In preparation for substantial completion of occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
 - 5. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
 - 6. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.
 - 7. Broom clean paved surfaces; rake clean other surfaces of grounds.
 - 8. Replace air-handling filters if units were operated during construction.
 - 9. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.
 - 10. Clean luminaires in accordance with manufacturer's recommendations. Clean all light fixtures.

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11. Remove from the OWNER's property all temporary structures and all materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work.

++ END OF SECTION ++

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SECTION 01750

TESTING, TRAINING AND STARTUP

PART 1 - GENERAL

1.1 GENERAL

- A. Scope:
 - 1. This Section covers general equipment and system testing and startup requirements, services of the manufacturer's representatives and special coordinating services required of the CONTRACTOR that shall apply during construction and training of the OWNER's personnel for facilities operation.
 - 2. Specific testing and tracking procedures and requirements found in the Technical Specifications shall also apply.
- B. The CONTRACTOR shall inform all Subcontractors and manufacturers of the requirements herein and include the required services in its costs for the work specified in these Contract Documents. Where a minimum amount of time is stated in the Technical Specifications for manufacturers' services, any additional time required to perform the specified services shall be provided at no additional cost to the OWNER.
- C. Scheduling:
 - 1. Equipment testing and plant startup are requisite to satisfactory completion of the Contract and, therefore, shall be completed within the contract time.
 - 2. All equipment testing and plant startup activities shall be realistically allowed for and shown on the CONTRACTOR's Construction Schedule, in accordance with Section 01321, Progress Schedule.
 - 3. All equipment testing and plant startup activities shall be scheduled in conformance with the restrictions specified in Section 01030, Special Project Constraints.
- D. Equipment testing shall be satisfactorily completed prior to commencing plant startup associated with the particular equipment item or equipment package. The equipment shall not be considered ready for testing until the following conditions are satisfied:
 - 1. Manufacturer's certification of equipment installation has been accepted by the ENGINEER.
 - 2. Electrical and/or instrumentation Subcontractor certification of motor control logic has been accepted by the ENGINEER.
 - 3. Related Technical Submittals, O&M Manual and Final Shop Drawings have been accepted by the ENGINEER.
 - 4. Operator training services have been furnished by the CONTRACTOR (operational testing only).
 - 5. Testing procedures have been submitted in writing and accepted by the ENGINEER in accordance with Section 01300, Contractor Submittals. All testing procedures and results shall be submitted in writing.
- E. Startup Plan:
 - 1. Prior to completion of work, CONTRACTOR shall submit to the ENGINEER for review, a detailed Startup Plan for the associated items of equipment and/or systems.
 - 2. The Startup Plan shall include:

- a. A detailed sub-network of the CONTRACTOR's Construction Progress Schedule including the following activities:
 - 1) Manufacturer's Services;
 - 2) Installation Certifications;
 - 3) Operator Training;
 - 4) O&M Manual;
 - 5) Functional Testing;
 - 6) Performance Testing;
 - 7) Operational Testing;
 - 8) All other activities necessary to affect a coordinated and successful Testing, Training and Startup.
- b. Written testing plan with proposed data logs for each item of equipment to be tested.
- c. A discussion of any coordination required with the OWNER's staff and/or any system or equipment outage requirements.
- d. The Plan shall be updated and/or revised as necessary prior to subsequent Construction Progress Meetings.
- e. Testing shall not be scheduled earlier than 30 days after approval of the Plan.

1.2 SERVICES DURING CONSTRUCTION

A. General:

1. Manufacturer's Representative:

- a. The CONTRACTOR shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract, for as many days as may be necessary for assembly, installation, testing assistance and operator training.
- b. Manufacturer's field representatives shall observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, or perform an installation check, as required.
- c. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until operator training is complete and testing and startup problems have been resolved to the satisfaction of the ENGINEER.
- d. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than 24 inches in size, and any other items of equipment specifically exempted by the ENGINEER in writing), whether or not specifically set forth in the Technical Specifications.
- e. The CONTRACTOR shall maintain a service record on each item of equipment and shall deliver these service records to the ENGINEER prior to acceptance of operational testing.

B. Fulfillment of Specified Minimum Services:

1. The CONTRACTOR shall obtain prior written approval from the ENGINEER for providing manufacturers' services.
2. All requests to the ENGINEER for prior approval shall (1) be in writing, (2) be submitted not less than 10 calendar days prior to the providing of the subject services, (3) state the service to be provided, and (4) state the reason(s) why the timing of the service is appropriate.

3. Request made to the ENGINEER less than 10 calendar days prior to the manufacturers' services may not receive consideration and response prior to the times the services are provided.
 4. Visits of manufacturers and their representatives to the jobsite or training classroom without prior approval as provided herein may not act to fulfill the specified minimum man-day requirements.
- C. Certificate of Proper Installation:
1. Equipment requiring factory tests shall not be delivered to the jobsite until the CONTRACTOR submits acceptable certified test results to the ENGINEER.
 2. Equipment shall not be considered ready for functional testing until after the following certifications have been submitted and accepted by the ENGINEER.
 - a. Manufacturer Representatives:
 - 1) The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written and signed report addressed to the OWNER certifying that the equipment has been properly installed, adjusted, lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated satisfactorily under full-load conditions and is ready for full-time operation.
 - 2) For pumps, compressors, blowers, engines, motors, and other rotating or reciprocating equipment, the report shall certify that the equipment operates within the manufacturer's allowable limits for vibration.
 - 3) The report shall also certify that all controls, protective devices, instrumentation, and control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated; and that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 4) The CONTRACTOR shall also sign said certification.
 - 5) The CONTRACTOR shall submit "Manufacturer's Certification of Proper Installation" on the OWNER form.

1.3 STARTUP AND TESTING

- A. General:
1. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful project startup.
 2. The ENGINEER shall not be responsible to instruct the CONTRACTOR in the startup of the project, however, the ENGINEER will be available prior to and during startup to provide operational and technical support to the CONTRACTOR.
 3. The CONTRACTOR shall furnish all labor, consumables (power, water, chemicals, air, etc.) tools, equipment, instruments, and services required and incidental to completing all functional, performance and operational testing of installed equipment.
 4. The CONTRACTOR shall submit the proposed test procedures to the ENGINEER for review at least 30 days prior to testing.
 5. The CONTRACTOR shall give the ENGINEER written notice confirming the date of testing at least five working days before the time the equipment is scheduled to be tested.
 6. All testing shall be witnessed by the ENGINEER to be considered valid.
 7. Test Reports:
 - a. CONTRACTOR shall submit written detailed results of all functional, performance and operational testing.

- b. Upon successful completion of Operational testing all equipment installation, testing and maintenance records shall be submitted to the ENGINEER.
 - c. Said records shall be bound separately for each piece of equipment or system and shall be collected by type of record.
 - 8. For factory tests, written test results shall be submitted to the ENGINEER at least 10 days prior to shipment.
- B. Functional testing:
- 1. All items of mechanical and electrical equipment shall be functionally tested by the CONTRACTOR after installation for proper operation.
 - 2. A minimum of ten (10) days prior to the start of functional testing, the CONTRACTOR shall submit interconnection diagrams for the equipment and for the alarms, controls and instruments associated with the equipment. This requirement shall not relieve the CONTRACTOR of meeting any requirements in the technical specifications for earlier submittal of the interconnection diagrams.
 - 3. Minimum Test Requirements
 - a. The functional test of each piece of mechanical equipment shall continue for not less than eight (8) continuous hours without interruption.
 - b. The functional test shall include checking for proper rotation, alignment, speed, flows, pressure, vibration, sound level, etc. Initial equipment and system adjustment and calibrations shall be performed in the presence of and with the assistance of the manufacturer's representative.
 - c. The functional test shall include a demonstration of the proper performance of all alarms, local and remote controls, instrumentation, equipment functions, and all other electrical, mechanical and piping systems.
 - d. All parts shall operate satisfactorily in all respects, under continuous full load, and in accordance with the specified requirements, for the full duration of the eight-hour test period.
 - e. If any part of a unit shows evidence of unsatisfactory or improper operation during the eight-hour test period, correction or repairs shall be made and the full eight-hour test operation, as specified herein, shall be repeated after all parts operate satisfactorily.
- C. Performance testing:
- 1. Where performance testing is required by the Technical Specifications, the testing shall be supervised by the manufacturer's representative. These services shall continue until such times as the applicable equipment or system has been successfully tested for performance and has been accepted by the ENGINEER for operational testing.
 - 2. Performance testing shall take place after functional testing is successfully completed in accordance with Paragraph 1.3 B.
 - 3. Performance testing shall demonstrate that the equipment meets all performance requirements specified.
- D. Startup/operational testing:
- 1. Upon successful completion of operator training and the functional, performance and leakage testing, the CONTRACTOR shall startup the plant facilities and test the equipment operation and performance by conducting a seven (7) day, continuous operational test of the completed facilities as an operational process unit to demonstrate to the ENGINEER's satisfaction that all equipment and systems required

- by these specifications will operate in the manner in which they are intended to perform.
2. The OWNER will provide CONTRACTOR-trained operating personnel for the duration of the operational test. Said operation shall be conducted and under the supervision and direction of the CONTRACTOR and/or manufacturer's representative.
 3. Operational Defects:
 - a. All defects in materials or workmanship which appear during the operational test shall be immediately corrected by the CONTRACTOR.
 - b. In the event of a malfunction or deficiency that results in shutdown or partial operation of a system or process unit or results in performance that is less than that specified, the startup duration shall be repeated for that corresponding system or process unit and any other affected equipment so its proper operation and performance as required by the Contract Documents is demonstrated for a minimum of seven (7) continuous and trouble free days.
 4. If the operational test is interrupted through no fault of the CONTRACTOR the test may resume at the earliest mutually agreeable time.
 5. No unit process or part thereof shall be placed in service until it has successfully completed operational testing.
 6. During plant startup, the CONTRACTOR shall provide the appropriate construction trades and the services of authorized Manufacturer's representatives for operational testing and as necessary, to correct faulty equipment operation.
 7. After completion of all startup/operational testing, the CONTRACTOR shall repaint, hose, scrub, clean up and otherwise return the work to a "like new" condition, prior to OWNER acceptance.

1.4 TRAINING OF OWNER PERSONNEL

A. General:

1. Operation and maintenance training of OWNER's personnel shall be provided for mechanical, electrical, instrumentation and control equipment as listed in this Section or elsewhere in the Specifications.
2. For the purposes of this requirement, operations training is considered to be separate from maintenance training. Instructions are to be tailored to the needs of each group.
3. These training services shall be conducted by the manufacturer's representative and shall ensure measurable and observable means that OWNER personnel are qualified to perform equipment task requirements, including essential knowledge, skills and abilities.
4. Training shall be conducted by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods.
5. Training materials shall be submitted to the OWNER (see Paragraph 1.4 C below) for review. Acceptance of training materials is required prior to start of training.
6. All training shall be completed prior to beginning operational testing.
7. The OWNER shall have the right to videotape any or all training sessions, or may designate separate sessions or portions thereof for the sole purpose of videotaping.

B. Training coordinator:

1. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting training duties.

2. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- C. Training schedule:
1. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER's personnel and manufacturer's representatives, and shall submit a training schedule and the training materials for each piece of equipment or system for which training is to be provided.
 2. The training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the then current Plan of Operation.
 3. Equipment and/or systems shall be deemed suitable for use in training upon satisfactory completion of functional testing.
 4. All training with regards to a unit process or part thereof shall be completed prior to the start of operational testing.
 5. As a minimum, training shall be provided on the following equipment and systems:
 - a. Aeration System
 6. The CONTRACTOR shall provide distinct and separate training sessions for both operations and maintenance personnel, meeting the following criteria:
 - a. Maintenance Training:
 - 1) Maintenance training shall be provided for all items in 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide one (1) training session on a day agreed to by the ENGINEER.
 - 3) Training shall emphasize theory of operations, troubleshooting, and preventative maintenance and repair procedures.
 - 4) The discussion shall encompass issues relating to instrumentation, electrical, and mechanical systems.
 - b. Operations training:
 - 1) Operations training shall be provided for each piece of equipment listed in Paragraph 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide one (1) training session addressing two (2) operating shifts at the same time.
 - 3) Session to be provided for each shift within the following time periods.
 - a) Wednesday Day Shift: 1:00 P.M.-3:00 P.M.
 - c. Training session schedules shall be approved by the ENGINEER.
 - d. Training shall emphasize theory of operations, startup instructions, emergency and normal shutdown instructions, lockout procedures, troubleshooting, preventative maintenance, and alarm and control logic.
 7. The CONTRACTOR shall confirm each training period a minimum of three working days prior to the schedule time.
 8. If a manufacturer's representative fails to conduct a scheduled training class, the CONTRACTOR hereby agrees to compensate the OWNER for labor costs, including overhead, for all OWNER personnel in attendance for the entire scheduled training period.
 9. If the CONTRACTOR or the manufacturer's representative fails to provide training that qualifies the OWNER personnel to perform equipment task requirements, the CONTRACTOR hereby agrees to provide remedial training to ensure OWNER personnel proficiency at no additional cost to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 RECORD KEEPING

- A. The CONTRACTOR shall maintain as a minimum, the following records:
 - 1. Equipment manufacturer's shop drawings.
 - 2. Daily logs indicating all equipment testing and startup activities.
 - 3. Log and time sheets of all manufacturer's representatives performing services on the jobsite.
 - 4. Updated equipment testing and startup schedules.
 - 5. Records of system cleaning.
 - 6. Hydrostatic and pressure test records.
 - 7. Equipment alignment and vibration measurements and corrective actions.
 - 8. Equipment lubrication records.
 - 9. Insulation resistance measurements.
 - 10. Equipment and system release logs (from construction to startup).
 - 11. Daily work reports.

3.2 GENERAL PROCEDURES

- A. The general work procedures listed below outline the work to be performed by the CONTRACTOR. Additional procedures applicable to specific equipment items are specified elsewhere.
- B. Technical assistance and support:
 - 1. Obtain the assistance of the appropriate construction trades and the manufacturer or vendor, as required for technical assistance during equipment installation, testing, and startup by the CONTRACTOR and for training of the OWNER's Operation and Maintenance personnel.
 - 2. Furnish names and telephone numbers of manufacturer's and vendor's current technical service representatives for use by the ENGINEER.
- C. Instructions:
 - 1. Maintain an adequate manufacturer's instruction file so that the information will be readily available during equipment testing and startup.
 - 2. Prior to equipment testing, finalize, and transmit to the ENGINEER the applicable technical manuals as required under Section 01300, Contractor Submittals.
- D. Removal of rust preventives:
 - 1. Prior to equipment testing, remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation or equipment maintenance.
- E. Lubricants:
 - 1. At least 60 days prior to startup, provide a list of the manufacturer's recommended lubricants for use in the plant. All equipment lubrication shall be listed with the lubricant types and quantities recommended and approved by the equipment manufacturers.

2. Provide the necessary lubricants for startup and the initial 60 days of operation.
 3. Flush systems and install the initial charge of all lubricants. Dispose of flushing oil in accordance with applicable regulations.
 4. The CONTRACTOR shall lubricate the equipment in accordance with the manufacturer's recommendations until the equipment is accepted by the OWNER.
 5. Maintain a lubrication record for each item of equipment. The CONTRACTOR shall submit the lubrication records to the ENGINEER prior to equipment testing.
- F. Packing and seals:
1. Install, adjust, and replace packing, mechanical seals, and accessories, as necessary, during the equipment testing and startup period.
 2. Adjust seal water and flushing water flow rates in accordance with the equipment manufacturer's recommendations.
- G. Removal of temporary bracing:
1. Prior to equipment testing, remove all temporary supports, bracing, or other foreign objects that were installed in vessels, transformers, rotating machinery, or other equipment to prevent damage during shipping, storage, and erection, and repair any damage sustained.
- H. Rotation, alignment, and vibration:
1. Prior to equipment testing, check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.
 2. Prior to equipment testing, perform the cold alignment and hot alignment to the manufacturer's tolerances.
 3. Prior to equipment testing, test equipment vibration and correct any vibration in excess of the manufacturer's recommendation.
- I. Tie-ins at the contract limits:
1. Provide proper notification, preparation, and coordination for safe tie-ins and minimal interference with the plant operation.
 2. Obtain approval and make the necessary tie-ins at the unit limits as required by the Contract Documents and as approved by the ENGINEER.
 3. Prior to startup, remove the temporary blind flanges, plugs, bulkheads, seals, etc.
- J. Leak and pressure tests:
1. Provide the ENGINEER with 3-day advance notification in writing of the schedule for non-operating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the ENGINEER.
 2. Provide the water, air and any special media required for the test purposes.
 3. Prior to startup, conduct all leak and pressure tests in accordance with applicable codes, regulations, and the Contract Documents, and as approved by the ENGINEER. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER, to be considered valid.
 4. Maintain a record of the leak and pressure test data and work completed.
 5. Dispose of the test media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 6. Isolate in-line equipment as necessary for protection against test pressure.
- K. Pressure/vacuum safety relief devices:

1. Prior to equipment testing, test and adjust all safety devices as recommended by the equipment manufacturer.
 2. Prior to plant startup, provide the ENGINEER with a list of all field or factory equipment settings.
- L. Flushing and chemical/mechanical cleaning:
1. Prior to equipment operation, conduct all flushing, blowing, and chemical/mechanical cleaning operations without using the permanently installed equipment.
 2. Provide any special media needed for flushing and/or cleaning purposes.
 3. Dispose of all media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
 4. All systems shall be free of trash and construction debris before initiating startup.
 5. Maintain a record of the work completed.
- M. Screens, strainers, and blind flanges:
1. Provide and install temporary strainers, screens, and blind flanges as necessary to protect the equipment and to test the equipment and pipelines.
 2. Prior to startup, remove all of the temporary blinds and temporary appurtenances.
 3. Clean the screens and strainers as required during startup.
 4. At the end of startup, clean all of the permanently installed screens and strainers.
- N. Purging/inerting:
1. Prior to startup, purge and/or passivate the facilities as specified.
 2. Install purge/inerting connections in accordance with the manufacturer's recommendations.
 3. Provide purge or inerting materials and conduct the necessary operations as recommended by the equipment manufacturer.
- O. Drying out:
1. Prior to startup, dry out the facilities as specified or recommended by the equipment manufacturer to prevent contamination of catalysts, operating materials, and/or product.
 2. Dry out systems, protective coatings, refractories, and linings as specified or recommended by the equipment manufacturers.

3.3 SPECIFIC PROCEDURES

- A. In addition to the work responsibilities described in Subsection 3.2, the procedures outlined below further define the work responsibilities of the CONTRACTOR for specific systems and items of equipment.
- B. Mechanical equipment:
1. Level baseplates and soleplates and grout under all load bearing surfaces.
 2. Install suitable supports and flexible connections to alleviate any piping stresses that may be imposed on pumps, compressors, and drivers.
 3. In accordance with the manufacturer's recommendations, chemically clean lube oil, seal oil, and cooling systems. Dispose of waste and cleaning media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 4. In accordance with the manufacturer's recommendations, charge the lube oil, seal oil, and cooling systems with flushing media and circulate for cleaning purposes.

Dispose of any flushing media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.

5. Charge the lube oil systems, seal oil systems, and cooling systems with the amount and type of operating oil or coolant recommended by the manufacturer.
6. Operate the equipment and check for excessive vibration, abnormal operating noises, overheating and lubricant leakage, etc., and test any safety shutdown/alarm devices for proper operation, and make any operating tests required by the ENGINEER. The adjustments required for proper operation shall be made prior to operational testing.
7. Utilize manufacturer's representative for technical assistance during installation and startup.
8. All safety hazards, e.g., exposed drive shafts or rotating equipment members, exposed electrical circuitry, open electrical junction boxes and panels, improperly supported piping and conduits, missing safety devices, etc., shall be corrected prior to supplier training of the OWNER's personnel.
9. The CONTRACTOR shall perform a comprehensive safety inspection and correct any safety deficiencies found before implementing plant startup.
10. Prior to startup, install all warning and safety signs, labels, and devices.

C. Tanks:

1. Test all tanks and internals, as required to demonstrate conformance to the Contract Documents. Dispose of test media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
2. Prior to startup, conduct chemical cleaning or flushing operations as specified. Dispose of wastes and cleaning media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
3. Prior to startup, install all chemical identification, warning, and safety signs and labels.

D. Piping systems:

1. Provide the ENGINEER with 3-day advance notification in writing of test schedule.
2. Hydrostatically or pneumatically test all piping as required by the codes and contract documents.
3. After successful testing of the piping, slowly drain the system and then flush the system. Orifice plates shall be installed after testing. If installed with the piping, they will be removed and replaced with spacers or pipe spools of equal length prior to the pressure test.
4. Dewater the system, remove blind flanges, and perform tightness tests, as required by the ENGINEER.
5. Insulate or paint piping, flanges, threaded joints, or field welds after the specified testing of each item has been completed unless instructed otherwise by the ENGINEER.
6. Leave exposed all welded joints (longitudinal, girth, and nozzle) in underground piping that have not been shop tested until the specified testing has been completed. After final testing of these joints, cover the system.
7. Prior to substantial completion and startup, check pipe hangers, supports, guides, and pipe specialties for the removal of all shipping and erection stops and for the correctness of the cold and hot settings for the design service, make adjustments as necessary to obtain proper installation. Provide the ENGINEER with instructions for the hot settings.

8. As necessary during equipment testing and at the end of substantial completion and startup, clean or replace the screens and filter elements as appropriate for the filter type and service.
9. Prior to startup, verify, to the extent required by the ENGINEER, that specified valve packing has been provided on valves installed in the plant.
10. Prior to startup, install all of the valve and piping system identification labels.
11. Prior to startup, check and record the position of all process system valves.
12. Prior to startup, correct support, vibration, and thermal expansion problems detected during the preliminary equipment testing.
13. Prior to the startup, retorque all hot and cold service bolting as required to ensure a permanent and proper installation.
14. Prior to startup, demonstrate to the ENGINEER's satisfaction that each piping system (e.g., chemical, sample, utility, irrigation process, etc.) functions as designed and required by the Contract Documents.

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Testing, Training and Startup

Solids Holding Tank Refurbishment

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SECTION 03 01 03
CONCRETE RESTORATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all labor, materials, equipment and incidentals, as shown, specified, and required to furnish and install concrete repairs. The work includes:
1. Removal of deteriorated concrete.
 2. Providing cementitious repair materials.
 3. Fabrication and placement of reinforcement including ties and supports.
 4. Design, erection, and removal of formwork.
 5. Building into the repairs all sleeves, frames, anchors, inserts and other items required to be embedded in the repairs.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
1. 308R, Guide to Curing Concrete
 2. 318, ACI 318, Building Code Requirements for Reinforced Concrete
 3. 347, Guide to Formwork for Concrete
- B. ASTM International
1. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 2. A185, Standard Specification for Welded Steel Wire Fabric For Concrete Reinforcement
 3. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 4. A706, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
 5. C33, Standard Specification for Concrete Aggregates
 6. C94, Standard Specification for Ready-Mixed Concrete
 7. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
 8. C150, Standard Specification for Portland Cement
 9. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
 10. C171, Standard Specification for Sheet Materials for Curing Concrete
 11. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 12. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

1.3 QUALITY ASSURANCE

- A. Qualifications:
1. System applicator:

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- a. Experienced applicator with a minimum 5 years' experience endorsed by the restoration system manufacturer.
- B. Manufacturer:
 - 1. Manufacturer shall have a minimum 5 years' experience in production of concrete restoration products.
 - 2. System applicator shall follow all recommendations of the system manufacturer regarding storage, handling, surface preparation, application, environmental conditions during storage, preparation and application, and all other manufacturer recommendations.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product data sheets for each material supplied.
 - 2. Manufacturer's installation instructions for each material supplied.
- B. Shop Drawings:
 - 1. Reinforcing steel shop drawings including mechanical connections as applicable.
- C. Ready-Mix Concrete:
 - 1. Mix design data and supporting criteria.
 - 2. Laboratory Test Reports: Submit copies of laboratory test reports for materials and mix design tests.
 - 3. Delivery Tickets: Furnish to OWNER copies of all weighmaster certificate delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C94, Section 16. Delivery tickets shall be signed by a Certified Weighmaster.
- D. Work Plan: Submit a work plan detailing the CONTRACTOR'S detailed work procedure. Work plan shall include, but is not limited to:
 - 1. Examination
 - 2. Concrete removal and surface preparation
 - 3. Installation of reinforcing and embedded items
 - 4. Rebuild procedure
 - 5. Finishing and curing

1.5 PRE-REPAIR CONFERENCE

- A. Required Meeting Attendees:
 - 1. CONTRACTOR
 - 2. Repair Subcontractor
 - 3. Technical representative for repair material manufacturer
 - 4. OWNER.
- B. Schedule and conduct prior to incorporation of respective products into Project. Notify OWNER of location and times at least seven days prior to the anticipated meeting date.
- C. Agenda shall include:

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1. Review of field conditions. Conduct field observations of Work to be performed.
2. Based on field observations, repair material manufacturer's technical representative shall make material selection and repair method recommendations.
3. Technical representative for repair material manufacture shall review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
4. Limitations of manufactured products shall be reviewed to ensure products are installed in accordance with the written instructions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Inspect materials delivered to the site for damage and proper manufacturing dates. Store products in accordance with manufacturer's directions. Store products in a neat, orderly fashion and in a temperature controlled environment in accordance with the manufacturer's recommendations. Protect products from damage.

PART 2 - PRODUCTS

2.1 FORMWORK:

- A. Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.
- B. Provide 3/4-inch chamfer at all external corners.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60 for all non-welded bars. ASTM A706, Grade 60 for welded bars.
- B. Mechanical Couplers: Reinforcement bars may be spliced with a mechanical connection. Provide a full mechanical connection which shall develop in tension or compression, as required, at least 125% of specified yield strength (f_y) of the bar in accordance with ACI 318 Section 12.14.3.4. The locations of the connections are subject to the approval of the OWNER.
- C. Plain Steel Wire: ASTM A82.
- D. Welded Wire Fabric: ASTM A185. Furnish in flat sheets, not rolls.
- E. Stainless Steel Wire: 16-gauge stainless steel type 316 for shallow depth concrete repairs.
- F. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

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1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 2. For slabs on unformed surfaces, use 5000 psi concrete blocks.
 3. At all formed surfaces, provide supports complying with CRSI "Manual of Standard Practice" as follows: Plastic protected or stainless-steel legs.
- G. Adhesive Dowels: Provide one of the following:
1. HIT-HY 200 as manufactured by Hilti, Inc.
 2. SET-XP as manufactured by Simpson Strong-Tie, Inc.
 3. Or approved equal meeting ACI 355.4.

2.3 BONDING AGENT AND REINFORCING PROTECTION

- A. For use in all mortar repair, concrete repair, anti-corrosion coating and for unplanned cold-joints.
- B. When bonding cementitious repair materials to existing concrete with and without exposed reinforcing:
1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
 2. Or approved equal.

2.4 HAND APPLIED MORTARS – HORIZONTAL APPLICATION

- A. Two-component, polymer-modified, Portland cement-based, screed mortar intended for horizontal surfaces in form and pour applications.
- B. Cured Mortar Properties:
1. Compressive Strength, ASTM C109: 5,000 psi at 28 days.
 2. Bond Strength, ASTM C882: 2,000 psi at 28 days.
 3. Shrinkage, ASTM C157: <0.05% for a 1-inch x1-inch x11-1/4-inch specimen size.
- C. Manufacturers and Products
1. Sika Corporation: SikaTop 123 Plus
 2. Or equal.

2.5 HAND APPLIED MORTARS – VERTICAL AND OVERHEAD APPLICATIONS

- A. Two-component, polymer-modified, Portland cement-based, non-sag mortar intended for vertical and overhead surface applications.
- B. Cured Mortar Properties:
1. Compressive Strength, ASTM C109: 5,400 psi at 28 days.
 2. Bond Strength, ASTM C882: 2,000 psi at 28 days.
 3. Shrinkage, ASTM C157: 0.05% for a 1-inch x1-inch x11-1/4-inch specimen size.
- C. Manufacturers and Products
1. Sika Corporation: SikaTop 123 Plus
 2. Or equal.

