San Jacinto River Authority
Purchasing Department
1577 Dam Site Road
Conroe, Texas 77304

REQUEST FOR COMPETITIVE SEALED PROPOSALS
CSP 19-0047

SJRA WOODLANDS DIVISION
Ground Storage Tank No. 2 at Water Plant No. 4

Date Issued: JULY 12, 2019

Response Due Date & Time: August 12, 2019 at 11:00 AM CST
Location for Delivery: as stated above

SJRA PROJECT NO. 19-0047

AECOM TECHNICAL SERVICES, INC., F-3580

NIGP CLASS and ITEM

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Disclosure Requirements

Chapter 176 of the Texas Local Government Code mandates the public disclosure of certain information concerning persons doing business or seeking to do business with the San Jacinto River Authority, including affiliations and business and financial relationships such persons may have with San Jacinto River Authority officers. An explanation of the requirements of Chapter 176, applicable forms and a complete text of the new law are available at: http://www.sjra.net. If you are unable to obtain such information online, please contact the San Jacinto River Authority Purchasing Department, 1577 Dam Site Road, Conroe, Texas 77304 or call (936) 588-3111.

BY DOING BUSINESS OR SEEKING TO DO BUSINESS WITH THE SAN JACINTO RIVER AUTHORITY, YOU ACKNOWLEDGE THAT YOU HAVE BEEN NOTIFIED OF THE REQUIREMENTS OF CHAPTER 176 OF THE TEXAS LOCAL GOVERNMENT CODE AND THAT YOU ARE SOLELY RESPONSIBLE FOR COMPLYING WITH THEM.

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SECTION 00 11 13

INVITATION TO SUBMIT PROPOSALS

GENERAL NOTICE

The San Jacinto River Authority is requesting Competitive Sealed Proposals (CSP) for the Construction of the following project in Montgomery County, Texas:

CSP No. 19-0047 San Jacinto River Authority
Ground Storage Tank No. 2 at Water Plant 4

PROJECT DESCRIPTION

Work includes the installation of a new 2,000,000 gal precast concrete ground storage tank at Water Plant No. 4. Contractor is to provide appurtenant piping, electrical conduit, and miscellaneous related improvements.

Competitive Sealed Proposals must be delivered to the **San Jacinto River Authority, G&A Building, 3rd Floor Receptionist, 1577 Dam Site Road, Conroe, TX 77304** no later than **11:00 AM** (CST) on **AUGUST 12, 2019**. Proposals will be publicly opened and read aloud at this time. Address proposals to:

Elton D. Brock, MBA, CTPM, CTCM, CPSM, C.P.M.
Purchasing Manager
San Jacinto River Authority
Purchasing Department
1577 Dam Site Road
Conroe, TX 77304

A **mandatory** Pre-Submittal Conference will be held at **Woodlands Division, 2436 Sawdust Rd, The Woodlands, TX 77380**, at **10:00 AM (CST)** on **JULY 24, 2019**. Proposals will not be accepted from Offering Firms which fail to attend the Pre-Submittal Conference.

A complete set of (CSP) Documents may be accessed via a link from the SJRA Website (http://www.sjra.net/purchasing/bidopportunities/), Purchasing Tab, Bid Opportunities.

Attendance at the Pre-Submittal Conference may be the only opportunity for Offerors to see the existing conditions of the site prior to Proposal due date.

The SJRA reserves the right to reject any or all Proposals and to waive informalities and irregularities.

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SECTION 00 21 13.02CN

INSTRUCTIONS TO OFFERORS

(COMPETITIVE SEALED PROPOSALS)

1. Overview of Competitive Sealed Proposal Process.

The objective of the Competitive Sealed Proposal (CSP) process is to competitively procure goods and services with the firm whose Proposal provides the best value for the Owner (SJRA). Proposals will be received, publically opened, and the names and monetary Proposals of Offerors read aloud. Subsequently, the Proposals will be ranked according to the criteria described in this CSP Document. Both cost and non-cost factors will be evaluated and scored. One or more Offerors may be invited back for discussions or to present their Proposal to the SJRA before the final rankings are made.

The SJRA may enter into contract negotiations with the highest ranked firm for the completion of the Work. If the negotiations with the highest ranked firm are unsuccessful, the SJRA will formally close negotiations with this firm and initiate contract negotiations with the next highest ranked firm. Upon Standard Form of Agreement between both parties, a Contractor-executed Contract may be recommended for approval by the SJRA Board of Directors or the SJRA General Manager, as applicable. Upon approval, the Contract will be executed by the General Manager of the SJRA.

2. Defined Terms.

2.1. Definitions for the following terms used in these Instructions do not replace definitions for similar terms that may be contained within other sections of the Contract Documents.

2.2. Certain additional terms used in these Instructions to Offerors have the meanings indicated below and are applicable to both the singular and plural thereof.

2.2.1. Addendum or Addenda- Additions, deletions, and/or changes to any part of the CSP issued in writing by the Owner prior to Proposal due date and time.

2.2.2. Apparent Best Value Offeror- the Offering Firm whose Proposal for completion of the Work provides the best value for the Owner as defined by the ranking detailed in Article 11 of Instructions to Offerors.

2.2.3. Board of Directors – The governing body of the SJRA comprised of seven (7) directors appointed to six (6) year terms by the Governor of the state of Texas.

2.2.4. Contract Negotiations- Discussions which take place between the Owner and the Apparent Best Value Offeror in an effort to reach Standard Form of Agreement on contract scope of work, price, time and other contractual requirements.

2.2.5. Contractor – The successful Offeror to this CSP who enters into a contractual relationship with the Owner for completion of the Work, following any contract approval by the SJRA Board of Directors or the SJRA General Manager, as applicable.

2.2.6. CSP Document- Abbreviation of the Competitive Sealed Proposals Document, the document used to request Competitive Sealed Proposals for the procurement of goods and services as authorized under Government Code Chapter 2269, Subchapter D.

2.2.7. Engineer's Opinion of Probable Construction Cost – Engineer's opinion of project construction cost to owner developed by the Principal Architect/Engineer. Actual contract amount may vary significantly.

2.2.8. Issuing Office - The location from which the CSP Documents are issued. For this project the issuing office is San Jacinto River Authority, 1577 Dam Site Road Conroe, Texas 77304.

2.2.9. Offeror, Offering Firm- Firm which responds to a CSP by submitting a Proposal directly to Owner. Offeror and Offering Firm shall have the same meaning in the Instructions to Offerors.

2.2.10. Owner - The San Jacinto River Authority (SJRA).

2.2.11. Proposal- Offeror's submittal which conforms to the requirements set forth in this CSP.

2.2.12. Proposal Form- As detailed in the requirements of this CSP, contains unit pricing for all parts of the Work and their aggregate as detailed and affirmed on the Proposal Form and may include additional forms supplied by Offeror and/or the Owner that relate to the Offeror's proposed cost for completing the Work.

2.2.13. SJRA- San Jacinto River Authority, a government agency whose mission is to develop, conserve, and protect the water resources of the San Jacinto River basin.

2.2.14. Statement of Qualifications, (SOQ) - Offeror submitted documents which describe the Offering Firm's qualifications for performing the Work and contain no pricing or cost data. Requirements for the Statement of Qualifications (SOQ) are set forth in Article 8 and Article 10 of the Instructions to Offerors (this CSP).

2.2.15. Subcontractor - Any contractor hired by the Contractor to furnish services, or goods and services, specified in this CSP.

2.2.16. Successful Offeror - The Firm who has completed negotiations with the Owner and, following any approval by the SJRA Board of Directors or the SJRA General Manager, as applicable, is selected to enter into a Contract with the Owner to complete the Work.

2.2.17. Supplier- Any supplier of materials and/or equipment to Contractor for the Project.

3. Schedule.

CSP Documents Posted on Website:	July 12, 2019
Legal Advertisements:	July 12, 2019 and July 19, 2019
Pre-Proposal Conference ([Non-]Mandatory):	July 24, 2019, 10:00 am (CST)
Deadline for Questions and Inquiries:	July 31, 2019, 12:00 pm (CST)
Proposal Submission Deadline:	August 12, 2019, 11:00 am (CST)
Anticipated Construction Start:	October 2019

4. Competitive Sealed Proposal Documents/Copies.

4.1. This Request for Competitive Sealed Proposals (CSP) consists of the following documents:

4.1.1. Invitation to Submit Proposals (00 11 13);
4.1.2. Instructions to Offerors (00 21 13.02);
4.1.3. Proposal Form (00 41 00.02), Contractor shall also complete and submit the provided Microsoft Excel spreadsheet of the Proposal Form;
4.1.4. Statement of Qualifications (00 21 13.03);
4.1.5. All Contract Documents referenced in this CSP;
4.1.6. Addenda to this CSP issued by the SJRA Purchasing Department;
4.1.7. Any attached forms; and
4.1.8. Proposal Security (Offeror's Bond)

4.2. A complete set of CSP Documents may be accessed may be viewed and accessed via a link from the SJRA Website (http://www.sjra.net/purchasing/bidopportunities/) Purchasing Tab (Bid Opportunities).

4.3. Complete sets of CSP Documents must be used in preparing Proposals; neither Owner nor Principal Architect/Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of CSP Documents.

4.4. Owner and Principal Architect/Engineer, in making copies of CSP Documents available on the above terms, do so only for the purpose of obtaining Proposals for the Work and do not confer a license or grant for any other use.

5. Competitive Sealed Proposal Process\Contract Documents.

5.1. All questions about the Competitive Sealed Proposal Process or the meaning or intent of the Contract Documents are to be directed to the SJRA Purchasing Department.

Contact:

Elton D. Brock, MBA, CTPM, CTCM, CPSM, C.P.M.
Purchasing Manager
San Jacinto River Authority
Purchasing Department
1577 Dam Site Road
Conroe, TX 77304

5.2. All questions shall be submitted to the buyer referenced above via email.

5.3. Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda and posted via link a link from the SJRA Website (http://www.sjra.net/purchasing/bidopportunities/) Purchasing Tab (Bid Opportunities).

6. Pre-Submittal Conference.

6.1. A single **mandatory** Pre-Submittal Conference will be conducted at the offices of the San Jacinto River Authority, **Woodlands Division, 2436 Sawdust Road, The Woodlands, TX. 77380, at 10:00 A.M, July 24, 2019**.Representatives of Owner and Principal Architect/Engineer will be present to discuss the project. **Proposals will not be accepted from offering firms who fail to attend the pre-submittal conference.**

6.2. All questions about the meaning or intent of the Competitive Sealed Proposal and Contract Documents are to be directed to the SJRA Purchasing Department. The SJRA Purchasing Department will address all questions as Owner considers necessary in response to inquiries arising at the conference through written Addenda and posted via link a link from the SJRA Website (http://www.sjra.net/purchasing/bidopportunities/) Purchasing Tab (Bid Opportunities). Oral statements may not be relied upon and will not be binding or legally effective.

7. Estimated Budget.

7.1. An Engineer's Opinion of Probable Construction Cost (project cost estimate) has been generated by the Principal Architect/Engineer. If an award is made, the actual contract amount may vary.

7.2. The Engineer's Opinion of Probable Construction Cost for this project is $2,960,000.

8. Basis for Ranking of Proposals.

8.1 The Owner will consider the qualifications (Statement of Qualifications) of the Offerors and their respective proposed Contract Price (Proposal Form) when evaluating Proposals to determine which Offeror, in the sole opinion of the Owner, will provide the best value to the Owner. All procurements shall conform to Chapter 2269 of the State of Texas Government Code. The Proposals will be evaluated using the following criteria and weighting:

8.1.1. Proposed Project Cost: The Offeror's Proposed Cost of Performing the Work shall be indicated as the "Total Proposal Price" (indicated as "E" on in the Proposal Form (Specification Section 00 41 00.02). The Owner has established an internal budget for this Project. The total Proposal Price is defined per the Proposal Form to include the cost(s) of the proposed Total Base Items ("A"). The Total Proposal Price may and at the Owner's sole discretion, be inclusive of the individual or collective costs associated with the Offeror's Total Extra unit Price Items ("B"), and Total Cash Allowances ("C") costs. Total Alternate Items ("D") will not be included in the Proposal Price. For example: Total Proposal Price ("E") = A + B + C.

The Owner will evaluate the Total Proposal Price (including an requested costs for Extra Unit Price Items, Sash Allowances and Alternate Items, as identified) that the Owner can award with its available budget at the time Contract is negotiated. Attach the Proposal Form and all information/documents required to be submitted with the Proposal. Contractor shall also complete and submit the provided Microsoft Excel spreadsheet of the Proposal Form.

8.1.2. Experience/Past Performance of Offeror with Similar Projects: Provide general information about the Organization as required in Table 1 and Table 2 of Specification Section 00 21 13.03 Statement of Qualifications (SOQ). Provide any additional information as required by the Construction Experience section of Table 2. Describe the Organizational structure and the qualifications of the management team as it relates to this Project in Table 3. Provide a narrative format as described in Table 4, describe Offeror's experience as a general contractor and describe the Organization's operating philosophy and approach to constructing, completing, and commissioning projects. Describe the Organization's approach to managing Subcontractors and Suppliers (Table 11), quality management and construction contract administration. Limit the narrative portion responding to this criterion to no more than 10 pages in length. Provide a list of projects completed by the Organization in the last five (5) years using copies of Table 5.

Experience should include, as a minimum, the satisfactory completion of at

least five (5) prestressed concrete ground storage tanks for proposed key personnel. A higher point score for this criteria will be given to Offerors whose proposed key personnel have obtained the given minimum experience within the last five (5) years.

Offeror must demonstrate experience in the construction of projects of similar construction cost and/or techniques and describe how they intend to provide the needed experience and expertise. Submit descriptions of projects on which proposed key personnel have experience by submitting completed copies of the attached Table 12, with at least one project for each of the key individuals. If Offeror does not have specific experience with projects of this type and magnitude, the Offeror may describe its proposed approach and how its experience with other projects enhances its capability to successfully complete this Project. Offeror may submit photographs, project descriptive narratives, letters of recommendation, project awards, and references to demonstrate experience in constructing a project which meets the Owner's expectations for a quality Project constructed on time and within budget (Tables 13 and 14). This narrative is not to exceed one (1) page in length.

Provide information to demonstrate the ability of the Organization to complete projects within budget and on time. Offerors are to provide a tabulation of all projects completed by the Organization within the last five (5) years on Tables 13 and 14 to demonstrate performance in these areas. Comments may be added to the tabulations to indicate any reasons for amending the contract amounts or completion dates. Provide narrative information to indicate the number of projects and dollar volume currently under contract by the Organization and the projected completion date of each active project. Describe how the resources dedicated to these assignments will impact Offeror's ability to effectively execute the construction of this Project. Provide an estimate of the amount of the Project that will be done using in-house resources and the amount to be performed by Subcontractors and Suppliers. This narrative is not to exceed five (5) pages in length.

8.1.3. Experience and Qualifications of Proposed Key Personnel with Similar Projects: Provide information on the managerial structure and the key personnel that will be actively working on this Project in Tables 6 through 10 and Table 12. Key personnel include the Project Manager, Project Superintendent, Safety Manager, and Quality Control Manager. If more than one of these key roles are to be filled by one individual, provide this with the list of proposed individuals. The Offeror is to provide a list of individuals from which the individual for any given position may be selected if the Offeror is not able to commit to one individual for the Project at the time the Proposal is submitted. Qualifications of these individuals will be considered in evaluating the qualifications of the Offeror. The Proposal

must offer to commit the services of the proposed key personnel for the life of the Project as a condition of qualification. Failure to offer to commit the proposed key Personnel may result in the disqualification of the Offeror and may void the award of the Contract.

Provide the resumes (not to exceed one page for each) of proposed key personnel with the SOQ describing their education and experience in Table 6. Include more detailed information on projects on which they have had significant involvement in the last five (5) years, or that demonstrate their experience with similar projects. This list is to include the name and a current telephone number of references for each of these project assignments. Offerors are to include a list of the current project assignments for each of the individuals proposed, the anticipated completion date for this assignment and the percentage of the time they will have available to devote to this Project. The Project Superintendent must be dedicated to this Project full time for the duration of the Project.

8.1.4. Approach: The Offeror shall include a brief write-up, not to exceed three (3) pages, that summarizes the Offeror's approach to overall project sequence of construction for entire project limits and corresponding time lines, proposed construction methods, and site restoration. Approach should focus on construction of GST and related work as well as impacts to maintaining the existing groundwater treatment plant in service. Phasing of construction should also be addressed.

8.1.5. Financial Management (Stability): Provide the past two (2) years of available financial statements, preferably audited, with this Proposal. Provide financial statements showing the name and address of the firm preparing the financial statements and the date of preparation. Offerors may choose to report on the financial stability of their Organization to demonstrate that they have the ability to complete the Project in a manner that will not impose undue efforts on the part of the Owner to invoke rights under bonds to complete the Project or for Offeror to meet financial obligations. Describe the Offeror's systems and philosophy for financial management of the Project. Describe Offeror's systems and philosophy for contracting with Subcontractors and Suppliers and managing payments and retainage. Provide other information if desired to demonstrate solid financial management practices that will enhance completion of the Project. This narrative is not to exceed two (2) pages in length.

This is a Pass or Fail. Any Offeror receiving a score of "Fail", will be automatically disqualified.

8.1.6. Other Factors: The Owner will consider other factors in evaluating Proposals, including the following (narratives for this Section shall not exceed five (5) pages total in length):

8.1.6.1. Safety: Demonstrated success in the implementation of a project site safety program. This may be demonstrated by documentation of the Offeror's safety program, and statement regarding their commitment to safety. Indicators such as the EMR (Experience Modification Ratio) may be used to demonstrate the effectiveness of the safety program.

8.1.6.2. Claims Experience and Litigation History: List all claims or litigation involving construction project owners that have been filed within the last five (5) years, whether or not still outstanding. Provide a brief description of the nature of each suit and, if not already resolved, when it is anticipated that the suit will be resolved.