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2.6 PORTLAND CEMENT READY-MIX CONCRETE

- A. Ready-mix concrete. Mixes subject to the following limitations:
1. Specified 28-day Compressive Strength: 4,000 psi.
 2. Air content: 6% \pm 1%.
 3. Slump, before addition of superplasticizer: 3½-inch \pm ½-inch
 4. Cementitious content-pounds per cubic yard: ASTM C150 Type II 625 min, 800 max
 5. Maximum water-cement ratio: 0.375
 6. Aggregates: ASTM C33
 7. Fine Aggregate: Provide clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 8. Coarse Aggregate: Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter. Size to be No 67.
 9. Provide admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control. Do not use admixtures containing calcium chloride.
 10. Use an independent testing facility acceptable to OWNER for preparing and reporting proposed mix designs.
 11. Only when approved by OWNER, site mixed concrete may be substituted for ready-mix concrete, provided the site mixed concrete meets the above specifications.

2.7 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
1. Waterproof paper.
 2. Polyethylene film.
 3. White burlap-polyethylene sheet.
- C. Curing Compound: ASTM C309 Type 1-D (water retention requirements):
1. Product and Manufacturer: Provide one of the following:
 - a. Super Aqua Cure VOX, as manufactured by The Euclid Chemical Company.
 - b. Sealtight 1100, as manufactured by W.R. Meadows, Incorporated.
 - c. Or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Sound existing concrete surfaces with hammer, chain, reinforcing bar, or similar metal object. Mark areas of unsound concrete.
- B. Loose, delaminated concrete should be removed until the substrate consists of sound concrete. Where corrosion of the reinforcement exists, continue bulk removal along

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the reinforcing steel and adjacent areas with evidence of corrosion-induced damage that would inhibit bonding of repair materials. Bulk concrete removal should include undercutting the corroded reinforcing steel by approximately 3/4 inch minimum. The shape of the prepared cavity should be kept as simple as possible generally square or rectangular in shape. The edges of the patches should be sawcut perpendicular to the surface to a depth of 1/2 inch to 1 inch to avoid feather edging the repair material.

- C. Pneumatic chipping hammers shall be used for concrete removal. Nominal 30-lb class or less pneumatic chipping hammers shall be used for removal of concrete at rebuild areas. Nominal 15-lb class or less pneumatic chipping hammers shall be used for detail work and work adjacent to and beneath reinforcing steel.
 - 1. Exercise care to avoid cracking underlying sound concrete, punching through member, or damaging embedments.
 - 2. Limit chipping hammer size and impact angle to minimize damage to sound concrete. Impact angle shall be no more than 60 degrees to the surface.
 - 3. Slope the removal of the substrate to avoid abrupt changes in removal thickness.
 - 4. Remove concrete at 45-degree angles to eliminate reentrant corners.
- D. Use abrasive blasting to remove residual dust, debris, fractured concrete, and contaminants that prevent proper bonding. If abrasive blasting is not feasible, pressure washing using a minimum 3000 psi may be acceptable depending on the bond strength required. Blowing with oil-free compressed air or alternately, the use of a vacuum, may be appropriate if dust is still present after the blasting. The final surface texture should be rough, with approximately a 1/4 inch amplitude.
- E. Bond-inhibiting corrosion should be removed from the reinforcing steel by an abrasive blasting wire wheel or needle scaler. If the cross-sectional area of the reinforcing steel has been significantly reduced, greater than 10%, provide additional rebar as directed by OWNER and in accordance with the Drawings. Apply the reinforcement protection anti-corrosion coating after the reinforcing steel has been cleaned.
- F. A saturated, surface dry (SSD) surface is not recommended if an epoxy bonding agent is to be used. When using epoxy bonding agents ensure the surface is dry, follow the manufacturer's recommended surface preparation requirements. Provide epoxy bonding agent for all concrete and mortar repairs unless directed otherwise OWNER or the manufacturer.
- G. Provide reinforcement as directed by OWNER or as shown in the Drawings.

3.2 INSTALLATION

- A. Install the epoxy bonding agent in accordance with the manufacturer's printed instructions using a stiff bristle brush. Systematically coat existing concrete substrate and exposed reinforcing. Ensure that working times and pot life are not exceeded during installation and before placing repair material.
- B. Apply the repair material in accordance with the manufacturer's printed instructions. Thoroughly consolidate the repair materials into corners and around any exposed reinforcement.

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- C. For hand applied repairs scrub a thin coat of the repair mortar into the substrate to prevent sloughing or sagging of repair on vertical and overhead surfaces. Apply the material with adequate pressure before the bond coat dries.
- D. When using multiple lifts, apply at thickness recommended by the manufacturer, thoroughly roughen the surface of the first lift by scoring the soft mortar to achieve an aggressive finish, similar in profile to the prepared concrete substrate. Do not feather edges onto adjacent surfaces.
- E. Finish the repair material to produce a final finished appearance as required to match the existing adjacent concrete surface.
- F. Curing: Beginning curing operations immediately after final finishing. Cure intermediate layers of mortar in accordance with the manufacturer's instructions. Cure all cementitious repair materials in accordance with manufacturer's written instructions. Wet cure for a minimum of five (5) days unless directed otherwise by the OWNER or manufacturer. Conform to the curing requirements in ACI 308R. Use curing compounds only when directed by OWNER.

3.3 FIELD QUALITY CONTROL

- A. Inspect and check each repaired area for cracks, spalls, popouts and loss of bond between repaired area and surrounding concrete. Check each repaired area for voids by tapping with a hammer or steel rod and listening for dull or hollow sounds. Immediately repair defects.
- B. The OWNER may employ a testing laboratory to perform field quality control testing. OWNER will direct the number and type of tests and cylinders required. Furnish all necessary assistance required by OWNER. Test samples which fail to meet specification requirements will be rejected and replaced by CONTRACTOR and no additional costs to OWNER.

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SECTION 03 01 06

CRACK REPAIR BY EPOXY INJECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall furnish all material, tools, equipment, appliances, transportation, labor and supervision required to repair cracks by the injection of an epoxy resin adhesive.

1.2 QUALITY ASSURANCE

- A. Qualifications for Epoxy Injection Staff:
1. Manufacturer's Site Representative:
 - a. Capable of instructing successful methods for restoring concrete structures utilizing epoxy injection process.
 - b. Understands and is capable of explaining technical aspects of correct material selection and use.
 - c. Experienced in the operation, maintenance, and troubleshooting of application equipment.
 2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
 - a. Licensed and certified by epoxy manufacturer.
 - b. Minimum 3 years' experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.
 3. CONTRACTOR shall retain the services of a qualified and authorized technical representative of the materials manufacturer to provide a site visit to specifically address the parameters of the repair and provide recommendations at the beginning of the installation and to make periodic visits to ensure that the work is performed in accordance with the manufacturer's recommendations and achieves the repair objectives.

1.3 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's specifications and installation instructions for all materials and accessories including:
1. Manufacturer's recommended surface preparation procedures and application instruction for epoxy adhesives.
 2. Installation instructions for repairing core holes with epoxy grout.
 3. Manufacturer's Certificate of Compliance: Certified test results for each batch of epoxy adhesive.
 4. Statements of Qualification for Epoxy Adhesive:
 - a. Manufacturer's site representative.
 - b. Injection applicator.
 - c. Injection pump operating technician.

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5. Epoxy adhesive two component ratio and injection pressure test records for concrete crack repair work.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Package adhesive material in new sealed containers and label with the following information:
 1. Manufacturer's name.
 2. Product name and lot number.
 3. Material Safety and Data Sheet, MSDS.
 4. Mix ratio by volume.
- B. Store adhesive containers at ambient temperatures below 100°F and above 45°F. Condition adhesive before use as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Materials, equipment and accessories specified in this section shall be products of one of the following:
 1. Concrese Series, as manufactured by BASF Building Systems.
 2. Sikadur Series, as manufactured by Sika Corporation.
 3. Euco Series, as manufactured by Euclid Chemical Company.

2.2 EPOXY ADHESIVE

- A. Epoxy adhesive grout shall be a 100% solids 2-part water insensitive low-viscosity epoxy resin system.
- B. Epoxy shall be suitable for grouting both dry and damp cracks.
- C. Adhesive Properties:

7-day, Tensile Strength, psi	ASTM D638	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	1.0% min.
Compressive Yield Strength, 7 days @ 73°F, psi	ASTM D695	8,000 min.
Compressive Modulus, psi	ASTM D695	1.5x10 ⁵ min.
Heat Deflection Temperature, °F	ASTM D648	120 min.
Water Absorption @ 24 hours, percent	ASTM D570	1.0% max.
Bond Strength @ 2 days, psi	ASTM C882	1,000 min.
Bond Strength @ 14 days, psi	ASTM C882	1,500 min.

2.3 SURFACE SEAL

- A. The surface seal material is that material used to confine the injection adhesive in the fissure during injection and cure.
- B. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

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- C. Capable of removal after injection adhesive has cured.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean cracks in accordance with epoxy adhesive manufacturer's instructions.
- B. Surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter which may be detrimental to the integrity of the bond between the epoxy and the injection surface. Acids and corrosives used for cleaning shall not be permitted.
- C. Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete at that location, unless otherwise specified by the adhesive manufacturer.
- D. Unless the crack is in submerged concrete, remove any water that can be seen by visual inspection from the crack before the injection process, and remove water that appears during the injection process.
- E. Do not inject cracks when the temperature of the concrete is below freezing and moisture conditions indicate the possibility of ice on the internal surfaces of the crack.
- F. Do not inject adhesive if the temperature of the concrete is not within the range of application temperatures recommended by the manufacturer of the adhesive.

3.2 INSTALLATION

- A. Sealing: Apply surface seal in accordance with manufacturer's instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.
- B. Entry Ports:
 - 1. Establish openings for epoxy entry in surface seal along crack.
 - 2. Determine space between entry ports equal to thickness of concrete member to allow epoxy to penetrate the full thickness of the wall.
 - 3. Provide a means to prevent concrete dusts and fines from contaminating the crack or ports when drilling.
 - 4. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
 - a. Cracks extend entirely through wall.
 - b. Backfill of walls on one side.
 - c. Difficult to excavate behind wall to seal both crack surfaces.
 - d. Core drill to verify epoxy depth where only one side of wall is exposed.
- C. Epoxy Injection:
 - 1. Condition epoxy at a minimum of 70°F, or as recommended by the manufacturer.
 - 2. Start injection into each crack at lowest elevation entry port.

3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.
 4. Plug first port and start injection at second port until adhesive flows from next port.
 5. Inject entire crack with same sequence.
- D. Finishing:
1. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy material from cracks.
 2. Remove surface seal from cured injection adhesive.
 3. Finish crack face flush with adjacent concrete.
 4. Indentations or protrusions caused by placement of entry ports are not acceptable.
 5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.
- E. Equipment:
1. The equipment used to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.
 2. The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi plus or minus 5 psi and shall be equipped with a manual pressure control override.
 3. The injection equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of plus or minus 5 percent by volume at any discharge pressure up to 160 psi.
 4. Do not use batch mix pumps.

3.3 FIELD QUALITY CONTROL

- A. Injection Pressure Test:
1. The mixing head of the injection equipment shall be connected and the equipment run until clear uniformly mixed material flows into the purge pail. The Operator shall engage the equipment shut-off nozzle valve and subsequently bump the on-off switch while monitoring pressure on psi gauge until the pressure reaches 200 psi. Pressure gauge shall be monitored for one minute. If pressure is maintained between 190 – 200 psi, check valves shall be considered to be functioning properly and the injection may proceed. If pressure drops below 190 psi, CONTRACTOR shall be required to have new seals installed on the check valves and the equipment shall be subsequently retested.
 2. The pressure test shall be run for each injection unit at the beginning and after meal break of every shift that the unit is used in the work of crack repair.
 3. The adequacy and accuracy of the equipment shall be solely the responsibility of CONTRACTOR.
- B. Metering Accuracy Ratio Test:
1. The epoxy mixture ratio shall be monitored continuously while injecting by placing a strip of masking tape on the sides of the A & B reservoirs full height. After filling reservoirs, the A & B levels shall be marked and monitored while running injection machine into purge pail for a period of one minute at 160 psi discharge pressure.

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2. The ratio test shall be run for each injection unit at the beginning of every shift that the unit is used in the work of crack repair and when injection work has stopped for more than 1 hour.
- C. Proof of Ratio and Pressure Test:
1. At all times during the course of the work CONTRACTOR shall keep complete and accurate records available to ENGINEER of the pressure and ratio tests specified above.
 2. In addition, ENGINEER at any time without prior notification of CONTRACTOR, may request CONTRACTOR to conduct the tests specified above in the presence of ENGINEER.
- D. Daily Log
1. Maintain a written daily log for each day of injection work that includes:
 - a. Ambient temperatures at the start and end of the workday and 4 hours after the end of the workday.
 - b. Weather conditions, such as rain, snow, and wind, including changes during the shift.
 - c. Crack cleaning methods, if any, including locations.
 - d. Record of injection adhesive, including manufacturer, product and batch number, and amount used each day.
 - e. Signature and printed name of person responsible for record keeping.
- E. Core Testing
1. Initial Cores:
 - a. Obtain 4-inch diameter cores for the full crack depth taken from ENGINEER selected locations.
 - b. Visual inspection for depth of penetration:
 - 1) Three cores from the first 100-feet and one core for each 100-feet thereafter.
 - 2) It is permitted to obtain 2-inch cores if they are only used to verify adhesive penetration.
 - c. Splitting tensile strength per ASTM C496:
 - 1) One core for the first 100-feet and once core for each 75-feet thereafter.
 - d. Mark each of the cores with a "T" for top or "B" for bottom for cores taken vertically, or "H" for cores taken horizontally.
 - e. Mark the respective end of the core with the letters "IS" (injection side) to indicate the side from which the injection was performed.
 2. Test Requirements:
 - a. Adhesive Penetration: Minimum of 90% of the crack shall be full of epoxy adhesive.
 - b. Splitting tensile strength / Compression Test: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.
 3. Acceptance Criteria:
 - a. If initial cores pass the tests as specified, epoxy adhesive injection Work at the area represented by cores will be accepted.
 - b. If adhesive penetration or bond strength are not acceptable, stop injection Work until the areas represented by the testing are accepted, and changes in procedures or materials for continued injection Work have been accepted. Reinject adhesive in the locations where injection has not been acceptable. If partial injection has blocked all access to the cracks on surfaces that can be

reinjected, drill injection holes into the concrete to intersect the crack in their void areas.

F. Core Hole Repair:

1. Fill core holes with epoxy grout as required by the Project Specifications. Finish surface shall blend with adjacent concrete.

++ END OF SECTION ++

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Crack Repair by Epoxy Injection

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SECTION 03 11 03
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Falsework and formwork, as required to construct cast-in-place concrete, including placing of all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. REFERENCES
 - 1. American Concrete Institute (ACI)
 - a. ACI 301, Specifications for Structural Concrete for Buildings.
 - b. ACI 347, Guide for Concrete Formwork.

1.2 SYSTEM DESCRIPTION

- A. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
 - 2. Coordinate formwork specifications herein with the requirements for finished surfaces specified in Section 03 30 03, Cast-In-Place Concrete.

1.3 SUBMITTALS

- A. Submit for information purposes the following: Copies of manufacturer's data and installation instructions for all proprietary materials, including form coatings, manufactured form systems, ties and accessories.
- B. Shop Drawings: Forming, shoring and bracing drawings for footings, walls and roofs.
- C. Calculations: Calculations verifying the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, falsework or roof forms, or any other part of forming, shoring or bracing which may be considered critical by the ENGINEER. The drawings, with supporting calculations, must be signed and sealed by a Civil or Structural Engineer registered in the State of Utah.

1.4 QUALITY ASSURANCE

- A. Allowable Tolerances: Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
- B. Furnish and install all items for permanent or temporary facilities in accordance with manufacturer's instructions.

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Concrete Formwork

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PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood overlaid with MDO or HDO specifically designed for concrete forms, metal, metal-framed plywood-faced or other acceptable panel materials, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material with sufficient thickness to remain watertight and withstand pressure of newly placed concrete without bow or deflection.
- B. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.
 - 1.

2.2 DESIGN OF FORMWORK

- A. The CONTRACTOR shall design all formwork prior to fabrication. The design shall account for all the tolerances, finishes, rebar supports, construction joint locations, and other features and other nonstructural formwork requirements specified. Forms shall contain pouring and observation windows to allow placement of concrete through windows or shall be staged to allow visual observation at all times of the fresh concrete to ensure correct placement and vibration. Provide a formwork and placement design that will limit free fall of concrete in forms 8-inch or less in width to 5 feet; and for forms wider than 8 inches, limit this fall to 8 feet, except as hereinafter specified. Review methods with ENGINEER prior to start of work. Use placement devices, such pumps, as required.
- B. Falsework supports for structural slabs shall be sufficiently rigid and strong to support the wet concrete and the men and equipment necessary for its placement without appreciable deflections. A minimum of 50 PSF for live load shall be allowed in the design.
- C. All forms, falsework, shoring, and other structural formwork required shall be structurally designed by the CONTRACTOR and the design shall comply with all applicable safety regulations, current OSHA regulations, and other codes. Where federal or state agencies require a licensed engineer to prepare and/or seal all formwork, falsework or shoring designs, the CONTRACTOR shall hire this engineer and pay all costs. The designs shall be made available to any governing agency upon request. Comply with applicable portions of ACI 347, ACI 318 current edition, and these Specifications. All design, supervision, and construction for safety of property and personnel shall be the CONTRACTOR's full responsibility.

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Concrete Formwork

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PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 FORM CONSTRUCTION

- A. Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary form windows where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate form windows on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.
- D. Falsework:
 - 1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
 - 2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.
- E. Forms for Concrete:
 - 1. Do not use metal cover plates for patching holes or defects in forms.
 - 2. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
 - 3. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
- F. Openings and Built-In Work:

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Concrete Formwork

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1. Provide openings in concrete formwork shown or required by other Sections or other contracts.
 2. Accurately place and securely support items to be built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORM COATINGS

- A. Coat form contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections and other contracts. Use necessary setting drawings, diagrams, instructions and directions.
- B. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

3.5 FIELD QUALITY CONTROL

- A. Before concrete placement, check the formwork, including tolerances, lines, ties, tie cones, and form coatings. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed Work is within specified tolerances.
- C. If forms are unsatisfactory in any way, either before or during placing of concrete, postpone or stop placement of concrete until the defects have been corrected, and reviewed by ENGINEER.

3.6 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Chapter 2 and ACI 347, Chapter 3.7 except as specified below.
 1. Removal of Forms and Supports: Continue curing in accordance with Section 03 30 03, Cast-In-Place Concrete, Paragraph 3.5. Forms are to remain in-place for the time specified below following the end of concrete placement. The durations shown represent a cumulative number of days, or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above or below 50°F.

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Concrete Formwork

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Temperature:	Above 50°F	Below 50°F or when retarders are used
Structural Slabs	Do not remove forms until site-cured test cylinders develop 100% of 28-days strength.	

2. When high-early strength concrete is specified, a schedule for removal of forms will be developed in the field from the age/ strength relationships established for the materials and proportions used by tests in accordance with ACI 301, Section 2.3.4.
3. When construction loads are approximately equal to the structural live load, the forms for structural slabs, joists, and beams shall remain in place until the concrete has reached the specified compressive strength.

++ END OF SECTION ++

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SECTION 03 15 03

PLASTIC LINER FOR CONCRETE PIPE AND STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: This Section covers embedded PVC sheet linings (plastic liner) to be applied to the following interior surfaces of precast and cast-in-place reinforced concrete structures.
 - 1. Vertical wall surface of precast or cast-in-place reinforced concrete structures
 - 2. Underside of top slab of precast or cast-in-place reinforced concrete structures.
- B. Provide plastic liner for the solids holding day tank. Apply to all concrete surfaces on interior of tank, excluding floors, and including ceiling, beams, and walls from finished floor to ceiling

1.2 QUALITY ASSURANCE

- A. The manufacturer of the sheet lining shall furnish an affidavit attesting to the successful and completely satisfactory use of the materials as a lining for the service intended for a period of 5 years, minimum.
- B. The accepted lining system manufacturer's standard printed specifications covering the installation of the lining in concrete structures shall be considered as being incorporated herein, and all work for and in connection with said plastic lining installation shall be strictly in accordance therewith. Such manufacturer's specifications shall include and cover application of sheets to concrete forms, including preparation of forms, joint welding and removal of forms; miscellaneous requirements covering transportation, handling, storing, and inspection; and necessary precautions with respect to ventilation and protection of workers.
- C. All work for and in connection with the installation of plastic sheet lining, the preparation of surfaces, and the sealing and welding of joints shall be performed by the manufacturer of the lining or by a firm or individual who has been trained and certified by said manufacturer.
 - 1. Training certification shall be submitted by manufacturer in writing.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide detailed layout and installation drawings including the following:
 - a. Sheet layout
 - b. Attachment to forms
 - c. Arrangement of butt and corner joints
 - d. Sealing and welding details
 - e. Repair details
 - f. Acceptable solvents, adhesives and cleaning agents

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- g. Application and inspection guide
- h. Sequencing and layout plan for the lining system
- i. Material Safety Data Sheets
- j. Applicato's certification for each installer
- k. Proposed equipment for pre-cleaning the structure, preparing the concrete prior to installation of the new lining system, including rated operating pressures, flow rates in gallons per minute, and total horsepower.

B. Product Data:

- 1. Provide complete specifications and data describing the materials to be furnished

C. Precast Certification

- 1. Provide certification from precast pipe, manhole, or structure manufacturer that the specified product has been used and installed per this specification.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Per Manufacturer's standard instructions, specifications and recommendations.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

- A. Plastic liner shall be SP Mastic Co-Lining System as manufactured by Linabond Co-Lining Systems.
- B. Or Equal.

2.2 SERVICE CONDITIONS AND PERFORMANCE

- A. Plastic liner will be used in applications in contact with raw sewage and the air space above the raw sewage. Hydrogen sulfide off-gassing from the sewage will potentially result in sulfuric acid accumulation on the surface of the plastic liner.
- B. Plastic liner shall be resistant to up to 20% sulfuric acid and other chemicals which may be expected to exist in the gas space above wastewater.

2.3 MATERIALS

- A. The material used in the plastic liner, welding strips and other accessory items, shall be a combination of poly vinyl chloride resin, pigments and plasticizers, specially compounded to remain flexible. Poly vinyl chloride resin shall constitute not less than 99 percent by weight, of the resin used in the formulation. Copolymer resins will not be permitted. Material shall be white.

2.4 PROTECTIVE LINING SYSTEM MATERIALS

- A. Materials shall consist of a primer, a PVC surface activator, a high solids structural polymer, a seam material, a UV top-coat, and extruded polyvinyl chloride (PVC) sheets

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and corner pieces as manufactured or supplied by Linabond, Inc., Sylmar, California, telephone number (818) 362-7373. Materials list for the protective lining system shall be submitted and shall include certification from a certified laboratory that the materials meet the following specifications. No substitutes for these materials will be allowed.

- B. Primer: The concrete primer shall be a two (2) component, high solids primer with fast cure, that provides a chemical and mechanical bond with the substrate and the structural polymer. Primer shall be Linabond EP30-HS or approved equal.
- C. Structural Polymer: The structural polymer shall be a plural-component, high solids, high strength, closed-cell polyurethane. It shall be trowelable, or sprayable with airless-spray plural component equipment. It shall be non-flow and shall be resistant to weathering, aging, dilute (10%) solutions of sulfuric acid and intermittent wetting by raw sewage. The structural polymer shall be Linabond SP Mastic as manufactured by Linabond, Inc. or approved equal.
- D. Semi-Rigid PVC Sheet Liner: The material shall be a semi-rigid homogeneous thermoplastic polyvinyl sheet liner, that has been specifically formulated for application with the surface activator. The sheet liner shall be Linabond Semi-Rigid PVC Liner as manufactured by Linabond, Inc. or approved equal.
- E. Flexible PVC Sheet Liner: The material shall be a homogeneous thermoplastic flexible PVC sheet liner of 40 mil uniform thickness, that has been specifically formulated for application with the surface activator. The sheet liner shall be Linabond Vinylthane Flexible PVC Liner as manufactured by Linabond, Inc. or approved equal.
- F. Surface Activator: Surface activator shall provide cross-linking with the PVC sheet liner and the structural polymer and shall be Linabond CLA-2 Instant Activator as manufactured by Linabond, Inc. or approved equal.
- G. Seam Material: This component is an expansionless version of Linabond's structural polymer, which retains the chemical, and covalent bonding properties of the structural polymer. It is typically used for seam and termination overlay beads. It can also be in the overlaps between adjacent PVC sheets. Seam material shall be Linabond Mastic Seam Material as manufactured by Linabond, Inc. or approved equal.
- H. Premolded PVC Corners: The Premolded corner units shall be made of Vinylthane that has been specifically formulated for application with the surface activator. All corners shall have minimum available lap area that is three (3) inches deep. The PVC premolded corners shall be as manufactured by Linabond, Inc or approved equal.
- I. Physical Properties:
 - 1. All plastic liner plate sheets, welding strips and other accessory items, shall have the following minimum physical properties when tested at 77°F±5° (25°C±3°):
 - a. Tensile Strength: 2200 psi
 - b. Elongation at break: 200%
 - c. Shore Durometer, Type D: 50-60 (1 second), 35-50 (10 seconds)
 - 2. Following exposure to 20% sulfuric acid and other chemicals which simulate the conditions found in the air space above wastewater, the physical properties of the plastic liner shall not change significantly

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3. Plastic liner shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4-inch (6 mm) settling cracks, which may occur in the pipe or in the joint after installation, without damage to the lining.
 4. Plastic liner shall be repairable at any time during the life of the pipe or the structure
- J. Plastic Liner Sheet Design:
1. Plastic liner sheets shall be provided in a minimum width of 4-feet
 2. Plastic liner sheets shall be a minimum of 0.040 inch thickness.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Concrete formwork to which plastic liner is fastened for installation, whether at a concrete precasting facility or on-site for cast-in-place concrete, shall be clean and free of debris, oils, or other materials which may stain, alter or affect the plastic liner in any way or leave impressions in the plastic liner subsequent to placing concrete. Any form release agents or other materials applied to the formwork shall be approved by the plastic liner manufacturer as being compatible with the plastic liner material.

3.2 PROTECTIVE LINING SYSTEM INSTALLATION

- A. Field Inspector: The Contractor shall be responsible for obtaining the services of a qualified field inspector who has been trained and certified by the manufacturer of the protective lining system. The Field Inspector shall continuously perform testing and provide daily field documentation and inspection services to the lining Contractor during all the protective lining installation to document as to whether the work, including surface preparation, mixing, drying times and application procedures, is being performed per the manufacturer's recommendations. The field inspector shall review performance, quality, and progress of the lining system work, and shall inform the Engineer and/or the Owner of its findings. The Field Inspector shall provide daily electronic documentation (including photography and QC forms), and monitor the progress and quality of the lining system work as per Linabond inspection requirements. A private internet workroom containing each day's QC documents, testing and photographs will be made available by Linabond to the Owner and Engineer for the purpose of monitoring installation progress, quality, and compliance to the specifications.
- B. Test Application: Prior to beginning the lining work, the lining Contractor shall prepare a test area in a location designated by the Engineer and shall demonstrate the protective lining system application. This test area shall be a minimum of 10 square feet and will be used by the Engineer for approval of proper application procedures and quality of workmanship for the lining work.
- C. Control of Ambient Conditions in Structures to be Lined: The Contractor shall control ambient conditions in the structures to be lined, and provide protective enclosures during surface preparation, application, and curing to meet the ambient conditions

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specified below. The Contractor shall continue to meet the ambient conditions throughout the lining system work. The ambient conditions requirements inside the structures during all phases of lining system work shall be as follows:

1. Air temperature – no lower than 65 degrees F. Lining at temperatures greater than 90 degrees F should be avoided as they drastically reduce the work-life of the structural polymer material.
2. Relative humidity: No higher than 90%.
3. Concrete substrate surface temperature: no lower than 55 degrees F but, and at least 5 degrees F higher than the dew point temperature. Lining at temperatures greater than 90 degrees F should be avoided as they drastically reduce the work-life of the structural polymer material.
4. No dust generation shall be allowed during this period.