8.1.6.3. Ability to Meet Proposed Budget and Time for Construction: Provide information to demonstrate the ability of the Organization to complete Projects within budget and on time. Offerors are to provide a tabulation of all Projects (up to 25 maximum) completed by the Organization within the last ten (10) years on Tables 13 and 14 to demonstrate performance in these areas. Comments may be added to the tabulations to indicate the reasons for amending the contract amounts or completion dates. Provide narrative information to indicate the number of Projects and dollar volume currently under contract by the Organization and the projected completion date of each active Project. Describe how the resources dedicated to these assignments will impact Offeror's ability to effectively execute the construction of this Project. Provide an estimate of the amount of the Project that will be done using in-house resources and the amount to be performed by Subcontractors and Suppliers. This narrative is not to exceed two (2) pages in length.

8.1.6.4. Experience of Trade (Sub) Contractors on Similar Projects: Offeror's proposed Trade (Sub) Contractors' experience should include, as a minimum, identification of the satisfactory completion of at least five (5) similar type installations on similar projects unless otherwise required as part of subsection 8.1.2. List Trade (Sub) Contractors and other persons and organizations proposed for those portions of the work for which such identification is required on Table 11.

8.2. Table of criteria and weighting for the ranking of Offeror's Proposals.

Rating Category	Description	Weighting Points
8.1.1	Proposed Project Cost (E= A+B+C)	50
8.1.2	Experience/Past Performance of Offeror with Similar Projects	10

8.1.3	Experience and Qualifications of Proposed Key Personnel with Similar Projects	10
8.1.4	Project Approach	20
8.1.5	Financial Management (Stability)	Pass/Fail
8.1.6	Other Factors	10
	Total	**100**

9. Proposal Form.

9.1. A Proposal Form (00 41 00.02) is included with the CSP Documents; additional copies may be obtained at (http://www.sjra.net/purchasing/bidopportunities/)(Purchasing Tab).

9.2. All blanks on the Proposal Form must be completed in ink, by hand, or electronically printed.

9.3. Contractor shall also complete and submit the provided Microsoft Excel spreadsheet of the Proposal Form. Template may be obtained via the SJRA website (http://www.sjra.net/purchasing/bidopportunities/) (Purchasing Tab).

9.4. The Proposal price shall include such amount as the Offeror deems proper for overhead and profit.

10. Offering Firm's Statement of Qualifications (SOQ).

10.1. SOQs shall not exceed fifteen (15) pages, including transmittal letters and narratives, and excluding completed SOQ tables and attachments, covers and plain section dividers. SOQs shall be printed on single side 8 ½" by 11" pages with not less than 1 inch margins, not less than 1.25 line spacing and not less than 11 point font.

10.2. The SOQ must be submitted with the Proposal and include, as a minimum, the information as described in Article 8, Basis for Ranking of Proposals. Failure to submit the required information in the SOQ may result in the Owner considering the Proposal non-responsive and result in rejection of the Proposal by Owner. Offerors may be required to provide supplemental information if requested by the Owner to clarify, enhance or supplement the information provided in the SOQ.

10.3. Offerors must provide requested SOQ information using the tables provided in specification section 00 21 13.03 - Statement of Qualifications. A copy of these tables will be made available in Microsoft Word to assist with the preparation of the SOQ. Information in these tables must be provided completely and in detail. The information in these tables will be used to make direct comparisons with the information provided by other Offerors. Failure to include the information

completely and clearly may result in lower scores in the evaluations. Information that cannot be totally incorporated in the table may be included in an appendix to the table. Appendices must be clearly referenced by appendix number in the table, and the appended material must include the appendix number on every sheet of the appendix. Each appendix must include only the information that responds to the question or item number to which the appended information applies. The required tables are listed below:

Table 1	General Information
Table 2	Organizational Experience
Table 3	Organizational Structure
Table 4	Project Experience and Resources
Table 5	Current Projects and Projects Completed within the last 5 Years
Table 6	Proposed Key Personnel
Table 7	Proposed Project Managers
Table 8	Proposed Project Superintendent
Table 9	Proposed Project Safety Manager
Table 10	Proposed Quality Control Manager
Table 11	Subcontractors and Suppliers
Table 12	Project information for Key Personnel
Table 13	Demonstration of Budget Performance
Table 14	Demonstration of On-time Performance
Table 15	Approach

10.4. Offerors may provide supplemental information to the SOQs using AIA, AGC or other industry standard SOQ tables and / or Offerors may submit additional information such as organizational brochures or other marketing information to help demonstrate their ability to provide best value to the Owner. This information may not be submitted as a substitute to the information specifically requested in this Section, or in the SOQ tables. If this information is to be included as an appendix to the information requested in Article 10.3. (above), the appendix must specify the paragraph or section to which the appendix applies and the paragraph or section must accurately reference the appendix.

11. Ranking of Offeror's Proposals.

11.1. The Owner will consider the qualifications (Statement of Qualifications) of the Offerors and Offeror's proposed Subcontractors, Suppliers and consultants, in

addition to the proposed cost(s) (Proposal Form) when evaluating Proposals to determine which Proposal offers the best value to the Owner. Owner will rank each of the Offeror's Proposals based on the criteria and criteria weighting described in Article 8, Basis for Ranking of Proposals.

11.2. Evaluation and ranking of the Proposals will be completed no later than the 45th Calendar day after the date of Proposal opening. Offerors are requested not to withdraw their Proposals within ninety (90) Calendar days from the date on which Proposals are opened. Proposal Security of the highest ranking firms will be held by the Owner until contract negotiations are finalized.

11.3. In evaluating Proposals, Owner will consider the selection criteria set forth in Article 8 of these Instructions to Offerors and whether or not the Proposals comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested by Owner.

11.4. Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the General Conditions. Owner may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to recommendation of award to Owner's Board of Directors or its General Manager, as applicable.

11.5. Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Proposal and to establish the responsibility, qualifications and financial ability of Offerors, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

11.6. The Owner, at its discretion, may also choose to conduct interviews with the top ranking Offerors to provide Offerors a better opportunity to demonstrate they can provide the best value to the Owner for this Project. Should the Owner choose to conduct interviews with the top ranking Offerors, they will be notified of:

11.6.1. The time and place for the interview.
11.6.2. Interview format and agenda.
11.6.3. Questions to prepare for the interview.
11.6.4. Individuals that are expected to participate in the interview.

Failure to participate in the interview may result in disqualification from consideration for the Project.

12. Award of Contract.

12.1. It is the intent of the San Jacinto River Authority to award this contract to the Offering Firm whose Proposal for completion of the Work provides the best value for the Owner after consideration of the relative importance of costs and other evaluation factors described in the Basis for Ranking Proposals set forth in Article 8 of these Instructions to Offerors.

12.2. The Owner reserves the right to adopt the most advantageous interpretation of the Proposals submitted in the case of ambiguity or lack of clearness in stating Proposal Prices, to reject any or all Proposals, and/or to waive informalities.

12.3. Owner reserves the right to reject any or all Proposals, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced, or conditional Proposals and to reject the Proposal of any Offeror if Owner determines that an award to that Offeror would not provide the best value for the Owner, whether because the Proposal is not responsive or the Offeror is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner.

12.4. Owner also reserves the right to waive all informalities not involving price, time or changes in the Work and to negotiate contract terms with the Apparent Best Value Offeror. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

12.5. The qualifications of a firm shall not deprive the Owner of the right to accept a Proposal, which in its judgment offers the best value to the Owner. In addition, the Owner reserves the right to reject any Proposal where circumstances and developments have, in the opinion of the Owner, changed the qualifications or responsibility of the firm.

12.6. Material misstatements in the information submitted for evaluation may be ground for rejection of Offeror's Proposal. Any such misstatement, if discovered after award of the contract to such firm, may be grounds for immediate termination of the contract. Additionally, the Offeror will be liable to the Owner for any costs or damages to the Owner resulting from such misstatements, including costs and attorneys' fees for collecting such costs and damages.

12.7. If the Contract is to be awarded, it will be awarded to the Apparent Best Value Offeror following successful Contract Negotiations and following any required

approval by the SJRA Board of Directors or the SJRA General Manager, as applicable.

12.8. If Contract Negotiations with the Apparent Best Value Offeror are unsuccessful, The Owner will formally close Contract Negotiations with this Firm and attempt to open Contract Negotiations with the next highest-ranked firm according to the selection criteria set forth in Article 8 of these Instructions to Offerors.

12.9. If the Contract is to be awarded, Owner will notify Successful Offeror of intent to submit contract for approval by SJRA's Board of Directors within ninety (90) Calendar days after the day of the Proposal opening. Following approval by the SJRA Board of Directors or the SJRA General Manager, as applicable, the General Manager of the SJRA may execute the contract.

12.10. The Offeror may submit exceptions or alternatives not in accordance with the terms and conditions of the Contract Documents, or for Work that is not in strict compliance with the Contract Documents. In such event, Offeror must describe the intent and substance of the changes in the Proposal in adequate detail so they are clearly identifiable and understandable. Alternates will not be considered in the ranking and evaluation of the Proposals. Upon selection of the Proposal that offers the best value to the Owner, the Owner and Principal Architect/Engineer may consider proposed alternates in negotiating a final Contract scope, time/schedule and price.

12.11. Addenda may be issued to clarify, correct, or change the Contract Documents, prior Addenda or the related supplemental data as deemed advisable by Owner or Principal Architect/Engineer.

13. Interpretation and Addenda.

13.1. All questions about the meaning or intent of the Competitive Sealed Proposal and Contract Documents are to be directed to the SJRA Purchasing Department in writing. Interpretations or clarifications considered necessary by Owner's Representative in response to such questions will be issued by written Addenda and posted via a link from the SJRA website (http://www.sjra.net/purchasing/bidopportunities/) Purchasing Tab (Bid Opportunities).

Contact:

Elton D. Brock, MBA, CTPM, CTCM, CPSM, C.P.M.
Purchasing Manager
San Jacinto River Authority
Purchasing Department
1577 Dam Site Road
Conroe, TX 77304

13.2. To properly qualify their Proposal, each Offeror shall, prior to submitting their Proposal, check the receipt of all Addenda and acknowledge such receipt on the Proposal Form and on the acknowledgement line of the Addendum Cover page. Proposals submitted without such acknowledgment of all issued Addenda and letters of clarification may cause Proposal to be considered non-responsive. Such Addenda and letters of clarification shall become a part of the executed contract and modify the contract documents accordingly.

13.3. Questions received after the deadline for Questions and Inquiries may not be answered.

13.4. Only questions answered by formal written Addenda issued by Owner will be binding. Oral and other interpretations or clarifications will be without legal effect.

13.5. Addenda may be issued to clarify, correct, or change the Contract Documents, Addenda or the related supplemental data as deemed advisable by Owner or Principal Architect/Engineer. Addenda may also be issued to modify the CSP Documents as deemed advisable by Owner or Principal Architect/Engineer.

13.6. Notification of Addenda will be by default via the SJRA Purchasing Department.

13.7. The Owner will not be responsible or liable for any failure. Offerors are encouraged to visit the SJRA webpage where the CSP Documents are issued until the legal limit for filing addenda (48 hours prior to Proposal due date and time) has passed to ensure receipt of all addenda.

14. Confidentiality of Proposal Information.

All materials submitted to the SJRA and upon receipt by the SJRA become public property and are subject to the Texas Public Information Act, Government Code Chapter 552. If an Offeror does not desire proprietary Information in the SOQ to be disclosed, each page must be identified and marked proprietary at the time of submittal. The SJRA will, to the extent provided by law, endeavor to protect such information from disclosure. The final decision as to what information must be disclosed, however, lies with the Texas Attorney General. Failure to identify proprietary information will result in all unmarked sections being deemed non-proprietary and available to the public upon request. Proposers shall not be permitted to mark entire Proposal as proprietary.

15. Examination of Contract Documents and Site.

15.1. It is the responsibility of each Offeror before submitting a Proposal:

15.1.1. To examine thoroughly the Contract Documents and other related data

identified in the CSP Documents (including "technical data" referred to below);

15.1.2. To visit the site to become familiar with and satisfy Offeror as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work;

15.1.3. To consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;

15.1.4. To study and carefully correlate Offeror's knowledge and observations with the Contract Documents and such other related data; and

15.1.5. To promptly notify The SJRA Purchasing Department of all conflicts, errors, ambiguities or discrepancies which Offeror has discovered in or between the Contract Documents and such other related documents.

15.2. Reference is made to the General Conditions Article 4 and Contract Specification Section 00 31 19 – Existing Condition Information for identification of:

15.2.1. Reports of explorations and tests of subsurface conditions at or contiguous to the site which have been utilized by Principal Architect/Engineer in preparation of the Contract Documents. While such reports are intended to be an accurate record of the conditions at the specific boring locations on the date taken, it is not a guarantee of specific Site conditions which may vary between boring locations and over time, and Offerors may not rely upon the general accuracy of the "technical data" contained in such reports and upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for the purposes of preparing a Proposal for construction.

15.2.2. Copies of such reports will be made available by Owner to any Offeror on request. Such reports are not part of the Contract Documents. Offeror is responsible for any interpretation or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information. Offeror acknowledges that Owner and Principal Architect/Engineer disclaim any responsibility for the accuracy, correctness, completeness, suitability, and sufficiency of such reports and for Offeror’s interpretation of such reports.

15.3. Information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site are based upon information and data furnished to Owner and Principal Architect/Engineer by owners of such Underground Facilities or others, and Owner and Principal Architect/Engineer do not assume and expressly disclaim responsibility for the accuracy or completeness thereof or for Offeror's interpretation of such information and data. The Contractor is advised to coordinate closely with

Owner, Principal Architect/Engineer and Utility Operator(s) prior to the commencement of any underground construction activities.

15.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective Offerors with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Contract Documents due to differing or unanticipated conditions appear in Article 6 of the Standard Form of Agreement and Article 4.2 of the General Conditions.

15.5. Before submitting a Proposal, each Offeror will be responsible for obtaining such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and underground facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance or furnishing of the Work, or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Offeror and safety precautions and programs incident thereto or which Offeror deems necessary to determine its Proposal for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

15.6. On request, the SJRA Purchasing Department may provide each Offeror access to the site to conduct such examinations, investigations, explorations, tests and studies, as each Offeror deems necessary for submission of a Proposal. Offeror must fill any resultant holes and clean up and restore the site to its former condition upon completion of such explorations, investigations, tests and studies.

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

15.8. Reference is made to Specification Section 01 11 13 - Work Covered By Contract Documents for the identification of the general nature of Work that is to be performed at the site by the Owner or others (such as utilities and other prime Contractors) that relates to the Work for which a Proposal is to be submitted. On request, Owner may provide to each Offeror for examination access to or copies of Contract Documents (other than portions thereof related to price) for such Work.

15.9. The submission of a Proposal will constitute an incontrovertible representation by Offeror that Offeror has complied with every requirement of this Article 15, that without exception the Proposal is premised upon performing and furnishing the Work required by the Contract Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by the Contract Documents, that Offeror has given Owner or Principal Architect/Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Offeror has discovered in the Contract Documents and the written resolutions thereof by Principal Architect/Engineer are acceptable to Offeror, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

15.10. The provisions of 15.1 through 15.9, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by Article 4.4 Hazardous Conditions of the General Conditions.

16. Proposal Security.

16.1. Each Proposal must be accompanied by Proposal Security made payable to the Owner in the amount not less than five percent (5%) of the total Proposal Amount, including any Cash Allowances and Alternates, and shall be in the form of a cashier's check or Offeror's Bond.

16.2. Offeror's Bond must be on the form provided within the Contract Documents (CSP) and must bear the impressed seal of the Surety, and be signed by the Offeror and an authorized individual of the Surety. Bonds will only be accepted from Sureties authorized to issue bonds in accordance with state law.

16.3. The Proposal Security of Successful Offeror will be retained until such Offeror has executed the Standard Form of Agreement, furnished the required contract securities and met the other conditions contained in Specification Section 00 41 00.02 – Proposal Form, whereupon the Proposal Security will be returned. If the Offeror fails to execute and deliver the Standard Form of Agreement and furnish the required contract security within ten (10) Calendar days after the SJRA Board of Directors has approved a contract award, Owner may annul its award and the Proposal Security of that Offeror will be forfeited. The Proposal Security of other Offerors whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of the seventh day after the Effective Date of the Standard Form of Agreement or the ninety-first day after the Proposal opening, whereupon Proposal Security furnished by such Offerors will be returned. Proposal Security, if submitted in the form of cashier's check, submitted with Proposals which are not competitive will be returned within ten (10) Calendar days after the Proposal opening.

17. Contract Times.

The number of Calendar days within which, or the dates by which, the Work is to reach Substantial and Final Completion are set forth in Specification Section 00 52 00 – Standard Form of Standard Form of Agreement between Owner and Contractor.

18. Substitutes and "Or-Equal" Items.

The Contract, if awarded, will be on the basis of goods and services described in the Drawings or specified in the Specifications with consideration for possible substitute or "or equivalent" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal"/“or equivalent” item of material or equipment may be furnished or used by Contractor if acceptable to Principal Architect/Engineer and Owner, application for such acceptance may be made prior to Contract award in accordance with Texas Government Code 2269.155. See section 6.02.5 in the General Conditions of the Contract for more information.

19. Subcontractors, Suppliers and Others.

19.1. If the Owner requests the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of material and equipment) to be submitted to Owner, Apparent Best Value Offeror, and any other Offerors so requested, shall within five (5) Calendar days from request submit to Owner a list of all such Subcontractors, Suppliers or other persons or organizations proposed for those portions of the Work for which such identification is requested. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person or organization if requested by Owner. If the Owner or Principal Architect/Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, Owner may, before giving notice of its intent to recommend award to Owner’s Board of Directors, request that Apparent Best Value Offeror submit an acceptable substitute without an increase in price.

If Apparent Best Value Offeror declines to make any such substitution, Owner may formally close contract negotiations with Offeror and enter into contract negotiations with the next most highly-ranked Offeror that proposes to use acceptable Subcontractors, Suppliers and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Proposal Security of any Offeror. Any Subcontractor, Supplier, other person or organization listed and to whom Owner or Principal Architect/Engineer does not make written objection prior to giving notice of its intent to recommend Award to Owner’s Board of Directors will be deemed acceptable to Owner and Principal Architect/Engineer, subject to revocation of such acceptance after the Effective Date of the Standard Form of Agreement as provided in Article 6.04 of the General Conditions.