3.3 PROTECTIVE LINING APPLICATION:

- A. The protective lining shall completely seal the areas shown on the drawings and as specified in Part 1 of this section. The system shall consist of four parts: primer, structural polymer, surface activator and polyvinyl chloride lining materials.
 1. Proportioning and Mixing: The structural polymer, the primer, and the seam material shall be mixed and proportioned in accordance with the manufacturer's written instructions using equipment acceptable to and certified by the manufacturer.
 2. Once application begins, the Contractor shall have such equipment available, maintained, and kept in good working order for the duration of the work. The Owner's designated representative shall daily verify that the equipment is set to the proper operating parameters. No verification or inspection releases the Contractor from responsibility for equipment availability, equipment operation, material application, or any other requirements of the specifications.
 3. Spray equipment shall be able to provide plural component spray at a mix ratio of equal parts (one part to one part) by volume. For the structural polymer, spray equipment shall be capable of supplying a minimum of 3 gallons per minute at a temperature of 130-140 degrees F at the spray nozzle. Mix ratio, application flow rate, temperature and pressure readings must be verifiable through a monitoring system including digital readout and hard copy printouts. The readouts and printouts must show instantaneous and cumulative value readings for mix ratio and volumetric flow rate. For any 8 of 10 readings, mix ratio and flow rate must meet the values specified above within a plus or minus 5 percent maximum deviation. A solenoid shutdown device shall be provided to turn off the spray equipment in the event that the mix ratio exceeds said 5 percent maximum deviation. (Such equipment is available through dealers such as Spray-Quip, Inc., 713-923-2771, who are familiar with these materials.)
 4. Pumping and Computer and Miscellaneous Equipment: Pumping equipment and computer equipment utilizing an integrated Digital Flow Monitoring system with built in alarms shall be approved by Linabond Inc, prior to use. The Contractor shall supply all the tools and equipment needed to properly install the materials per Linabond's requirements, including but not limited to the following: fiberglass crown jacks (if required), seam material plural component application guns, spray

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application rig, communications equipment and any necessary staging equipment. All equipment shall be maintained and operated per the manufacturer's written instructions. Filters shall be checked twice daily (if operated) and cleaned as necessary. At all times during use, a qualified operator certified by the manufacturer shall attend the spray equipment.

- B. Linabond Primer: The primer shall only be applied to a clean, prepared, and dry sound-concrete surface only. The primer shall be rolled or spray applied and allowed to tack prior to application of the structural polymer. The structural polymer should be applied within 3 days of primer application.
1. Linabond Structural Polymer: : The structural polymer shall only be applied to a clean and dry primed concrete surface at a minimum average thickness of 125 wet mils or sufficient to completely embed the PVC liner material, whichever is greater. If the material is trowel applied, the material shall be mixed per the manufacturer's recommendations, and shall be applied in the manner described in the Manufacturer's application guide. If a notched trowel is used, rake marks will cause air entrapment in the liner, and therefore should be smoothed before embedding the PVC liner. If the material is spray applied, the spray equipment as described elsewhere in this document shall be utilized and maintained by the contractor. Bubbles in the liner greater than an equivalent area of 6-inch by 6-inch, and holes or discontinuities in the applied lining system, shall be repaired as specified in part 2.6 of this section. The Contractor shall keep accurate records of the placement of structural polymer and other system materials. Two copies of the records shall be submitted to the Engineer daily.
 2. Activator: The surface activator shall be applied to clean, dry PVC liner material by roller at a coverage rate between 150 and 200 square feet per gallon, in accordance with manufacturer's instructions. The Activator shall be applied to sheets in a warm (70 degree F minimum), protected environment. Under no circumstances should Activator, which has been allowed to sit open and evaporate, be applied. Activated polyvinyl chloride sheets shall be protected from debris or contamination prior to installation.
 3. Sheet Liner: The activator prepared surface of the PVC sheet liner shall be pressed into the structural polymer in the manner shown in the application guide and rolled to remove trapped air. PVC sheets shall be applied while the structural polymer is still in its wet and uncured state as described in the manufacturer's Application Guide. Temporary supports may be necessary on curved or otherwise stressed areas. When the surface temperatures of the structure walls or roof to be lined are rising due to exposure to exterior direct sunlight and/or will be completely encapsulated by lining, out-gassing of air or vapor from the concrete may result in bubbling, pinhole formations, and/or blistering in the lining system. Application of the lining system in such locations shall be postponed until the concrete is no longer exposed to direct sunlight, and its temperature is stable or dropping. The Contractor shall prevent such rising substrate temperatures by protecting the concrete substrate from sunlight or scheduling installation during advantageous times of day. Should bubbles, pinholes, or discontinuities form in the applied lining system, they shall be repaired as specified in part 2.6 of this section. Whenever possible, the Contractor shall use heat-forming of the semi-rigid PVC liner to conform to any odd shapes or details in the structure. Heat-forming of the liner shall be done before the structural polymer is applied. Where heat-forming is not possible, the Contractor shall use the flexible PVC liner.

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4. Sheet Liner Seams, Terminations, and Leading Edges: The PVC lining system shall extend to the limits shown on the drawings. All liner seams shall be completed as described in the manufacturer's Application Guide and detail drawings of this specification. The liner seams shall be of the overlap type (See Detail x for Overlap Joint). Overlap seams shall be lapped in the direction of the flow, and lapped downwards for horizontal seams. All liner terminations and leading edges shall have a 0.25-in to 0.5-inch deep by 0.125-in to 0.25-in wide saw-cuts unless otherwise specified, and shall be installed as indicated in the manufacturer's Application Guide and detail drawings of this specification. All liner seams, terminations, and leading edges shall be sealed using the seam material. The seams and terminations shall be taped, and a seam-overlay band of seam material shall be applied as described in the Linabond Application Guide and the detail drawings of this specification. The tape shall be removed before the seam material begins to gel, in order to obtain straight edges that are free of projections. The resulting seam-overlay band shall be smooth, relatively flat, free of sharp protrusions, and have a thickness between 0.08 and 0.2 inches.
 5. Premolded PVC Corners: Premolded PVC corners shall be installed at all inside and outside corners as indicated in the manufacturer's Application Guide and detail drawings of this specification. PVC sheets shall overlap the PVC corners by 3 inches. The premolded PVC corners shall be pre-treated with activator on all faces before embedding them into the applied structural polymer, and applying seam material.
 6. PVC Lining U.V. Blocker: The Contractor shall install a U.V. Blocker on all surfaces of the Protective Lining System that will be permanently exposed to sunlight. The liquid U.V. Blocker shall be applied by brush or roller to the PVC lining prior to replacing or installing the aluminum or concrete covers or other equipment. The U.V. Blocker shall be Linabond No. 55 Aliphatic Top-Coat, as manufactured by Linabond, Inc., or equal and shall be applied at the rate of 250 square feet per gallon.
- C. Curing of Protective Lining System: The finished lining shall be protected from damage during curing and shall be cured as recommended by the lining manufacturer but in all cases no less than three (3) days of curing time must elapse before the lined area can be placed into service.
- D. Testing and Inspection: Upon completion of the installation of the protective lining system, the surface of the lining shall be cleaned and prepared to permit visual inspection, and adhesion testing by the Engineer:
1. All surfaces of the lining shall be visually inspected for areas showing poor adhesion, air inclusion, edges or seam defects, insufficient overlap, inadequate bond or any other defects in the lining preventing a complete seal of the protected surfaces.
 2. To assure proper adhesion of the polyvinyl chloride lining to the structural polymer to the concrete surface, the protective lining system shall have a "pull-off test" performed at locations previously designated by the Engineer and prepared by the lining Contractor. The test shall be the "Standard Test Method for Pull-Off Strength of Coatings using Portable Adhesion Tester " per ASTM Designation D4541 and modified as follows. The 1 square inch area to be tested shall be cored through the lining system past the bond area with the concrete substrate. The allowable minimum value for the pull-off strength test shall be per the protective lining system

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manufacturer's recommendation but shall not be less than 40 psi after three (3) days of curing at a minimum ambient temperature of 55 F.

3. Access to the protective lining system surface shall be provided by the Contractor, by leaving the installation scaffolding in place for the duration of the curing and inspection period. The areas where the destructive testing (adhesion test) was performed shall be repaired per Part 2.6 of this section.

E. Repair of Protective Lining System Defects and Holidays:

1. The Contractor shall repair entrapped air pockets in the liner greater than an equivalent area of 6-inch by 6-inch (36 sq. in), and holes or discontinuities in the liner as follows:
2. For air pockets, cut open injection and exhaust ports and inject seam material or structural polymer until the void behind the liner is completely filled. For holes or discontinuity in the liner, trim all damaged or loose PVC sheeting.
3. Clean an area extending at least 4 inches in all directions from the cut line in the PVC sheet using a clean white rag dampened with acetone to remove dirt and dust. Tape the perimeters of an area extending 4.5 inches in all direction from the cut line.
4. Apply the Surface Activator over the cleaned area.
5. Apply seam material or structural polymer at 60 to 120 mils over the activated area, and force under the loose edges of the PVC sheet.
6. Activate a PVC sheet patch large enough to cover the cut line in the air pocket with a 4-inch lap beyond the air pocket, hole or discontinuity in all directions. Apply the PVC patch over the wet seam material or structural polymer. Roll to remove entrapped air.
7. The edges of the PVC patch shall be taped leaving a ½ inch perimeter of exposed PVC. The exposed perimeter of the patch shall be activated. A 1-inch seam-overlay bead of seam material shall then be applied as described in the Linabond Application Guide and the detail drawings of this specification. The tape shall be removed before the seam material begins to gel, in order to obtain straight edges that are free of projections. The resulting seam-overlay band shall be smooth, relatively flat, free of sharp protrusions, and have a minimum average thickness between 0.08 and 0.2 inches.
8. Areas where the lining adhesive strength failed to meet the minimum pull-off strength testing value specified shall have all the defective lining, including structural polymer, removed as directed by the Engineer. The area shall be relined with a new application of protective lining system, overlapping the adjacent lined areas a minimum of 4 inches in all directions and shall be re-inspected.

++ END OF SECTION ++

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SECTION 03 21 03
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Fabrication and placement of reinforcement including bars, ties and supports.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
 2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Parts A and B. For slabs, show top and bottom reinforcing on separate plan views. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement, unless otherwise noted. Keep splices to a minimum. Avoid splices in regions of maximum tension stresses whenever possible.
- B. Certificates: Submit one (1) copy of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. American Concrete Institute (ACI):
 - a. ACI 315, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - b. ACI 318, Building Code Requirements for Reinforced Concrete.
 2. Concrete Reinforcing Steel Institute:
 - a. Manual of Standard Practice, includes ASTM standards referred to herein.
- B. Allowable Placing Tolerances: Comply with ACI 318, Chapter 7 - Details of Reinforcement.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

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Concrete Reinforcing

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60 for all non-welded bars. ASTM A706, Grade 60 for welded bars.
- B. Mechanical Couplers: Reinforcement bars may be spliced with a mechanical connection. Provide a full mechanical connection which shall develop in tension or compression, as required, at least 125% of specified yield strength (f_y) of the bar in accordance with ACI 318 Section 12.14.3.2. The locations of the connections are subject to the approval of the ENGINEER.
 - 1. Dayton Superior Bar Lock S/CA Series.
 - 2. Or approved equal
- C. Threaded Splicing Systems: Dowel Bar Splicer System shall comply with ICC Report #4028. The completed splice shall exceed 160% of the specified yield strength (f_y) of the bar.
 - 1. Dayton Superior DB/DI parallel threaded couplers.
 - 2. Or approved equal
- D. Steel Wire: ASTM A82.
- E. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 - 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 - 2. At all formed surfaces, provide supports complying with CRSI "Manual of Standard Practice" as follows: Plastic protected or stainless steel legs.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI, "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
 - 1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 - 2. Bends or kinks not shown on approved Shop Drawings.
 - 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which concrete reinforcement is to be placed with installer, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, oil, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement operations. Locate and support reinforcing by hangers, as required.
 - 1. Place reinforcement to obtain the minimum concrete cover as shown. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Slab bars shall be tied at every intersection around the periphery of the slab and not less than every 48 inches in the field at walls and 60 inches in the field at slabs.
 - 2. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.
 - 3. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 - 4. Do not secure reinforcing steel to forms with wire, nails or other ferrous metal. Do not permit metal supports subject to corrosion to touch or be within the required clearance to formed or exposed concrete surfaces.
- D. Provide sufficient numbers of supports of strength required to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment or similar construction loads.
- E. Splices: Provide reinforcement lap splices by placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.
- F. Mechanical Couplers in Lieu of Lap Splicing:
 - 1. Provide mechanical butt splices in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Flame dry bars before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

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- G. Reinforcement Around Openings: Place an equivalent area of steel around the pipe or opening and extend on each side sufficiently to develop bond in each bar. See the Details on Drawings for bar extension length each side of opening. Where welded wire fabric is used, provide extra reinforcing using fabric or deformed bars.
- H. Field Bending: Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars. Rebending of bars at the same place where strain hardening has taken place due to the original bend will damage the bar. Consult with the ENGINEER prior to any pour if the CONTRACTOR foresees a need to work out a solution to prevent field bending.

3.3 INSPECTION OF REINFORCEMENT

- A. Do not place concrete until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

++ END OF SECTION ++

SECTION 03 30 03

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Place, finish, cure, strip, and repair concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
1. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 214, Recommended Practice for Evaluation of Strength Test Results of Concrete.
 3. ACI 301, Specifications for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
 4. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 5. ACI 305, Hot Weather Concreting.
 6. ACI 306, Cold Weather Concreting.
 7. ACI 309, Guide for Consolidation of Concrete.
 8. ACI 311, Guide for Concrete Inspection.
 9. ACI 318, Building Code Requirements for Reinforced Concrete.
 10. ACI 347, Guide to Formwork for Concrete
 11. ACI 350, Environmental Engineering Concrete Structures.

1.3 SYSTEM DESCRIPTION

- A. Class A Concrete shall be steel reinforced and includes:
1. Slabs.

1.4 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by ENGINEER, including names, sources and descriptions.
- B. Product Data: Submit for approval the following:
1. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 2. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for materials and mix design tests
- D. Delivery Tickets: Furnish to ENGINEER copies of all weighmaster certificate delivery tickets for each load of concrete delivered to the site. Provide items of information as

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specified in ASTM C94, Section 16. Delivery tickets shall be signed by a Certified Weighmaster.

1.5 QUALITY ASSURANCE

- A. Tests for Concrete Materials: Submit written reports to ENGINEER, for each material sampled and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.
- B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier, mix proportions and concrete strength curves for regular cylinder tests shall be established by an approved ready-mix supplier or an independent testing laboratory based on the relationship of 7, 14 and 28 day strengths versus slump values of 2, 4 and 6 inches, all conforming to these Specifications. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs, not previously used by the ready-mix supplier, and testing of concrete and materials shall be borne by CONTRACTOR.

1.6 CONCRETE PRE-CONSTRUCTION CONFERENCE

- A. Required Meeting Attendees:
 - 1. CONTRACTOR
 - 2. Concrete Subcontractor
 - 3. ENGINEER
 - 4. OWNER.
- B. Schedule and conduct prior to concrete placement into Project. Notify OWNER of location and times at least seven days prior to the anticipated meeting date.
- C. Agenda shall include:
 - 1. Review of field conditions. Conduct field observations of Work to be performed.
 - 2. Review of formwork.
 - 3. Review of concrete mixes to be used. Concrete slump requirements.
 - 4. Site access of concrete trucks.
 - 5. Pump truck location and access for two concrete trucks to deliver concrete.
 - 6. Placement requirements with the concrete pump and hoses.
 - 7. Power, lighting, and water requirements.
 - 8. Ambient temperature considerations during concrete placement.
 - 9. Procedures for hot or cold weather concreting.
 - 10. Vibrators to be used.
 - 11. Adequacy of core hole locations for placing and vibrating concrete.
 - 12. Concrete testing requirements.
 - 13. Curing methods.
 - 14. Form removal at 28-day concrete strength.
 - 15. Requirements for concrete truck wash out.
 - 16. Clean up after concrete placement.
 - 17. Safety requirements.

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PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement:
 - 1. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P (MS).
 - 2. Do not use cement which has deteriorated because of improper storage or handling.
- B. Aggregates: ASTM C33 and as herein specified.
 - 1. Do not use aggregates containing soluble salts, substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - 2. Fine Aggregate: Provide clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - 3. Coarse Aggregate: Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Coarse Aggregate Size: Size to be ASTM C33, No. 8 (3/8").
- C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

2.2 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER.
- B. Air-Entraining Admixtures: ASTM C260.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. SIKA AER, as manufactured by Sika Corporation.
 - b. MasterAir AE 200, as manufactured by BASF.
 - c. Daravair, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- C. High-Range Water-Reducing Admixture ("Superplasticizer"): ASTM C494, Type F/G.
 - 1. Superplasticizer shall be used in all Class A Concrete. Do not use high range water-reducing admixture containing more chloride ions than are contained in municipal drinking water. Add only at the job site to concrete in compliance with the manufacturer's printed instruction.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Sikament 320, as manufactured by Sika Corporation.
 - b. MasterGlenium, as manufactured by BASF.
 - c. Daracem-100, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.

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- D. Water-Reducing Admixture: ASTM C 494, Type A.
1. A water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. Do not use admixture containing any lignin, nitrates or chlorides added during manufacture.
 2. Product and Manufacturer: Provide one of the following:
 - a. Eucon WR-75, as manufactured by The Euclid Chemical Company.
 - b. MasterPozzolith, as manufactured by BASF.
 - c. WRDA series, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- E. Pozzolanic Admixtures:
1. Pozzolanic admixtures may be used in Class A Concrete.
 2. Provide Mineral admixtures, when used, meeting the requirements of ASTM C618 Class F.
 3. A substitution by weight, of the portland cement by pozzolan, so that the total tricalcium aluminate content of the resulting cement plus pozzolan is not greater than 8%, will be considered. However, the pozzolan shall not exceed 20% by weight of the cement plus pozzolan.
- F. Set-Control Admixtures: ASTM C494, as follows:
1. Type B, Retarding.
 2. Type C, Accelerating.
 3. Type D, Water-reducing and Retarding.
 4. Type E, Water-reducing and Accelerating.
 5. Type F, Water-reducing, high range admixtures.
 6. Type G, Water-reducing, high range, and retarding admixtures.
- G. Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Mixes subject to the following limitations:
1. Class A Concrete
 - a. Specified 28-day Compressive Strength: 4,000 psi minimum.
 - b. Air content: 6% \pm 1% at point of placement
 - c. Slump, before addition of superplasticizer: 3½ inches \pm ½ inches
 - d. Slump, after addition of superplasticizer: 9-inch maximum

Coarse Aggregate Size	Cementitious Content-Pounds Per Cubic Yard	Water-Cement Ratio by Weight
3/8"	625 min, 800 max	0.375

- e. Use superplasticizer in all Class A Concrete. Use water reducers in combination with superplasticizers as required for mixing.

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- B. Use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.
- C. Admixtures:
 - 1. Use air-entraining admixture in all concrete. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
 - 2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

2.4 EPOXY BONDING AGENT

- A. For use in all dry-packed holes, concrete repair and for unplanned cold-joints.
- B. Provide an epoxy-resin bonding agent, two component, polysulfide type.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Sikadur 32, Hi-Mod LPL, as manufactured by Sika Corporation.
 - 2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.
 - 3. Or approved equal.

2.5 CONCRETE CURING MATERIALS

- A. Curing Compound: ASTM C309 Type 1-D (water retention requirements):
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Super Aqua Cure VOX, as manufactured by The Euclid Chemical Company.
 - b. Sealtight 1100, as manufactured by W.R. Meadows, Incorporated.
 - c. Or approved equal.

2.6 EMBEDDED ITEMS

- A. Provide and install items such as plates, angles, inserts, bolts and similar items not specified elsewhere under this Section. Carbon steel embedded items shall be hot dip galvanized after fabrication.

PART 3 - EXECUTION

3.1 CONCRETE MIXING

- A. Provide concrete produced by the ready-mixed process.
- B. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by ENGINEER before implementation.
 - 1. Plant equipment and facilities: Conform to National Ready- Mix Concrete Association "Plant and Delivery Equipment Specification."
 - 2. Mix concrete in revolving type truck mixers that are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.

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3. Do not exceed the proper capacity of the mixer.
4. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
5. Mix concrete during transit only as recommended by the mixer manufacturer.
6. Mix at proper speed until concrete is discharged.
7. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
8. Provide access to the mixing plant for ENGINEER at all times.

3.2 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients or before 250 revolutions of the drum or blades, whichever occurs first.
- B. If an admixture is used to retard the set time and the concrete temperature does not exceed 85 degrees F, the travel and placing time may be extended to 120 minutes or 300 revolutions of the drum or blades, whichever occurs first.
- C. Take care to avoid spilling and separation of the mixture during transportation.
- D. Do not place concrete in which the ingredients have been separated.
- E. Do not retemper partially set concrete.
- F. Use suitable and approved equipment for transporting concrete from mixer to forms.

3.3 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation.
 1. Screed concrete that is to receive other construction to the proper level to avoid excessive skimming or grouting.
 2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 4. Do not place in cold weather, unless adequate precautions are taken against frost action.
 5. Unless otherwise approved, place concrete only when ENGINEER is present.
- B. Concrete Conveying:
 1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials.

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2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, ice and other deleterious materials.
 3. Pump concrete to point of delivery, however, do not use aluminum pipe for conveying.
- C. Placing Concrete into Forms:
1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints.
 2. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted.
 3. Vibrators shall have a frequency of at least 8,000 vpm, with amplitude required to consolidate the concrete in the section being placed. At least two stand-by vibrators in operable condition shall be at the placement site prior to initiating placement of the concrete.
 4. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
- D. Placing Concrete Slabs:
1. Deposit and consolidate concrete in a continuous operation, until the placing of a section is completed.
 2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Bring surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to beginning finishing operations.
- E. Quality of Concrete Work:
1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
 2. All concrete for liquid retaining structures shall be watertight.
 3. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
 4. Repair, remove, and replace defective concrete as ordered by ENGINEER at no additional cost to OWNER.
- F. Cold Weather Placing:
1. Protect all concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
 2. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing.

Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to ensure that the ambient temperature does not fall more than 30°F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost and ice before placing concrete.
5. When temperatures are expected to be below 32°F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50°F.
6. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.
7. Weather predictions made by the nearest NOAA station, and corrected for the local elevation and environmental conditions, may be used to determine whether cold weather protection shall be required. Thermometers will be used by ENGINEER and these readings shall determine whether cold weather protection shall be required and whether cold weather protection is adequate.

G. Hot Weather Placing:

1. When hot weather conditions exist as any combination of high air temperature, low relative humidity and wind velocity that would seriously impair the quality and strength of concrete, place concrete as recommended by ACI 305 and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 85°F. No concrete shall be placed if its temperature exceeds 90°F. Mixing water may be chilled, or chopped ice may be used, or liquid nitrogen may be added. Ice, when introduced into the mixer shall be in such form that it will be completely melted and dispersed throughout the mix at the completion of the mixing time. The addition of ice shall not increase the specified water to cement ratio.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
4. Thoroughly wet forms before placing concrete. Forms shall be free of standing water when concrete is placed.
5. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
6. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.
7. Obtain ENGINEER'S approval of other methods and materials proposed for use.

H. Removal of Forms:

1. The CONTRACTOR shall be responsible for all damage resulting from improper and premature removal of forms. Satisfy all applicable OSHA requirements with regard to safety of personnel and property.
 2. Forms and shoring for elevated structural slabs or beams shall remain in place in accordance with ACI 318, Chapter 6, and until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Removal of all supports prior to obtaining adequate field cured cylinder results and reshoring shall not be permitted.
- I. Patching:
1. Patching of concrete shall provide an acceptable and structurally sound surface finish uniform in appearance or the CONTRACTOR shall upgrade the finish by other means at no additional cost.
 2. Tie Holes: All tie holes, except where sealant is indicated, shall be filled with dry pack nonshrink grout. White cement shall be added as needed so the color of grout after curing matches the color of adjacent concrete. Tie holes shall be thoroughly sandblasted or roughened. Flush the patch area with water and allow to dry. Coat the surface of the existing concrete with an approved bonding agent prior to filling with nonshrink grout. Complete the repair in the time duration specified by the bonding agent manufacturer. The grout shall be rammed into place in thin layers and leveled to the plane of the surrounding concrete. Cure in accordance with the manufacturer's recommendations.
 3. Defective Areas: Remove all defective concrete such as honeycombed areas and rock pockets out to sound concrete. Small shallow holes caused by air entrapment at the surface of the forms shall not be considered defects unless the amount is so great as to be considered not the standard of the industry and due primarily of poor workmanship. If chipping is required, the edges shall be perpendicular to the surface. Feather edges shall not be permitted. The defective area shall be filled with a nonshrink, nonmetallic, grout. Use an approved bonding agent on horizontal patches prior to placing nonmetallic, non shrink grout. Since some bonding agents may not be compatible for some vertical surface patching techniques, demonstrate all methods for repair of vertical surfaces using the actual materials, methods, and curing procedures required by the manufactures of the materials on the project site. The CONTRACTOR shall consult with representatives of the bonding agent manufacturer and the nonshrink grout manufacturer, and these representatives shall be onsite and assist in the demonstration.
 4. Blockouts at Pipes or Other Penetrations: Conform to details shown or submit proposed blockouts for review. Use nonshrink, nonmetallic grout.

3.4 FINISH OF FORMED SURFACES

- A. Smooth Form Finish:
1. Produce smooth form finish (Class A, as defined by ACI-347) by selecting form materials that will impart a smooth, hard, uniform texture. Arrange panels in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas as above with all fins or other projections completely removed and smoothed.

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2. Use smooth form finish for surfaces that are to be covered with a coating material. The material may be applied directly to the concrete or may be a covering bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

3.5 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing after placing and finishing concrete as soon as free moisture and bleed water sheen has disappeared from the concrete surface. Keep concrete continuously moist during initial curing.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. The total curing duration shall not be less than ten (10) days. For concrete sections over 30-inch thick, continue curing for an additional seven (7) days, minimum. Avoid rapid drying at the end of the final curing period.

B. Use one of the following methods as approved by ENGINEER:

1. Slab:
 - a. Apply liquid curing compound immediately after final finishing when surface will no longer be damaged by traffic necessary to apply curing compound.

C. Liquid curing compound:

1. Apply the specified curing compound to concrete surfaces when permitted by ENGINEER. The compounds shall be applied by power spray equipment in accordance with the manufacturer's directions. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. Remove curing compound from exposed surfaces at the end of the curing duration.

D. Temperature of Concrete During Curing:

1. When the nighttime low temperature may drop to 40°F or below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period, by heating, covering, insulation or housing as required.
2. When the daytime high temperature may rise to 90°F or above, maintain the concrete temperature at a minimum and reduce temperature variations by providing moist curing continuously for the concrete curing period.
3. During either of the conditions specified above, the minimum curing time shall be 10 days (240 hours), after which coverings, housings, and insulation shall remain on the work for an additional 3 days, to allow gradual temperature equalization with the atmosphere.

E. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

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3.6 FIELD QUALITY CONTROL

- A. The CONTRACTOR will employ a testing laboratory to perform field quality control testing. ENGINEER will direct the number of tests and cylinders required. Furnish all necessary assistance required by ENGINEER.
- B. Quality Control Testing During Construction:
 - 1. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.
 - b. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C231; one for the first concrete load, and one for every two concrete loads thereafter, or when required by an indication of change. Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - d. Compressive Strength Tests: ASTM C39; one set of 6 standard compression cylinders for each 30 cubic yards or fraction thereof, of each mix design placed in any one day; 1 specimen tested at 7 days, 1 specimen tested at 14 days, 1 specimen tested at 21 days and 2 specimens tested at 28 days, 1 held. Cast, store and cure specimens as specified in ASTM C31.
 - 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - 2) Concrete that does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by ENGINEER, at the expense of CONTRACTOR.
 - e. Concrete Temperature: Test each time a slump test is made.
 - 2. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the same samples as the laboratory cured specimens.
 - a. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders.
 - b. When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
 - 3. The testing laboratory shall submit certified copies of test results directly to ENGINEER and CONTRACTOR after tests are made.
- C. Evaluation of Quality Control Tests:
 - 1. Do not use concrete delivered to the final point of placement that has slump or temperature outside the specified values, nor that which is older than specified in section 3.2.
 - 2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.

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3. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.

D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, provide the services of a concrete testing service to take cores drilled from hardened concrete for compressive strength determination at no additional expense to OWNER. Provide tests complying with ASTM C42 and the following:
 - a. Take at least three (3) representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% and no single core is less than 75% of the 28 day required compressive strength.
 - c. Report test results, in writing, to ENGINEER on the same day that tests are made. Include in test reports the Project identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
2. Fill core holes solid with non-shrink, high strength grout, and finish to match adjacent concrete surfaces.

3.7 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for the passage of work by other contractors, unless otherwise shown or directed, after the work of other contractors is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the Work.
- B. Installation of embedded items
 1. Install all embedded items prior to concrete placement, or, if necessary, as soon after concrete placement as possible, before concrete is set.
 2. Use temporary support and bracing to keep embedded items in place while concrete cures.
 3. Protect all embedded items from damage during concrete installation.

3.8 CONCRETE REPAIRS

- A. Repair of Formed surfaces:
 1. Repair exposed-to-view formed concrete surfaces that contain defects which adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

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2. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01-inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corner.
 3. Repair structural cracks and cracks in water-holding structures.
- B. Method of Repair of Formed Surfaces:
1. Repair and patch defective areas with cement mortar immediately after removal of forms and as directed by ENGINEER.
 2. Cut out honeycomb, rock pockets, voids over ½-inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with the specified bonding agent.
 - a. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete. CONTRACTOR shall impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
 3. Cracks which require repair shall be pressure grouted, epoxy injected, using one of the following in accordance with Section 03 01 06, Crack Repair by Epoxy Injection. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation Company.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.
 4. Fill holes extending through concrete by means of a plunger- type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling.
 5. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish of unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through

non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

4. Repair structural cracks and cracks in water-holding structures.

D. Methods of Repair of Unformed Surfaces:

1. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
2. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Euco Poly-Patch, as manufactured by The Euclid Chemical Company.
 - b. Sikatop 122, as manufactured by Sika Corporation.
 - c. Or approved equal.
3. Repair defective areas, except random cracks and single holes not exceeding 2-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least $\frac{3}{4}$ -inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials and proportions to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
4. Repair isolated random cracks, as approved by ENGINEER, and single holes not over 2-inch diameter, by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part portland cement to 2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
5. Cracks which extend through the full member section, or any cracks determined by ENGINEER to require pressure grouting repair, shall be pressure grouted, epoxy injected, using one of the following in accordance with Section 03 01 06, Crack Repair By Epoxy Injection. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.
6. Assure that surface is acceptable for flooring material to be installed in accordance with manufacturer's recommendations.

E. Other Methods of Repair:

1. Repair methods not specified above may be used if approved by ENGINEER.

++ END OF SECTION ++

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GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes epoxy, non-metallic, non-shrink, and ordinary Portland cement-sand grouts.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33, Standard Specification for Concrete Aggregates.
 - 2. ASTM C150, Standard Specification for Portland Cement.
 - 3. ASTM C595, Standard Specification for Blended Hydraulic Cements.
 - 4. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout.

1.3 SYSTEM DESCRIPTION

- A. Furnish ordinary cement-sand grout for the following:
 - 1. Foundation grout.
 - 2. Construction joint grout.
 - 3. As shown in the Drawings.
- B. Furnish non-shrink, non-metallic grout for the following:
 - 1. Equipment bases, 25 hp or less.
 - 2. Base plates.
 - 3. Guardrail and railings.
 - 4. Through-bolt and form tie openings.
 - 5. As shown in the Drawings.
- C. Furnish epoxy grout for the following:
 - 1. Equipment bases, 26 hp or more and/or sole plates with vibration, thermal movement, etc.
 - 2. Blockouts for gate guides.
 - 3. Retrofit waterstop installation.
 - 4. As shown in the Drawings.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and installation instructions for all proprietary materials.
 - 2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
 - 3. Forming method for fluid grout placements.
 - 4. Curing method for grout.
- B. Laboratory Test Reports and Certificates:

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1. For proprietary materials, submit copies of reports on quality control tests.
2. Submit certification that materials meet specification requirements for nonproprietary materials.
3. For ordinary cement-sand grout, copies of grout mix design and laboratory strength test reports.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver grout materials from manufacturers in unopened containers and bearing intact manufacturer's labels.
- B. Storage of Materials: Store grout materials in a dry shelter and protected from moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. High-Strength Epoxy Grout.
 1. Use 100% solids, prepackaged, solvent-free, moisture insensitive, high-strength epoxy grout.
 2. Product and Manufacturer: Provide one of the following:
 - a. E³-HP, as manufactured by The Euclid Chemical Company.
 - b. Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
 - c. Five Star HP Epoxy Grout by Five Star Products, Incorporated.
 - d. Or approved equal.
- B. Non-shrink, Non-metallic Grout:
 1. Prepackaged non-staining cementitious grout which shall meet the minimum requirements of ASTM C1107 and requiring only the addition of water at the jobsite.
 2. Product and Manufacturer: Provide one of the following:
 - a. NS, as manufactured by The Euclid Chemical Company.
 - b. Five Star Grout, as manufactured by Five Star Products, Incorporated.
 - c. Sika Grout 212, as manufactured by Sika Corporation.
 - d. Or approved equal.
- C. Ordinary Cement-Sand Grout: Prepare design mix for ordinary cement grout.
 1. Cement: Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
 2. Aggregates: ASTM C33 and as herein specified.
 - a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - b. Fine Aggregate: Clean, sharp, natural sand, free from loam, clay, lumps or other deleterious substances.
 - 1) Dune sand, bank run sand and manufactured sand are not acceptable.
 - c. Coarse Aggregate: Coarse aggregate not permitted.
 3. Admixtures: Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless

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otherwise authorized in writing by ENGINEER. Refer to Section 03 30 03 - Cast-In-Place Concrete, for additional admixture requirements.

4. Proportioning and Design of Mixes: Mixes are subject to the following limitations:
 - a. Specified 28-day Compressive Strength: 4,000 psi.
 - b. Minimum amount of water necessary for the mixture to flow under its own weight.
 - c. Fine Aggregate meeting ASTM C33.
 - d. Air Content Percentage: $\pm 1.5\%$.
 - e. Minimum Cement Content in Pounds per Cubic Yard: 658.
 - f. Slump at point of placement: 5 inch ± 1 inch.
5. Proportion mix by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and provide a complete report, from an independent testing laboratory, to ENGINEER, at least 30 days prior to start of Work. Do not begin grout production until ENGINEER has approved mix.
6. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning.
7. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Chapter 4.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which grout is to be placed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General:
 1. Mix, place and cure grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until ENGINEER provides clarification.
 2. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by CONTRACTOR.
 3. When placing grout conform to temperature and weather limitations in Section 03 30 03, Cast-In-Place Concrete.
- B. Through-bolt and form-tie holes: Fill space with dry pack dense grout hammered in with steel tool and hammer. Coordinate dry pack dense grout application with bonding agent.
- C. Columns, Beams and Equipment Bases: Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material prior to setting base plates and machinery. After shimming columns, beams and equipment indicated to be grouted on the plans to proper grade, securely tighten anchor bolts. Properly form

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around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with grout.

- D. Guardrails and Railings: After posts and rails have been properly inserted into holes or sleeves, fill the annular space between posts and cast-in-place sleeves and/or below base plates with non-shrink grout. Bevel grout at juncture with post so that moisture flows away from posts.
- E. Construction Joints: Ordinary cement-sand grout may be used in place of mortar over the contact surface of the old concrete at the interface of horizontal construction joints as outlined in Section 03 30 03, Cast-In-Place Concrete, of these Specifications.
- F. Curing: Cure all grout in accordance with manufacturer's written instructions. Wet cure ordinary cement-sand grout and non-shrink non-metallic grout for a minimum of three (3) days unless directed otherwise by the ENGINEER.

++ END OF SECTION ++

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SECTION 05 05 03

MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work necessary to furnish and install, complete, fabricated metalwork and castings as shown or as required to secure various parts together and provide a complete installation.

1.2 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for the fabrication and erection of the miscellaneous metal Work. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.
- B. Product Data: Submit copies of manufacturer's specifications, load tables, dimensions, diagrams, anchor details, and installation instructions for manufactured products.
- C. Samples: Submit representative samples of manufactured products.

1.3 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations. Clearly mark units for reassembly and coordinated installation.
- C. Qualifications: Qualify welding operators in accordance with requirements of current AWS Standard Performance Qualification Procedures in the applicable structural welding code.
 - 1. Qualification Tests: Performed by a recognized testing laboratory.
- D. Certification: Certify welders of structural and reinforcing steel for all positions of welding in accordance with such procedure.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Like Items of Materials: Provide end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, replacement, and manufacturer's service.

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- B. Lifting Lugs: Provide on equipment and equipment components weighing over 100 pounds.
- C. Furnish miscellaneous items:
 - 1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
 - 2. Items specified herein are not intended to be all-inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.

2.2 MATERIALS

- A. Carbon steel structural shapes:
 - 1. Wide flange sections: ASTM A992 Grade 50.
 - 2. Steel pipe columns: ASTM A53 Grade B.
 - 3. Hollow Structural Sections (HSS): ASTM A500 Grade B.
 - 4. Plates, Angles, Channels, and S Shapes: ASTM A36.
- B. Stainless Steel:
 - 1. Plates and Sheets: ASTM A240, Type 304L or 316
 - 2. Structural shapes: ASTM A276, A479 or A1069, Type 304L or 316.
 - 3. Fasteners and fittings: ASTM A320, Type 316
 - a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- C. Aluminum, Structural Shapes and Plates: Alloy 6061-T6, meeting Aluminum Assoc. Specification for Aluminum Structures
- D. Cast Iron: A48, Class 30
- E. Light Gauge Steel Framing:
 - 1. Manufactured by SSMA ICC ESR-3064P, or equivalent, to meet the requirements of AISI S100.
 - 2. ASTM A570 or A446 with a minimum yield strength of 33 ksi for 18 gauge and 20 gauge, 50 ksi for 14 gauge and 16 gauge.
 - 3. Framing members shall have the section properties as listed on the Drawings.
- F. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
 - 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 - 3. Provide two ASTM F436 washers for all bolts.
 - 4. Provide beveled washers at connections of sloped/tapered sections.
 - 5. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners.
- G. Cast-in-Place Anchor Rods:
 - 1. ASTM F1554, Grade 36 with weldability supplement S1, galvanized, unless shown otherwise.

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2. Provide ASTM F436 washers at all nuts unless shown otherwise.
3. Provide anchor bolt sleeves as required or as shown for location adjustment.
4. Provide stainless steel anchors where shown on the Drawings or listed in another specific specification section.

H. Galvanizing:

1. Zinc coated hardware: ASTM A153.
2. Fabrications: ASTM A123.
3. Members designated as galvanized on the drawings or as directed by ENGINEER shall be galvanized after fabrication in accordance with ASTM A385. Weight of zinc coating shall not be less than 2.5 ounces per square foot of actual surface and have a coating thickness of 0.0042 inch. Coating weight will be subject to verification by ENGINEER. Thickness of coating will be measured by means of a magnetic thickness gauge.
4. Each fabricated assembly shall be totally immersed in the galvanizing bath. The galvanizing procedure shall be such as to avoid distortion of the assembly. Straightening of members after galvanizing will not be permitted. Assemblies shall be held in the galvanizing bath until the temperature of the assembly is equal to the temperature of the bath. All deviations shall require approval by ENGINEER.
5. Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire surface has a uniform coating of 2.5 ounces of zinc per square foot.
6. Galvanized work shall be subject to inspection by ENGINEER at any time to ensure strict compliance with this specification. Any areas found to show defects or signs of improper galvanizing application will be rejected. Repairs shall be made by CONTRACTOR without additional cost to OWNER.

I. Surface preparation and Finish:

1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop. Comply with Section 09 91 03, Painting.

2.3 ALUMINUM STAIR TREAD

- A. Extruded bearing bars positioned and locked by cross bars. Treads shall be manufactured with a defined visible abrasive nosing and end plates capable of welding or bolting to stair stringers.
- B. Material:
 1. All supports, cross members, etc. shall be aluminum
 2. Bearing bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B221.
 3. Fasteners and fittings: ASTM A320, Type 316
 - a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- C. Manufacturer:
 1. Grating Pacific.
 2. Borden Metal Products.
 3. Ohio Grating.

2.4 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:

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1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.
 - b. Density: 0.956, ASTM D1505.
 - c. Vicant Softening Point: 256°F, ASTM D1525
 - d. Brittleness Temperature: -180°F, ASTM D746
- B. Fabricated Steel Sleeve:
1. Material: A36 steel.
 2. Dimensions, welding, and sizes as shown.

2.5 FABRICATIONS

- A. Miscellaneous Framings and Supports:
1. Fabricate units to the sizes, shapes, and profiles shown, or if not shown, of the required dimensions to receive the adjacent gratings, plates, tanks, doors, or other work to be retained by the framing.
 2. Except as otherwise shown, fabricate from structural shapes, plates, and bars of compatible material, all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and other items to be anchored to the work.
 3. Equip units with integrally welded anchors for casting into concrete or integrating into masonry. Furnish inserts for casting in, if units must be installed after concrete or grout is placed. Anchor spacing shall be 24" on-center, unless otherwise shown.
 4. Galvanize where shown.
- B. Miscellaneous Fabricated Metals:
1. The following additional items are listed as a guide. Some items on list may not be required, and list may not be all-inclusive. Submittal data for materials and products must be approved before they are incorporated in the work.
 - a. Access Walkway
 - b. Aluminum Stairways.
 - c. Float Switch Supports
 - d. Lifting Eyes.
 - e. Pipe Supports.
 - f. Steel Bases and Anchors.
 - g. Weir Plates.
- C. Stainless Steel Fabrication: Following welding fabrication all stainless steel assemblies shall be cleaned, descaled and passivated in accordance with ASTM A380.
- D. Anchors, Fasteners, and Fittings: Provide zinc-coated carbon steel for steel fabrications, and stainless steel for aluminum and stainless steel fabrications, unless shown otherwise.
- E. Pipe Sleeves
1. Provide as follows:
 - a. Hot-dip galvanized, Schedule 40 steel pipe sleeves where shown for piping passing through concrete or masonry.

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- b. Holes drilled with rotary drill may be provided in lieu of sleeves in existing walls.
- c. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
- d. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

PART 3 - EXECUTION

3.1 FABRICATION

A. General:

- 1. Exposed Surfaces Finish: Smooth, sharp, well-defined lines.
- 2. Provide necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
- 3. Conceal fastenings where practical.
- 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
- 5. Fabricate materials as specified.
- 6. Weld connections, except where bolting is directed.
- 7. Methods of fabrication not otherwise specified or shown shall be adequate for stress and as approved.
- 8. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases and where shown.
- 9. Round sharp edges to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.

B. Aluminum:

- 1. Fabricate as shown, and in accordance with the Aluminum Association Standards and manufacturer's recommendations as approved.
- 2. Grind smooth sheared edges exposed in finished work.

3.2 WELDING

A. General

- 1. Meet codes for Arc and Gas Welding in Building Construction of the AWS and AISC for techniques of welding employed, appearance, quality of welds made, and the methods of correcting defective work.
- 2. Welding Surfaces: Free from loose scale, rust, grease, paint, and other foreign material, except mill scale which will withstand vigorous wire brushing may remain.
- 3. A light film of linseed oil may likewise be disregarded.
- 4. Do not weld when temperature of base metal is lower than zero degrees F.
- 5. Finished members shall be true to line and free from twists.
- 6. Prepare welds and adjacent areas such that there is:
 - a. No undercutting or reverse ridges on the weld bead.
 - b. No weld spatter on or adjacent to the weld or any other area to be painted.
 - c. No sharp peaks or ridges along the weld bead.
- 7. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

B. Welding Operators: As specified in PART 1, Article 1.3 QUALITY ASSURANCE.

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3.3 INSTALLATION

- A. Set units accurately in location, alignment, and elevation, level, plumb, true, and square, measured from established lines and levels. Brace or anchor temporarily in formwork where units are to be built into concrete, masonry, or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible.
- C. Fit exposed edges accurately together to form tight, hairline joints. Do not weld, cut, or abrade the surfaces of galvanized or anodized units which are intended for bolted or screwed connections.
- D. Field Welding: Where field welding is necessary, grind joints smooth and touch-up the shop paint. Comply with the applicable provisions of AWS D1.1 for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding.
- E. Field Coat all miscellaneous ferrous and steel metals per Specification Section 09 91 03 - Painting, System 300.
- F. Where aluminum is in contact with dissimilar metals, or embedded in masonry or concrete, protect surfaces as specified in Section 09 91 03 - Painting, System 305.

++ END OF SECTION ++

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SECTION 05 05 06

ANCHORS, INSERTS, AND DOWELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all post-installed anchors and inserts required to anchor parts of the Work to supporting concrete or masonry construction, and plaster. This Section also includes adhesives for anchoring reinforcing dowels into existing concrete.

1.2 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM A36, Standard Specification for Carbon Structural Steel.
 - 2. ASTM A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
 - 3. ASTM D746, Standard Test Method for Brittleness of Temperature of Plastics and Elastomers by Impact
 - 4. ASTM D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique
 - 5. ASTM D1525, Standard Test Method for Vicat Softening Temperature of Plastics
- B. 2018 International Building Code (IBC)
- C. American Concrete Institute (ACI)
 - 1. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete
 - 2. ACI 355.4, Qualification of Post-installed Adhesive Anchors in Concrete

1.3 SYSTEM DESCRIPTION

- A. Provide the size, type, and length of anchor shown on the drawings or, if not shown, as specified in the detailed sections of these specifications.
- B. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown or specified, provide the size, length and capacity required to carry the design load times a minimum safety factor of 4.
- C. For equipment anchors, if the design load is not specified by the manufacturer, provide anchors of diameter no less than the diameter of the hole minus 3/16 inch. When the design load is not specified by the manufacturer, provide structural calculations.

1.4 SUBMITTALS

- A. Product Data: Submit for approval copies of material certification, manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

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- B. Installer's Qualifications: When installing adhesive anchors subject to sustained tension loading or when specifically noted in the Drawings, submit for approval copies of the installer's qualifications certified by the ACI/CRSI Adhesive Anchor Installer Certification program.

1.5 QUALITY ASSURANCE

- A. Post-installed concrete anchors shall be ICC approved for seismic applications in cracked concrete and prequalified in accordance with ACI 355.2 or ACI 355.4.

PART 2 - PRODUCTS

2.1 ANCHOR BOLTS

- A. Nonsubmerged Use in areas of wet use, washdown areas, or areas outside heated buildings:
1. Stainless steel Type 316, unless otherwise shown.
 2. Diameter, Length and Bend Dimensions: As required by equipment or machinery manufacturer. Unless otherwise required, provide 3/4-inch minimum diameter by 12-inches long and other geometry as shown.
 3. Furnish A320 nuts and washers of same material for each bolt, unless otherwise shown.
 4. Provide sleeves as required or as shown for location adjustment.
- B. Submerged Use:
1. Submerged use is defined as any connection 1 foot 6 inches below the normal water surface elevation in a water holding basin.
 2. As specified for nonsubmerged use, for equipment, machinery or other connections except as follows:
 - a. Coating of anchor bolt threads is not required.
 - b. Where threads are covered with fusion bonded coating, provide nut of proper size to fit and provide connection of equal strength to embedded bolt.
- C. For anchoring fabricated metalwork, structural steel, or other components where connections will be protected or dry:
1. Galvanized Steel, 36 ksi, minimum.
 2. Minimum Size: 3/4-inch diameter by 12-inch long, unless otherwise shown.
 3. At base plates with grout pads, furnish two nuts and two washers per bolt of same material as bolt, unless otherwise shown.

2.2 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:
1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.

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- b. Density: 0.956, ASTM D1505.
- c. Vicant Softening Point: 256°F, ASTM D1525
- d. Brittleness Temperature: -180°F, ASTM D746

- B. Fabricated Steel Sleeve:
 - 1. Material: A36 steel.
 - 2. Dimensions, welding, and sizes as shown.

2.3 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

- A. Provide for stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners.
- B. Lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper as manufactured by:
 - 1. Loc Tite Co., Permatex.
 - 2. Or equal

2.4 CONCRETE INSERTS

- A. For vertical support of grating or floor plate, provide cast-in metal fabrications as shown.
- B. Except as permitted below, or as otherwise shown, provide malleable iron inserts for hanging piping and conduit from concrete ceilings and soffits. Comply with Federal Specification WW-H-171-E (Type 18). Provide those recommended by the manufacturer for the required loading.
- C. Obtain inserts in sufficient time so as not to delay concrete or masonry work.
- D. Product and Manufacturer: Provide inserts of one of the following:
 - 1. Figure 282, as manufactured by Anvil/Grinnell.
 - 2. Sharktooth Insert, as manufactured by Hohmann and Barnard, Incorporated.
 - 3. Or equal.

2.5 ADHESIVE (EPOXY) ANCHORS AND DOWELS

- A. Provide adhesive anchors where specifically shown and where adhesive anchors are allowed. Unless otherwise shown, adhesive anchors are allowed for anchoring:
 - 1. Supports for pipe, conduit, and electrical boxes, devices, and panels, on floors and walls
 - 2. Handrails, guardrails, sunshades, stairs,
 - 3. Fixtures and equipment on floors and walls, and
 - 4. Single pipes and conduits <2 inch in diameter to ceilings and soffits.
- B. Adhesive shall be epoxy resin. Vinylester resin anchors are NOT allowed.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Installation to Concrete:
 - a. HIT-HY 200 as manufactured by Hilti, Inc.
 - b. SET-3G as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.4.

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2. Installation to solid-grouted Masonry:
 - a. HIT-HY 270 as manufactured by Hilti, Inc.
 - b. SET as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal.

2.6 EXPANSION ANCHORS

- A. Provide expansion anchors only where specifically shown and where expansion anchors are allowed. Unless otherwise shown, and except as noted below, expansion anchors are allowed for anchoring:
 1. Supports for pipe, conduit, and electrical boxes, devices, and panels, to floors and walls.
 2. Handrails, guardrails, and sunshades.
 3. Fixtures and equipment which have no moving parts, to floors and walls.
- B. Expansion anchors are NOT allowed in any submerged or chemical containment areas.
- C. Leveling nuts shall not be used with expansion anchors. If leveling nuts are required, provide adhesive anchors, unless otherwise shown.
- D. Wedge anchors: Provide one of the following:
 1. Installation to Concrete:
 - a. Hilti Kwik Bolt TZ by Hilti, Inc.
 - b. Strong-Bolt 2 by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.2.
 2. Installation to solid-grouted Masonry:
 - a. Hilti Kwik Bolt-3 by Hilti, Inc.
 - b. Wedge-All by Simpson Strong-Tie, Inc.
 - c. Or approved equal.
- E. Drop-in anchors, only where specific shown on the drawings: Provide one of the following:
 1. HDI by Hilti, Inc.
 2. Drop-In by Simpson Strong-Tie, Inc.
 3. Or equal.

2.7 SCREW ANCHORS

- A. Provide screw anchors only where specifically shown. Provide ICC approved screw anchors suited for seismic and cracked concrete applications.
- B. Installation to Concrete or Masonry:
 1. KH-EZ by Hilti, Inc.
 2. Titen HD by Simpson Strong-Tie, Inc.
 3. Or approved equal.

2.8 TOGGLE BOLTS

- A. Provide toggle bolts only where specifically shown, to fasten single pipes and conduits <1 inch and equipment weighing less than 50 lbs (4-bolts required) to hollow walls.

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- B. Provide spring-wing toggle bolts, with two-piece wings, carbon steel bolts with zinc coating in accordance with Federal Specification FF-S-325.
- C. Product and Manufacturer: Provide toggle bolts of one of the following:
 - 1. The Rawlplug Company, Incorporated.
 - 2. Haydon Bolts, Incorporated.
 - 3. Or equal.

2.9 OTHERS

- A. Powder actuated fasteners and other types of anchors not specified herein shall not be used, unless approved by ENGINEER.

2.10 ACCESSORIES

- A. Provide Belleville washers, or approved equal, at anchorage connections used to transfer anchorage loads at sheet metal equipment housings.

PART 3 - EXECUTION

3.1 INSTALLATION OF ANCHORS

- A. Obtain anchor bolts in sufficient time so as not to delay concrete or masonry work.
- B. Adhesives shall be stored and installed at the service temperature ranges recommended by the manufacturer.
- C. Locate and accurately set the anchor bolts using templates or other devices as necessary.
- D. Protect threads and shank from damage during installation of equipment and structural steel.
- E. Post-installed anchors are NOT acceptable substitutes for cast-in-place anchor bolts.
- F. Assure that embedded items are protected from damage and are not filled in with concrete.
- G. Unless otherwise shown, the minimum diameter of anchor bolts for structural steel is $\frac{3}{4}$ inch, and for other applications, $\frac{3}{8}$ inch.
- H. Unless otherwise shown, provide the following minimum embedment, where "d" is the nominal anchor diameter:
 - 1. Cast-in-place anchors: 12d.
 - 2. Adhesive anchors: 12d.
 - 3. Expansion anchors: 8d.
- I. Unless otherwise shown, provide a minimum edge distance equal to six times the bolt diameter for adhesive anchors, eight times the bolt diameter for expansion anchors and a bolt spacing equal to twelve times the bolt diameter.

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- J. Concrete shall have a minimum age of 21 days at the time of post-installed anchor installation.
 - 1. Concrete temperature at the time of adhesive anchor installation shall be at least 50°F.
- K. Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the Drawings that the bars can be cut, the CONTRACTOR shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by ferroskan, ground penetrating rebar (GPR), x-ray, chipping or other means.
- L. Drilling equipment used and installation of post-installed anchors shall be in accordance with the manufacturer's printed instructions.
- M. For the adhesive and expansion anchors, CONTRACTOR shall comply with the manufacturer's printed installation instructions on the drilled hole diameter and depth.
- N. CONTRACTOR shall properly clean out the hole utilizing a wire brush and compressed air in accordance with the manufacturer's printed installation instructions to remove all loose material from the hole, prior to installing adhesive or expansion anchors. Drilled and cleaned anchor holes shall be protected from contamination until the anchor is installed. A drilled anchor hole shall be re-cleaned assuming the hole was just drilled, if in the opinion of ENGINEER or Inspector that the hole has become contaminated after initial cleaning.
- O. Unless otherwise indicated by the manufacturer, adhesive shall be dispensed through a tube or cartridge extension, beginning at the maximum depth of the hole and withdrawn as adhesive is injected, followed by insertion and rotating the anchor to the specified depth. Where necessary, spaces around anchors at the surface shall be sealed at horizontal to vertically overhead locations to prevent loss of the adhesive during curing.
- P. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
- Q. Installed anchors shall be securely fixed in-place to prevent displacement. Unless shown otherwise on the Drawings, anchors shall be installed perpendicular to the concrete surface.
- R. Reinforcing adhesive dowel bars or all-threaded adhesive bars shall not be bent after being adhesively embedded in hardened, sound concrete.
- S. In lieu of the use of stacked standard washers, if threads of an anchor bolt protrude beyond the attachment, the installers shall use a fabricated filler plate of equal or greater size of the washer. Hole on the filler plate shall be 1/16 inch (or 2 to 3 mm) greater than the bolt size. Coat as appropriate in accordance with the material and installation location requirements.

3.2 FIELD QUALITY CONTROL

- A. Anchors shall be installed by qualified personnel in accordance with the manufacturer's printed installation instructions. Installation of adhesive anchors shall be performed by personnel trained to install adhesive anchors.
- B. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program.
- C. CONTRACTOR shall employ a special inspector to perform field inspection services in accordance with Chapter 17 of the IBC for all post-installed anchors.
 - 1. The special inspector must be periodically on the jobsite during post-installed anchor installation.
 - 2. Adhesive anchors installed to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official.
- D. CONTRACTOR shall employ a testing laboratory to perform field quality testing of installed adhesive anchors. A minimum of 10% of randomly selected adhesive anchors and reinforcing dowel bars greater than 3/8 inch diameter are to be tension tested to the least of 50 percent of expected adhesive ultimate bond strength or 80 percent of steel yield strength of the anchor rod. Maintain the proof load at the required load level for a minimum of 10 seconds.
 - 1. Tension testing shall be performed in accordance with ASTM E488.
 - 2. The independent testing laboratory shall submit an anchorage testing plan for approval to ensure the testing requirements are fulfilled.
 - 3. If failure of more than 5 percent of the tested anchors or reinforcing dowel bars occurs, CONTRACTOR will be required to pay for the costs involved in testing the remaining 90%.
 - a. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure.
- E. CONTRACTOR shall correct improper workmanship, remove and replace, or correct as instructed by the ENGINEER, all anchors or bars found unacceptable or deficient, at no additional cost to the OWNER.
- F. The independent testing and inspection agency shall complete a report on each area. The report should summarize the observations made by the inspector and be submitted to ENGINEER.
- G. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.