19.2. No Contractor shall be required to employ any Subcontractor, Supplier, other person or organization against whom Contractor has reasonable objection.

20. Preparation of Proposals.

20.1. Prepare one (1) unbound original of the complete Proposal Package, including the completed Proposal Form 00 41 00.02. Clearly mark this package with the word "Original". Prepare one (1) bound copy with original signatures, and one (1) electronic copy on a flash drive (in .pdf format) with a completed Proposal with original signatures, Statement of Qualifications 00 21 13.03, and a full set of Financials.

20.2. An Original Proposal is the Proposal containing the Original Signature of a person authorized to sign on behalf of the Offering Firm.

20.3. Proposals shall be enclosed in an opaque sealed Envelope (or Package), marked with **CSP No. No. 19-0047 - Ground Storage Tank No. 2 at Water Plant No. 4** and name and address of Offering Firm.

20.4. Each Original Proposal submitted by an Offeror shall contain the following:

20.4.1. Offerors Statement of Qualifications (SOQ; 00 21 13.03);
20.4.2. Completed Proposal Form (00 41 00.02);
20.4.3. Completed Certification of Proposal (00 41 00.02), Contractor shall also complete and submit the provided Microsoft Excel spreadsheet of the Proposal Form;
20.4.4. Form of Business (00 45 20);
20.4.5. Proposal Security (Offeror's Bond 00 43 13);
20.4.6. Resolution of Contractor (00 45 43);
20.4.7. Conflict of interest Forms (Form CIQ; 00 45 10) shall be submitted under a separate cover and not included in the sealed Proposal;
20.4.8. **One (1) flash drive with a Completed Proposal with Original signatures, Statement of Qualifications (SOQ) and a full set of Financials**; and
20.4.9. Any other Documentation required by the terms of this Competitive Sealed Proposal.

20.5. Conflict of Interest Questionnaire, Specification Section 00 45 10 of Contract shall be submitted under separate cover. If Offering Firm affirms that there are no Conflicts of Interest, Offeror shall indicate so by writing name of firm and "No Conflicts" on CIQ form and signing form.

20.6. Proposals submitted by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and

attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

20.7. Submitted Proposals by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

20.8. All names must be typed or printed in ink below the signature.

20.9. The Proposal shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Proposal Form).

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

20.11. Evidence of authority to conduct business as an out-of-state corporation in the state where the Work is to be performed shall be provided in accordance with Specification Section 00 41 00.02 – Proposal Form. State Contractor license number, if any, must also be shown.

21. Submission of Proposals.

21.1. Proposals shall be submitted at the time and place indicated in the Invitation to Submit Proposals (00 11 13) and accompanied by the Proposal Security and other required documents.

21.2. If the Proposal is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "SEALED PROPOSAL ENCLOSED" on the face of it. Proposals not received by the time or at the location specified will be returned unopened to the Offeror.

21.3. The clock used by the Owner at the place used for receiving Proposals shall conclusively determine the time that Proposals are received.

21.4. Proposals sent by facsimile or electronic mail or delivered to any other location other than the address provided in the Invitation to Offerors will NOT be accepted.

22. Modification and Withdrawal of Proposals.

22.1. Proposals may be modified or withdrawn by a document duly executed (in the same manner that a Proposal must be executed) and delivered to the place where Proposals are to be submitted prior to the date and time for the opening of Proposals.

22.2. If, within twenty-four (24) hours after Proposals are opened, any Offeror files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material or substantial mistake in the preparation of its Proposal, that Offeror may withdraw its Proposal. The Proposal Security may be retained by the Owner if Offeror cannot clearly demonstrate to the Owner evidence of a material or substantial mistake in its Proposal. Thereafter, that Offeror may be disqualified from responding to a reissued CSP for the Work to be furnished under these Contract Documents.

23. Opening of Proposals.

Proposals will be opened and (unless obviously non-responsive) the names and Monetary Proposals of Offering Firms read aloud at a public opening. An abstract of the Proposals will be made available no later than the seventh day after the Contract is awarded.

24. Proposals to Remain Subject to Acceptance.

All Proposals will remain subject to acceptance for ninety (90) Calendar days after the date of the opening, but Owner may, in its sole discretion, release any Proposal and return the Proposal Security prior to that date.

25. Prevailing Wage Rates.

Contractors for this Project must pay no less than the prevailing wage rates for the area established by the San Jacinto River Authority and included in Specification Section – 00 73 43 – Wage Scale for Construction.

26. Liquidated Damages or Economic Disincentives.

Provisions for liquidated damages or economic disincentives are set forth in Specification Section 00 52 00 -Standard Form of Standard Form of Agreement between Owner and Contractor and Specification Section 00 72 00 – General Conditions of the Contract.

27. Contract Security and Insurance.

Article 5 of the General Conditions sets forth Owner's requirements as to insurance and Performance and Payment Bonds. When the Successful Offeror delivers the original, hard copy executed Standard Form of Agreement to Owner, it must be accompanied by evidence of insurance and unsigned Performance and Payment Bonds as required by Article 5 of the General Conditions, unless prior written approval of Contractor’s evidence of insurance and unsigned performance and payment Bond forms has been received from the SJRA Purchasing Department. Such evidence of insurance shall include, without limitation, all required certificates and endorsements,

evidencing all required coverages, limits of liability, additional insured status, waivers of subrogation and other insurance requirements.

28. Conflict of Interest and Disclosure of Interested Parties.

28.1 Chapter 176 of the Texas Local Government Code mandates the public disclosure of certain information concerning persons doing business or seeking to do business with the San Jacinto River Authority, including affiliations and business and financial relationships such persons may have with San Jacinto River Authority officers. An explanation of the requirements of Chapter 176, applicable forms and a complete text of the law are available at: http://www.ethics.state.tx.us/forms/CIQ.pdf.

BY DOING BUSINESS OR SEEKING TO DO BUSINESS WITH THE SAN JACINTO RIVER AUTHORITY, YOU ACKNOWLEDGE THAT YOU HAVE BEEN NOTIFIED OF THE REQUIREMENTS OF CHAPTER 176 OF THE TEXAS LOCAL GOVERNMENT CODE AND THAT YOU ARE RESPONSIBLE FOR COMPLYING WITH THEM.

28.2 Texas Government Code Section 2252.908 requires persons who enter into a contract with a government entity to submit a disclosure of interested parties (Form 1295) to the government entity or state agency at the time business entity submits the signed contract to the government entity or state agency. Use the following link to access filing instructions: https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm.

29. Taxes.

Owner is exempt from payment of sales and use taxes of the State of Texas and of cities and counties thereof, on all goods and services to be incorporated into the Work. Said taxes shall not be included in the Proposal.

29.1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of goods to be incorporated into the Work.

29.2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to goods not incorporated into the Work, except to the extent the exemption referred to in paragraph 18.4 applies to the Project to exempt taxes on any such items.

29.3. If the Project is construction of a water or wastewater system certified by the Texas Commission on Environmental Quality as a regional system, equipment, services and supplies used solely to construct the Project are exempted from taxes imposed by Chapter 151, Limited Sales, Excise and Use Tax, Texas Tax

Code. Said taxes shall not be included in the Proposal. Owner will furnish any required certificates of tax exemption to Contractor.

30. Verification Company Does Not Boycott Israel

Pursuant to Section 2270.002 of the Texas Government Code, the Contractor shall be required to execute contemporaneous with its execution of the Standard Form of Agreement a verification that Contractor does not Boycott Israel and Contractor will not Boycott Israel during the term of this Standard Form of Agreement. “Boycott Israel” as used herein means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

31. Signing of Standard Form of Agreement.

SJRA’s Purchasing Department will transmit to the Successful Offeror the required number of unsigned counterparts of the Standard Form of Agreement with all other written Contract Documents attached. Contractor shall deliver original, hard copies of the required number of counterparts of the Standard Form of Agreement and written Contract Documents signed by Contractor, unsigned Bond forms, evidence of insurance as set out in Section 27 above, signed disclosure of interested parties (Form 1295), signed Conflict of interest Questionnaire, and signed and notarized Verification Company Does Not Boycott Israel, to SJRA Purchasing Department ten (10) Calendar days prior to the SJRA Board of Directors Meeting for which a contract award is anticipated. Notwithstanding the foregoing, the Standard Form of Agreement may be executed using electronic signatures at the option and in the discretion of Owner, and, in such event, the provisions of the Uniform Electronic Transaction Act, Chapter 332, Texas Business and Commerce Code, as amended, and any applicable policies and procedures of Owner regarding electronic signatures shall apply. However, the requirements of this Section 31 apply regardless of whether or not the Standard Form of Agreement is also executed using electronic signatures or transmitted electronically. Following and subject to award, the Owner shall deliver one (1) fully signed counterpart of the Standard Form of Agreement to Contractor. Within three (3) Calendar days of Contractor’s receipt of the fully executed Standard Form of Agreement, the Contractor shall deliver the original, hard copy fully executed Bonds to SJRA Purchasing Department.

END OF SECTION

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TABLE 1 – GENERAL INFORMATION								
Organization Doing Business As:								
Business Address of Principle Office:								
Main Telephone Number:								
Fax Number:								
Web Site Address:								
Form of Business (check one):		Corporation		Partnership		Individual		Joint Venture
IF A CORPORATION								
Date of Incorporation:								
State of Incorporation:								
Chief Executive Manager's Name:								
President's Name:								
Vice President's Name(s):								
Secretary's Name:								
Treasurer's Name:								
IF A PARTNERSHIP								
Date of Organization:								
General or Limited Partnership?:								
IF AN INDIVIDUAL								
Name:								
Business Address:								
IF A JOINT VENTURE								
Name of Lead Joint Venture Manager:								
Name of Firm:								
Joint Venture Partner Manager(s):								
Name of Firm(s):								
Individuals Not Listed Above Having Significant Business Control:								
Indicators of Organization Size:								
Current Number Full Time Employees:		Estimate of Current Year's Revenue:						
Average Number of Projects per Year:		Average Project Construction Cost:						

TABLE 2 – ORGANIZATIONAL EXPERIENCE

Organization Doing Business As:	
Business Address of Principle Office:	
Main Telephone Number:	
Fax Number:	
Web Site Address:	
Organization Doing Business As:	

ORGANIZATIONAL HISTORY

List of names that this organization has operated under over the history of the organization, including the names of related companies presently doing business:

Names of Organization:	From Date	To Date

List of companies, firms or organizations that own any part of the organization.

Name of Companies, Firms or Organization:	Percent Ownership

CONSTRUCTION EXPERIENCE

1.	Years' experience in projects similar to the proposed project: As a General Contractor: _____ As a Joint Venture Partner: _____	
2.	Has this or a predecessor organization ever defaulted on a project or failed to complete any work awarded to it? If yes provide full details in a separate attachment. (Attachment #_____)	
3.	Has this or a predecessor organization been released from a bid or proposal in the past ten years? If yes provide full details in a separate attachment. (Attachment #_____)	
4.	Has this or a predecessor organization ever been disqualification as a bidder or Offeror by any local, state, or federal agency within the last five (5) years? If yes provide full details in a separate attachment. (Attachment #_____)	
5.	Is this organization or your proposed surety currently in any litigation or contemplating litigation? If yes provide full details in a separate attachment. (Attachment #_____)	
6.	Has this or a predecessor organization ever refused to construct or refused to provide materials defined in the contract documents? If yes provide full details in a separate attachment. (Attachment #_____)	
7.	Has your company, firm, corporation, or business implemented an Employee Health and Safety Program compliant with 29 CFR 1910 "General Industry Standards" https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910 and/or 29 CFR 1926 "General Construction Standards" https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1926 as they apply to your Company's customary activities?	

8.	Has your company, firm, corporation, partnership, or institution represented by the company, firm, corporation, partnership, or anyone acting in representation, received citations for violations of OSHA within the past three (3) years? If YES, please provide the following additional information: Date of offense, location of establishment inspected, category of offense, final disposition of offense, if any, and penalty assessed.	
9.	Has your company, firm, corporation, partnership, or institution represented by the company, firm, corporation, partnership, or anyone acting in representation received citations for violations of environmental laws or regulations, of any kind or type, within the past five (5) years? Citations include notice of violation, notice of enforcement, suspension/revocations of state of federal licenses, or registrations, fines assessed, pending criminal complaints, indictments, or convictions, administrative orders, draft orders, final orders, and judicial final judgements. If YES, please provide the following additional information: Date of offense, location of where offense occurred, type of offense, final disposition of offense, if any, and penalty assessed.	
10.	Has your company, firm, corporation, partnership, or institution represented by the company, firm, corporation, partnership, or anyone acting in representation ever been convicted, within the past ten (10) years, of a criminal offense which resulted in a serious bodily injury or death? If YES, please provide the following additional information: Date of offense, location of where offense occurred, type of offense, final disposition of offense, if any, and penalty assessed.	
11..	Has your company filed or been named in any litigation involving your company and the Owner on a contract within the last five (5) years under your current company name or any other company name? If so, provide details of the issues and resolution if available. Include lawsuits where Owner was involved. (Notice: Failure to disclose this information during proposal submission, and later discovered, may result in contract termination at SJRA's option.)	
12.	Please provide a history of all OSHA actions, advisories, etc., Contractor has received on all jobs worked in any capacity, prime, or subcontractor. The history shall be for the two-year period preceding the Bid Date of the Project.	
13.	Please provide a list of all on-the-job injuries, accidents, and fatalities suffered by any present or former employees of Contractor during the same two-year period.	
14.	If less than the two-year period, give the date Contractor started doing business.	

THIS FORM MUST BE RETURNED WITH THE PROPOSAL RESPONSE

TABLE 3 – ORGANIZATIONAL STRUCTURE

Organization Doing Business As:	

PROPOSED PROJECT ORGANIZATION

1. Provide a brief description of the managerial structure of the organization and illustrate with an organizational cart. Include the title and names of key personnel. Include this chart at an attachment to this description. (Attachment No. _____)

2. Provide a brief description of the experience and qualifications of the organization's management team, including officers that will be directly involved in the project. Describe the individuals that are authorized to execute Contract Documents, Change Orders or receive payment for the organization. Include a copy of a board resolution or other documentation as appropriate for the structure of the company authorizing these individuals to conduct business on behalf of the organization. (Attachment No. _____)

SURETY REFERENCES

TABLE 4 – PROJECT EXPERIENCE AND RESOURCES

Organization Doing Business As:	

PROJECTS

1. Provide a list of major projects that are currently underway, or have been completed within the last five (5) years on Table 5, using additional copies as required. Identify those projects which specifically illustrate the organizations capability to provide best value to the Owner for this project.

Provide a narrative description (not to exceed 10 pages) of your organizations approach to completing this project to provide best value for the Owner. Including a description of your approach in the following areas:

1. Contract administration
2. Management of subcontractor and suppliers
3. Time management
4. Cost control
5. Quality management
6. Project site safety
7. Managing changes to the project
8. Managing equipment
9. Meeting HUB / MWBE Participation Goal

EQUIPMENT

2. Provide a list of major equipment proposed for use on this project. Attach additional information if necessary.

Equipment item	Primary use on project	Own	Will buy	Lease

DIVISION OF WORK BETWEEN ORGANIZATION AND SUBCONTRACTOR

3. What work will the organization complete using its own resources?

4. What work does the organization propose to subcontract on this project?

TABLE 5 – CURRENT PROJECTS AND PROJECTS COMPLETED WITHIN THE LAST 5 YEARS									
1	Project Owner:		Project Name:						
General Description of Project:									
Project Cost:				Date Project Completed:					
Key Project Personnel:	Project Manager		Project Superintendent		Safety Manager		Quality Control Manager		
Name:									
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)									
	Name		Title/Position		Organization		Telephone		E-mail
Owner:									
Designer:									
Construction Manager:									
2	Project Owner:		Project Name:						
General Description of Project:									
Project Cost:				Date Project Completed:					
Key Project Personnel:	Project Manager		Project Superintendent		Safety Manager		Quality Control Manager		
Name:									
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)									
	Name		Title/Position		Organization		Telephone		E-mail
Owner:									
Designer:									
Construction Manager:									
3	Project Owner:		Project Name:						
General Description of Project:									
Project Cost:				Date Project Completed:					
Key Project Personnel:	Project Manager		Project Superintendent		Safety Manager		Quality Control Manager		
Name:									
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)									
	Name		Title/Position		Organization		Telephone		E-mail
Owner:									
Designer:									
Construction Manager:									

TABLE 6 – PROPOSED KEY PERSONNEL

Organization Doing Business As:	

PROPOSED PROJECT ORGANIZATION

1. Provide a brief description of the managerial structure of the organization and illustrate with an organizational cart. Include the title and names of key personnel. Include this chart as an attachment to this description. See attachment No.

2. Provide a brief description of the managerial structure proposed for this project and illustrate with an organizational chart. Include the title and names of proposed key personnel and alternates. Include this chart at an attachment to this description. See attachment No.

EXPERIENCE OF KEY PERSONNEL

3. Provide information on the key personnel proposed for this project that will provide the following key functions. Provide information for candidates for each of these positions on the pages for each of these key personnel. Also provide biographical information for each primary and alternate candidate as an attachment. The biographical information must include the following as a minimum: technical experience, managerial experience, education and formal training, work history which describes project experience, including the roles and responsibilities for each assignment, and primary language. Additional information highlighting experience which makes them the best candidate for the assignment should also be included.

Role	Primary candidate	Alternate candidate
Project Manager		
Project Superintendent		
Project Safety Manager		
Quality Control Manager		

4. If key personnel are to fulfill more than one of the roles listed above, provide a written narrative describing how much time will be devoted to each function, their qualifications to fulfill each role and the percentage of their time that will be devoted to each role. If the individual is not to be devoted solely to this project, indicate how time it to be divided between this project and their other assignments.