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SECTION 05 05 09

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope:
 - 1. Provide all labor, materials, equipment, and incidentals as shown on the Drawings, specified and required to furnish and install structural steel, including connections, surface preparation and shop priming.
 - 2. Structural steel is that Work defined in AISC "Code of Standard Practice", Section 2, and as shown on the Drawings. The Work also includes:
 - a. Providing openings in and attachments to structural steel to accommodate the Work under this and other Sections and providing for the structural steel all items such as anchor bolts, studs and all items required for which provision is not specifically included under other Sections.
- B. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the structural steel.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures and diagrams showing the sequence of erection.
 - a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
 - b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
 - 2. Copies of manufacturer's specifications and installation instructions for products listed below. Include laboratory test reports and other data as required to show compliance with the Contract Documents.
 - a. Structural steel of each type, including certified copies of mill reports covering the chemical and physical properties.
 - b. High strength bolts of each type, including nuts and washers.
 - c. Unfinished bolts and nuts.
 - d. Shop primer and touch-up field primer paint in accordance with Section 09 91 03, Painting.

1.3 QUALITY ASSURANCE

- A. Reference Standards and Codes: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A36, Standard Specification for Carbon Structural Steel
 - 2. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

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3. ASTM A108, Specification for Steel Bar, Carbon and Alloy, Cold Finished
 4. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 5. ASTM A153, Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 6. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi tensile strength
 7. ASTM A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 8. ASTM A385, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
 9. ASTM A490, Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
 10. ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 11. ASTM A992, Standard Specification for Structural Steel Shapes
 12. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 13. ASTM F436, Standard Specification for Hardened Steel Washers
 14. ASTM F592, Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
 15. ASTM F1554, Standard Specification for Anchor Bolts
 16. ASTM F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
 17. AWS D1.1, Structural Welding Code
 18. AREA, Manual of Railway Engineering
 19. AISC, Manual of Steel Construction
 20. AISC 303, Code of Standard Practice for Steel Buildings and Bridges
 21. AISC 360, Specifications for Structural Steel Buildings
 22. Specifications for Structural Joints Using High-Strength Bolts, RCSC Specification
- B. Design of Members and Connections:
1. All details shown on the Drawings are typical; similar details apply to similar conditions, unless otherwise shown on the Drawings or specified. Verify dimensions at the site without causing delay in the Work.
 2. Examine conditions under which structural steel is to be provided, and notify ENGINEER, in writing, of unsatisfactory conditions existing or whenever design of members and connections may not be clearly shown on the Drawings. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.
- C. Source Quality Control:
1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 2. Steel fabricator shall have at least 5 years experience in the fabrication of structural steel for projects substantially similar to those required for this project.
- D. Qualifications for Welding Work:
1. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code" D1.1, Section 5, Qualification.

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2. Provide certification that all welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within the previous 12 months. Ensure that all certifications are kept current.
3. All welds will be subject to visual inspection. Where visually deficient welds are observed, the welds will be tested using non-destructive methods by a certified testing laboratory. If welds are found to be satisfactory, OWNER will pay for testing. Where welds are found unacceptable or deficient, pay for testing, correct improper workmanship, remove and replace, or correct as instructed, all welds found unacceptable or deficient. Responsibility belongs to CONTRACTOR to pay for all corrections and subsequent tests required to confirm the integrity of the weld.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site at such intervals to ensure uninterrupted progress of the Work.
 1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that Work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wide flange sections: ASTM A992 Grade 50.
- B. Steel pipe columns: ASTM A53 Grade B.
- C. Hollow Structural Sections (HSS): ASTM A500 Grade B.
- D. Plates, Angles, Channels, and S Shapes: ASTM A36, except where other type steel is shown on the Drawings.
- E. Crane Rails: As shown on the Drawings and as noted in the AISC Manual.
 1. Provide rails with tight end joints suitable for crane service with joint bars matching the rail sections, joint bar bolts and nuts complying with ASTM A325 with AREA alloy steel spring washers, and fixed or floating type rail clamps, as required to suit the conditions shown on the Drawings.
- F. Headed Studs and Deformed Bar Anchors:
 1. Studs: ASTM A108, complying with AWS Code Section 7, Type B; minimum yield strength 50,000 psi, minimum tensile strength 60,000 psi.
 - a. Uniform diameter.
 - b. Heads: Concentric and normal to shaft.
 - c. Weld end: Chamfered and solid flux.

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2. Deformed anchor bars: ASTM A1064, complying with AWS Code Section 7 Type C. Minimum yield strength 70,000 psi. Minimum tensile strength 80,000 psi.
 - a. Straight, unless indicated otherwise.
 - b. Solid flux.
 3. After welding, remove ceramic ferrules and maintain free from any substance which would interfere with function, or prevent bonding to concrete.
- G. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 3. ASTM F3125 high-strength bolts shall be used for twist-off / tension-controlled bolts.
 4. Provide ASTM F436 washers for all bolts in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.
 5. Provide beveled washers at connections of sloped/tapered sections.
 6. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners. Pre-tension all high-strength fasteners unless noted otherwise. Pre-tension any connection with designation (SC) slip critical. Slip critical (SC) connections must be free of paint, oil, or other materials that reduce friction at contact surfaces. Galvanized or lightly rusted surfaces are acceptable.
- H. Cast-in-Place Anchor Rods:
1. ASTM F1554, Grade 36 with weldability supplement S1 for threaded rods galvanized.
 2. Provide ASTM F436 washers at all nuts.
 3. Embedded anchors shall be headed with a standard square plate washer tack welded to the anchor head, unless a larger washer is shown otherwise in the Drawings.
 4. Only provide threads at the top of the anchor as required for connections.
- I. Common Bolts:
1. ASTM A307, Grade A for headed bolts galvanized.
- J. Stainless Steel Fasteners:
1. ASTM F593 Type 304 or 316 stainless steel with matching nut and washer for non-liquid containing (dry) structures.
 2. ASTM F593 Type 316 stainless steel for liquid-containing structures.
- K. Electrodes for Welding: E70XX complying with AWS D1.1 Section 8.
- L. Galvanizing:
1. Zinc coated hardware: ASTM A153.
 2. Fabrications: ASTM A123.
 3. Members designated as galvanized on the drawings or as directed by ENGINEER shall be galvanized after fabrication in accordance with ASTM A385. Weight of zinc coating shall not be less than 2.5 ounces per square foot of actual surface and have a coating thickness of 0.0042 inch. Coating weight will be subject to verification by ENGINEER. Thickness of coating will be measured by means of a magnetic thickness gauge.
 4. Each fabricated assembly shall be totally immersed in the galvanizing bath. The galvanizing procedure shall be such as to avoid distortion of the assembly. Straightening of members after galvanizing will not be permitted. Assemblies shall

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be held in the galvanizing bath until the temperature of the assembly is equal to the temperature of the bath. All deviations shall require approval by ENGINEER.

5. Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire surface has a uniform coating of 2.5 ounces of zinc per square foot.
6. Galvanized work shall be subject to inspection by ENGINEER at any time to ensure strict compliance with this specification. Any areas found to show defects or signs of improper galvanizing application will be rejected. Repairs shall be made by CONTRACTOR without additional cost to OWNER.

M. Surface preparation and Finish:

1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop per Section 09 91 03, Painting. Exposed, non-galvanized, steel shall be coated per Section 09 91 03, Painting.

2.2 FABRICATIONS

A. Shop Fabrication and Assembly:

1. General:
 - a. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC, Manual of Steel Construction, and as shown on the Shop Drawings. Provide camber in structural members as shown on the Drawings.
 - b. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.
 - c. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
2. Field Connections:
 - a. All field connections, unless otherwise specified below or noted, shall be made with high strength bolts, and shall be bearing type connections.
 - b. Field welding may be used only where noted or approved by ENGINEER.
3. High-Strength Bolted Construction:
 - a. Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints Using High-Strength Bolts" (RCSC).
4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. Shear Connectors: Install stud shear connectors in accordance with AWS D1.1 Section 4, and as recommended by the manufacturer.

B. Bracing:

1. Bracing shall have a minimum two bolt connection, or a shop welded connection of equivalent strength.
2. Vertical bracing and knee braces connecting to columns shall be on the centerline of the columns, unless otherwise noted.
3. Knee braces shall be at 45 degree angle, unless shown on the Drawings or noted.
4. All gussets shall be minimum 3/8-inch thick, unless otherwise shown on the Drawings.

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- C. Columns: Column shafts shall have "finished" bearing surfaces at the base and at all splice lines.
- D. Hollow Structural Sections (HSS): HSS shall be properly sealed to protect the internal surfaces.
- E. Monorails:
 - 1. All hoist beam splices shall be smooth and positive and keep the track in perfect alignment both horizontally and vertically. The top joint plate shall keep the splice from spreading and develop full strength at the splice. The splice shall be located as close as possible to the track support.
 - 2. Clamps for connecting hoist beams to support beams shall be of the flush type and suitable for the loads shown on the Drawings.
- F. Holes and Appurtenances for Other Work:
 - 1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the Shop Drawings. If large block-outs are required and approved by the ENGINEER, the webs shall be reinforced to develop specified shears. Provide threaded nuts welded to framing, and other specialty items as shown on the Drawings to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 3. Refer to Paragraph 1.1.B, above, for the requirements of coordination with others.
- G. Grind smooth all rough welds and sharp edges shall be ground to approximately 1/8 inch radius.

2.3 WELDING

- A. Comply with AWS Code, and other requirements indicated herein, for all welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work.
 - 1. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
- B. Test and qualify welders, welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned.
 - 1. Conduct tests in presence of approved testing agency.
 - 2. Certification within previous 12 months will be acceptable, provided samples of the welder's work are satisfactory.
- C. Before Starting Welding:
 - 1. Carefully plumb and align members in compliance with specified requirements.
 - 2. Fully tighten bolts.
 - 3. Comply with Section 5 of AWS Code for assembly and surface preparation.
 - 4. Preheat base metal to temperature stated in AWS Code.
 - a. When no preheat temperature is given in AWS Code and base metal is below 50°F, preheat base metal to at least 70°F.
 - b. Maintain temperature during welding.

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- c. Preheat surface of all base metal within distance from point of welding equal to thickness of thicker part being welded or 3 inches, whichever is greater, to specified preheat temperature.
 - d. Maintain this temperature during welding.
- 5. Each welder shall use identifying mark at welds.
- D. Make flange welds before making web welds.
- E. Where groove welds have back-up plates, make first three passes with 1/8 inch round electrodes.
 - 1. Use backup plates in accordance with AWS Code, extending minimum of 1 inch either side of joint.
- F. Flame cut edges of stiffener plates at shop or field butt weld. Do not shear.
- G. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
- H. Low Hydrogen Electrodes: Dry and store electrodes in compliance with AWS Code.
- I. Do not perform welding when ambient temperature is lower than 0°F or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
- J. Headed Studs and Deformed Bar Anchors:
 - 1. Automatically end welded in accordance with the AWS Code and manufacturer's recommendations.
 - 2. Fillet welding of headed studs and deformed bar anchors is not allowed unless approved by ENGINEER.
- K. Test in-place studs in accordance with requirements of AWS Code to ensure satisfactory welding of studs to members.
 - 1. Replace studs failing this test.
- L. When headed stud-type shear connectors are to be applied, clean top surface of members to receive studs in shop to remove oil, scale, rust, dirt, and other materials injurious to satisfactory welding. Do not shop paint or galvanize metal surfaces to receive field applied studs.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which structural steel Work is to be installed, and notify ENGINEER, in writing, of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

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3.2 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Surveys: Provide services of a registered surveyor to check lines and elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices before steel erection proceeds. Discrepancies shall be reported immediately to ENGINEER, in writing. Do not proceed with erection until corrections have been made, or until compensating adjustments to the structural steel Work have been agreed upon with ENGINEER.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work. Provide sufficient planking to comply with OSHA requirement of a tightly planked substantial floor within two stories or 30 feet, whichever is less, below each tier of steel beams on which Work is performed.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work.
 - 1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
 - a. Refer to Section 05 05 06, Anchors, Inserts and Epoxy Dowels, of these Specifications for anchor bolt installation requirements.
- F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
 - 2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
 - 3. Place non-shrink grout between bearing surfaces and bases or plates as specified in Section 03 60 03, Grout. Finish exposed surfaces, protect installed materials, and allow curing in strict compliance with the manufacturer's instructions, or as otherwise required.
 - 4. Leveling plates and wood wedges will not be permitted.
- G. Field Assembly: Set structural frames accurately to the lines and elevations as shown on the Drawings. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of the structure within tolerances as specified in AISC Manual. For members requiring accurate alignment, clip angles, lintels and

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- other members shall be provided with slotted holes for horizontal adjustment at least 3/8-inch in each direction, or more when required.
2. Splice members only where shown on the Drawings or specified.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Manual for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to ENGINEER. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Crane Runways:
1. Install runways complete with rails, crane stops and other required items. Set and adjust the gage, alignment and elevation of the crane rails to tolerances of AISC for crane rails, unless otherwise shown on the Drawings. Stagger joint locations in opposite rails. Rail joints shall, also, be at least 24-inches from crane girder joints. Provide flush joints at the top of all crane rails.
- L. Touchup Painting:
1. Unless otherwise specified below, comply with all requirements of touch-up painting specified in Section 09 91 03, Painting.
 2. Immediately after erection, clean field welds, bolted connections, and all damaged and abraded areas of the shop paint. Apply paint to all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness as specified in Section 09 91 03, Painting.

3.3 FIELD QUALITY CONTROL

- A. The CONTRACTOR will employ a testing laboratory approved by the ENGINEER to perform field quality control testing to inspect and to perform tests and prepare test reports in accordance with IBC section 1705.2 and AISC 360.
1. The testing agency shall conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state all deviations.
 2. Provide access for the testing agency to places where structural steel Work is being fabricated or produced so that required inspection and testing can be accomplished.
 3. The testing agency may inspect structural steel at the plant before shipment; however, ENGINEER reserves the right, at any time before Final Acceptance, to reject material not complying with specified requirements.
- B. Correct deficiencies in structural steel Work that inspection and/or laboratory test reports indicate do not comply with the Specifications. Perform additional tests, as may be required to reconfirm any non-compliance of the original Work, and as may be required to show compliance of corrected Work.

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++ END OF SECTION ++

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SECTION 09 91 03

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide and install coatings on all exposed surfaces as indicated herein, in other Specification Sections, and on the Drawings.

1.2 REFERENCE STANDARDS

- A. This section contains references to the governing standards and documents listed below. They are a part of this section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.
- B. ASTM International (ASTM):
1. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 2. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages
 3. ASTM D4417 – Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel.
 4. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 5. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- C. International Concrete Repair Institute (ICRI):
1. Guideline No. 310.1 – Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion
 2. Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealer, Linings, and Polymer Overlays
- D. NACE International, (NACE)
1. NACE RP0287 – Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape

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2. NACE SP0188 – Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
 3. NACE No. 1/SSPC-SP 5 - White Metal Blast Cleaning.
 4. NACE No. 2/SSPC-SP 10 - Near-White Metal Blast Cleaning.
 5. NACE No. 3/SSPC-SP 6 Commercial Blast Cleaning
 6. NACE No. 6/SSPC-SP13 – Surface Preparation of Concrete
- E. National Association of Pipe Fabricators (NAPF)
1. NAPF 500-03 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
- F. SSPC: The Society for Protective Coatings, (SSPC)
1. SSPC PA 1 - Shop, Field, and Maintenance Painting of Steel
 2. SSPC-PA 2 – Measurement of Dry Coating Thickness with Magnetic Gages.
 3. SSPC-PA 11 - Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
 4. SSPC-SP 1 Solvent Cleaning
 5. SSPC-SP 2 Hand Tool Cleaning
 6. SSPC-SP 3 Power Tool Cleaning
 7. SSPC-SP 5/NACE No. 1 – White Metal Blast Cleaning
 8. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.
 9. SSPC-SP 10/NACE No. 2 - Near-White Metal Blast Cleaning.
 10. SSPC-SP 13/NACE No. 6 – Surface Preparation of Concrete
 11. SSPC-SP 16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
 12. SSPC-VIS 1 - Guide to Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
- G. Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization references to those documents shall mean the replacement documents or the last version of the document before it was discontinued.

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1.3 QUALITY ASSURANCE

- A. Quality Control shall be in accordance with Section 01 45 00, Quality Control.
- B. Experience: Both Coatings Manufacturer and Coatings Installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings Installer shall be approved and endorsed, in writing, by Coatings Manufacturer.
- C. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.
- D. Coatings Manufacturer Recommendations: Coatings Installer shall follow all recommendations of the Coatings Manufacturer regarding storage, handling, surface preparation, application of coatings, recoat times, environmental conditions during storage, preparation and application of coatings, and all other Coatings Manufacturer recommendations.
- E. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 1-year complete replacement warranty for all coatings in accordance with the requirements of Section 01 78 36, Product Warranty. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 1-year warranty.

1.4 DEFINITIONS

- A. Dry Film Thickness (DFT): Thickness of fully cured coating, measured in mils.
- B. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter per pounds per gallon, as determined by EPA Method 24.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, Submittal Procedures.
- B. Shop Drawings: Coatings Manufacturer shall submit for approval the following:
 - 1. Copies of Manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general Manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.
 - 2. Safety Data Sheets: Copies of current Safety Data Sheets (SDS) for materials.
 - 3. Copies of Manufacturer's complete color charts for each coating system.
 - 4. Letter from the Coatings Manufacturer approving and endorsing Coatings Installer.
 - 5. Letter from Coatings Manufacturer stating that volatile organic compounds (VOCs) meet all Federal, State and Local requirements.

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6. Furnish copies of the final, approved submittal to the Coatings Installer so that it is clear which product is to be used for which each system.

C. Reference Samples:

1. Provide reference samples of paint colors and textures as required by the ENGINEER. Reference samples will show the color and texture of the final paint to be applied and shall be approved by the ENGINEER prior to painting. Reference samples should be applied to similar substrates to the final surfaces to be painted. If ENGINEER chooses to forego reference samples, CONTRACTOR must receive the allowance to forego reference samples before painting begins or all painted surfaces will be re-painted at the ENGINEER's discretion and at no additional cost to the OWNER.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Products shall be transported in accordance with the requirements of Section 01 66 00, Transportation and Handling of Goods
- B. Protection: Protect all pre-coated items from coating damage during shipping.
- C. Store products in accordance with the requirements of Section 01 66 10, Product Storage, Handling, and Delivery, and in accordance with Manufacturer's directions.
- D. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

- A. Provide coating types as listed in the following table. The systems referenced in the table are those provided by Carboline, Sherwin-Williams, and TNESEC. If manufacturers other than specified manufacturers are desired, the CONTRACTOR shall submit equivalent paint systems.

COATING TYPE	DESCRIPTION	CARBOLINE SERIED	SHERWIN WILLIAMS SERIES	TNESEC SERIES
Acrylic Block Filler, Primer	Waterborne acrylic, single component block filler for application on rough faced concrete masonry units.	Sanitile 100	Pro Industrial Heavy Duty Block Filler	Series 54 Masonry Filler
Acrylate	Modified Waterborne Acrylate designed for application on porous surfaces such as	Flexxide Elastomer	Loxon XP	Series 156, Enviro-crete

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	rough-faced concrete masonry units or wood surfaces. Flexible and breathable, moisture and UV resistant. Matte Finish			
Epoxy (Phenalkamine, Polyamidoamine, Polyamide, Amine)	Above Grade: Epoxy designed for use as a primer or interior finish on steel or other ferrous or non-ferrous metals for above grade atmospheric exposed substrates. Polyamidoamine or polyamide cure.	Carboguard 60	Macropoxy 646	Series N69, V69 or L69 (type per local VOC regulations), Hi-Build Epoxoline II
	Non-Potable: Epoxy designed for use on steel or other ferrous metals not in contact with potable water but submerged or immersed in wastewater or non-potable water. Includes below grade, buried, or aluminum in contact with concrete. Polyamidoamine or phenalkamine or amine cure.	Carboguard 890 Series	Sher-glass FF or Seaguard 6100 or Tank Clad HS	Series N69, V69 or L69 (type per local VOC regulations), Hi-Build Epoxoline II
	Potable: Epoxy designed for use on steel or other ferrous metals in contact with potable water. Polyamidoamine or polyamide or amine cure.	Carboguard 635 VOC or Carboguard 891 VOC	Macropoxy 5500 or Macropoxy 646 PW	Pota-Pox Plus Series N140, L140 or V140 (type per local VOC regulations)

B. All coatings used shall comply with Federal, State and local VOC limits based on application location.

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2.2 COLOR

- A. Color Pigments: Pure, nonfading, lead-free applicable types to suit the substrates and service indicated.
- B. Provide colors as described in the drawings or specifications, or as selected by ENGINEER from standard color palette. For piping system colors, reference pipe schedule.
- C. Where existing colors are to be matched or satisfactory color is not available from standard color palette, provide custom-mixed colors.
- D. Provide samples of each color on the substrate to be coated for approval by the ENGINEER prior to beginning coating application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify ENGINEER of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION

- A. Coatings Installer shall prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints.
- C. Steel – Structural, Tanks, Pipe and Equipment:
 - 1. Prior to the specified surface preparation SSPC-SP1 Solvent Cleaning shall be performed to all surfaces.
 - 2. SSPC-SP2 Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
 - 3. SSPC-SP3 Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

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4. SSPC-SP5/NACE 1 White Metal Blast Cleaning: Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
 5. SSPC-SP6/NACE 3 Commercial Blast Cleaning: Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each 9 square inch of surface area.
 - a. Minimum angular anchor profile of 1.5 mils
 6. SSPC-SP10/NACE 2 Near-White Blast Cleaning: Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each 9 square inch of surface area.
 - a. Minimum angular anchor profile of 1.5 mils
- D. Ductile or Cast Iron – Pipe, Pumps, Valves and Fittings
1. Ductile iron pipe and fittings shall be delivered without asphalt, cement lining, or any other lining.
 2. All oils, small deposits of asphalt paint, grease, and soluble deposits shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting.
 3. Exterior Preparation: Uniformly abrasive blast the entire exterior surface using angular abrasive to an NAPF 500-03-04: "External Pipe Surface Condition". When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, loose mold coating, rust and other foreign matter. Tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife. Any area where rust reappears before application shall be re-blasted. The surface shall contain a minimum angular anchor profile of 1.5 mils in accordance with ASTM D 4417, Method C.
- E. Galvanized Steel, Aluminum, Stainless Steel, and Non-Ferrous Metal Substrates:
1. SSPC-SP16 Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals: Not for carbon steel. Requires sweep blasting of the entire surface to remove all foreign matter. Dense and uniform surface profile is required.
 - a. Non-Immersion minimum uniform anchor profile of 1.0 – 2.0 mils
 - b. Immersion minimum uniform anchor profile of 1.5 – 2.5 mils
 2. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the coating and service conditions.
- F. Wood Substrates:
1. Wood surfaces to be painted shall be cleaned of dirt, oil or other foreign substances with mineral spirits, scrapers, sandpaper or wire brush.
 2. Patching may be required where approved by the ENGINEER. All joints in wood members including trim, siding, soffits, and joints between wood and dissimilar materials shall be filled with joint sealant prior to coating.
- G. PVC Substrates:

1. PVC surfaces to be painted shall be clean, dry and free of oil, grease, and other contaminants. Thoroughly and uniformly abraded to create a surface for coating to adhere to.
- H. Concrete and Masonry Substrates:
1. All surfaces must be clean, dry and free of oil, grease and other contaminants, prior to preparation in accordance with NACE No. 6/SSPC-SP13. Concrete surfaces must be sound and capable of supporting the coating system.
 2. Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive Blast, Shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, existing coatings, and other contaminants and to provide the recommended ICRI-CSP Profile.
 3. Cracks, voids and other surface imperfections should be filled with the recommended filler or surfacer prior to the installation of the materials.
 4. Allow CMU mortar to cure for 14 days. Level protrusions and mortar splatter prior to the installation of the materials.
 5. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through the coating system according to manufacturer's written recommendations.
 6. Level or grind concrete substrates to produce a uniform and smooth surface, including removal of sharp edges, ridges, form fins, and other concrete protrusions.
 7. All surfaces to be painted or repainted, shall be repaired, cleaned and finished to the standards as specified herein and in Division 3, Concrete for new concrete.
- I. Coatings Manufacturer representative shall observe Coatings Installer's methods of preparing surfaces and approve of the work prior to Coatings Installer beginning coating installation. If, after a period of time, Coatings Manufacturer is satisfied with Coatings Installers methods, Coatings Manufacturer can allow Coatings Installer to proceed without inspection following surface preparation. Coatings Manufacturer and installer will still both be held equally accountable for any coatings failure.
- 1.

3.4 APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions as outlined in the product data sheet, application guides and technical bulletins.
- B. The application of coatings to steel substrates shall be in accordance with SSPC PA1 - Shop, Field, and Maintenance Painting of Steel.
- C. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- D. Products applied by brush and roller application may take multiple coats to achieve specified dry film thickness.
- E. Uniformly apply coatings at spreading rate required to achieve specified Dry Film Thickness (DFT).

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- F. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems
- G. In accordance with SSPC-PA11 Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating. Coating shall be applied to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present.
- H. Each coat of paint shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat.

3.5 COATINGS SCHEDULE

- A. Paint all exposed surfaces not specifically excluded in 3.3.C, below. Provide and install Coatings in accordance with the following Table, unless otherwise specified in other Sections:

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO OF PRIMER COATS	PRIME COAT THICKNESS (EACH COAT)	FINISH COATING	NO OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
027	Ferrous metals and steel in contact with wood, concrete, or dissimilar metals	Epoxy	1	2-4 MDFT	Epoxy	1	2-4 MDFT
300	Exposed Ferrous Pipe Systems and Exposed Steel Items	Epoxy	2	4-6 MDFT	Polyurethane (Finish)	1	3-5 MDFT
302	Immersed Ferrous Pipe Systems and Steel Items	Epoxy*	1	6-10 MDFT	Epoxy*	1	6-10 MDFT

- B. Items Delivered with Factory Applied Primer:
 - 1. For items delivered with a factory applied primer and requiring painting under this Section, the factory applied primer may be used in lieu of field applied primer only under the following conditions:
 - a. The ENGINEER approves the use of the factory applied primer in lieu of field applied primer.
 - b. The factory applied primer is certified by the Coatings Manufacturer as compatible with the field applied finish coat.
 - c. The Coatings Manufacturer's recommended recoat time for the factory applied primer has not been exceeded.
 - 2. If all of the above conditions are not met, the Coatings Installer shall re-prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations and primer applied, in accordance with this Section.
- C. Table Definitions:
 - 1. SF/Gal: Square foot of coverage per gallon of coating used.
 - 2. MDFT: mil dry film thickness

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3. mil: 1/1000 of an inch paint thickness
 4. Ferrous Pipe: Includes Ductile Iron, Cast Iron, Steel, and Galvanized Steel piping
 5. Steel Items: Includes steel and galvanized steel items such as structural steel, doors, window frames, overhead coiling doors, bollard posts, steel gates, steel fences, and all other steel and galvanized steel items.
 6. Non-Metallic Pipe: Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Fiberglass Reinforced Plastic, High Density Polyethylene
 7. Exposed: Located above grade, exposed to the atmosphere not submerged. Includes surfaces inside and outside of buildings.
 8. Submerged: In an area which normally is under water or other liquid or is intermittently under water or other liquid.
 9. Buried: Located below grade, surrounded by backfill.
- D. Surfaces Not Requiring Painting:
1. Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
 - a. Concrete surfaces.
 - b. Reinforcing steel.
 - c. Copper, bronze, brass, Monel, aluminum, chromium plate, and stainless-steel surfaces, except where:
 - 1) Required for electrical insulation between dissimilar metals.
 - 2) Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - 3) Color coding of equipment and piping is required.
 - d. Existing piping, fittings and pipe supports.
 - e. Pipe unions or portions of piping systems where painting would make disassembly difficult or impossible.
 - f. Prefinished electrical, mechanical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches, HVAC equipment enclosures, ductwork, acoustical tile, cabinets, louvers, and wall panels.
 - g. Electrical conduits.
 - h. Cathodic protection anodes.
 - i. Insulated piping and insulated piping with jacket will require prime coat only.
 - j. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.
 - k. Glass, plexiglass or other transparent or translucent material intended to allow passage of light.
 - l. Civil/site materials such as asphalt, gravel, rock, chain-link fence, and plantings.