TABLE 7 – PROPOSED PROJECT MANAGERS

Organization Doing Business As:	

PRIMARY CANDIDATE

1.	Name of Individual:	
	Years of Experience as Project Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

2. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

ALTERNATE CANDIDATE

3.	Name of Individual:	
	Years of Experience as Project Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

4. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

TABLE 8 – PROPOSED PROJECT SUPERINTENDENT

Organization Doing Business As:	

PRIMARY CANDIDATE

1.	Name of Individual:	
	Years of Experience as Project Superintendent:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Superintendent:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

2. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

ALTERNATE CANDIDATE

3.	Name of Individual:	
	Years of Experience as Project Superintendent:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Superintendent:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

4. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate Role on Project:	

TABLE 9 – PROPOSED PROJECT SAFETY MANAGER

Organization Doing Business As:	

PRIMARY CANDIDATE

1.	Name of Individual:	
	Years of Experience as Project Safety Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Safety Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

2. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

ALTERNATE CANDIDATE

3.	Name of Individual:	
	Years of Experience as Project Safety Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Project Safety Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

4. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

TABLE 10 – PROPOSED QUALITY CONTROL MANAGER

Organization Doing Business As:	

PRIMARY CANDIDATE

1.	Name of Individual:	
	Years of Experience as Quality Control Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Quality Control Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

2. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

ALTERNATE CANDIDATE

3.	Name of Individual:	
	Years of Experience as Quality Control Manager:	
	Years of Experience With This Organization:	
	Number of Similar Projects as Quality Control Manager:	
	Number of Similar Projects in Other Positions:	

Current Project Assignments:

Name of Assignment:	Percent of Time Used for This Project:	Estimated Project Completion Date:

4. Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

Name:		Name:	
Title/ Position:		Title/ Position:	
Organization:		Organization:	
Telephone:		Telephone:	
E-mail:		E-mail:	
Project:		Project:	
Candidate's Role on Project:		Candidate's Role on Project:	

TABLE 11 – SUBCONTRACTORS AND SUPPLIERS

Organization Doing Business As:	

PROJECT SUBCONTRACTORS

1. Provide a list of subcontractors that will provide more than 10 percent of the work (based on contract amounts)

Name	Work to be provided	Est. percent of contract

2. Provide information on the proposed key personnel, project experience and a description of past relationship and work experience for each subcontractor listed above using the Project Information forms.

SUPPLIERS

3. Provide a list of major equipment or materials proposed for use on this project. Attach additional information if necessary.

Supplier name	Equipment / material provided	Furnish only	Furnish and install

TABLE 12 – PROJECT INFORMATION FOR KEY PERSONNEL

Project Owner:		Project Name:	
General Description of Project:			

PROJECT BUDGET AND SCHEDULE PERFORMANCE

Budget history

	Amount	% of Bid Amount
Bid :		
Change Orders		
Owner Enhancements:		
Unforeseen Conditions:		
Design Issues:		
Total:		
Final Cost:		

Schedule performance

	Date	Days
Notice to Proceed:		
Contract Substantial Completion Date at Notice to Proceed:		
Contract Final Completion Date at Notice to Proceed:		
Change Order Authorized Substantial Completion Date:		
Change Order authorized Final Completion Date:		
Actual / Estimated Substantial Completion Date:		
Actual / Estimated Final completion Date:		

KEY PROJECT PERSONNEL

	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name:				
Percentage of Time Devoted to The project:				
Proposed for This Project:				
Did Individual Start and Complete The Project?:				
If Not, Who Started or Completed the Project in Their Place:				
Reason for Change:				

Reference Contract information (Listing names indicates approval to contact the named individuals as a reference)

	Name	Title/ Position	Organization	Telephone	E-mail
Owner:					
Designer:					
Construction Manager:					
Surety:					

ISSUES / DISPUTES RESOLVED OR PENDING RESOLUTION BY ARBITRATION, LITIGATION OR DISPUTE REVIEW BOARDS:

Number of Issues Resolved:		Total Amount Involved in Resolved Issues:		Number of Issues Pending:		Total Amount Involved in Resolved Issues:	

TABLE 13 – DEMONSTRATION OF BUDGET PERFORMANCE

Organization Doing Business As:

PROVIDE INFORMATION ON ALL PROJECTS COMPLETED BY THE ORGANIZATION WITHIN THE LAST FIVE (5) YEARS:

Owner Name	Project Description	Original Contract Price	Owner Enhancements	Unforeseen Conditions	Design Issues	Contractor Issues	Total Changes	Percent Changes

TABLE 14 – DEMONSTRATION OF ON-TIME PERFORMANCE

Organization Doing Business As:

PROVIDE INFORMATION ON ALL PROJECTS COMPLETED BY THE ORGANIZATION WITHIN THE LAST FIVE (5) YEARS:

Owner Name	Project Description	Original Contract Date for Substantial Completion	Original Contract Date for Final Completion	Amended Contract Date for Substantial Completion	Amended Contract Date for Final Completion	Actual Contract Date for Substantial Completion	Actual Contract Date for Final Completion

Affidavits

One of the following four affidavits shall be executed and provided with this information. The individual signing the affidavit shall attach evidence of their authority to bind the Organization to an agreement.

REMAINDER OF PAGE INTENTIONALLY LEFT BLANK

AFFIDAVIT FOR CORPORATION

State _____ §

County of _____ §

_____ , being duly sworn deposes and says
(Name)

That he is _____ of the Corporation submitting the
(Title)
foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations; and that he is authorized to make this affidavit on behalf of the Corporation.

_____
Signature

Signed and sworn to me before this _____ day of _____, 20 __

_____
Notary Public

My commission expires: _____

AFFIDAVIT FOR PARTNERSHIP

State _____ §

County of _____ §

_____ , being duly sworn deposes and says
(Name)

That he is _____ of the Company submitting the
(Title)
foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations; and that he is authorized to make this affidavit on behalf of the Partnership.

_____
Signature

Signed and sworn to me before this _____ day of _____, 20__

_____
Notary Public

My commission expires: _____

AFFIDAVIT FOR INDIVIDUAL

State _____ §

County of _____ §

_____ , being duly sworn deposes and says
(Name)

That he is _____ of the company submitting the
(Title)
foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations.

_____
Signature

Signed and sworn to me before this _____ day of _____, 20__

_____
Notary Public

My commission expires: _____

AFFIDAVIT FOR JOINT VENTURE STATEMENT

We the undersigned do hereby give notice to our agreement to bid as a joint venture on the Project.

_____
Name of Joint Venture

_____
Name of firm

_____
Signature

Signed and sworn to me before this _____ day of _____, 20__

_____
Notary Public

My commission expires: _____

_____
Name of firm

_____
Signature

Signed and sworn to me before this _____ day of _____, 20__

_____
Notary Public

My commission expires: _____

END OF SECTION

SECTION 00 31 19

EXISTING CONDITION INFORMATION

1.1 SUMMARY

A. Section Includes:

1. Existing Condition Information
2. Offeror Responsibilities

1.2 MEASUREMENT AND PAYMENT (NOT USED)

1.3 SUBMITTALS (NOT USED)

1.4 SUBSURFACE INVESTIGATION REPORT (NOT USED)

1.5 UNDERGROUND FACILITIES REPORTS (NOT USED)

1.6 EXISTING CONDITION INFORMATION

A. Contract Documents indicate physical conditions in or relating to existing surface and subsurface structures which are at or contiguous to the site that were known to, and have been used by, the SJRA and Principal Architect/Engineer in preparation of Contract documents.

B. Contractor to field verify all existing dimensions, elevations and other conditions prior to initiating work.

1.7 OFFEROR RESPONSIBILITIES

A. Offeror shall have full responsibility for reviewing and verifying information and data, for locating underground facilities and existing structures shown or indicated in the Contract Documents, and for coordination of the Work with the owners of such underground facilities and existing structures during construction.

END OF SECTION

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SECTION 00 31 32
GEOTECHNICAL INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site Investigation Reports
2. Geotechnical Reports: See Attachment
3. Offeror Responsibilities

1.2 SITE INVESTIGATION REPORTS

A. In the design and preparation of Contract Documents for this Project, the SJRA and Principal Architect/Engineer have used information in geotechnical reports for the investigation and analysis of soils and subsurface conditions at the Project site.

B. A copy of each report is available for examination via the Brazos Valley Online Bidding System (http://brazosbid.csxt.gov).

C. Neither the SJRA nor Principal Architect/Engineer is responsible for accuracy or completeness of any information or data.

1.3 GEOTECHNICAL REPORTS

A. Refer to the Geotechnical Engineering Report Rev. 1 prepared by Terracon Consultants Inc., dated February 20, 2019.

1.4 OFFEROR RESPONSIBILITIES

A. Offeror shall take full responsibility for interpretation and use of information contained in above listed reports for its bidding and construction purposes.

B. Offeror may perform additional soils investigations as Offeror deems appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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Geotechnical Engineering Report
Revision 1

SJRA Water Plant No. 4 GST No. 2
The Woodlands, Texas
February 20, 2019
Terracon Project No. 97185112

Prepared for:
AECOM Technical Services, Inc.
Houston, Texas

Prepared by:
Terracon Consultants, Inc.
Conroe, Texas

February 20, 2019

AECOM Technical Services, Inc.
5444 Westheimer Road, Suite 4000
Houston, Texas 77056

Attn: Mr. Keith O'Connor, P.E.
P: (281) 647 4406
E: Keith.OConnor@aecom.com

Re: Geotechnical Engineering Report, Revision 1
SJRA Water Plant No. 4 GST No. 2
West Branch Crossing Drive
The Woodlands, Texas
Terracon Project No. 97185112

Dear Mr. O'Connor:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P97185112, Revision 1 dated December 13, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
(Texas Firm Registration No. F-3272)

STATE OF TEXAS
BOBBIE S. HOOD
92951
LICENSED
PROFESSIONAL ENGINEER

Sureel S. Saraf, Ph.D.
Staff Geotechnical Engineer

Bobbie Sue Hood, P.E.
Geotechnical Services Manager

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report
Revision 1
SJRA Water Plant No. 4 GST No. 2
West Branch Crossing Drive
The Woodlands, Texas
Terracon Project No. 97185112
February 20, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed construction of a new ground storage tank at the existing SJRA Water Plant No. 4 located on West Branch Crossing Drive in The Woodlands, Texas. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Estimated settlement of foundations
- Seismic site classification per IBC
- Below-grade construction

The geotechnical engineering Scope of Services for this project included the advancement of three test borings to depths of approximately 30 feet below existing site grade, and one test boring to a depth of approximately 100 feet below existing site grade.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located on an approximately 3.0-acre land parcel on the west side of West Branch Crossing Drive, about 0.37 miles south of the intersection of Woodlands Parkway and West Branch Crossing Drive in The Woodlands, Texas. (See Exhibit D)
Existing Improvements	Existing Ground Storage Tank No. 1, equipment pad on the west side of the existing storage tank, single-story building on the south side of the existing tank, and associated concrete paved driveway and parking area.
Current Ground Cover	Clear within the anticipated footprint of Ground Storage Tank No. 2.
Existing Topography	Fairly level.
Geology	Based on the geologic maps published by the Bureau of Economics Geology, the site is located on the Willis Formation is the oldest formation of the Houston Group. The Willis Formation was deposited early in the Pleistocene epoch, during the Aftonian Interglacial Stage. It is fluviatile, consisting of sands, silts, and clays in approximately equal amounts. The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, major sea level fluctuations during the glacial stages, subsidence and faulting activities. Most of these faulting activities have ceased for millions of years, but some are still active. A detailed geologic fault investigation and study of the site geology were beyond the scope of this study.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Work Order No. 2 for SJRA Water Plant No. 4 Ground Storage Tank No. 2, consisting of the geotechnical scope of work was provided by the client via email on September 18, 2018. Tank dimensions and maximum foundation loads were provided by DN Tanks and AECOM via email on December 13, 2018.
Project Description (Per DN Tanks)	Construction of a new Ground Storage Tank (GST) with a storage capacity of 2,000,000 gallons and inside diameter of 124 feet, with water height of 24 feet and wall height of 25 feet. The GST is anticipated to be a circular wire-wrapped pre-stressed concrete structure designed in accordance with American Concrete Institute (ACI) 372R.

Item	Description
Foundation System	Concrete slab with a perimeter thickened edge.
Finished Floor Elevation	Within about 1 feet above existing grade.
Maximum Loads	■ Beneath the Tank Floor: 1,600 pounds per square foot (psf) ■ Beneath the Thickened Perimeter Footing: 2,900 pounds per square foot (psf)

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

Groundwater Conditions

Borings B-1 through B-4 were advanced using dry drilling techniques to depths of about 10 to 15 feet at which depth groundwater and/or caving soils necessitated switching to wet rotary drilling. Wet rotary techniques were used thereafter to the termination depth of these borings (about 30 to 100 feet). Groundwater observations are included on the GeoModel and Boring Logs in the **Figures** and **Exploration Results** sections, respectively

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

Surficial soils observed at this site consisted of clayey sand to a depth of about 6 to 15 feet below existing grade. Underlying soils consisted of alternate layers of sandy lean and fat clay, silty sand, and clayey sand to the boring termination depth of about 30 to 100 feet below existing grade.

Groundwater was observed during dry drilling in Borings B-1 through B-4 at depths of about 7 to 13 feet below existing grade. After a 15-minute monitoring period, groundwater was observed in Borings B-1 through B-4 at depths of about 4 feet to 7½ feet below existing grade.

Some of the near surface clayey sands are loose and are not suitable for support of the structure in their existing condition. A minimum of 72 inches of the existing weak soils should be removed and replaced with compacted select fill. Additional fill may be required to achieve design grade. All fill should be select fill meeting the requirements outlined in **Earthwork**. In order to support the anticipated loads, the fill below the perimeter should be chemically treated as outlined in **Fill Material Types**.

Following overexcavation of 72 inches of weak soils and placement of a select fill pad as outlined in **Earthwork**, the ground storage tank can be supported on a concrete slab-on-grade foundation system with a perimeter thickened edge, to support the wall and roof loads. Recommendations for design and construction of this shallow foundation are provided in **Shallow Foundations**.

Potential vertical rise and estimated settlements are discussed in **Shallow Foundations**.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, and other debris/unsuitable surface material. In addition, a minimum of 72 inches of the existing weak soil should be removed. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Once final subgrade elevations have been achieved, the exposed subgrade should be carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction areas should be scarified to a minimum depth of 6 inches, moisture adjusted to within 2 percent of the optimum moisture content, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

A minimum of 72 inches of the weak soil below existing grade, weak areas detected during proof rolling, as well as zones of fill containing organic matter and/or debris, should be removed and replaced with select fill compacted as outlined in **Fill Compaction Requirements**.

Proof rolling should be performed under the direct observation of the geotechnical engineer or his/her representative. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Fill Material Types

Fill required to replace weak soils and to achieve the design grades for the proposed tank should be select fill that meets the following criteria:

Fill Type	USCS Classification	Acceptable Location for Placement
Select Fill[1]	CL and/or SC (10≤PI≤20)	May be used for grading and to construct the pad beneath the ground storage tank. Should be treated with a mixture of lime/flyash and used below the thickened perimeter edge footing.
On-Site Soils[1]	SC (10≤PI≤20)	May be used for grading and to construct the pad beneath the ground storage tank. Should be treated with a mixture of lime/flyash and used below the thickened perimeter edge footing.
Aggregate Base Material	To be specified by tank manufacturer	Below the tank floor in accordance with the tank manufacturer's specifications. Some manufacturers specify a polyethylene (or other material) between the bottom of the concrete floor and top of the base material.

1. In order to achieve 2,900 psf bearing pressure for the perimeter thickened slab, select fill and listed on-site soils for grading and to construct the pad below the thickened edge must be chemically treated. The chemically treated select fill and listed on-site soils should extend a minimum of 3 feet beyond the edges of the thickened-edge footing. The select fill and listed on-site soils should be treated with 10 percent lime-flyash applied as 3 percent lime and 7 percent flyash. The percentages are given as application by dry weight of soil, and are equivalent to about 12 pounds per cubic foot of lime-flyash. The soils should be treated in accordance with TxDOT Standard Specification Item 265 for lime-flyash treated subgrade. If preferred, cement treated sand may be used in place of the chemically treated select fill or on-site soils below the perimeter thickened edge. If cement treated sand is used, cement should be applied at a rate of 1.5 sacks per ton of sand.

If blended or mixed soils are intended for use to construct the building pad, Terracon should be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing with a pulvimixer at the site. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the slab performance. If blended soils are used, we recommend that additional samples of the blended soils, as well as the clay clods, be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

Fill Compaction Requirements

Select fill and on-site soils should meet the following compaction requirements.

Item	Description
Fill Lift Thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches.
Compaction Requirements	■ The select fill and on-site soils (and chemically treated soils) should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill and on-site soils (and chemically treated soils) should be moisture adjusted to within 2 percent of the optimum moisture content.

Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.

Grading and Drainage

All grades must provide effective drainage away from the structure during and after construction. Water permitted to pond next to the structure can result in distress in the structure. These greater movements can result in unacceptable differential floor slab movements, cracked slabs and walls. Slab and foundation performances described in this report are based on effective drainage for the life of the structures and cannot be relied upon if effective drainage is not maintained.

Exposed ground should be sloped away from the structure for at least 10 feet beyond the perimeter of the structure. After construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary, as part of the building's maintenance program.

SHALLOW FOUNDATIONS

Based on information provided by the client, we understand that the proposed ground storage tank is planned to be supported using a concrete slab with a perimeter thickened edge to support the wall and roof loads.

Based on the subsurface conditions observed during our field and laboratory programs, this type of foundation system may be utilized to support the proposed ground storage tank planned at this site, provided the subgrade is properly prepared as described in this report. Recommendations for this type of foundation system are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Concrete Slab with Perimeter Thickened Edge

According to the preliminary information provided by Mr. Ryan E. Wessels, P.E. with DN Tanks, the ground storage tank wall loads will be supported on a thickened perimeter footing bearing approximately 12 inches below finished grade. The perimeter footing and concrete bottom will be supported on aggregate base material as specified by the tank manufacturer. Chemical treatment of the select fill or on-site soils will be required in order for the thickened edge to be designed as planned. The footing width should be designed based on the bearing pressures provided below. We anticipate that finished floor grade of the new tank will be within about 1 foot of existing grade. If the design finished grade is different than assumed, Terracon should be notified to review and/or modify our recommendations given in this report.