3.6 FIELD QUALITY CONTROL, INSPECTION AND TESTING

- A. The Coating Installer shall perform the quality control procedures listed below in conjunction with the requirements of this section.
- B. Inspect materials upon receipt to ensure that products are as per the approved submittal and supplied by the approved Manufacturer.
- C. Coatings Installer shall keep a daily log of the items listed in this section, and at a minimum shall record the following items for any day when coating work is performed.

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1. Description of items worked on.
 2. Description of work performed.
 - a. Step in coating system (i.e.: surface preparation, stripe coat, primer, intermediate, finish, etc.)
 3. Specific names of persons performing the work.
 4. Product information:
 - a. Product Name/Number
 - b. Material Batch Number
 - c. Quantities used
 - d. Thinner Used
 5. Paint log shall be kept on-site. Paint log shall be signed daily, for any day when coating work is performed, by the supervisor of the coating installer field crew and by the ENGINEER.
 6. Any painted surface which was not recorded in the paint log shall be stripped, re-prepared, and recoated at the ENGINEER's discretion.
- D. The Coating Installer shall perform the quality control procedures listed below in conjunction with the requirements of this section.
- E. Surface Profile and Degree of Surface Cleanliness: Inspect and record substrate profile (anchor pattern) and degree of cleanliness. Surfaces shall meet the manufacturer's recommended anchor profile and degree of blast cleaning.
1. Prepared surfaces shall be inspected for surface cleanliness after cleaning and drying, prior to the coating application.
 2. Visually confirm the specified degree of surface cleanliness of the ferrous metal surface in accordance with SSPC-VIS 1.
 3. The specified surface profile of the prepared substrate shall be verified in accordance with ASTM D4417 – Method C Replica Tape or NACE RP0287.
 4. Surface profile shall be equal to the manufacturer's recommendation in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6.
 - a. Compare the substrate profile once every 50 square feet with the Concrete Surface Profile (CSP) comparators in accordance with ICRI Guideline No. 310.2.
- F. Concrete Moisture Testing: After surface preparation verify and record concrete dryness in accordance with one or more of the following moisture tests.
1. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - a. Moisture vapor transmission not to exceed 3 lb per 1,000 square feet in a 24-hour period.
 2. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 - a. Relative humidity not to exceed 80 percent.
 3. ASTM D4263— Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - a. No moisture present.
 4. Consult manufacturer regarding questions and or recommendations in reference to moisture problems or questions.

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- G. Measure and record ambient air temperature, relative humidity and dew point temperature once every two hours of each work shift to ensure that the products are being applied within the manufacturer's recommendations.
- H. Measure and record substrate temperature once every two hours using an infrared or other surface thermometer to ensure that the products are being applied within the manufacturer's recommendations.
- I. Film Thickness:
 - 1. Wet-Film Thickness shall be taken every 100 square feet in accordance with ASTM D4414 or other agreed-upon method.
 - 2. The Dry-Film Thickness (DFT) shall be measured in accordance with SSPC-PA2 Measurement of Dry Coating Thickness.
 - a. Verify and record the DFT of each coat and total DFT of each coating system are as specified.
- J. Holiday (Spark) Testing: Upon full cure of coating system numbers 302 and 303 the coating system shall be checked by spark detection in accordance with NACE SP0188 and the Manufacturer's instructions to verify a pinhole-free surface. Areas which do not pass the spark detection test shall be corrected at no cost to the OWNER.
 - 1. Submit written reports of the test results and actions taken to correct non-conforming work.
- K. The coating installer is responsible for keeping the ENGINEER informed of progress so that ENGINEER may provide additional quality control at his discretion.
- L. Inspection by the ENGINEER or others does not absolve the coating installer from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

3.7 MANUFACTURER'S FIELD SERVICES

- A. Paint manufacturer's representative shall visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these Specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

3.8 ACCEPTANCE CRITERIA

- A. Surfaces shall be prepared, applied, and tested in accordance with the specification and referenced standards herein.

3.9 REPAIR

- A. Damaged Materials: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat

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entire surface where touch-up result is visibly different, either in sheen, texture, or color.

- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.10 PROTECTION

- A. Protect all adjacent surfaces from overspray, dripping or other transfer of coatings not intended for those surfaces. Use masking, tape, drop cloths, plastic and other protective materials as appropriate.
 - 1. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, stainless steel surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
 - 2. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors, fan housings, etc. to prevent coatings from falling inside.
 - 3. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.
- B. Protect the completed Work from traffic, physical abuse, immersion and chemical exposure until the complete system has thoroughly cured as per manufacturer's written instructions.
- C. At the completion of the Work, Coating Installer shall remove materials and debris associated with the Work of this section.
- D. Clean surfaces not designated to receive coating. Restore designated areas in a manner acceptable to ENGINEER.
- E. Protect the completed Work from damage until Final Acceptance. Coating damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.
- F. Completely remove all masking, tape, drop cloths, plastic and other protective materials within 48 hours of completion of application of finish coat. Take special care to remove masking and plastic which cover tank vent openings, HVAC registers, vents, motor vents, and other areas where airflow is critical to proper operation.

3.11 WARRANTY INSPECTION

- A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by the CONTRACTOR in accordance with this Specification and to the satisfaction of the ENGINEER and at the CONTRACTOR'S expense.
- B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repair at all points where failures are observed by removing the deteriorated

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paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this specification as determined by the ENGINEER.

- C. All costs for CONTRACTOR'S inspection, Manufacturer's inspection and all costs for repair shall be borne by the CONTRACTOR.

++ END OF SECTION ++

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SECTION 09 97 23.24

COATINGS FOR WASTEWATER STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide and install impermeable, high-strength, corrosion-resistant, monolithic lining for the solids holding tanks and related structures subject to attack from hydrogen sulfide and acid generated by microbiological sources, as indicated herein, in the Specifications and on the Drawings.
- B. System shall be a multi-component resin-based lining system with underlayment specifically designed to protect the concrete surfaces of municipal wastewater structures from chemical attack. The main purpose of this membrane is to offer protection of the substrate from chemicals or gases that cause deterioration.

1.2 COORDINATION:

- A. Coordinate surface preparation of substrates to avoid later difficulty or delay in performing the Work of this section.
- B. Review installation procedures under other sections and coordinate the installation of items that must be installed prior to application of the protective lining.
- C. Substrate surface preparation and lining application, including concrete resurfacing, to be completed by manufacturer's approved CONTRACTOR.
- D. CONTRACTOR shall coordinate with ENGINEER regarding the availability of work areas, completion times, safety, access and other factors which can impact plant operations.

1.3 QUALITY ASSURANCE

- A. Quality Control shall be in accordance with Section 01 45 00, Quality Control.

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- B. Experience: Both coatings manufacturer and coatings installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings installer shall be approved and endorsed, in writing, by coatings manufacturer.
- C. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.
- D. Coatings Manufacturer Recommendations: Coatings installer shall follow all recommendations of the coatings manufacturer regarding storage, handling, surface preparation, application of coatings, re-coat times, environmental conditions during storage, preparation and application of coatings, and all other coatings manufacturer recommendations.
- E. Regulatory Requirements: Conform to applicable codes and ordinances for flame, fuel, smoke and volatile organic compounds (VOC) ratings requirements for finishes at time of application
- F. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 1-year complete replacement warranty for all coatings. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 1-year warranty. Warranties shall be provided in accordance with the requirements of Section 01 78 36, Product Warranty.

1.4 REFERENCES

- A. Section contains references to the governing standards and documents listed below. They are a part of this section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.
- B. American Concrete Institute (ACI):
 - 1. ACI 224 – Causes, Evaluation, and Repair of Cracks in Concrete Structures
 - 2. ACI 301 – Specifications for Structural Concrete
 - 3. ACI 308 – Guide to Curing Concrete
- C. ASTM International (ASTM):

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1. ASTM C1583/1583M – Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
2. ASTM D1653 – Standard Test Methods for Water Vapor Transmission of Organic Coating Films.
3. ASTM D2794 – Standard Test Method for Resistance of Organic Linings to the Effects of Rapid Deformation (Impact).
4. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
5. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
6. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
7. ASTM D7682 – Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty.
8. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials
9. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. International Concrete Repair Institute (ICRI):

1. Guideline No. 310.1 – Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion
2. Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealer, Linings, and Polymer Overlays

E. NACE International (NACE):

1. NACE SP0188 – Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
2. NACE SP0892 – Standard Practice for Coatings and Linings over Concrete for Chemical Immersion and Containment Service
3. NACE No. 6/SSPC-SP13 – Surface Preparation of Concrete

F. SSPC: The Society for Protective Coatings, (SSPC)

1. SSPC-SP 1 - Solvent Cleaning
2. SSPC-SP 13/NACE No. 6 Surface Preparation of Concrete
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- G. Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents, the last version of the document before it was discontinued.

1.5 JOB CONDITIONS

A. Environmental Requirements:

1. Proceed with corrosion protection lining Work only when temperature and moisture conditions of substrates, air temperature, relative humidity, dew point and other conditions comply with the manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the material will be vulnerable to such environmental damage. Record all such conditions and include in final Site Quality Control Report.
2. Maintain substrate temperature and ambient temperature before, during and after installation in accordance with material manufacturer's instructions.
3. Provide adequate ventilation during installation and full curing periods of the protective lining.
4. Protective Lining shall not be applied when ambient air temperature is within 5 degrees F of the dew point and falling.

- B. Dust and Contaminants: Protect work and adjacent areas from excessive dust and airborne contaminants during protective lining application and curing. Schedule Work to avoid excessive dust and airborne contaminants.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, Submittal Procedures.

- B. Shop Drawings: Coatings Manufacturer shall submit for approval the following:

1. Copies of manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.

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2. Safety Data Sheets: Copies of current Safety Data Sheets (SDS) for any materials brought on-site, including all clean-up solvents, repair or resurfacing mortars and lining materials.
3. Qualification Data:
 - a. Qualified CONTRACTOR Training Certificates from manufacturer.
 - b. Submit proof of acceptability of CONTRACTOR by manufacturer to ENGINEER.
 - c. Submit letter from manufacturer stating that the CONTRACTOR has successfully applied the corrosion protection lining system on projects of similar size and scope.
 - d. List of references substantiating the projects.
4. Construction Details: Copies of manufacturer's computer-generated standard lining details for specified materials, including: leading edge termination, metal embedment in concrete, joint detail, wall-to-slab detail, pipe termination detail, and any other detail at the request of the ENGINEER.
5. Jobsite Layout Plan: Including material storage/staging and equipment storage /staging.
6. Jobsite Reports: Submit at the completion of Work
 - a. Daily Reports: Include surface preparation, substrate conditions, ambient conditions application procedures, lining materials applied, material quantities, material batch number, description of work completed and location thereof.
 - b. Quality Control Reports: Include all quality control testing and physical specimens.
 - c. CONTRACTOR shall maintain a copy of records until the expiration of the specified warranty period.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored, handled and delivered in accordance with the requirements of Section 01 66 10, Product Storage, Handling, and Delivery.
- B. Deliver material in manufacturer's original, unopened and undamaged packages.
- C. Protection: Protect all pre-coated items from coating damage during shipping and handling.
- D. Store products in accordance with manufacturer's directions.

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- E. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 GENERAL

- A. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

2.2 MATERIALS, PRODUCTS, AND MANUFACTURERS

- A. Quadex, LLC

- 1. Wall Structure Underlayment: Quadex Aluminaliner
- 2. Patching, Resurfacing, Underlayment: Quadex Hyperform
- 3. Epoxy Topcoat Materials: Quadex Structure Guard

- B. CIM Industries

- 1. Primer: CIM EMT
- 2. Polyurethane Topcoat: CIM 1000

- C. Sauereisen SewerGard

- 1. Underlayment: Sauereisen Filler Compound No. 209
- 2. Surface Material: Sauereisen No. 210S

- D. Sherwin Williams

- 1. Underlayment: Duraplate 2300
- 2. Surface Material: Duraplate 6100

- E. Tnemec

- 1. Underlayment: Mortarclad Series 218
- 2. Surface Material: Perma-Shield FR Series G436

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2.3 SERVICE CONDITIONS AND PERFORMANCE

- A. Provide a high solids, resin based coating system suitable for severe wastewater applications.
 - 1. The lining system shall be a non-sagging application permitting repair of vertical, horizontal, and overhead surfaces.
- B. The surfaces to receive the protective lining may be subject to the following conditions:
 - 1. Withstanding constant exposure to raw wastewater, permeation from hydrogen sulfide and other sewer gases, or attack from organic acids generated by microbial sources with no adverse effects. Products must have enough field history and accelerated laboratory testing to substantiate product viability for these exposures.
- C. The lining system, including underlayment, primer and surface materials, shall be from a single manufacturer.
- D. Chemical Resistance (ASTM D 1308):
 - a. Reagent: 6% sulfuric acid solution
 - b. Film Integrity: Unaffected
- E. Coating Thickness: 250 mils thick, minimum
- F. Texture: Semi-smooth for all surfaces

2.4 PROPERTIES

- A. Either trowel or spray application is acceptable provided the Installer follow all Manufacturer recommendations.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coatings are to be installed on concrete floor of the Solids holding tank.

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- B. CONTRACTOR shall provide, erect, and maintain all required hoists, scaffolding, staging and planking, and perform all access related hoisting work required to complete the Work of this section as specified.
- C. CONTRACTOR shall cover or otherwise protect finish work or other surfaces not being coated within the scope of this section. CONTRACTOR shall erect and maintain protective tarps, enclosures and/or masking to contain debris, including dust or other airborne particles from surface preparation or application activities. This may include the use of dust or debris collection apparatus as required at no additional cost to OWNER.

3.2 STORAGE, MIXING, AND THINNING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.
- B. All protective coating materials shall be used within the manufacturer's recommended shelf life.
- C. Storage: Coating materials shall be protected from exposure to inclement weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application.
- D. Mixing:
 - 1. Coatings of different manufacturers shall not be mixed together.
 - 2. Mixing of multi-component coating systems shall be performed in accordance with Manufacturer's recommendations. Components must be mixed in complete batches only and used immediately.

3.3 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas and conditions under which concrete coatings are to be placed and notify ENGINEER, in writing, of any conditions which could be detrimental to the proper and timely installation of the Work. Do not proceed with the Work until any unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Site Verification of Conditions

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1. CONTRACTOR shall examine the areas and conditions under which the protective coating Work is to be performed in accordance with NACE SP0892 and SSPC-SP13/NACE No. 6 and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work.
2. All concrete should be cured using the procedures described in ACI 308, allowing a minimum of 28 days at 75 degrees F.
3. The CONTRACTOR shall confirm the presence of a vapor barrier or positive side waterproofing on the exterior of the concrete structure.
4. Commencement of the Work of this section shall indicate that the substrate and other conditions of installation are acceptable to the CONTRACTOR and his CONTRACTOR and will produce a finished product meeting the requirements of the Specifications. All defects resulting from accepted conditions shall be corrected by CONTRACTOR at his own expense.

3.4 SURFACE PREPARATION

- A. Surface preparation shall not begin until at least 7 days after new concrete has been placed. Chemical resistant coatings shall not be applied until at least 28 days after new concrete has been placed.
- B. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning in accordance with SSPC-SP1 before abrasive blast cleaning. Surface preparation shall be performed in accordance with the latest editions of the following standards:
 1. ASTM D-4258: Standard Practice for Surface Cleaning Concrete for Coating
 2. ASTM D-4259: Standard Practice for Abrading Concrete
- C. Concrete surfaces and deteriorated concrete surfaces to be coated or lined shall be abrasive blast cleaned in accordance with SSPC SP13 to remove existing coatings, laitance, deteriorated concrete, and Concrete Surface Profile CSP 4 – 6 per ICRI 310.2.
 1. Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE Standard TM-01-70.
 2. The air compressor must be equipped with efficient oil and water traps to ensure that the compressed air is clean and free of oil particles. Refer to NACE procedure for "Blotter Testing" of compressed air.
- D. Concrete surfaces requiring repairs in excess of 1/4 inch depth shall be restored with underlayment, and brought flush with the surface, in accordance with the coating

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manufacturers' recommendations to provide a continuously smooth and even surface for application of topcoat.

- E. Surfaces shall be clean and as recommended by the coating manufacturer before coating or lining is started.
- F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.
- G. All surfaces to be coated shall be completely dry, clean, and contaminant-free prior to application. For polyurethane lining system, after completing surface preparation, surface dryness shall be verified according to ASTM D4263. Any indication of moisture will require an appropriate corrective measure. The surface shall be re-tested after taking the corrective measure.
- H. The concrete surface shall be notched to a depth equal to the total lining thickness with a power grinding tool on the perimeter of all lining termination points. The notch shall be clean and neat.

3.5 APPLICATION

- A. Application shall be in accordance with all manufacturer requirements, and as specified herein. Where manufacturer requirements conflict with manufacturer's published application recommendations, manufacturer requirements shall prevail. Application under conditions outside manufacturer's recommended range will require written instruction from the manufacturer and approval by the ENGINEER.
- B. Coatings shall be installed on all surfaces described in paragraph 1.1.A of this section, with the systems indicated.
- C. CONTRACTOR shall give the ENGINEER a minimum of 3 days advance notice of the start of any field surface preparation work or coating application Work. All such Work shall be performed only in the presence of the ENGINEER.
- D. All concrete surfaces shall be coated before installation of any equipment in the area to be protected, including chemical storage tanks, pumps, pipe supports and stands, etc.

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- E. CONTRACTOR shall supply all temporary heating, cooling or night-time work, if required, and provide protection from the sun, heat, or other environmental conditions which may adversely affect the coatings. Moisture content of concrete, air temperature, relative humidity, and all other conditions shall be within limits recommended by coatings manufacturers.
- F. CONTRACTOR shall fill all "bug holes" and other defects in the concrete to which the chemical resistant coatings are applied prior to application of the chemical resistant coatings system in accordance with the recommendations of the coatings manufacturer approved for use in each area. Filler shall be allowed to cure in accordance with manufacturers recommendation.
- G. All surfaces receiving the polyurethane membrane lining shall be visually dry and at least 5°F (3°C.) above the Dew Point prior to starting the installation to prevent moisture entrapment. The Relative Humidity must be below 85%.
- H. CONTRACTOR shall apply coating to prepared concrete surface. CONTRACTOR shall repeat coating application as recommended by manufacturer for complete coverage. Application and mixing shall be by the method recommended by the coatings manufacturer with the equipment recommended as the best for installing the coating system supplied. Apply the materials in the recommended quantities to provide the dimensional requirements and chemical resistance specified for the system. Successive topcoats shall be applied within 24 hours so as to not exceed the recoat window.
- I. Saw cuts – All areas where the installed lining does not transition into another surface of a different angle shall be saw cut to terminate the lining. The saw cut shall be 1/4 inch wide by 1/4 inch deep. See construction details.
- J. CONTRACTOR shall apply termination and expansion joint strips at the junction of the chemical resistant coating with other surfaces and at expansion joints as recommended by the coating's manufacturers.
- K. Wet film thickness shall be monitored throughout the installation by means of frequent measurements with a high-range wet film thickness gage.
- L. Whether spray or trowel application is used, the application shall be according to the principles of good workmanship outlined in SSPC-PA1-82 and shall provide a finish which is continuous, uniform in thickness, and verified free of pores or other defects using electrical discontinuity testing (high voltage spark testing).

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3.6 CURING OF COATINGS

- A. CONTRACTOR shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this section, whichever is the highest requirement, prior to placing the completed coating system into service.
- B. In the case of enclosed hydraulic structures, forced air ventilation, using heated or cooled air if necessary, is required for the application and curing of coatings on the interior surfaces.
 - 1. During curing periods continuously exhaust air from the lowest level of the structure using portable ducting. After all interior coating operations have been completed provide a final curing period for a minimum of 10 days, unless a shorter period is recommended by the coating manufacturer, during which the forced ventilation system shall operate continuously.

3.7 FIELD QUALITY CONTROL, INSPECTION, AND TESTING

- A. CONTRACTOR shall perform the quality control procedures listed below in conjunction with the requirements of this section.
- B. Inspect materials upon receipt to ensure that the products are supplied by the approved Manufacturer.
- C. Proper, safe access shall be provided in locations as requested by the ENGINEER to facilitate inspection. Additional illumination shall be furnished when the ENGINEER requests. Proper ventilation and atmospheric monitoring shall be provided as well as all other safety equipment and precautions required by OSHA for a safe inspection in all areas.
- D. Measure and record ambient air temperature, relative humidity and dew point temperature once every two hours of each work shift.
- E. Measure and record substrate temperature once every two hours using an infrared or other surface thermometer.
- F. Concrete Surface Profile: Inspect and record substrate profile (anchor pattern). Surfaces shall be profiled equal to the CSP 5 amplitude as recommended by the coating manufacturer in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6.
 - 1. Compare the substrate profile once every 50 square feet with the Concrete Surface Profile (CSP) comparators in accordance with ICRI Guideline No. 310.2.

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2. Perform replication of the concrete surface profile every 500 square feet using replica putty in accordance with ASTM D7682. Submit replications to the ENGINEER as part of the Jobsite Reports.
- G. Concrete Surface Cleanliness: Prepared concrete surfaces shall be inspected for surface cleanliness after cleaning and drying, prior to resurfacing or coating application.
- H. Concrete Moisture Testing: After surface preparation verify concrete dryness in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6 and one of the following test methods.
1. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 2. Moisture vapor transmission not to exceed three lb per 1,000 square feet in a 24-hour period.
 3. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 4. Relative humidity not to exceed 80 percent.
 5. ASTM D4263— Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 6. No moisture present.
 7. Consult protective lining system manufacturer regarding questions and or recommendations about moisture problems or questions.
- I. Surface pH Testing – Existing Concrete: After surface preparation test the pH of cement particles collected from the concrete substrate. The particles shall be measured using pH indicating paper or pH meter. The pH testing is to be performed once every 50 square feet for the first 500 square feet and then once every 500 square feet thereafter. Acceptable pH values shall be a minimum of 9.0 as measured using color indicating pH paper with readable color calibrations and a scale at whole numbers or pH meter.
- J. The ENGINEER will conduct wet-film thickness testing. CONTRACTOR shall recoat any areas found deficient in thickness at no additional cost to OWNER.
1. Wet-Film Thickness shall be taken every 100 square feet in accordance with ASTM D4414 or other agreed-upon method.
 2. The Dry-Film Thickness can be determined using a surface area calculation for material consumption.

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K. Holiday Testing:

1. ENGINEER will visually inspect coverage for blisters, sags, and holidays. CONTRACTOR shall repair areas identified by this inspection prior to conducting holiday test.
2. CONTRACTOR shall holiday test, in the presence of the ENGINEER, all coated surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems.
 - a. Holiday testing equipment and procedures shall be done in strict accordance with the latest edition of the NACE "Standard Recommended Practice Discontinuity (Holiday) Testing of Protective Coatings."
 - b. Areas that contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.
3. Holiday detectors shall be of the following type:
 - a. High voltage pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at a voltage of at least 110 V/mil desired thickness.

L. Any damaged areas, faulty areas, or discontinuities (pinholes) found during quality control inspection shall be repaired in accordance with the Manufacturer's recommendations at no additional cost to OWNER.

M. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve CONTRACTOR of its responsibility to perform the Work in accordance with this specification section.

3.8 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's technical representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.9 ACCEPTANCE CRITERIA

- A. Surfaces shall be prepared, applied, and tested in accordance with the specification and referenced standards herein

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3.10 ADJUSTMENT AND CLEANING

- A. At the completion of the Work, CONTRACTOR shall remove all material and debris associated with the Work of this section.
- B. At the completion of the Work, CONTRACTOR shall clean all surfaces to which coatings were applied, as well as all adjacent, uncoated surfaces in a manner acceptable to the ENGINEER.
- C. Coatings shall be protected from damage until Final Acceptance of all Work in the area that was coated. Coatings damaged in any manner by CONTRACTOR prior to Final Acceptance of all Work in that area shall be repaired or replaced in a manner acceptable to the ENGINEER at no additional cost to the OWNER.
- D. Just prior to Final Acceptance of all Work in the area that was coated, CONTRACTOR shall clean all coatings, as recommended by the manufacturer, to provide a finished product acceptable to the OWNER.

3.11 WARRANTY INSPECTION

- A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by the CONTRACTOR in accordance with this Specification and to the satisfaction of the ENGINEER and at the CONTRACTOR'S expense.
- B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repair at all points where failures are observed by removing the deteriorated paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this specification as determined by the ENGINEER.
- C. All costs for CONTRACTOR'S inspection, Manufacturer's inspection and all costs for repair shall be borne by the CONTRACTOR.

+ + END OF SECTION + +

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SECTION 10 05 03

IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Furnish and install signs, placards, and labels for safety equipment, hazards, and equipment and piping identification.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Provide manufacturer's literature showing available letter sizes and styles, standard and custom colors, and standard mounting details.
 2. Provide drawings showing layouts, actual letter sizes and styles, colors, and project-specific mounting details.

PART 2 - PRODUCTS

2.1 IDENTIFICATION LABELS

- A. Pipe Labels and Flow Direction Arrows:
1. Label, Lettering Color, Size and Placement: In accordance with ANSI A13.1, and as listed below.
 2. Label Colors: The paint colors listed in the table below are based on Sherwin Williams System 4000 Color Codes

SERVICE ID	DESCRIPTION	PIPE PAINT COLOR	LABEL TEXT COLOR	LABEL BACKGROUND COLOR
A	Aeration Air	4086-SAFETY BLUE	WHITE	BLUE
FSS	Foam Spray System	4085 - SAFETY GREEN	WHITE	GREEN
OF	Overflow	4091 - SILVER BRITE	WHITE	GREY
TSL	Thickened Sludge	1668 - PINEAPPLE CREAM	BLACK	CLEAR
WWS	Wall Wash System	4085 -SAFETY GREEN	WHITE	GREEN

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Identification Devices

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3. Label Size:

PIPE DIAMETER (INCHES)	ARROW TAPE WIDTH	TEXT HEIGHT & TAPE WIDTH	TEXT FONT
< 3/4"	1-1/8"	31 pts & 1/2"	ARIAL
3/4" TO 2"	1-1/8"	75 pts & 1-1/8"	ARIAL
2-1/2" TO 7"	1-1/8"	125 pts & 2-1/4"	ARIAL
8" TO 10"	2-1/4"	250 pts & 4"	ARIAL
>10"	4"	350 pts & 4"	ARIAL

4. Label Placement:

- a. Pipe Labels should be positioned so that they can be easily seen from a normal angle of approach. Labels shall be positioned on the pipes so they can be easily read. Proper label placement is on the lower side of the pipe if the employee has to look up to the pipe, on the upper side of the pipe if the employee has to look down towards the pipe, or directly facing the employee if on the same level as the pipe. Labels should be located near valves, branches, where a change in direction occurs, on entry/re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification.
 - 1) Text labels shall be placed on the quadrant lines of pipe: Top, sides, or bottom of pipes.
 - 2) Text labels shall be placed behind flow direction arrows.
 - 3) Text labels shall read left to right on horizontal or angled pipe, and from bottom to top on vertical pipes.
 - 4) One set of flow direction arrows and a text label shall be used on a pipe flowing one direction only.
 - 5) Two set of multi-flow direction arrows and a text label shall be used on piping flowing both directions.
 - 6) Flow arrows shall go completely around the circumference of the pipe.
- b. Pipe labels shall be placed on both sides of wall or floor penetrations.
- c. Pipe labels shall be placed adjacent to shutoff valves where appropriate.
- d. Pipe labels shall be placed in line with each other where multiple pipes are stacked for quick identification.
- e. Pipe labels shall be placed adjacent to changes of direction where helpful.
- f. Pipe labels shall be placed at regular intervals on straight runs of pipe as needed; approximately 50 feet apart.

5. Message: Matching "Pipe Label Text" based on their Process Service as indicated in the Drawings, Pipe Schedule, and in the following table:

SERVICE ID	DESCRIPTION	PIPE LABEL TEXT
A	Aeration Air	COMPRESSED AIR
FSS	Foam Spray System	UTILITY WATER
OF	Overflow	DRAIN
TSL	Thickened Sludge	WAS
WWS	Wall Wash System	UTILITY WATER

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6. Size for finished outside diameter of pipe and insulation.
 7. Snap-Around Type Labels:
 - a. Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from washdown, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.
 - b. Labels:
 - 1) For 6 Inches and Over Diameter Pipe: May furnish strap-on type fastened without use of tools with plastic or stainless steel straps.
 - 2) Firmly grip pipe so labels remain fixed in vertical pipe runs.
 - c. Manufacturers and Products:
 - 1) T & B/Westline, Rariton, NJ, Model WSS Snap-Around.
 - 2) Seton Name Plate Corp., New Haven, CT, Setmark Series.
 - 3) Or equal.
 8. Self-Adhesive Type Labels:
 - a. Manufacture from high performance cast PVC film with low initial tac adhesive to allow repositioning.
 - b. Labels may consist of individual letters without background color to be placed separately, or as a single label with a background color.
 - c. Minimum 7-year exterior life.
- B. Valve and Equipment Labels:
1. Applies to valves and equipment with assigned tag numbers wherever specified.
 2. Lettering: Black bold face, 3/4-inch minimum high.
 3. Background: OSHA safety yellow.
 4. Materials: Either of the following:
 - a. Aluminum or stainless steel base with a baked-on finish that is suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
 - b. Fiberglass with fiberglass-encased lettering.
 5. Furnish 1-inch margin on each end of label for mounting. On fiberglass labels furnish grommets at each end for mounting.
 6. Size:
 - a. As appropriate for lettering provided.
 - b. Provide same-size labels for equipment series which are adjacent.
 7. Message: Equipment names and tag numbers as used in Sections where equipment is specified and/or on Drawings.
 8. Manufacturers and Products:
 - a. T & B/Westline Co., Rariton, NJ; Type KQ.
 - b. Seton Name Plate Corp., New Haven, CT; Style EB.
- Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SIGNS

- A. Install signs at locations as shown on the drawings. Signs should be installed approximately 5'-6" off of finished floor, attached to doors where appropriate. Where two signs are indicated in the same location, signs should be mounted side-by-side, where possible.

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Identification Devices

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- B. Install all signs plumb and level. They shall be attached with four stainless steel screws or anchor bolts as required for substrate. Provide theft/tamper-resistant fasteners on all signs.

3.2 INSTALLATION OF PIPE IDENTIFICATION LABELS

- A. Provide pipe identification label with flow arrows on all exposed piping systems as follows:
 - 1. At all connections to equipment, valves, tees or wall penetrations.
 - 2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.
- B. Install pipe identification labels after all painting has been completed.

3.3 INSTALLATION OF EQUIPMENT IDENTIFICATION LABELS

- A. Install equipment identification labels on all equipment and valves which have been given a tag number in the Drawings or Specifications. Provide identification label which includes equipment name and tag number.
- B. Where no damage will be caused to equipment, mount equipment identification label directly to equipment. Otherwise, mount equipment identification labels to concrete equipment base or wall space. Install equipment identification label such that it is clear which piece of equipment is being labeled.
- C. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

++ END OF SECTION ++

SECTION 40 05 06

PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 FLEXIBLE COUPLINGS (FC)

- A. Features:
 - 1. Description: Sleeve-type flexible couplings.
 - 2. Pressure and Service: Same as connected piping.
 - 3. Sleeve and Follower material: Ductile iron or steel.
 - 4. Coating and Lining: End and center rings shall be epoxy lined and coated, minimum 16 mils thickness. For potable water service, lining shall be NSF-61 certified.
 - 5. Gasket: EPDM
 - 6. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
- B. Manufacturers and Products:
 - 1. Romac;
 - a. Style 501 (2-inch through 24-inch)
 - b. Style 400 (12-inch through 96-inch)
 - 2. Dresser Piping Specialties; Style 38
 - 3. Smith-Blair, Inc.; Style 411.
 - 4. Or Equal.

2.2 FLANGED COUPLING ADAPTERS (FCA)

- A. Features:
 - 1. Description: Sleeve-type flexible couplings with flange on one end.
 - 2. Pressure and Service: Same as connected piping.
 - 3. Adapter body material: Ductile iron or steel.
 - 4. Coating and Lining: End and center rings shall be epoxy lined and coated, minimum 16 mils thickness. For potable water service, lining shall be NSF-61 certified.
 - 5. Gasket: EPDM
 - 6. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
- B. Manufacturers and Products:
 - 1. Romac;
 - a. Style FCA 501 (3-inch through 16-inch)

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2. Dresser Piping Specialties; Style 227.
3. Smith-Blair, Inc.; Style 127.
4. Or Equal.

2.3 ELASTOMER EXPANSION JOINTS (EEJ)

A. Features:

1. Type: Reinforced elastomer molded single widearch expansion joint.
2. End Connections: Flanged, drilled 125# ANSI B16.1 standard with split hot-dip galvanized steel retaining rings.
3. Washers: Use with retaining rings to provide leak-proof joint at twice the rated pressure.
4. Thrust Protection: Control rods with gusset connection shall prevent over-extension.
5. Bellows Arch lining shall be Buna-N, nitrile, or butyl.
6. Rated Temperature: 250 deg F.
7. Rated Deflection and Pressure:
 - a. Lateral deflection shall be ¾-inch minimum.
 - b. Burst Pressure: Four times the working pressure.
 - c. Compression deflection and minimum working pressure as follows:

Size (inch)	Deflection (inch)	Pressure (psig)
2-1/2 to 12	1.06	150
14	1.65	130
16 to 20	1.65	110

B. Manufacturers and Products:

1. Proco; Style 231.
2. General Rubber Corp.; Style 1015 Maxijoint.
3. Mercer; Flexmore Series 450.
4. Goodall Rubber Co.; Specification E-711.
5. Or equal.

2.4 DISMANTLING JOINTS (DMJ)

A. Features:

1. Pressure Rating
 - a. Minimum Working Pressure Rating: Not less than 150 psi
 - b. Pressure rating to be no less than test pressure for piping system in which the Restrained Dismantling Joint is used.
 - c. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
2. Thrust Restraint
 - a. Provide steel tie rods, ASTM A 193 GR B7
 - b. Number and arrangement of tie rods to provide dismantling joint assembly which meets pressure rating requirement.
3. Materials of Construction
 - a. Flanged Adapter Body: Steel
 - b. Follower Flange: Ductile Iron

- c. Gasket: Buna-N, NSF-61 approved
 - d. Flange: Steel, per AWWA C207
 - e. Spigot: Steel
 - f. Studs: Type 304 stainless steel
 - g. Coating: NSF-61 approved epoxy
- B. Manufacturers and Products:
- 1. Smith-Blair, Model 975 or 972, as required for pressure rating
 - 2. Romac Industries, Style DJ400
 - 3. Or Equal.

2.5 JOINT RESTRAINT HARNESS LUGS AND TIE RODS

- A. Features:
- 1. Harness Lugs:
 - a. Description: Steel harness lug installed on back side of flanges to allow tie rods to span across unrestrained piping components.
 - b. Materials: ASTM A36 steel for all piping except stainless steel. Stainless steel for stainless steel piping, SST grade to match pipe flange.
 - c. Profile Shape: Three-hole triangular or rectangular profile shape cut with plasma arc or oxy-fuel. Holes plasma arc cut or drilled.
 - d. Coating: Fusion bonded epoxy. NSF 61 certified when in contact with potable water.
 - e. Flange Compatibility: Coordinate lug style with pipe flange bolt pattern.
 - 2. Tie Rods and Hardware:
 - a. Provide 316L Stainless Steel all thread rods, in multiples of four rods per joint.
 - b. Provide two 316L Stainless Steel nuts at each end of tie rod.
 - c. Provide 316L Stainless Steel washers between nuts and harness lugs or plates.
- B. Manufacturers:
- 1. Romac
 - 2. Trumbull
 - 3. Or equal

2.6 MODULAR MECHANICAL SEALS

- A. Features:
- 1. Type: Interconnecting synthetic rubber links shaped and sized to continuously fill annular space between pipe and sleeve, blockout, or core-drilled opening in concrete slabs or walls.
 - 2. Links: EPDM
 - 3. Bolts and nuts: Type 316 stainless steel
 - 4. Pressure plates: composite
 - 5. Temperature range: -40 to 250 degrees Fahrenheit
 - 6. Pressure rating: guaranteed by the manufacturer to provide a water-tight seal with a differential hydrostatic head of 40-feet of water
- B. Manufacturers and Products:
- 1. PSI-Thunderline; Link-seal, Type S-316
 - 2. Or equal

2.7 SERVICE SADDLES

- A. Double-Strap Iron:
 - 1. Features:
 - a. Description: Double strap iron.
 - b. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
 - c. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
 - d. Taps: Iron pipe threads.
 - e. Materials:
 - 1) Body: Malleable or ductile iron.
 - 2) Straps: Galvanized steel.
 - 3) Hex Nuts and Washers: Steel.
 - 4) Seal: Rubber.
 - 2. Manufacturers and Products:
 - a. Smith-Blair; Series 313 or 366.
 - b. Dresser; Style 91.
 - c. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. Follow all manufacturer's directions
- B. Thrust Restraint for Unrestrained Couplings:
 - 1. Provide thrust restraint for the following coupling types, as shown on the Drawings.
 - a. Flexible couplings
 - b. Flanged coupling adapters
 - c.
 - 2. If no thrust restraint is shown on the Drawings, but pipe schedule indicates a test pressure greater than zero, notify ENGINEER to request appropriate thrust restraint detail.
- C. Flexible Couplings
 - 1. Follow all manufacturer's directions
 - 2. No more than 1-inch gap between pipe ends
 - 3. Center flexible coupling in joint
 - 4. Tighten bolts in an alternating pattern to provide even tension around the coupling
 - 5. Tighten bolts to specified torque
 - 6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material
- D. Flanged Coupling Adapters
 - 1. Follow all manufacturer's directions
 - 2. No more than 1-inch gap between pipe plain end and flange face
 - 3. Tighten flange bolts prior to tightening coupling bolts
 - 4. Tighten bolts in an alternating pattern to provide even tension around the coupling

5. Tighten bolts to specified torque
 6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material
- E. Restrained Mechanical Joint Glands
1. Follow all manufacturer's directions
 2. Tighten mechanical joint gland bolts before tightening restraint lugs
 3. Tighten restraint lugs until torque head breaks off
 4. In buried installations, wrap joint with plastic fastened to pipe to protect bolts and coupling from backfill material
- F. Pressure Gages
1. Follow all manufacturer's directions
 2. Install diaphragm seals where process liquid would be detrimental to gage life (wastewater, chemical service, etc.)
 3. Check gage accuracy

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Piping Specialties

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SECTION 40 05 07
PIPING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Details of each pipe support type used.

PART 2 - PRODUCTS

2.1 SUPPORT SYSTEMS:

- A. Channel-type support systems
 - 1. 316L Stainless Steel
- B. Hanger- and Clevis-type support systems
 - 1. 316L Stainless Steel
- C. Stanchion-type support systems
 - 1. 316L Stainless Steel
- D. Plain Steel Pipe Stand
 - 1. 316L Stainless Steel
- E. Adjustable Pipe Saddle Support
 - 1. 316L Stainless Steel
- F. Flange Mounted Pipe Support
 - 1. 316L Stainless Steel

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In addition to the pipe supports specifically called for on the drawings, CONTRACTOR shall provide pipe supports as required to fully support all piping systems.
- B. CONTRACTOR shall design, supply and install pipe support system using manufacturer's standard available pipe support hardware.
- C. Pipe supports shall, at a minimum, be installed at the following locations:
 - 1. On both sides of each valve, piece of equipment or other appurtenance, such that allowance is made for removal of the valve, piece of equipment, or other appurtenance while leaving the pipe system fully supported. Support piping connections to equipment by pipe support and not by the equipment.

2. Along straight runs of pipe, the maximum distance between supports shall be as listed below:

Pipe Diameter	Maximum Distance Between Supports	Minimum Hanger Rod Diameter (if Hanger Rods are used)
2" and smaller	6-feet	1/2"
2-1/2" to 6"	8-feet	3/4"
8" to 12"	10-feet	2 @ 3/4"
14" to 18"	10-feet	2 @ 1"
Over 18"	Custom Design	

3. Directly supporting valves 8-inch in diameter and larger.
 4. At least two supports on each side of flexible couplings or flanged coupling adapters to provide that no load is applied to the flexible coupling.
 5. On the pipe within two pipe diameters of each side of elbows and each branch of tees and crosses.
 6. Where piping passes through walls, such that no load is transferred to the wall.
- D. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
1. Support no pipe from the pipe above it.
 2. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
- E. Bracing and lateral support:
1. Provide lateral sway bracing on 10-foot maximum centers
 - a. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
 2. Install lateral supports for seismic loads at all changes in direction.
- F. Thermal expansion and thrust restraint
1. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
- G. Support types:
1. Horizontal Suspended Piping:
 - a. Single Pipes: Adjustable swivel-ring, splint-ring or clevis hangers.
 - b. Grouped Pipes: Trapeze hanger systems.
 - c. For insulated piping, furnish galvanized steel protection shields, welding insulation saddles, or precut sections of rigid insulation (with vapor barrier) at all hanger locations.
 2. Horizontal Piping Supported From Walls:
 - a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall-mounted framing also acceptable.
 - b. Stacked Piping:
 - 1) Wall-mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
 - 2) Piping clamps that resist axial movement of pipe through support not acceptable.

- c. Insulated piping shall have the insulation removed in the vicinity of wall brackets and piping clips to allow only direct pipe wall contact with the support system.
- 3. Horizontal Piping Supported From Floors:
 - a. Stanchion Type:
 - 1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
 - 2) Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
 - 3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
 - b. Floor-Mounted Channel Supports:
 - 1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
 - 2) Attach channel framing to floors with anchor bolts.
 - 3) Attach pipe to channel with clips or pipe clamps.
 - c. Concrete Cradles:
 - 1) Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
- 4. Vertical Pipe:
 - a. Support with wall brackets and base elbow or riser clamps on floor penetrations.
 - b. Insulated piping shall have the insulation removed in the vicinity of wall brackets and riser clamps, to allow only direct wall contact with the support system.
- H. Standard Attachments:
 - 1. To Concrete Ceilings: Concrete inserts.
 - 2. To Steel Beams: I-beam clamp or welded attachments.
 - 3. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
 - 4. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
 - 5. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.
 - 6. Repair mounting surfaces to original condition after attachments are made.
- I. Isolation:
 - 1. Install elastomeric inserts designed to isolate piping from pipe supports where copper pipe is run in stainless steel supports, or where other dissimilar metals are in contact with pipe supports.
- J. Materials:
 - 1. Channel-type, hanger-type and trapeze-type support systems and pipe racks constructed of channel systems:
 - a. Provide non-metallic support systems in all chemical storage and feed areas or as otherwise noted on the Drawings. Provide type 316 stainless steel fasteners.
 - b. Provide type 304 stainless steel support systems and fasteners in all other areas.
 - 2. Stanchion-type support systems
 - a. Provide steel and ductile iron stanchion components
 - b. Coat stanchions after assembly per specification Section 09 91 03, Painting.

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Piping Support Systems

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SECTION 40 05 10

PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for each piping system.
 - a. Include information on pipe, fittings and joint systems.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Complete descriptions and data for all coatings and linings.
 - 4. Tests and inspection data for pipe and coatings/linings.
 - 5. Qualifications for welders and/or technicians performing joining processes that requires specialized equipment to perform the work or as specifically identified herein.
- B. Operation and Maintenance Data as specified in Submittal Procedures section of these specifications.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM DATA SHEETS

- A. Piping system data sheets (PSDS) have been attached to this Specification and are incorporated herein by reference. Provide piping systems in accordance with piping system data sheets.

2.2 THRUST RESTRAINT

- A. Provide rigid or restrained joints and fittings for all piping systems specified with a test pressure in the Pipe Schedule.
- B. Unless otherwise specified in the Pipe Schedule or shown on the Drawings, thrust blocks shall not be used.

PART 3 - EXECUTION

3.1 PIPE SCHEDULE

- A. A Pipe Schedule is included in the Specifications and is incorporated herein by reference. Install piping systems in accordance with Pipe Schedule.

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Pipe and Fittings

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- B. For pipe which is shown on the Drawings, but not referenced in the Pipe Schedule, CONTRACTOR to provide pipe material and fittings which are appropriate for the intended service and acceptable to the ENGINEER.

3.2 PREPARATION

- A. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.
- B. Repair any coatings or linings which were damaged during shipping and handling using manufacturer-approved coating and lining repair materials in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. General:
 - 1. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.
- B. Joint Assembly:
 - 1. Flanged Joints (FLG):
 - a. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
 - b. Follow a bolt tightening pattern which produces uniform bearing pressure.
 - c. Do not over-tighten bolts. Follow manufacturer's recommendation for bolt torque.
 - d. Provide gasket at every flanged joint.
 - e. Provide insulating flange kit where indicated on Drawings and required in this Specification.
 - 2. Threaded and Coupled Joints (THR):
 - a. Conform to ANSI B1.20.1.
 - b. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
 - c. Ream pipe ends and clean chips and burrs after threading.
 - d. Make connections with not more than three threads exposed.
 - e. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.
 - f. PVC Threaded Joints:
 - 1) Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
 - 2) Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
 - g. HDPE Threaded Joints:
 - 1) Joining HDPE pipe with threaded connections is not allowed unless specifically approved by the ENGINEER
 - h. Provide dielectric union or insulating coupling where indicated on Drawings and required in this Specification.
- 3. Grooved-End Joints (GRV):
 - a. Type: Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.
 - b. Grooved end joints are not allowed for plastic pipes unless approved by the ENGINEER.
- 4. Welded Steel and Stainless Steel Joints (WLD)

- a. Field welded joints shall be in accordance with AWWA C206
 - b. Welder Qualifications:
 - 1) All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used.
 - 2) Welders shall be qualified by the CONTRACTOR under the provisions of ASME BPVC for shop welds and ANSI/AWS D1.1 for field welds.
 - 3) Furnish all material and bear the expense of qualifying welders.
 - c. Backing rings will not be permitted for 30-inch and smaller pipe. Single field-welded butt joints with outside backing rings may be used for pipe larger than 30 inches in diameter.
 - d. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.
 - e. Butt Straps
 - 1) Butt straps shall be used as closure pieces and where shown on the Drawings.
 - 2) Where used or required, shall be as shown on the Contract Drawings or as approved during shop drawing review.
 - 3) When fitting up the ends of pipe to be welded or fitting butt-strap pieces, minor jacking or clamping will be allowed. Cold working the metal and sledges or localized application of heat and working the metal and sledges will not be allowed. If field displacement of joints, where butt strap joints are indicated, does not allow proper fit-up with the tolerances indicated, special closure butt straps or mitered pieces shall be shop fabricated and installed.
 - 4) Butt straps shall be welded on both the inside and outside of the pipe and at each end of the pipe and strap to avoid stress multiplication.
 - f. Prior to the backfilling or beginning the welding procedure, any tack welds or joint stops used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with ANSI/AWWA C206. Where more than one pass is required, all dirt, slag, and flux shall be removed before the succeeding bead is applied.
 - g. Repair of Welds: All welds that are defective shall be repaired by the CONTRACTOR to meet the requirements of this section at no additional cost to the OWNER. Defects in welds or defective welds shall be removed, and that section of the joint shall then be re-welded. Only sufficient removal of defective material that is necessary to correct the defect is required. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.
- C. Exposed Piping Installation:
- 1. Piping Runs:
 - a. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
 - b. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.
 - 2. Supports: As specified in Piping Support Systems section of these specifications.
 - 3. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.
 - 4. Provide unions or flanges at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

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Pipe and Fittings

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5. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection;
6. Install piping to allow for contraction and expansion without stressing pipe, joints, or connected equipment.
7. Piping clearance, unless otherwise shown:
 - a. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - b. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet 0 inch, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - c. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - d. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
 - e. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
 - f. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
 - g. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

D. Cleaning:

1. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines with water at 2.5 fps minimum flushing velocity until foreign matter is removed. At a minimum, flush for a period of time which will flush the entire pipeline volume three times.
 - a. If impractical to flush large diameter pipe at 2.5 fps, clean in-place from inside by brushing and sweeping, then flush line at lower velocity. If lower velocity is used, flush the entire pipeline volume five times.
2. Provide temporary means of removing flushing water from pipeline during flushing.
3. Provide means for removal/screening of debris from the flushing water, disposal of debris and disposal of flushing water.

3.4 TESTING

- A. Pressure test piping in accordance with the Pipe Schedule, Testing of Pressure Piping Systems section of these specifications.

3.5 SUPPLEMENTS

- A. The following supplements are attached to this Specification section and incorporated herein by reference:
1. 40 05 19 – Piping System Data Sheet - Ductile Iron Process Pipe (DIP)
 2. 40 05 23.03 – Piping System Data Sheet - Welded Stainless Steel Pipe (WSSTP)
 3. 40 05 31.02 – Piping System Data Sheet - PVC Pressure Pipe (PVC2)

++ END OF SECTION ++

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Pipe and Fittings

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SECTION 40 05 10.01

PIPE SCHEDULE

1.1 DESCRIPTION

A. General:

1. This schedule is provided for the convenience of the CONTRACTOR. Some flow streams may be shown on the drawings, but not listed here.

B. Flow Stream IDs:

1. A – Aeration
2. TSL – Thickened Sludge
3. OF – Overflow
4. UW – Utility Water

C. Pipe Materials:

1. Ductile Iron Process Pipe (DIP)
2. Welded Stainless Steel Pipe (WSSTP)
3. Solvent Welded PVC Pipe (PVC1)

D. Joint Types:

1. FLG – Flanged
2. GRV – Grooved End
3. THR – Threaded Union
4. WLD – Butt Welded

E. Lining Systems:

1. CE – Ceramic Epoxy
2. CM – Cement Mortar
3. FE – Fusion Bonded Epoxy
4. GL – Glass

1.2 PIPE SCHEDULE

Contractor shall install piping systems in accordance with the following pipe schedule:

Contractor shall install piping systems in accordance with the following pipe schedule:

SERVICE	DESCRIPTION	EXPOSURE	SIZE RANGE	MATERIAL	JOINT TYPE	TEST PRESSURE	LINING	COATING SYSTEM/ COLOR	NOTES
A	Aeration Air Piping	Exposed	All	WSSTP	WLD, GRV	150 psi	None	None	Type 316L Stainless Steel
OF	Overflow	Wall Pipe Embedded in Concrete	All	WSSTP	FLG	10 psi	None	None	Type 316L Stainless Steel
TSL	Thickened Sludge	Exposed	All	WSSTP	WLD	150 psi	None	None	Exterior Pipe to be insulated per Section 40 42 13 System INS-02 1" Insulation Thickness
FSS	Foam Spray System	Exposed	All	PVC1	THR	250 psi	None	None	Schedule 80
WWS	Wall Wash System	Exposed	All	WSSTP	THR	250 psi	None	None	Type 316L Stainless Steel

++ END OF SECTION ++

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Pipe Schedule

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SECTION 40 05 23.03**PIPING SYSTEM DATA SHEET – WELDED STAINLESS STEEL PIPE (WSSTP)**

ITEM	DESCRIPTION
Pipe	ANSI/AWWA C220, Standard for Stainless Steel Pipe, 1/2-inch diameter and larger, latest revision. Pressure class to accommodate test pressure listed in Pipe Schedule. Type as indicated in the Piping Schedule. Minimum Schedule 10.
Linings/Coatings	Factory Finish: <ol style="list-style-type: none">1. All pipe and fittings shall be pickled after manufacture by immersion in acid bath until all weld discoloration and iron pickup is removed.2. Passivate all piping welds after fabrication.3. Thoroughly wash all pipe and fittings with clear water after pickling.
Joints	Full penetration butt-welded, flanged, rolled grooved end, or threaded where shown and/or required. Field welded pipe joints are prohibited unless approved by ENGINEER. Where approved, field welds shall be pickled, passivated and cleaned.
Joint Restraint Harnesses	AWWA M11 steel harness restraint ring welded to pipe to allow tie rods to span across unrestrained piping components. Stainless steel, grade to match pipe flanges. 3/16 inch (on diameter) clearance between the specified pipe O.D. up through 24 inch piping, and 1/4 inch clearance for pipes larger than 24 inches.
Fittings	All fittings 6" and smaller shall be forged. Buried fittings 8" to 24" may be fabricated or forged. Buried fittings larger than 24" shall be fabricated. Exposed fittings 24" and smaller shall be forged. Exposed fittings 30" to 48" may be fabricated or forged. All fittings larger than 48" shall be fabricated. Fabricated: Type 304 stainless steel fabricated in accordance with AWWA C208; elbows to have a 22.5 degree maximum miter section angle and a radius of 2.5 times the diameter, unless shown otherwise; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M 11. Fitting wall thickness shall be equal to or greater than adjoining pipe. Forged: Butt-welding fittings, ASTM A403M, type 304 stainless steel. Fitting wall thickness to match adjoining pipe. Threaded: Piping 4" and less, threaded per ANSI B1.20.1, pressure class to accommodate test pressure, stainless grade to match pipe grade (ASTM A351 CF8 for grade 304 pipe and CF8M for grade 316

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Piping System Data Sheet – Welded Stainless Steel Pipe (WSSTP)

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ITEM	DESCRIPTION
	pipe).
Flanges	<p>Type 304 stainless steel, flat-faced, pressure class to exceed test pressure. Raised-face flanges only allowed when mating to equipment with raised-face flanges. Raised-face flanges are not allowed to mate with flat-faced flanges.</p> <p>AWWA C207 ring or hub, Class D minimum.</p> <p>Or</p> <p>ANSI B16.5 slip-on or weld neck, Class 150 minimum.</p>
Bolting	<p>Hex Bolts: ASTM A320/A320M, Type 304 stainless steel, grade 5</p> <p>Nuts: ASTM F594, Type 304 stainless steel, grade 5.</p>
Gaskets	<p>Corrosive acid and alkali free non-metallic conforming to AWWA C207 and ASME B16.21, as follows:</p> <ul style="list-style-type: none"> • Class D (to 175 psi), 4"-24": Rubber, Full Faced, 1/8" thick • Class D (to 175 psi), 26"-144": Rubber, Ring, 1/8" thick • Class E (to 175 psi), 4"-24": Rubber, Ring, 1/16" thick • Class E (to 275 psi), 4"-24": Nonasbestos, Ring, 1/16" thick • Class E (to 275 psi), 26"-144": Nonasbestos, Ring, 1/8" thick • Class F (to 300 psi), 4"-24": Nonasbestos, Ring, 1/16" thick • Class F (to 300 psi), 26"-48": Nonasbestos, Ring, 1/8" thick <p>Provide full-face gaskets for flat-face flanges; flat ring gaskets for raised-face flanges.</p> <p>Gaskets for rolled grooved ends shall be as recommended by manufacturer for sewage service.</p>
Thread Lubricant	Non-seizing, industrial grade thread sealing compound that is insoluble in water

++ END OF SECTION ++

SECTION 40 05 31.01**PIPING SYSTEM DATA SHEET – SOLVENT WELDED POLYVINYL CHLORIDE PIPE (PVC1)**

ITEM	DESCRIPTION
Pipe	Schedule 80 Polyvinyl Chloride (PVC), unless indicated otherwise. Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785.
Fittings	Schedule to match pipe above, ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type.
Joints	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	One-piece, molded hub type PVC flat face flange in accordance with Fittings above, 125-pound ANSI B16.1 drilling
Bolting	Hex Bolts: ASTM A193 B8, Type 304 stainless steel Nuts: ASTM A194 Grade 8, Type 304 stainless steel
Gaskets	Flat-Face Mating Flange: Full-faced 1/8-inch thick EPDM rubber.
Solvent Cement	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.
Thread Sealant	Teflon Tape.

++ END OF SECTION ++

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Piping System Data Sheet – Solvent Welded PVC Pipe (PVC1)

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Piping System Data Sheet – Solvent Welded PVC Pipe (PVC1)

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SECTION 40 05 51

VALVES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for make and model.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Certificate of Compliance for: Butterfly valves; full compliance with AWWA C504.
- B. Tests and inspection data.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

1.3 TRADE NAME ABBREVIATIONS

- A. FKM: Fluorocarbon (FPM or Viton®)
- B. PTFE: Polytetrafluoroethylene (Teflon®)

PART 2 - PRODUCTS

2.1 GENERAL

- A. All valves shall be the same size as the pipe in which they are installed, unless specifically noted otherwise on the Drawings.
- B. All valves shall include all appurtenant parts (operators, chainwheels, handwheels, valve stems, floor stands, gear boxes, operating nut, etc.) for a complete operating valve.
 - 1. Valve shall be, as much as practical, fully factory assembled.
- C. All valves shall open by turning counter-clockwise. Maximum force required for operation shall be 80 lbs.
- D. Where Lead-Free Bronze or Brass is specified, materials shall be in compliance with California Health & Safety Code Section 116875. Not more than a weighted average of 0.25 percent of the wetted surface of the valve shall be lead. Valve shall be provided with a "hang tag" or other marking that easily identifies the valve as Lead-Free.
- E. Coatings and Linings:
 - 1. Provide factory-applied coatings as described herein.