Some of the surface and near-surface clayey sands were in a loose condition at the time of our soil borings. These loose soils are not suitable for support of the tank walls and would lead to increased settlement below the interior tank floor. Based on the conditions observed, we recommend that a minimum of 72 inches of the existing weak soils be removed. Additional removal might be necessary, depending on the condition of the soils at the time of construction. The overexcavation should be backfilled with select fill or on-site soils meeting the requirements for select fill. The soil below the perimeter footing should consist of either lime/flyash treated select fill, lime/flyash treated on-site soil meeting the requirements for select fill, or cement treated sand (1½ sack per ton.) The chemically treated soils may also be used below the tank floor if preferred. Materials should be compacted as described in **Compaction Requirements**. Additional fill soils as described herein may be used as required to achieve final grade elevation. Specifications for the described fill soils are outlined in **Material Requirements**.

The tank footing should be designed to resist hoop stresses created by internal earth pressure resulting from the weight of the soil confined within the footing and from the surcharge loading from the tank. For calculating the lateral earth pressures on the footing, we recommend a coefficient of lateral earth pressure of 0.5 be used for the compacted fill soils. The effect of the tank surcharge at the ground surface should be added to the computed lateral earth pressures. A surcharge load, q, will typically result in a lateral load equal to 0.5q.

Lateral loads transmitted to the perimeter footing will be resisted by soil-concrete friction on the base of the footing and tensile strength of the hoop steel reinforcement within the perimeter footing. An allowable friction of 300 psf may be used on the base of the footing.

Settlement Analysis

A settlement analysis was performed for the proposed tank that will be constructed at this site. The analysis was based on our laboratory test results and the soil conditions observed in the soil borings. Center and edge settlements were estimated for the proposed tank using a commercially available settlement analysis software program, UniSettle. The analyses were performed using the Boussinesq method of stress distribution. The settlement of the tank floor will be a factor of the contact pressure exerted by the fluid load on the soil which is determined by the height of the fluid in the tank. Our analysis was based on a newly constructed tank with contact pressures of 2,900 psf and 1,600 psf for the perimeter footing and interior slab, respectively, and a diameter of 124 feet. The estimated center and edge settlements from our analyses are presented below.

Item	Description
Water Height in Tank	24 feet
Tank Diameter	124 feet
Contact Pressure or Load	1,600 psf on interior bottom floor 2,900 psf on perimeter footing
Estimated Total Center Settlement	4½ inches
Estimated Total Edge Settlement	3½ inches
Estimated Center Settlement After Hydro-Test	3¾ inches
Estimated Edge Settlement After Hydro-Test	3 inches
Estimated Modulus of Subgrade Reaction[1]	10

1. Subgrade modulus was estimated based on the load of 1,600 psf and the calculated settlement.

We recommend that all plumbing fittings be flexible to allow for the estimated settlements presented above. The soil around the exterior of the tank should be sloped away from the tank to provide positive drainage and avoid ponding of water adjacent to the tank.

Hydro-Testing Procedures

Hydro-testing of the ground storage tank should be performed under the observation of Terracon to monitor soil deformation. A procedure for hydro-testing of the tank foundation is provided below. The tank pre-load contractor may also develop a procedure for hydro-testing that is acceptable to the design team.

Survey Control: For monitoring settlements during hydro-testing, we suggest that a minimum of four survey reference points be established around the perimeter of the tank (maximum distance from each other, if feasible) prior to filling the tank. These reference points should be tied to a remote benchmark away from the tank.

Loading: The tank should be filled and observed in stages. The initial filling should be one-half of the capacity. Settlement monitoring of the above-mentioned reference points should be performed at least twice daily for two days and then daily for five days. If the time-rate of settlement plot indicates a decreasing rate of settlement, the filling of the tank to its full capacity may be resumed and the settlement readings repeated in a similar manner.

Data Evaluation: The measured survey data should be reviewed by the structural engineer, tank manufacturer, and Terracon. Based on the time-rate settlement curves, the completion of hydro-testing of the tanks should be assessed by the design team. If authorized, we would be pleased to evaluate the settlement data obtained during hydro-testing of the completed tanks.

Construction Considerations

Excavation for the perimeter thickened slab foundation should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the excavation should be performed using a smooth-mouthed excavation bucket or by hand labor. The excavation should be neatly excavated and properly formed. Disturbance of the bearing area of the foundation should be minimized during the excavation operations. Soft zones observed during construction should be overexcavated to a firm and undisturbed soil layer, and all loose materials in the trench bottom should be removed before placement of concrete. Any disturbed soil should be replaced with concrete. Water should not be allowed to accumulate at the bottom of the foundation excavation.

To reduce the potential for groundwater seepage into the excavation and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavation is completed and properly cleaned. The bearing surface of the foundation should be evaluated immediately prior to placing concrete. If the excavation is to be left open overnight, we recommend that the excavation bottom be protected by a layer of lean concrete (typically 2 to 4 inches thick). The excavation subgrade should be evaluated before placement of the lean concrete layer.

As an acceptable alternative to the lean concrete seal slab, a leveling aggregate base material with an overlying protective polyethylene sheeting may be used to protect the subgrade, provided the compaction of the base material can be maintained.

Foundation Construction Monitoring

The performance of the foundation system for the proposed ground storage tank will be highly dependent upon the quality of construction. In order to provide a level of confidence in the

settlements provided, it is imperative that the subgrade preparation, fill compaction, and foundation installation be monitored full-time by Terracon. We would be pleased to develop a plan for compaction and foundation installation monitoring to be incorporated in the overall quality control program.

SEISMIC CONSIDERATIONS

Description	Value
2012 International Building Code (IBC) [1]	D

1. In general accordance with the *2012 International Building Code,* Table 1613.3.2 and *ASCE 7,* Chapter 20.

BELOW GRADE CONSTRUCTION

The sides of below-grade structure excavations may either be sloped or formed with vertical cuts. For vertical-sided excavations greater than 5 feet in depth, the excavations will require the use of shoring, bracing or some form of retention to prevent sloughing and caving of the soil into the excavation. The excavations, and shoring/bracing used to support those excavations, made near existing structures will require special care to prevent disturbance of the streets during construction of the project.

OSHA standards provide recommendations for the design of temporary sloped excavations with a depth more than 5 feet and less than 20 feet. The OSHA standards provide maximum allowable slopes contingent on three designated soil types: Type A, Type B, and Type C. According to OSHA standards, temporary sloped excavations should be no steeper than 0.75-horizontal on 1-vertical (0.75H:1V) for Type A soils, 1H:1V for Type B soils, and 1.5H:1V for Type C soils. Based on our soil borings, we anticipate excavations will be in Type C soils. However, the soil type should be evaluated by a contractor designated Competent Person at the time of construction. The surface soils should be protected from deterioration and weathering if they are left open for significant periods of time.

The contractor should use a trench box or shoring and bracing as necessary to maintain a safe and clean excavation which meets with the Occupational Safety and Health Administration (OSHA) requirements. Excavations must be performed and inspected under the supervision of a contractor designated Competent Person. The Competent Person, as defined by the OSHA Standard, 29 CFR Part 1926.650 to .652, Subpart P – Excavations, must evaluate the excavations at the time of construction activity to safeguard workers.

Excavations should be performed with equipment capable of providing a relatively clean bearing

area. Excavating equipment should not disturb the soil beneath the design excavation bottom and should not leave large amounts of loose soil in the excavation.

As a safety measure, no equipment should be operated within 5 feet of the edge of the excavation and no materials should be stockpiled within 10 feet of the excavation. Excavations should not approach closer than 10 feet from existing structures/facilities without some form of protection for the facilities. Proper berming or ditching should be performed to divert any surface runoff away from the excavation.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location

of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

Contents:

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

The following field exploration program was proposed by AECOM:

Number of Borings	Planned Boring Depth (feet) [1]	Planned Location
3	30	Along the Perimeter of the GST
1	100	Center of the GST

1. Below ground surface.
2. Total footage is planned to be 190 feet.

Boring Layout and Elevations: We use handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet. Field measurements from existing site features may also be utilized. If available, approximate elevations are obtained by interpolation from a site specific, surveyed topographic map.

Subsurface Exploration Procedures: We advance soil borings with an ATV-mounted drill rig using continuous flight augers (solid stem). Six samples are obtained in the upper 12 feet of each boring and at intervals of 5 feet thereafter. Soil sampling is typically performed using open-tube and/or split-barrel sampling procedures. In the open-tube sampling procedure, an open, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. The samples are placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. In addition, we observe and record groundwater levels during drilling and sampling.

Our exploration team prepares field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Property Disturbance: We will backfill borings with auger cuttings upon completion. Our services do not include repair of the site beyond backfilling our boreholes, and cold patching existing

pavements. Excess auger cuttings will be dispersed in the general vicinity of the borehole. Because backfill material often settles below the surface after a period, we recommend boreholes to be periodically checked and backfilled, if necessary. We can provide this service, or grout the boreholes for additional fees, at your request.

Laboratory Testing

The project engineer will review field data and assign laboratory tests to understand the engineering properties of various soil strata. Exact types and number of tests cannot be defined until completion of field work. The anticipated laboratory testing included the following:

- Water content
- Unit dry weight
- Atterberg limits
- Percent finer than No. 200 sieve
- Unconfined compressive strength
- One dimensional consolidation properties

Results of consolidation tests are presented graphically in Supporting Information.

Our laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we will describe and classify soil samples in accordance with the Unified Soil Classification System (USCS).

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

SITE LOCATION

SJRA Water Plant No. 4 GST No. 2 ■ The Woodlands, Texas
February 20, 2019 ■ Terracon Project No. 97185112

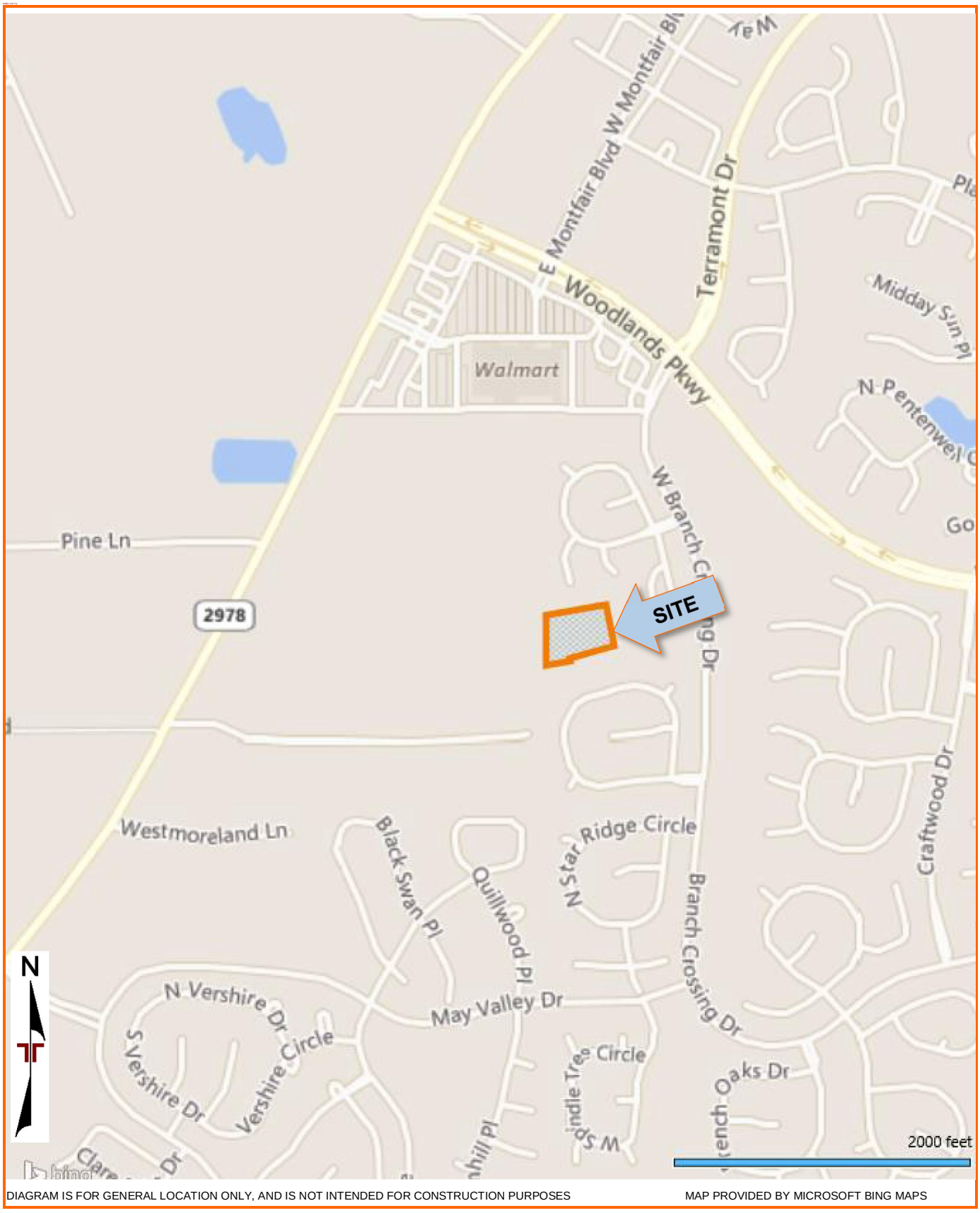


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

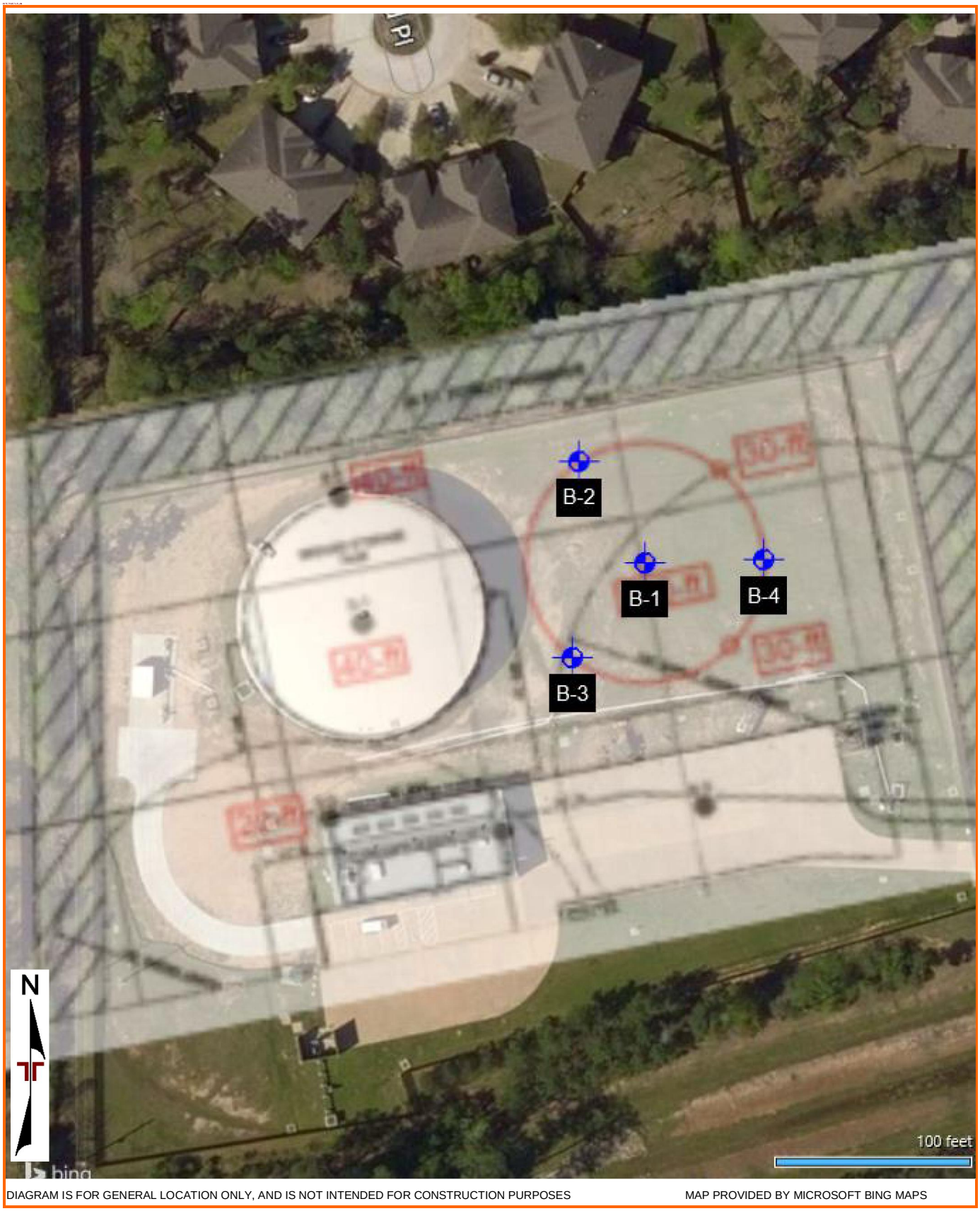


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-4)

BORING LOG NO. B-1

PROJECT: SJRA Water Plant No. 4 GST No. 2

CLIENT: AECOM Technical Services, Inc.
Houston, Texas

SITE: West Branch Crossing Drive
The Woodlands, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		See Exploration Plan Latitude: 30.1854° Longitude: -95.5868° **CLAYEY SAND (SC)**, tan and light brown, medium dense				3.0 (HP)							
						4-5-8 N=13				17		29-13-16	48
			5			2-4-9 N=13							
		6.0				3.0 (HP)	UC	1.90	3.5	16	114		
2		**SANDY FAT CLAY (CH)**, light gray, light brown, and reddish-brown, stiff to hard				4.25 (HP)				16		50-14-36	54
			10			4.25 (HP)							
		15.0				25-39-50 N=89							
3		**CLAYEY SAND (SC)**, light gray, light brown, and reddish-brown, very dense	15										
		20.0				36-43-50/-2"				14		30-13-17	49
4		**SILTY SAND (SM)**, tan, medium dense to very dense	20										
						25-34-41 N=75							
			25										
						26-38-50/-1"							
			30										
						18-28-39 N=67				21			22
			35										
						20-27-30 N=57							
			40										
		45.0				7-11-13 N=24							
		CLAYEY SAND (SC), reddish-brown, tan, and light gray, medium dense	45										
		50.0				12-11-14 N=25				29			30
		SILTY SAND (SM), reddish-brown and tan, medium dense to very dense	50										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Dry Auger: 0' - 10'
Wet Rotary: 10' - 100'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- *While drilling*
- *After 15 Minutes*
- *After 24 hours*