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2. Where liquid epoxy coatings are specified, coatings shall conform to AWWA C550.
3. Field coat the exterior of all valve bodies with the same coating as is required for the adjacent pipe unless otherwise specified.

F. Nuts, Bolts and Washers

1. Hex Bolts: ASTM A320/A320M, Type 304 stainless steel, [Grade B8, Class 2](#)
2. Nuts: ASTM F594, Type 304 stainless steel, [Grade B8, Class 2](#)
3. Washers: Type 304 stainless steel

2.2 BALL VALVES

A. **BAV-05:** Stainless Steel Ball Valve (3" and Smaller)

1. Service: Water, air
2. Features:
 - a. Threaded ends
 - b. Rated minimum 800 psig WOG (Water-Oil-Gas)
 - c. Stainless steel body
 - d. Polished stainless steel ball
 - e. PTFE seat
 - f. Stainless steel lever-type handle
3. Manufacturers and Products:
 - a. Apollo; Type 76
 - b. Watts; Type S-FBV-1
 - c. Or Equal

B. **BAV-06:** Stainless Steel Ball Valve (3" through 6")

1. Service: Water, air
2. Features:
 - a. Flanged ends
 - b. Rated minimum 275 psig
 - c. ASTM A351 CF8M stainless steel body
 - d. Polished Type 316 stainless steel ball
 - e. Reinforced PTFE seat
 - f. Stainless steel lever-type handle
3. Manufacturers and Products:
 - a. Apollo; Type 87A
 - b. Or Equal

2.3 CHECK VALVES

A. **CKV-20:** Duckbill Check Valve

1. Service: Water.
2. Features:
 - a. All-elastomer check valve
 - 1) Designed to allow flow in only one direction
 - 2) One-piece reinforced elastomeric construction
 - 3) Valve sleeve contours to "duckbill" shape when closed
 - 4) For Flanged-End Application:

- a) Bottom of valve sleeve will be flat, perpendicular to flange, and provide for flow continuing along the same invert as the pipe to which the valve is attached if the valve were attached horizontally and upright.
 - b) Top of valve sleeve will flare away from valve centerline.
 - 5) For In-Line Flanged Applications:
 - a) Valve sleeve will fit entirely into adjacent piping.
 - 6) The "duckbill" portion of the valve sleeve will be thinner and more flexible than the valve body
- b. Elastomeric material: FKM
- c. Flanged connection:
 - 1) Elastomeric, integral to valve body
 - 2) Compatible with ANSI B16.5 class 150# flanges.
- 3. Manufacturers and Products:
 - a. Flanged-End Application:
 - 1) Tide-Flex Series 35-1
 - 2) Or Equal
 - b. Pipe-Inserted In-Line Flanged Application
 - 1) Tide-Flex Series 37
 - 2) Or Equal
 - c. Flanged-End In-Line Flanged Application
 - 1) Tide-Flex Series 33 (1" to 3"); Series 39 (4" to 24"); Series 39F (30" to 84")
 - d. Or Equal

2.4 OPERATORS

- A. General:
 - 1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
 - 2. Operator self-locking type or equipped with self-locking device.
 - 3. Provide position indicator on all valves.
 - 4. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally threaded bronze or ductile iron nut.
 - 5. Valve handles, wheels, etc. to be designed to accommodate a padlock.
- B. Manual Operator:
 - 1. Galvanized and painted handwheels.
 - 2. Lever operators allowed on quarter-turn valves 8 inches and smaller.
 - 3. Cranks on gear type operators.
 - 4. For all valves above 5'-0" above adjacent working surface (finished floor or finished grade), provide chain wheel operator with tiebacks
 - 5. For all exposed valves below adjacent working surface (finished floor or walkway), provide extension stem, floor stands, and other accessories to permit operation from 2'-6" above adjacent working surface.
 - 6. For all buried valves 3" and larger, provide stem extension, valve bonnet, valve box and 2" AWWA operating nut such that operating nut is within 12" of adjacent finished grade.

- a. For small-diameter buried valves, provide cross-shaped handle for operating with forked key.

2.5 ACCESSORIES

- A. T-Handled Operating Wrench:
 1. One each galvanized operating wrench, 4 feet long.
 2. Manufacturers and Products:
 - a. Mueller; No. A-24610.
 - b. Clow No.; F-2520.
 - c. Or Equal
- B. Cast Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 6-inch ID shaft.
 1. Box: Cast iron with minimum depth of 9 inches.
 2. Lid: Cast iron, minimum depth 3 inches, marked WATER.
 3. Extensions: Cast iron.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning:
 1. Clean all mating faces of valve (threads, flange faces, etc.) prior to assembly.
 2. Remove all debris from valve body prior to assembly.
 3. Take extra care to clean mating faces of existing pipe and fittings which may have corrosion, dirt, debris and mineral build-up which should be removed for a proper fit.
- B. Apply joint compound, lubricant, etc. as recommended by valve manufacturer for proper installation prior to installation.
- C. Install valves in accordance with the following schedule and as noted on the Drawings:

3.2 INSTALLATION

- A. Install valves per manufacturer's recommendations.
- B. Install valves so handles operate from fully open to fully closed without encountering obstructions.
- C. Install valves in location and orientation for easy access for routine operation and maintenance. Access should be such that an operator can operate the valve by reaching a handle, chain, etc. at a height between 2'-6" and 5'-0" above adjacent work surface (for buried valves, this is accomplished with a t-handle wrench and the operating nut being within 12" of finished grade).
- D. Install plug valves with the seat side as indicated on the Drawings. If manufacturer's recommendations differ from indicated seat direction on the drawings, or if no seat side

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is indicated, install plug valves with seat side as recommended by the manufacturer after obtaining approval from the ENGINEER.

3.3 TESTS AND INSPECTION

- A. Valve may be either tested while testing pipelines, or as a separate step.
- B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
- C. Inspect air release and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
- D. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.
- E. Set, verify, and record set pressures for all relief and regulating valves.

++ END OF SECTION ++

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.SECTION 40 05 91

TESTING OF PRESSURE PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all labor, materials, equipment, and incidentals as shown on the Drawings required to perform the pressure testing of piping systems.

1.2 SUBMITTALS

- A. Testing Plan: Submit prior to testing and include at least the information that follows.
 - a. Testing dates
 - b. Piping systems and section(s) to be tested
 - c. Test type
 - d. Method of isolation
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested
- B. Certifications of Calibration: Testing equipment
- C. Certified Test Report

1.3 REFERENCE

- A. Reference Section 40 05 10.01, Pipe Schedule for test pressure.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Notify ENGINEER in writing 5 days in advance of testing. Perform testing in presence of ENGINEER.

3.2 PRESSURE TESTING

- A. General:
 - 1. Complete installation of piping system, including all thrust restraint, prior to pressure testing.
 - a. If thrust blocking is specified, wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
 - 2. Prior to test, remove and replace with pipe spools or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.

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Testing of Pressure Piping Systems

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3. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.
 4. Piping to be Pressure Tested and Test Pressure: as indicated on Piping Schedule.
- B. Hydrostatic Testing (Pipe Other than PSDS HDPE2):
1. Testing Fluid: Clean, potable water.
 2. Pipeline Protection:
 - a. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
 - b. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
 3. Exposed Piping:
 - a. Perform testing on insulated piping prior to application of insulation
 - b. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
 - c. Examine joints and connections for leakage.
 - 1) Correct visible leakage and retest as specified.
 - 2) Empty pipe of water prior to final cleaning or disinfection.
 4. Buried Piping:
 - a. Test after backfilling has been completed.
 - b. Expel air from piping system during filling.
 - c. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
 - d. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
 - e. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
 - f. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

where:

L = Allowable leakage, in gallons per hour.
 S = Length of pipe tested, in feet.
 D = Nominal diameter of pipe, in inches.
 P = Test pressure during leakage test, in pounds per square inch.

- g. Correct leakage greater than allowable, and retest as specified.

- C. Testing with Air:
1. Perform only where specifically allowed or called for in Pipe Schedule.
 2. Do not perform on:
 - a. PVC or CPVC pipe.
 - b. Buried and other non-exposed piping.
 3. Use Oil-free, dry air.
 4. Procedure:
 - a. Apply 25% of specified test pressure to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.
 - b. Correct visible leaks and repeat preliminary test until visible leaks are corrected.

- c. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
- d. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
- e. Correct visible leakage and retest as specified.
- 5. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.
- 6. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

3.3 PIPE PRESSURE TESTING LOG

- A. All pressure tests shall be witnessed by ENGINEER. CONTRACTOR shall keep a pipe pressure testing log to document the pressure testing and ENGINEER's approval of such.
 - 1. Specific details of the contents and format pipe pressure testing log shall be determined by the CONTRACTOR and approved by the ENGINEER.
 - 2. At a minimum, pipe pressure testing log shall record, on a daily basis for any day when pipe pressure testing is performed:
 - a. Test Report Documentation:
 - 1) Test date
 - 2) Description and identification of piping tested
 - 3) Test fluid
 - 4) Test pressure
 - 5) Remarks, including:
 - a) Leaks (type, location)
 - b) Repair/replacement performed to remedy excessive leakage
 - 3. Pipe pressure testing log shall be kept on-site. Pipe pressure testing log shall be signed on a daily basis, for any day when pipe pressure testing log work is performed, by the supervisor of the CONTRACTOR's field crew and by the ENGINEER.
 - 4. Any piping system which was pressure tested, but which was not recorded in the pipe pressure testing log, shall be re-tested at the ENGINEER's discretion.

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Testing of Pressure Piping Systems

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SECTION 40 42 13

PIPING INSULATION

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. **INS-01:** Flexible Elastomeric Pipe Insulation (up to 6" diameter)
 - 1. Material: Flexible elastomeric pipe insulation, closed cell structure
 - 2. Provide a minimum of ¾-inch thickness
 - 3. Temperature Rating: -40 degrees to 200 degrees Fahrenheit
 - 4. Nominal Density: 6 pcf
 - 5. Conductivity in accordance with ASHRAE 90.1 and minimum of 0.27 BTU-in/hr-ft² degrees F at 75 degrees F per ASTM C177 or ASTM C518.
 - 6. Minimum water vapor transmission of 0.10 perm-inch per ASTM E96
 - 7. Flame Spread Rating: Less than 25 per ASTM E84
 - 8. Joint sealant and tape per manufacturer
 - 9. Manufacturers and Products:
 - a. Rubatex: R-180-FS
 - b. Armstrong: Armaflex AP
 - c. Or Equal
- B. **INS-02:** Rigid Fiberglass with PVC Cover
 - 1. Material:
 - a. Insulation: UL rated, preformed, sectional rigid fiberglass
 - b. Vapor Barrier Jacket: Kraft paper with aluminum foil with pressure sensitive adhesive lap
 - c. Cover: Preformed PVC Cover
 - 1) UV resistant
 - 2) Joints designed to shed water
 - 3) Color: White.
 - 4) Provide Identification Labels per the requirements of 10400 – Identification Devices
 - 2. Temperature Rating: 0 degrees to 850 degrees Fahrenheit
 - 3. Conductivity in accordance with ASHRAE 90.1 and minimum of 0.27 BTU-in/hr-ft² degrees F at 75 degrees F per ASTM C177 or ASTM C518.
 - 4. Minimum water vapor transmission of 0.02 perm-inch per ASTM E96
 - 5. Flame Spread Rating: Less than 25 per ASTM E84
 - 6. Fittings and valves:
 - a. Insulate with fabricated sections of insulation

- b. Wrap with vapor barrier jacket
- c. Provide preformed PVC fitting cover specifically designed for fitting or valve
- 7. Manufacturers and Products:
 - a. Owens-Corning Fiberglass; ASJ/SSL-II with PVC Cover
 - b. Johns Manville Corp; Micro-Lok with Zeston 2000 PVC Cover
 - c. Or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Insulate all piping, valves and fittings for the piping systems (Flow Stream IDs) where insulation is called for in 40 05 10.01 - Piping Schedule
- B. Install insulation according to manufacturer's instructions
 - 1. Install insulation only after piping system has passed pressure testing.
 - 2. Requirement for insulation does not negate the requirement for coating of the piping system. Apply piping coating system as called for in 40 05 10.01 – Piping Schedule. Allow coating system to completely cure prior to installation of pipe insulation.
 - 3. If heat tracing is required on piping system, do not install pipe insulation until after heat tracing has been installed and successfully tested.
 - 4. Do not "gap" insulation at pipe supports. Trim insulation to allow for pipe support while providing continuous insulation of piping in those parts of the pipe not in contact with pipe support.
 - 5. Install removable/replaceable insulation sections and cover panels over fittings or valves which require maintenance access.
 - 6. Use accessories, adhesives and tapes per manufacturer's recommendations.
- C. Finishing
 - 1. Overall installation shall result in smooth, straight, neat and clean piping insulation system. No frayed ends, irregular lumps or other unsightly installation result will be acceptable.

++ END OF SECTION ++

SECTION 46 41 21

TANK AGITATION COARSE AERATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. This Section includes the supply of a coarse-bubble aeration system including piping, drop pipes, diffuser elements mounted on assemblies, supports, fittings, gaskets, and accessories required for a complete installation to provide tank aeration and mixing to keep solids in suspension and prevent septic conditions from forming within the tank. The system shall utilize the plant's existing two (2) blowers capable of supplying an air flow of 300 cfm each.
- B. The tank agitation aeration equipment manufacturer shall be responsible for supplying all air piping including the drop pipes from the existing air distribution piping from the limits indicated on the Drawings. Air piping and valves beyond the limits indicated on the Drawings will be supplied by the CONTRACTOR.
- C. Services of the manufacturer of the tank agitation aeration equipment shall include factory testing, submittals including shop drawings and operations and maintenance manuals, delivery of the equipment to meet CONTRACTOR'S installation schedule and coordination with the CONTRACTOR during installation, start-up and testing of equipment.

1.2 DEFINITIONS

- A. Standard Conditions: Defined as 14.7 pounds per square inch absolute ambient pressure, and clean water at a temperature of 20-deg C and zero dissolved oxygen.

1.3 SUBMITTALS

- 1. Extended Warranty
- 2. Product Data: Submit for approval manufacturer's literature, illustrations, specifications and engineering data.
- 3. Dimensional Drawings:
 - a. Drop Pipes and spacing along existing aeration header piping along tanks.
- 4. Tank Agitation Aeration Equipment Air Diffuser Assemblies:
 - a. Number of air diffuser elements and assemblies.
 - b. Complete materials list, material specifications, dimensions and tolerances of all parts of the diffuser assemblies.
 - c. Curve showing head loss versus air flow rate for a diffuser element.
 - d. Testing and sampling plans for source quality control of the diffuser elements.
- 5. Method for supporting and preventing uncontrolled movement of the agitation air drop assembly piping resulting from flotation dynamic forces and thermal expansion
- 6. Data shall be provided to show the chemical resistivity of the diffuser element materials.
- 7. Complete Operations and Maintenance Manuals in Accordance with Division 1 requirements.
- 8. Test Results from Factory Testing.

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Tank Agitation Coarse Aeration System

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1.4 EXTENDED WARRANTY

- A. The diffuser assembly material shall be capable of providing a five-year life in the plant wastewater environment without failure due to cracking or rupture.
- B. The equipment manufacturer shall guarantee all agitation air diffuser elements for a five-year period following the substantial completion date of this contract and shall replace at their own expense all diffuser elements that fail to meet this requirement.
- C. A warranty form, signed by an authorized representative of the Manufacturer, shall be submitted prior to final payment to the CONTRACTOR.

1.5 QUALITY ASSURANCE

- A. Factory Testing of Fabricated Components
 - 1. Dynamic Wet Pressure Testing:
 - a. Test one diffuser for each manufacturing lot for headloss when submerged under water.
 - b. The submergence and control orifice losses shall be deducted from the measured pressure upstream of the diffuser assembly
 - 2. Pressure Testing of Pipe Spools and Manifolds
 - a. The test method shall be hydraulic pressure type. The pipe section shall be capped, flanged, or plugged at all outlet ports. The pipe section shall be filled with water to a pressure point of 250 psi. The supply valve shall be closed to isolate the pipe section interior pressure. The pressure shall be monitored for 15 minutes without any loss in pressure from the initial 250 psi for the component to pass the pressure test.
 - b. A certification document shall be provided summarizing the pressure testing and list of components (by part number) tested. Pass/Fail indication shall be designated on the document for each component. Certification Document: Pressure Testing Certification.
 - 3. Material Grade Verification of Stainless Steel Components
 - a. Non-destructive Elemental Analysis; 10% of all finished stainless steel components shall be tested using an XRF (X-Ray Fluorescence) Analyzer. A minimum of (3) components shall be tested for any system. A summary report of the test with a list of part numbers tested shall accompany the material to the project site. A duplicate copy shall be held by the Coarse Bubble Aeration and Mixing System manufacturer. Certification Document: Material Grade Certification.

1.6 SPARE PARTS

- A. Furnish two complete sets of all special tools required for the assembly, disassembly, adjustment and/or maintenance of all components of the tank agitation aeration equipment.
- B. Furnish the following spare equipment:
 - 1. 30 agitation air diffuser elements

1.7 DESIGN REQUIREMENTS

- A. Tank Configuration:
 - 1. Plant Elevation: 4300 feet above MSL.
 - 2. Number of Tanks: 1
 - 3. Nominal Overall Dimensions (each Tank):
 - a. Width: 28 feet
 - b. Length: 28.5 feet
 - c. Tank Side-water Depth: Up to 18 feet maximum
- B. System Performance Requirements
 - 1. Aeration system to be placed in a solids holding tank for thickened Waste Activated Sludge, WAS. Tank will be used intermittently. When used the tank will fill and solids will be held for 1-3 days. Provide sufficient number of diffusers to achieve the following design conditions:
 - a. Sufficient aeration shall be delivered to prevent septic conditions in the tank. Aeration system shall be capable of circulating an air flow range of 300-600 scfm.
 - b. Flow:
 - 1) Average tank influent rate: 95 gpm
 - 2) Peak tank influent rate: 760 gpm
 - c. Average solids concentration in tank: 4.0% thickened WAS
- C. System Constraints:
 - 1. Access to tank for installation shall be via a 30-inch manway on the North wall of the tank.
 - 2. The tank agitation aeration system shall be capable of on/off blower operation without clogging of the aeration system piping or diffusers.
 - 3. The aeration system shall be capable of operation in process fluids with up to 4% solids concentration without clogging of the aeration system with solids in the diffusers and/or piping.
 - 4. Air surge protection; the aeration system and individual diffusers shall be capable of handling a mass flow surge from the blower or air supply system without detrimental effects to the diffusers. The design surge rate shall be three times the design flow. During start-up and commissioning of the system, the supply air shall be spiked for air surge testing to confirm the supplied diffusers can handle the surge without deformation, disconnection or any damage to the diffuser and system piping.
 - 5. Uninhibited flow paths; the aeration system piping shall have a minimum of 6" of clearance from the bottom of the distribution pipes to the tank floor surface to adequately allow solids to flow unrestricted and prevent solids build-up against the piping.
 - 6. All pipe joints that are to be field connected shall be either flanged or grooved coupling type. All joints shall be rated for 150 psi to ensure integrity of the aeration system piping which is subjected to dynamic hydrostatic loading and thermal expansion and contraction.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Manufacturer:

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Tank Agitation Coarse Aeration System

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1. Provide the following:
 - a. Red Valve Tideflex Coarse Bubble Diffusers Or
 - b. Approved Equal
 2. The complete diffused aeration equipment shall be furnished by a single manufacturer who is fully experienced in the design and construction of such equipment.
- B. Tank Agitation Aeration Diffuser Assemblies:
1. Use identical diffusers of the same model, type and manufacturer throughout the installation.
 2. The material used for the assemblies shall be corrosion resistant and UV resistant.
 3. All diffuser assembly hardware shall be Type 316L stainless steel.
 4. The surface of the assembly shall be smooth to prevent biological growth from attaching.
- C. Tank Agitation Aeration System Piping:
1. A diffused aeration piping system, consisting of drop pipes, air headers and diffuser laterals, shall be furnished to distribute air from the existing air supply piping to the diffusers.
 2. Diffused aeration piping shall be provided complete with all fittings, specials, flanges, couplings, slip joints, anchors, gaskets, bolts and nuts, pipe supports, fittings, connections, appurtenances and accessories that are indicated on the drawings or otherwise required for proper installation and functioning of the diffused aeration system.
 3. Field connections in the diffused aeration system shall be flanged, threaded, mechanically coupled made with grooved-end couplings. Field welding of the diffused aeration equipment will not be allowed.
 4. Drop Pipes
 - a. The size and location of the drop pipes shall be as indicated on the drawings.
 - b. The drop pipes, air headers, and diffuser laterals shall be constructed of Type 316L stainless steel.
 - c. The connection of the drop pipe to the air distribution header shall be made using a fixed joint to allow ease of installation and alignment.
 - d. The drop pipe shall be supported along the tank. Hanging the drop pipe from the existing upper supply air piping will not be allowed.
 5. Air Distribution Headers
 - a. Headers shall be evenly spaced along the tank.
 - b. All horizontal air distribution piping at the bottom of the drop legs shall be Type 316L Stainless Steel.
 6. Air Distribution Header Design:
 - a. Existing headers shall be employed.
- D. Air Distribution Drop Pipe and Header Supports
1. Welded pipe supports shall be fabricated from AISI Type 316L stainless steel.
 2. Non-welded parts shall be 316L stainless steel.
 3. Supports shall be provided complete with all bases, anchor bolts and nuts, plates, rods and other accessories required for proper installation.
 4. Each air distribution drop pipe and header shall have a minimum of two supports.
- E. Drain

1. Provide a 1 inch drain on the inlet pipe, 4 inches above where the aeration system attaches to the tank floor. The drain shall be equipped with a stainless steel ball valve to allow fluid to be drained from the pipe manifold to the tank.
- F. Pickling of Stainless Steel
1. After fabrication, all stainless steel assemblies and parts shall be completely immersed for a minimum of 15 minutes in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 deg F.
 2. Parts shall be free from iron particles or other foreign material.
 3. All parts shall be completely neutralized by immersion in a continuous fresh water bath after the pickling operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions.
- B. Cleaning/Protection of Air Piping System:
1. Immediately prior to installation, all air piping shall be thoroughly cleaned.
 2. After installation, all surfaces shall be protected from contamination by dust, dirt, construction debris and moisture (including atmospheric moisture) in a manner satisfactory to the ENGINEER.
 3. All openings in partially completed work shall be temporarily sealed off, except where installation is actively in progress. Openings where installation is in progress shall be sealed off at the end of each day's work, or whenever the work is temporarily stopped for any reason.
 4. Work shall be suspended whenever inclement weather, including dust storms, are imminent.
 5. Any surfaces that become contaminated prior to acceptance shall be thoroughly cleaned by the CONTRACTOR to the satisfaction of the ENGINEER.
 6. The diffuser elements shall not be installed until all cleaning operations are complete.
- C. Placement:
1. The diffuser element assemblies and support headers shall be installed at the manufacturer recommended height above the tank basin floor and in such a manner that all diffuser elements are within $\pm 1/2$ inch of the manufacturer's specified elevation.
 2. Diffuser assemblies shall be leveled within $\pm 1/4$ inch of a common horizontal plane.
 3. Deforming of air headers, diffuser connectors, diffusers or pipe supports to align or level the system will not be allowed.
- D. Field Testing:
1. Prior to initiating any field testing, all piping shall be inspected for proper joints, and support.
 2. The tank shall be flooded with water to the top of the diffusers. The level of the diffusers shall then be checked to ensure that they are at the same elevation, within the specified limits.
 3. Uniform Air Flow Test:

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- a. After completion of the leveling tests, add water to the tank to cover the diffusers and distribution piping manifold with at least 3 inches of water.
 - b. Pass air through the diffusers to check operation of the diffusers. Use soap spray testing to confirm that piping above water surface is not leaking. Correct any leaks found in the system.
 - c. Visually inspect the surface of the water above the diffusers to ensure that air flow is uniformly distributed across the tank, as well as uniformly distributed across the diffusers.
 - d. All items found to be defective shall be replaced.
 - e. Repair all leaks and continue testing for at least 24 hours until the system shows no visual signs of leakage.
4. Three-Day Test
- a. Fill tank with plant water to normal operating levels.
 - b. Operate at peak air flow rates for a minimum of three days.
 - c. If any diffuser system failures occur during this period, the CONTRACTOR shall drain the basins, make repairs/modifications and then re-run the three-day test.
 - d. At the end of the test or retest, the tank shall remain at standard operating levels.

+ + END OF SECTION + +

SECTION 46 70 00

MISCELLANEOUS WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. This section covers all ancillary equipment and services, which are not covered in other sections, to be provided for the successful completion of the project.
 - 2. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install a completely operational equipment system and services specified in this section.
 - 3. All equipment and services specified in this section shall be specifically designed for wastewater service.

1.2 RELATED DOCUMENTS

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

1.3 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit complete shop drawings of all the complete equipment systems and services specified in this section in accordance with the Requirements of Division 01.
- B. Special tools necessary for the maintenance and repair of the equipment system and services specified in this section, shall be furnished as part of the work. Special tools shall be stored in a metal toolbox and identified with the equipment number by means of a stainless steel or solid plastic name tag.
- C. The CONTRACTOR shall obtain from the manufacturer of each piece of equipment a list of suggested spare parts for all items. The CONTRACTOR shall furnish all these parts suitably packaged and labeled in boxes or crates as appropriate and as described above for special tools.

PART 2 - PRODUCTS

2.1 FOAM MITIGATION AND WALL SPRAY SYSTEMS

- A. Spray systems shall be furnished and installed for spraying utility for foam mitigation and wall washing at the locations indicated on the drawings.
- B. Pipe material shall be per the requirements of Section 40 05 10.01, Pipe Schedule.

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- C. Main Service Pipe: The existing main service pipe is shown on the drawings provides service water to the spray nozzles. Appropriate fittings shall be used to install the nozzles as shown on the drawings.
- D. Spray Nozzles for the Foam Mitigation Spray System
1. Furnish nozzles meeting the following characteristics:
 - a. Spray Pattern: Flood Jet Nozzles to promote mixing of foam with sludge and to mitigate foam formation.
 - b. Design Operation: 2.4 gpm at 85 psi.
 - c. Size: As shown on the drawings.
 - d. Number of Nozzles: As shown on the drawings.
 - e. Material: Stainless Steel
 2. The spray nozzle shall be oriented toward the tank water surface. The complete system shall provide complete coverage of the tank water surface to promote in-tank mixing and to mitigate foam formation.
 3. Nozzles that deviate from the requirements above must be approved by the ENGINEER prior to procurement and installation. Nozzles should be submitted for approval with calculations showing the coverage of the tank surface water for intermittent and 24-hour continuous operation.
 4. Manufacturers:
 - a. Spraying Systems 3/8" HHSJ 90 07
 - b. Or Approved Equal
- E. Spray Nozzles for the Wall Wash Spray System
- a. Spray Pattern: spiral jet pattern to promote washing of sludge from the walls of the holding tank.
 - b. Spray Angle Range: 90°.
 - c. Design Operation: 28 gpm at 85 psi.
 - d. Size: As shown on the drawings.
 - e. Number of Nozzles: As shown on the drawings.
 - f. Material: Stainless Steel
 2. The spray nozzle shall be installed oriented toward the tank walls. The layout shall provide full coverage to promote complete scouring of the tank walls.
 3. Nozzles that deviate from the requirements above must be approved by the ENGINEER prior to procurement and installation. Nozzles should be submitted for approval with calculations showing the coverage of the tank surface water for intermittent and 24-hour continuous operation.
 4. Manufacturers:
 - a. Spraying Systems 1/2" H1/2U-316SS 80 200
 - b. Or Equal

PART 3 - EXECUTION

3.1 MANUFACTURER SERVICES

- A. The CONTRACTOR shall provide manufacturer's trained service representative for installation, start up and training, of the specified equipment system and services in this section as required.

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- B. The CONTRACTOR shall retain services of the manufacturer's trained service representative until specified equipment system and services in this section are fully operational as required.
- C. The CONTRACTOR shall provide all instruments, necessary labor, tools required for the installation.
- D. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.

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