Terracon
11133 Interstate 45 S, Ste T
Conroe, TX

Boring Started: 01-04-2019
Boring Completed: 01-04-2019
Drill Rig: ATV
Driller: Van & Sons
Project No.: 97185112

BORING LOG NO. B-1

PROJECT: SJRA Water Plant No. 4 GST No. 2

CLIENT: AECOM Technical Services, Inc.
Houston, Texas

SITE: West Branch Crossing Drive
The Woodlands, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
4		See Exploration Plan Latitude: 30.1854° Longitude: -95.5868° **SILTY SAND (SM)**, reddish-brown and tan, medium dense to very dense *(continued)*	55			1.0 (HP)							
			60			17-19-19 N=38							
			65			6-10-11 N=21							
			70			17-25-33 N=58							
		70.0											
5		**FAT CLAY (CH)**, light brown and light gray, very stiff	75			12-12-16 N=28							
			80			4.25 (HP)				26		66-20-46	95
			85			4.0 (HP)							
		90.0	90			4.5 (HP)							
		SANDY LEAN CLAY (CL), light brown and light gray, very stiff	95			4.5 (HP)							
		100.0	100			3.25/4.5							
		Boring Terminated at 100 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Dry Auger: 0' - 10'
Wet Rotary: 10' - 100'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- While drilling
- After 15 Minutes
- After 24 hours

Terracon
11133 Interstate 45 S, Ste T
Conroe, TX

Boring Started: 01-04-2019 | Boring Completed: 01-04-2019

Drill Rig: ATV | Driller: Van & Sons

Project No.: 97185112

BORING LOG NO. B-2

PROJECT: SJRA Water Plant No. 4 GST No. 2

CLIENT: AECOM Technical Services, Inc.
Houston, Texas

SITE: West Branch Crossing Drive
The Woodlands, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 30.1855° Longitude: -95.5869° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**CLAYEY SAND (SC)**, tan and light brown, medium dense				4.0 (HP)							
				▼		1.5 (HP)				16		30-12-18	47
		- light brown, light gray, and reddish-brown to 8 feet	5	▽		1.5 (HP)		1.03	4.2	14	120		
						1.0 (HP)				15		25-13-12	41
		8.0		▽		4.25 (HP)				15			54
2		**SANDY LEAN CLAY (CL)**, light brown, light gray, and reddish-brown, very stiff to hard	10			12-20-25 N=45				17		45-16-29	53
			15			21-29-33 N=62							
		20.0				27-39-50/-1"							
4		**SILTY SAND (SM)**, light brown, light gray, and reddish-brown, very dense	20										
			25			27-33-42 N=75				14			23
		30.0											
		Boring Terminated at 30 Feet	30			20-32-39 N=71							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Dry Auger: 0' - 12'
Wet Rotary: 12' - 30'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- ▽ *While drilling*
- ▽ *After 15 Minutes*
- ▼ *After 24 hours*

Terracon
11133 Interstate 45 S, Ste T
Conroe, TX

Boring Started: 01-07-2019 | Boring Completed: 01-07-2019

Drill Rig: ATV | Driller: Van & Sons

Project No.: 97185112

BORING LOG NO. B-3

PROJECT: SJRA Water Plant No. 4 GST No. 2

CLIENT: AECOM Technical Services, Inc.
Houston, Texas

SITE: West Branch Crossing Drive
The Woodlands, Texas

LOCATION See Exploration Plan

Latitude: 30.1852° Longitude: -95.5869°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**CLAYEY SAND (SC)**, tan and light brown, loose to medium dense				2.5 (HP)							
				▼		7-7-7 N=14				15		22-12-10	46
			5	▽		1.25 (HP)							
						0.75 (HP)				14		30-11-19	45
2		8.0 **SANDY LEAN CLAY (CL)**, light brown, light gray, and reddish-brown, very stiff				3.25 (HP)							
			10			4.25 (HP)							
		12.0 **CLAYEY SAND (SC)**, light brown and light gray, dense to very dense		▽									
						33-47-50 N=97				15		41-13-28	41
3			15										
			20			26-29-29 N=58							
		25.0				14-21-20 N=41				18			44
4		**SILTY SAND (SM)**, tan, dense	25										
		30.0				14-14-16 N=30							
		Boring Terminated at 30 Feet	30										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Dry Auger: 0' - 15'
Wet Rotary: 15' - 30'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- ▽ *While drilling*
- ▽ *After 15 Minutes*
- ▼ *After 24 hours*

Terracon
11133 Interstate 45 S, Ste T
Conroe, TX

Boring Started: 01-07-2019 | Boring Completed: 01-07-2019

Drill Rig: ATV | Driller: Van & Sons

Project No.: 97185112

BORING LOG NO. B-4

PROJECT: SJRA Water Plant No. 4 GST No. 2

CLIENT: AECOM Technical Services, Inc.
Houston, Texas

SITE: West Branch Crossing Drive
The Woodlands, Texas

LOCATION See Exploration Plan

Latitude: 30.1854° Longitude: -95.5866°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**CLAYEY SAND (SC)**, reddish-brown and dark tan, loose to very dense - tan and light brown from 2 to 4 feet - light gray, light brown, and reddish-brown from 4 to 15 feet				1.25 (HP)							
						1.0 (HP)				16		29-16-13	44
			5			0.75 (HP)				15		32-12-20	40
						2.5 (HP)	UC	1.16	3	15	115		
						4.25 (HP)						41-14-27	
			10			15-24-31 N=55							
		15.0				36-50/3"				12		35-14-21	23
4		**SILTY SAND (SM)**, light brown and reddish-brown, very dense	15										
						46-50/5"							
			20										
			25			20-22-31 N=53							
		30.0				24-28-40 N=68							
		Boring Terminated at 30 Feet	30										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Dry Auger: 0' - 12'
Wet Rotary: 12' - 30'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- *While drilling*
- *After 15 Minutes*
- *After 24 hours*

Terracon
11133 Interstate 45 S, Ste T
Conroe, TX

Boring Started: 01-07-2019 | Boring Completed: 01-07-2019

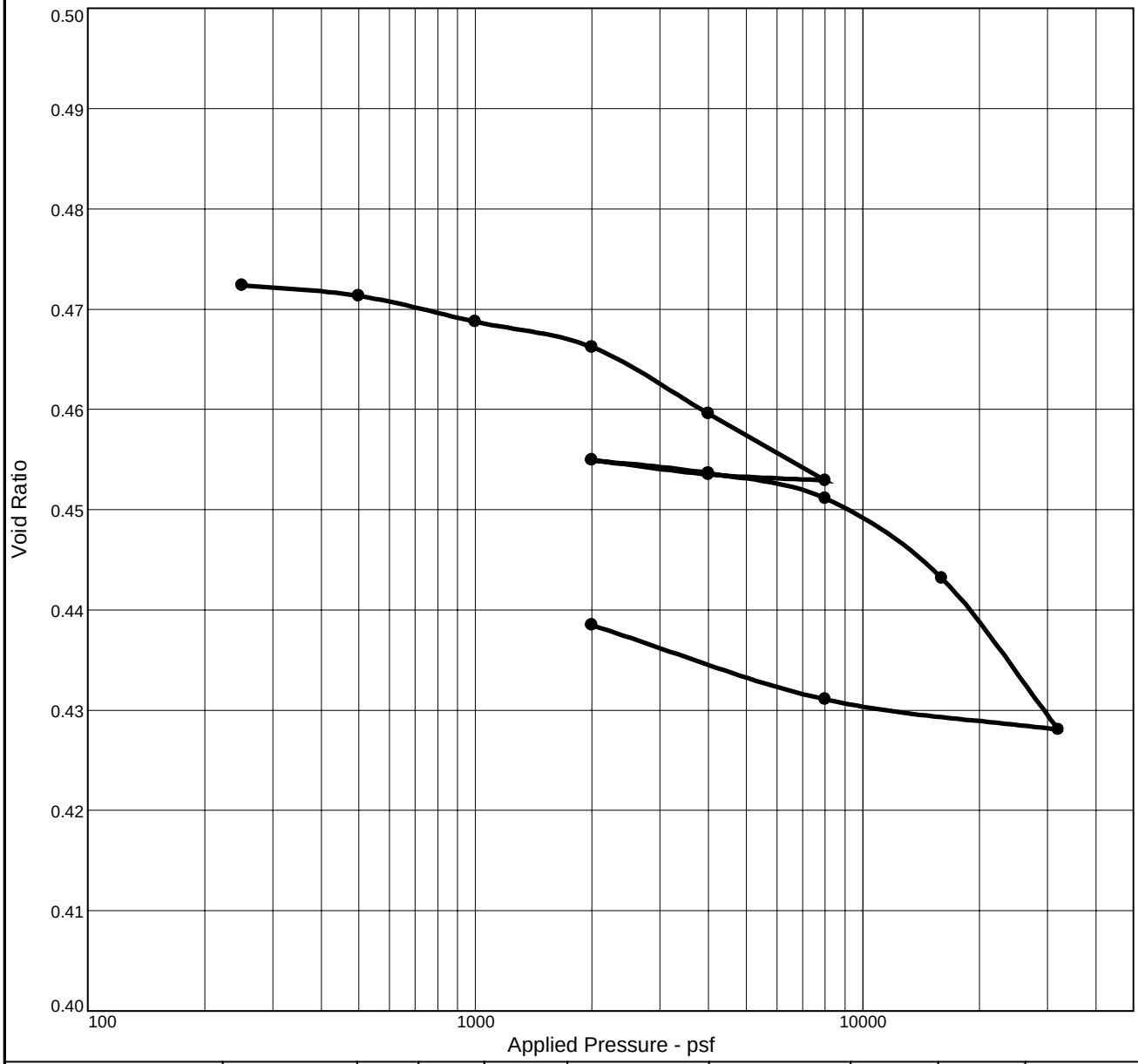
Drill Rig: ATV | Driller: Van & Sons

Project No.: 97185112

SUPPORTING INFORMATION

Contents:

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
87.4 %	15.3 %	114.5			2.70		4415	0.05	0.01	0.472

MATERIAL DESCRIPTION	USCS	AASHTO
Reddish-Brown Sandy Fat Clay		

Project No. 97185112 **Client:**

Project: SJRA Water Plant No. 4 GST No. 2

Location: B-1 **Depth:** 10-12 ft.

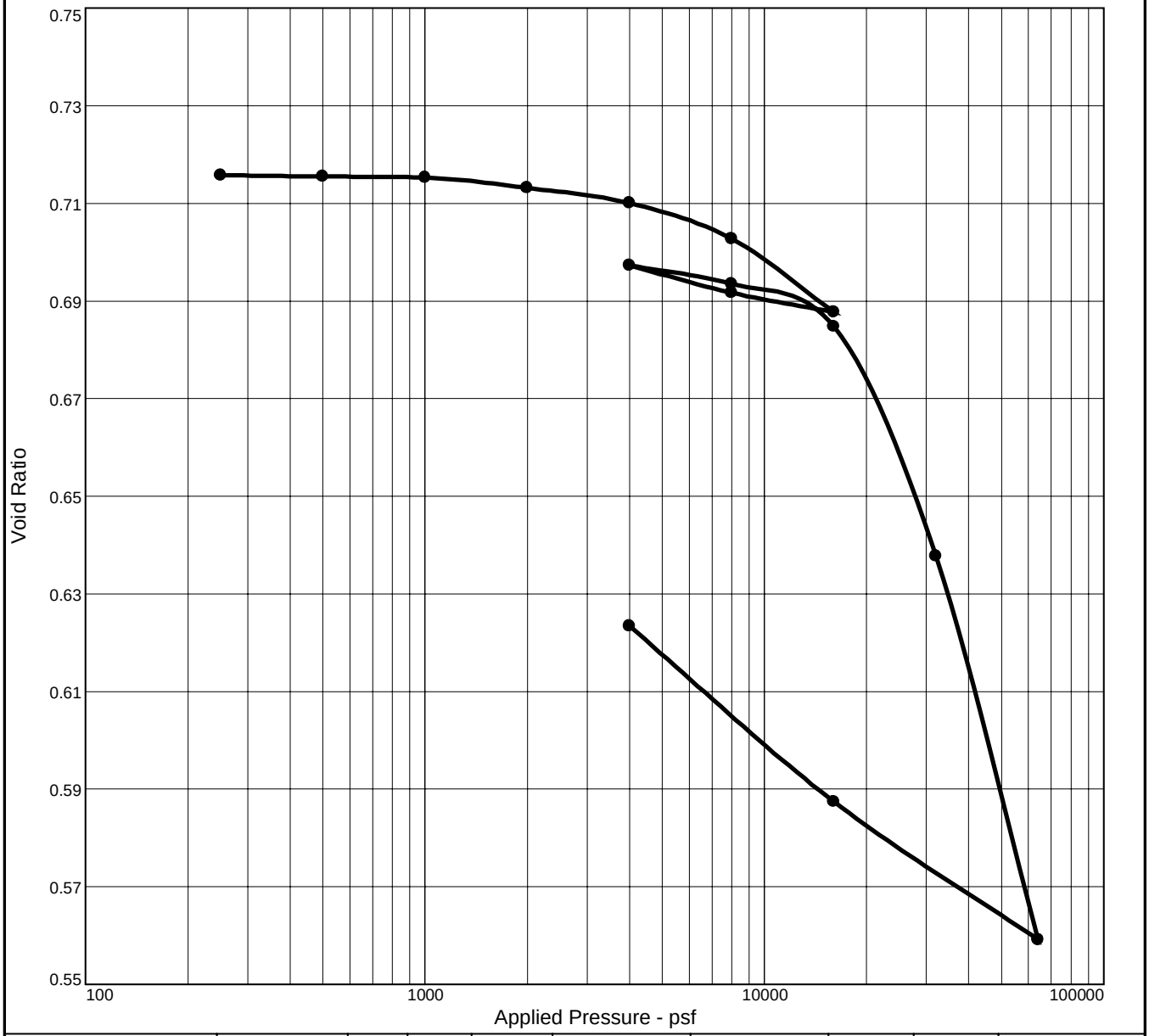
Terracon Consultants, Inc.

Houston, TX

Remarks:

ASTM D2435
Specific gravity assumed

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
94.8 %	24.7 %	100.1			2.75		18240	0.26	0.05	0.716

MATERIAL DESCRIPTION	USCS	AASHTO
Light Brown and Light Gray Fat Clay		

Project No. 97185112 **Client:**

Project: SJRA Water Plant No. 4 GST No. 2

Location: B-1 **Depth:** 83-85 ft.

Terracon Consultants, Inc.

Houston, TX

Remarks:

ASTM D2435
Specific gravity assumed

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

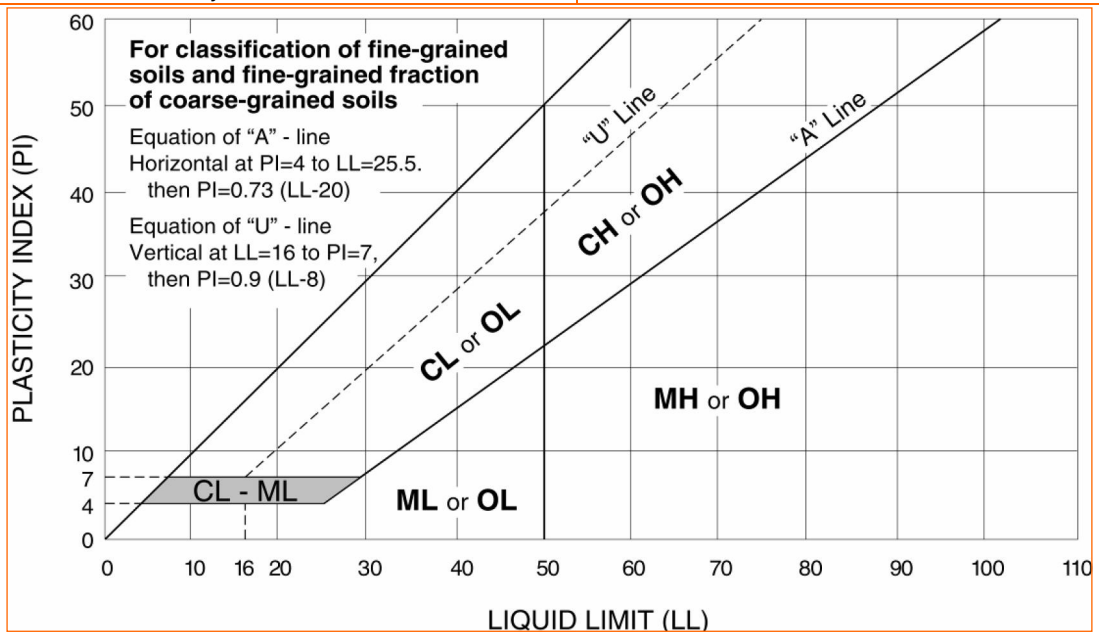
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009
Technical Manual for Design and Construction of Road Tunnels – Civil Elements

DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)	
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [1]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) [1]

RQD, as a percentage	Diagnostic description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

Joint Openness Descriptors

Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

SECTION 00 31 32.10

TRENCH SAFETY GEOTECHNICAL INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. Trench Safety Geotechnical Information: Geotechnical Information obtained for use in design of the trench safety system is included as an attachment to this document.

B. A hard copy of each report will be made available as information only to Offerors at:

Elton Brock, MBA, CTPM, CTCM, CPSM

San Jacinto River Authority

Purchasing Department

1577 Dam Site Road

Conroe, TX 77304

Report No. [ ] on [subject], prepared by [firm name], titled [name].

1.2 MEASUREMENT AND PAYMENT (NOT USED)

1.3 SUBMITTALS (NOT USED)

PART 2 - NOT USED

PART 3 - NOT USED

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SECTION 00 41 00.02

PROPOSAL FORM

To: **The San Jacinto River Authority**
1577 Dam Site Road
G & A Building, 3rd Floor Receptionist
Conroe, Texas 77304

Project: Ground Storage Tank No. 2 at Water Plant No. 4
CSP No.: CSP No. 19-0047
Project No.: SJRA Project No. WDPR009.1003.2H001
Offeror: _____
(Print or type full name of proprietorship, partnership, corporation, or joint venture)

1.0 OFFER

A. Total Proposal Price: The undersigned Offeror proposes and agrees, if this Proposal is accepted, to enter into an Agreement with Owner in the form included in the Contract Documents to perform all Work as specified or indicated in Contract Documents for the Contract Amount indicated in this Proposal or as modified by a Change Order or Change Directive.

B. Proposal Security: Included with the Proposal is a Proposal Security in the amount of 5 percent of the Total Proposal Price subject to terms described in Specification Section 00 21 13.02 – Instructions to Offerors.

C. Period for Proposal Acceptance: Offeror accepts all of the terms and conditions of the Request for Proposals and Instructions to Offerors, including without limitation those dealing with the disposition of required Bonds. This offer shall remain open to acceptance and is irrevocable for 90 days after Proposal Date (opening). That period may be extended by mutual written agreement of the SJRA and Offeror.

D. Liquidated Damages: Offeror accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.

E. Addenda: Offeror hereby acknowledges it has received, examined and carefully studied all Addenda and all Addenda have been considered and all related costs are included in the Total Proposal Price. Offeror hereby acknowledges receipt of the following Addenda:

Addendum No.	Addendum Date	Signature Acknowledging Receipt

F. Proposal Supplements: The following documents shall be provided with the proposal:

- Offeror's Statement of Qualifications (SOQ).
- Completed Certification of Proposal
- Completed Felony Conviction Notice Form
- Form of Business 00 45 20
- Proposal Security (Offeror's Bond 00 43 13)
- Resolution of Contractor 00 45 43
- One (1) flash drive with a Completed Proposal with Original signatures, Statement of Qualifications (SOQ) and a full set of Financials.
- Others as listed: _____

G. Conflict of Interest Forms:

Conflict of Interest Forms (Form CIQ) shall be submitted under separate cover and not be included in the sealed proposal.

2.0 CONTRACT TIME

A. If Proposal is accepted, Contractor shall achieve Substantial Completion of the Work within 365 calendar days after the date when the Contract Time Requirements commence to run as provided in Article 2.3 of the General Conditions, and Contractor shall achieve Final Completion within 30 calendar days after the date required for Substantial Completion of the Work, subject to adjustments of Contract Time Requirements as provided in the Contract.

3.0 OFFEROR REPRESENTATIONS

A. Offeror is familiar with and is satisfied as to all federal, state and local laws and regulations that may affect cost, progress, performance and furnishing of the Work.

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

C. Offeror has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site and (2) Hazardous Conditions identified in reports and

drawings provided to Offeror or available for Offeror review. Offeror understands that neither Owner nor Principal Architect/Engineer is responsible for the accuracy of these documents and they are not part of the Contract Documents.

D. Offeror has obtained and carefully studied all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions including surface, subsurface and Underground Improvements at or contiguous to the Site which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Offeror, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents to be employed by Offeror, and safety precautions and programs incident thereto.

E. Offeror does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Proposal for performance of the Work at the Contract Amount proposed, within the Contract Time Requirements proposed and in accordance with the terms and conditions of the Contract Documents. Offeror shall make no claims against the Owner and shall bear all risk of losses, if any, resulting on account of the amount and character of the Work, or because the conditions under which the Work must be done vary or differ from conditions or information contained in the Contract Documents, or are different from what were estimated or anticipated by it.

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

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

H. Offeror has given Owner or Principal Architect/Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Offeror has discovered in the Contract Documents, and the written resolution thereof by Principal Architect/Engineer are acceptable to Offeror.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Proposal is submitted.

J. Laws to be Observed: In the performance of the Contract, the Contractor must comply with all applicable federal, state, and local laws, ordinances and regulations, including but not limited to laws concerned with labor, safety, minimum wages, and the environment. The Contractor will make himself familiar with and shall at all times observe and comply with all federal, state, and local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall Indemnify and save harmless the Owner, and its representatives against any claim arising from violation of any such law, ordinance or regulation by himself or by his subcontractor or by his employees.

K. Review by Owner:

(a) The Owner and authorized representatives, agents and employees of the Owner shall at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, books and accounting records, subcontracts, purchase orders, and all other relevant data, documents and records pertaining to this Contract.

L. Offeror will submit written evidence of its authority to do business in the state where the Project is located with its Proposal, form 00 45 20 – Form of Business.

M. Offeror further represents that this Proposal is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Offeror has not directly or indirectly induced or solicited any other Offeror to submit a false or sham Proposal; Offeror has not solicited or induced any individual or entity to refrain from submitting a Proposal; and Offeror has not sought by collusion to obtain for itself any advantage over any other Offeror or over Owner.

4.0 DEFINED TERMS:

A. Terms defined in this Proposal, if any, shall be for the purposes of this Proposal. Terms with initial capital letters not defined herein shall have the meaning assigned to them in the other Bid Documents or Contract Documents.

5.0 TOTAL PROPOSAL PRICE HAS BEEN CALCULATED BY OFFEROR, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

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SAN JACINTO RIVER AUTHORITY
Ground Storage Tank No. 2 at Water Plant No. 4
PROPOSAL FORM

A. BASE ITEMS

Item No.	Spec. Reference	Description	Qty.	Unit	Unit Price (this column controls)	Proposal Price
1	33 16 14	2 Million Gallon Prestressed Concrete Ground Storage Tank and foundation No. 2 at Water Plant 4 and all appurtenances, as shown in Contract Documents, Complete in Place	1	LS		
2	40 05 13	Yard Piping (Up to Flange at Tank) Including Pipe, Valves, Fittings, and Appurtenances, Complete in Place.	1	LS		
3	Div 31 and 32	Site Work Including Fence Removal and new Fencing, Grading, Erosion, Storm Water Pollution Prevention, and Site Restoration Per Specification Section 01 74 23 – Restoration of Site, Complete in Place.	1	LS		
4	Div 26 and 40	Field Instruments, Electrical Devices, Heat Trace, Conduits and Fittings with Associated Appurtenances, Complete in Place.	1	LS		
5	31 41 00	Trench Safety System for Water and Storm Sewer Construction, All Depths, Complete in Place.	480	LF		
6	31 41 00	Design of Trench Excavation and Shoring Safety Plan for Water and Storm Sewer Construction, All Depths, Complete in Place.	1	LS		
7	01 32 36.01	Quarterly Aerial Photo	1	LS		
A. Total Base Items:					**$_____**	

B. EXTRA UNIT PRICE ITEMS						
Item No.	Spec. Reference	Description	Qty.	Unit	Unit Price (this column controls)	Proposal Price
1	32 92 13	Extra Hydro-Mulching , When Authorized by Owner, Complete in Place	0.5	Acres	$2,000.00[1]	
2	31 21 33 31 23 00 33 16 14	Extra Structural Excavation, When Authorized by Owner, Complete in Place	400	Cubic Yard	$20.00[1]	
3	31 21 33	Extra Compacted Sand, When Authorized by Owner, Complete in Place	5	Cubic Yard	$15.00[1]	
4	31 21 33	Extra Compacted Well Graded Crushed Stone, When Authorized by Owner, Complete in Place	5	Cubic Yard	$50.00[1]	
5	31 21 33	Extra Compacted Pea Gravel, When Authorized by Owner, Complete in Place	5	Cubic Yard	$50.00[1]	
6	31 21 33 33 16 14	Extra Select Fill, When Authorized by Owner, Complete in Place	400	Cubic Yard	$15.00[1]	
7	31 21 33 33 16 14	Extra Chemically Treated Select Fill, When Authorized by Owner, Complete in Place	400	Cubic Yard	$18.00[1]	
8	03 21 00	Extra Reinforcing Steel, When Authorized by Owner, Complete in Place	500	LB	$1.00[1]	
B. Total Extra Unit Price Items:					**$**_____	

Table B Footnotes:
(1) Minimum Unit Price determined prior to Proposal. Can be increased by the Offeror by crossing out the Minimum and noting revised Unit Price on the line above.

C. CASH ALLOWANCES			
Item No.	Spec. Reference	Description	Cash Allowance [1]
		N/A	
C. Total Cash Allowances:			**$0**

Table C Footnotes:
(1) Fixed price determined prior to Proposal. Cannot be adjusted by Offeror.

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D. ALTERNATE ITEMS						
Item No.	Spec. Reference	Description	Qty.	Unit	Unit Price (this column controls)	Proposal Price
1	33 16 15	Adder for Ground Storage Tank No. 1 cleaning and recoating. Add 30 Calendar Days to Contract Duration Upon Approval.	1	LS		
2	Drawings	Adder for Ground Storage Tank No. 1 Radar Level Device Installation including all electrical and instrumentation improvements to reconnect to Woodlands PLC. Add 15 Calendar Days to Contract Duration Upon Approval.	1	LS		
D. Total Alternate Items:					**$**_____	

Note: Alternate Items **shall not** be included in Total Proposal Price.

E. TOTAL PROPOSAL PRICE:
(Add Totals for Items A, B, and C ONLY) **$**_____

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6.0 SIGNATURES: By signing this Document, I agree that I have received and reviewed all Bid Documents, Contract Documents and Addenda and considered all costs associated with the Bid Documents, Contract Documents and Addenda in calculating the Total Proposal Price.

Offeror:_____
(Print or type full name of your proprietorship, partnership, corporation, or joint venture.*)

** By:_____
Signature Date

Name:_____
(Print or type name) Title

Doing Business as: _____

Business Address:_____
(Mailing)

_____
(Street, if different)

Telephone and Fax Number:_____
(Print or type numbers)

* If Proposal is a joint venture, add additional Proposal Form signature sheets for each member of the joint venture.

** Offeror certifies that the only person or parties interested in this offer as principals are those named above. Offeror has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive Proposing.

Note: This document constitutes a Governmental record, as defined by § 37.01 of the Texas Penal Code. Submission of a false Governmental record is a criminal offense as provided in § 37.10 of the Texas Penal Code.

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7.0 CERTIFICATION OF PROPOSAL

The undersigned affirms that they are duly authorized to execute this Proposal, that this Proposal has not been prepared in collusion with any other Offeror, and that the contents of this Proposal have not been communicated to any other Offeror prior to the official opening of this Proposal. Additionally, the undersigned affirms that the Offeror is willing to sign the attached SJRA Agreement (if applicable).

Signed By: _____ Title: _____

Typed Name: _____ Company Name: _____

Phone No.: _____ Fax No.: _____

Email: _____

Proposal Address: _____
P.O. Box or Street City State Zip

Order Address: _____
P.O. Box or Street City State Zip

Remit to Address: _____
P.O. Box or Street City State Zip

Federal Tax ID No.: _____

Date: _____

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FELONY CONVICTION NOTIFICATION

Any person and/or business entity that enters into a contract with the San Jacinto River Authority must give advance notice to the SJRA if any employee or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. The notice must also describe the role that the employee, owner, or operator will perform in executing the contract. The SJRA may require substitution of employees in the performance of the contract.

The SJRA may terminate a contract with a person or business entity if the SJRA determines that the person or business entity failed to give notice as required by this clause, misrepresented the conduct resulting in the conviction, or failed to substitute personnel at SJRA's request.

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

Signature of Authorized Company Official Date

Authorized Company Official's Name and Title (Printed)

Firm Name

A. My firm is not owned or operated by anyone who has been convicted of a felony nor does it have any employees who have been convicted of a felony:

Signature of Authorized Company Official Date

B. My firm has employee(s) or is owned or operated by the following individual(s) who has/have been convicted of a felony:

Signature of Authorized Company Official Date

C. Provide a general description of the conduct resulting in the conviction of a felony.

Signature of Authorized Company Official Date

D. Describe the role that the person(s) convicted of a felony will play in the performance of the contract.

Signature of Authorized Company Official Date

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SECTION 00 43 13

OFFEROR'S BOND

THAT WE, _____, as Principal,
(Offeror)
("Offeror"), and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the San Jacinto River Authority, a political sub-division of the State of Texas, in the sum of _____ Dollars ($_____) (an amount equal to five (5) percent of the Total Bid Price, including Cash Allowances and Alternates, if any, for the payment of which sum, well and truly to be made to the San Jacinto River Authority and its successors, the Offeror and Surety do bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Offeror has submitted on or about this day a proposal offering to perform the following:

_____

_____
(Project Name, Location and Number)
in accordance with the Drawings, Specifications, and terms and conditions related thereto to which reference is hereby made.

NOW, THEREFORE, if the Offeror's offer as stated in the Section 00 41 00.02 – Proposal Form is accepted by the San Jacinto River Authority, and the Offeror executes and returns to the San Jacinto River Authority Section 00 52 00 – Standard Form of Agreement between Owner and Contractor, required by the San Jacinto River Authority, on the forms prepared by the San Jacinto River Authority, for the Work and also executes and returns the same number of the Performance, Payment and Maintenance Bonds (such bonds to be executed by a Corporate Surety authorized by the State Board of Insurance to conduct insurance business in the State of Texas, and having an underwriting limitation in at least the amount of the bond) and other submittals as required, in connection with the Work, within the Contract Time, then this obligation shall become null and void; otherwise it is to remain in full force and effect.

If Offeror is unable to or fails to perform the obligations undertaken herein, the undersigned Offeror and Surety shall be liable to the San Jacinto River Authority for the full amount of this obligation which is hereby acknowledged as the amount of damages which will be suffered by the San Jacinto River Authority on account of the failure of such Offeror to perform such obligations, the actual amount of such damages being difficult to ascertain.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving Party may hereafter prescribe by written notice to the sending Party.

IN WITNESS THEREOF, the Offeror and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

_____
(Name of Offeror)

By:_____
Name:
Title:

By:_____
Name:
Title:
Date:

ATTEST/SURETY WITNESS: (SEAL)

(Full Name of Surety)

(Address of Surety for Notice)

(Telephone Number of Surety)

By:_____
Name:
Title:
Date:

By:_____
Name:
Title:
Date:

END OF SECTION

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SECTION 00 45 10

CONFLICT OF INTEREST QUESTIONNAIRE

Local Government Code Chapter 176 requires Offerors with the San Jacinto River Authority ("SJRA") to file a Conflict of Interest Questionnaire with the SJRA.

The Conflict of Interest Questionnaire is available for downloading on the Texas Ethics Commission's website at: http://www.ethics.state.tx.us/forms/CIQ.pdf. The completed Conflict of Interest Questionnaire will be posted on the SJRA website. Also you will find a list of the SJRA Local Government Officers on the SJRA website.

For your convenience the CIQ form is attached as part of this document. Although the SJRA has provided this document for the Offeror's convenience, it is the Offeror's responsibility to submit the latest version of the CIQ form as promulgated by the Texas Ethics Commission.

The Failure of any Offeror to comply with this law is a Class C misdemeanor.

END OF SECTION

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SECTION 00 45 20
FORM OF BUSINESS

Please mark the box describing your firm's form of business, fill in the requested information, and include the relevant attachments.

[ ] Corporation
Corporate Name: _____
State of Incorporation: _____
Mailing Address: _____
Type of Corporation: _____

Certificate of Assumed Name, if operating under a name different than that on the corporate charter (the Certificate must have been issued within the past 10 years to be valid)

*Certificate of Good Standing

*Certificate of Existence (if non-Texas corporation, Certificate of Authority)

[ ] Partnership/Joint Venture
Partnership/Joint Venture Name: _____
Mailing Address: _____
Type of Partnership/Joint Venture: _____

Copy of the Partnership or Joint Venture Agreement, **or**
Affidavit with the name of the partnership or joint venture, the names of the individual partners or participants in the joint venture, and a statement that the partnership or joint venture is in existence

Certificate of Assumed Name, (the Certificate must have been issued within the past 10 years to be valid)

If firm is a limited partnership, the Certificate of Limited Partnership

If any partner or joint venturer is a corporation, the above information relating to corporation must be included as to each sum partner or joint venturer.

[ ] Sole Proprietorship

Name: _____
Mailing Address: _____

Certificate of Assumed Name, if operating under a name different than that of the sole proprietor (the Certificate must have been issued within the past 10 years to be valid)

** Must be furnished upon request of the SJRA and must be less than 90 days old.*

END OF SECTION

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SECTION 00 45 43

RESOLUTION OF CONTRACTOR

_____ ("Contractor"),

(Name of Contractor, e.g., "Biz. Inc.", "Biz LLP")

is a _____,

(Type of Organization, e.g.: Corporation, Limited Partnership, Limited Liability Partnership, Limited Liability Company, etc.)

which is bound by acts of _____,

(Name and Form of Governing Entity, e.g., "Biz Inc. Board of Directors", "Bill Smith, GP", etc.)

("Governing Entity").

On the day of _____, 20___, the Governing Entity resolved, in accordance with all documents, rules, and laws applicable to the Contractor, that

_____, is authorized to act as the

(Contractor's Representative)

Contractor's Representative in all business transactions (initial one) ____ conducted in the State of Texas OR ____ related to this Contract; and

The Governing Entity warrants that the above resolution (a) was entered into without dissent or reservation by the Governing Entity, (b) has not been rescinded or amended, and (c) is now in full force and effect; and

PART 1 - IN AUTHENTICATION OF THE ADOPTION OF THIS RESOLUTION, I SUBSCRIBE MY NAME ON THIS ____ DAY OF _____, 20___.

_____ _____

(Authorized Signature for Governing Entity) (Print or Type Name and Title of Authorized Signatory)

SWORN AND SUBSCRIBED before me on _____

Date

_____

Notary Public in and for the State of Texas

My Commission Expires:_____ _____

Expiration Date Print or Type Name of Notary Public

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SECTION 00 52 00

STANDARD FORM OF AGREEMENT

BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT is dated as of _____ by and between **the San Jacinto River Authority** (hereinafter called "**OWNER"**) and _____ (hereinafter called "**CONTRACTOR"**).

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

Article 1. WORK.

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

Construction of **Ground Storage Tank No. 2 at Water Plant No. 4**

Article 2. PRINCIPAL ARCHITECT/ENGINEER AND OWNER'S REPRESENTATIVE.

The project has been designed by AECOM Technical Services, Inc., 19219 Katy Freeway, Houston, TX 77094, who is hereinafter called "PRINCIPAL ARCHITECT/ENGINEER" and who assumes all duties and responsibilities and has the rights and authority assigned to PRINCIPAL ARCHITECT/ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents. OWNER'S Representative shall be AECOM Technical Services, Inc.

Article 3. CONTRACT TIMES.

The Work will be Substantially Completed within 365 **calendar days** after the date when the Contract Time Requirements commence to run as provided in Article 2.3 of the General Conditions, and CONTRACTOR shall achieve Final Completion within 30 **calendar days** of the date required for Substantial Completion.

OWNER and CONTRACTOR recognize that **time is of the essence** of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in the above paragraph, 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 the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) and, as a reasonable estimate of such damages, CONTRACTOR shall pay OWNER five hundred Dollars ($500.00) for each and every day of delay in CONTRACTOR achieving Substantial Completion of the Work and readiness for final payment beyond the times specified in the above paragraph. OWNER shall have the option of deducting the amount of any liquidated damages from any monies that may be owed to CONTRACTOR or to recover such amount from the CONTRACTOR or its sureties, at CONTRACTOR'S expense.

Article 4. CONTRACT AMOUNT.

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to the Proposal and any subsequent Change Orders and Change Directives thereto.

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'S Representative or PRINCIPAL ARCHITECT/ENGINEER as determined by the OWNER and as provided in the General Conditions and Supplemental Conditions, if any.

OWNER shall make progress payments on account of the Contract Amount on the basis of CONTRACTOR'S Applications for Payment as recommended by OWNER'S Representative or PRINCIPAL ARCHITECT/ENGINEER and in conformance with the procedures described in the General Conditions. All such payments will be measured by the schedule of values established in Article 2.4.2.07 of the General Conditions (and on the number of units of each Unit Price item completed, if unit price contract). Upon final completion and acceptance of the Work in accordance with Article 14.11 of the General Conditions, OWNER shall pay the remainder of the Contract Amount as recommended by OWNER'S Representative as provided in said Article 14.11.

In accordance with Water Code Section 49.276 – PAYMENT FOR CONSTRUCTION WORK, Subsection (d), in making progress payments, 10 percent of the estimated amount shall be retained until final completion and acceptance of the contract work. However, if the OWNER at any time after 50 percent of the contract work has been completed finds that satisfactory progress is being made, it may authorize any of the remaining progress payments to be made in full. The OWNER shall not be obligated to pay any interest on the 10 percent retainage held on the first 50 percent of contract work completed. With regards to the retainage on the remaining 50 percent of the contract work completed, the OWNER shall pay interest on such retainage from the date the retainage is withheld to the date of payment to the CONTRACTOR. The interest rate to be paid by the OWNER'S depository bank on interest bearing accounts of similar amounts during the period of time interest accrues as provided herein.

Article 6. CONTRACTOR'S REPRESENTATIONS.

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in Article 7) and the other related data identified in the Proposal Documents.

CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work.

CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Legal Requirements that may affect cost, progress, performance, and furnishing of the Work.

CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site. CONTRACTOR acknowledges that such reports and drawings are not Contract Documents, are not warranted or represented in any manner by Owner to accurately show the conditions at the Site, and may not be complete for CONTRACTOR'S purposes. CONTRACTOR acknowledges that OWNER and PRINCIPAL ARCHITECT/ENGINEER do not assume responsibility for the accuracy or completeness of the information and data shown or indicated in the Contract Documents with respect to subsurface conditions or Underground Facilities at or contiguous to the Site or CONTRACTOR'S interpretation of such information and data. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary research, examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of the Work at the Contract Amount, within the Contract Time Requirements and in accordance with the other terms and conditions of the Contract Documents.

CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Contract Documents.

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

CONTRACTOR has given PRINCIPAL ARCHITECT/ENGINEER through the OWNER or OWNER'S Representative written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by PRINCIPAL ARCHITECT/ENGINEER is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 7. CONTRACT DOCUMENTS.

The Contract Documents are comprised of the following:

1. This Agreement.
2. Exhibits to this Agreement:
3. Performance, Payment, Maintenance, and Surface Correction Bonds.
4. General Conditions of the Contract.
5. Supplemental Conditions, if any.
6. Specifications 01 10 00 through 40 99 00, prepared by AECOM Technical Services and sealed on July 12, 2019.
7. Drawings.
8. Addenda:

Addendum No.	Addendum Date	Signature Acknowledging Receipt

9. CONTRACTOR'S Proposal Form pursuant to Competitive Sealed Proposal No. 15-053.
10. Prevailing Wage Rates.
11. The following which may be delivered or issued after the Effective Date of the Agreement and are not attached thereto: All written Change Orders or Change Directives pursuant to Article 3.3 of the General Conditions.

There are no Contract Documents other than those listed in this Article. The Contract Documents may only be amended, modified, or supplemented as provided in Article 3.3 of the General Conditions.

Article 8. INDEMNITY PROVISIONS.

THE GENERAL, SPECIAL, AND SUPPLEMENTAL CONDITIONS, IF ANY, INCORPORATED INTO THIS AGREEMENT CONTAIN PROVISIONS THAT MAY RELIEVE ONE PARTY FOR RESPONSIBILITY IT WOULD OTHERWISE HAVE UNDER THE LAW FOR DAMAGES OR OTHER LIABILITY ARISING OUT OF THE WORK.

EACH OF THE PARTIES HERETO SPECIFICALLY AGREES THAT IT HAS A DUTY TO READ THIS AGREEMENT, THE GENERAL, SPECIAL, AND SUPPLEMENTAL CONDITIONS, IF ANY, AND ALL OTHER CONTRACT DOCUMENTS AND AGREES THAT IT IS CHARGED WITH NOTICE AND KNOWLEDGE OF THE TERMS OF THIS AGREEMENT AND ALL CONTRACT DOCUMENTS; THAT IT HAS IN FACT READ THIS AGREEMENT AND ALL CONTRACT DOCUMENTS AND IS FULLY INFORMED AND HAS FULL NOTICE AND KNOWLEDGE OF THE TERMS, CONDITIONS AND EFFECTS OF THIS AGREEMENT; THAT IT HAS HAD THE OPPORTUNITY TO BE REPRESENTED BY INDEPENDENT LEGAL COUNSEL OF ITS CHOICE PRECEDING ITS EXECUTION OF THIS AGREEMENT AND HAS RECEIVED OR VOLUNTARILY CHOSEN NOT TO RECEIVE THE ADVICE OF ITS ATTORNEY IN ENTERING INTO THIS AGREEMENT; AND THAT IT RECOGNIZES THAT CERTAIN TERMS OF THIS AGREEMENT AND THE CONTRACT DOCUMENTS RESULT IN ONE PARTY ASSUMING THE LIABILITY INHERENT IN SOME ASPECTS OF THE TRANSACTION AND RELIEVING THE OTHER PARTY OF ITS RESPONSIBILITY FOR SUCH LIABILITY. EACH PARTY HERETO AGREES AND COVENANTS THAT IT WILL NOT CONTEST THE VALIDITY OR ENFORCEMENT OF ANY EXCULPATORY PROVISION OF THIS AGREEMENT ON THE BASIS THAT THE PARTY HAD NO NOTICE OR KNOWLEDGE OF SUCH PROVISION OR THAT THE PROVISION IS NOT "CONSPICUOUS".

Article 9. MISCELLANEOUS.

Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

CONTRACTOR certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Article 9:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the proposal process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the proposal process or the execution of the Contract to the detriment of OWNER, (b) to establish Proposal or Contract prices at artificial noncompetitive levels, or (c) to deprive OWNER of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Proposers, with or without the knowledge of OWNER, a purpose of which is to establish Proposal prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the proposal process or affect the execution of the Contract.

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

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

Any provision or part thereof of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions or parts thereof shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision or part thereof.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in duplicate. One counterpart has been delivered to OWNER and one counterpart has been delivered to CONTRACTOR. All portions of the Contract Documents have been signed, initialed, or otherwise clearly identified by OWNER and CONTRACTOR or identified by PRINCIPAL ARCHITECT/ENGINEER on their behalf.

This Agreement will be effective on _____, (which is the effective date of the Agreement).

OWNER: San Jacinto River Authority

By: _____

Attest: _____

Address for giving notices:

CONTRACTOR:

By: _____

(CORPORATE SEAL)

Attest: _____

Address for giving notices:

License No. _____

Agent for service of process: _____

END OF SECTION

SECTION 00 60 20

MONTHLY SUBCONTRACTOR PAYMENT REPORTING FORM

Legal Project Name: _____

SJRA Project No.: _____

Contractor's Company Name: _____

Address: _____

CERTIFICATION

BEFORE ME, the undersigned authority, on this day personally appeared _____, _____ [title] of _____ [Contractor], and, upon oath, after first being duly sworn, deposed and stated:

"My name is _____ and I am the _____ [title] of _____ [Contractor], hereinafter referred to in this affidavit as "Contractor". The facts set forth herein are within my personal knowledge and are true and correct, and I am competent and authorized to make this affidavit on behalf of Contractor.

Contractor has paid each and all of its Subcontractors, laborers, suppliers, vendors and materialmen, if any, in full, for all work, labor, materials, equipment and/or services provided to Contractor for incorporation in or use or work on the Project, through the period ending _____ *[end date of last paid pay period]* (the "Pay Period"), except to the extent of any contractual retainage withheld by Contractor, or other amounts withheld by Contractor for defective work or otherwise in accordance with its contract with any Subcontractor, laborer, supplier, vendor or materialman and identified in the Payment Notifications described below.

Contractor acknowledges that SJRA is relying on Contractor's statements and representations herein in making payment for Work performed on the Project. Contractor agrees to indemnify SJRA from any and all loss, cost or expense, including but not limited to attorneys' fees incurred, resulting from any false or incorrect information contained in this affidavit."

EXCEPTION: Contractor sent Payment Notifications to the following Subcontractors, laborers, suppliers, vendors or materialmen explaining why Contractor withheld payment, copies of which are attached:

Name: _____	Name: _____
Street Address: _____	Street Address: _____
City, State, and Zip Code: _____	City, State, and Zip Code: _____
Amount of Payment Withheld: _____	Amount of Payment Withheld: _____
Date Payment First Withheld: _____	Date Payment First Withheld: _____
Description of Good Faith Reason: _____	Description of Good Faith Reason: _____
_____	_____

(Signature of Contractor's Representative) (Print or Type Name of Contractor's Representative)

SWORN TO AND SUBSCRIBED before me on: _____
Date

_____
Notary Public in and for the State of Texas

My Commission Expires: _____ _____
Expiration Date Print or Type name of Notary Public

END OF SECTION

SECTION 00 61 13.13

PERFORMANCE BOND

STATE OF TEXAS

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS: That _____(Contractor) of the City of _____, County of _____, and State of Texas, as Principal, and _____ authorized under the Laws of the State of Texas to act as surety on bonds for principals, as Surety, are held and firmly bound unto San Jacinto River Authority (Owner), in the penal sum of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Owner, dated the _____ day of _____, 20__, for construction of: _____ _____(the "Contract"), which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform said Contract and shall in all respects duly and faithfully observe and perform all and singular the covenants, conditions and agreements in and by said Contract agreed and covenanted by the Principal to be observed and performed, within the time provided therein and any extensions thereof that may be granted by the Owner, and during the life of any guarantees or warranties contained in or required under said Contract, and shall also well and truly perform all the undertakings, covenants, terms, conditions and agreements of any and all modifications of said Contract that may hereafter be made, then this obligation shall be void; otherwise to remain in full force and effect;

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 2253 of the Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said statute to the same extent as if it were copied at length herein.

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to work performed thereunder, or the plans, specifications, or drawings, accompanying the same, shall in anyway affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or the work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument on the _____ day of _____, 20__.

Principal	Surety
BY:_____	BY:_____
TITLE:_____	TITLE:_____
ADDRESS:	PHYSICAL ADDRESS:
_____	_____
_____	_____
_____	_____
	MAILING ADDRESS FOR NOTICE OF CLAIMS:
	_____
	_____
	_____
	TELEPHONE:_____
	LOCAL RECORDING AGENT PERSONAL IDENTIFICATION NUMBER:
	_____

The name and address of the Resident Agent of Surety is:

_____

END OF SECTION

4840-5159-9954, v. 1

SECTION 00 61 13.16
STATUTORY PAYMENT BOND

STATE OF TEXAS

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS: That _____(Contractor) of the City of _____, County of _____, and State of Texas, as Principal, and_____ authorized under the Laws of the State of Texas to act as surety on bonds for principals, as Surety, are held and firmly bound unto San Jacinto River Authority (Owner), in the penal sum of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Owner, dated the _____ day of _____, 20__, for construction of: _____ _____(the "Contract"),

which Contract is hereby referred to and make a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all claimants supplying labor and material to him or a Sub-Contractor in the prosecution of the work provided for in said Contract, then, this obligation shall be void; otherwise to remain in full force and effect;

PROVIDED, HOWEVER, That this bond is executed pursuant to the provisions of Chapter 2253 of the Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said statute to the same extent as if it were copied at length herein.

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to work performed thereunder, or the plans, specifications, or drawings, accompanying the same, shall in anyway affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or the work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument on the _____ day of _____, 20__.

Principal	Surety
BY:_____	BY:_____
TITLE:_____	TITLE:_____
ADDRESS:	PHYSICAL ADDRESS:
_____	_____
_____	_____
_____	_____
	MAILING ADDRESS FOR NOTICE OF CLAIM:
	_____
	_____
	_____
	TELEPHONE:_____
	LOCAL RECORDING AGENT PERSONAL IDENTIFICATION NUMBER:
	_____

The name and address of the Resident Agent of Surety is:

_____

END OF SECTION

4825-7140-3858, v. 1

SECTION 00 61 19.01

SECOND-YEAR MAINTENANCE BOND

THAT WE, _____ _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the San Jacinto River Authority ("SJRA") in the sum of $_____ _____ (10% of Contract Amount), for the payment of which sum to be made to the SJRA and its successors, Contractor and Surety do bind themselves, their successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the SJRA for_____, all of such work to be done as set out in full in said Contract Documents therein referred to and adopted by the SJRA, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall, without cost to Owner and in accordance with the requirements of the Contract Documents and Owner's written instructions:

(a) correct Defective Work, or, if it has been rejected by Owner, remove it from the Site and replace it with Work that is not Defective, and

(b) satisfactorily correct or remove and replace any damage to other Work or the work of others, or damage to other property, whether personal or real property, resulting from the correction, removal or replacement of such Defective Work;

with regard to any and all Defective Work discovered within two (2) years from the date of Substantial Completion, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when given in accordance with the definition of Written Notice in the General Conditions of the Contract.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and Surety has attached its current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

By: _____
Name:
Title:

_____
Name of Contractor

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

_____
Full Name of Surety

_____
Address of Surety for Notice

_____

_____
Telephone Number of Surety

By: _____
Name:
Title:

Date:

By: _____
Name:
Title: Attorney-in-Fact

Date:

END OF SECTION

SECTION 00 61 20

ONE-YEAR SURFACE CORRECTION BOND

THAT WE, _____ _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the San Jacinto River Authority ("SJRA") in the sum of $_____such sum being equal to four percent of the Original Contract Price, for the payment of which sum to be made to the SJRA and its successors, Contractor and Surety do bind themselves, their successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has entered into a Contract in writing with the SJRA dated of even date herewith, for _____, all of such work to be done in accordance with the Contract documents therein referred to, and adopted by the SJRA.

NOW THEREFORE, if the Contractor shall comply with the provisions of Paragraph 13.7.1 of the General Conditions, and repair, replace, restore, and correct surface work associated with backfill operations of subsurface work not in accordance with the Contract documents discovered within one year from the date that the One-year Maintenance Bond has expired, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Principal and Surety have signed and sealed this instrument on the respective dates written below their signatures.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

By: _____
Name:
Title:

_____
Name of Contractor

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

_____
Full Name of Surety

_____
Address of Surety for Notice

_____

_____
Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

END OF SECTION

SECTION 00 62 04

HISTORY OF OSHA ACTIONS AND LIST OF ON-THE-JOB INJURIES

Prior to award of the Contract, Successful Offeror will be required to file the following with the San Jacinto River Authority:

1. A history of all OSHA actions, advisories, etc., Contractor has received on all jobs worked in any capacity, prime or subcontractor. The history shall be for the two-year period preceding the Bid Date of the Project.

2. A list of all on-the-job injuries, accidents, and fatalities suffered by any present or former employees of Contractor during the same two-year period.

3. If less than the two-year period, give the date Contractor started doing business.

4. Provide the company Experience Modification Rate (EMR) for the three-year period preceding the Proposal Submission Date of the Project.

An officer of the company must certify in a notarized statement that the information submitted is true and correct.

END OF SECTION

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SECTION 00 62 07

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

Contractor certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State, or local department or agency;

2. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction: violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph 2 of this certification; and

4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award.

Company:

_____
Typed Name & Title of Authorized Representative

_____ _____
Signature of Authorized Representative Date

☐ I am unable to certify the above statements. My explanation is attached.

END OF SECTION

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SECTION 00 62 10

NAME AND QUALIFICATIONS OF PROPOSED SUPERINTENDENT (FOR FILING)

Prior to award of the Contract, Offeror selected will be required to file the following with the San Jacinto River Authority:

1. The name and qualifications of the Superintendent being proposed to supervise the Project.

This information must be submitted to the SJRA within the time period stated in within 10 days of written notification of contract award. An officer of the company must certify in a statement that the information submitted is true and correct.

END OF SECTION

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SECTION 00 62 16

AFFIDAVIT OF INSURANCE

BEFORE ME, the undersigned authority, on this day personally appeared

_____,
Affiant

who being by me duly sworn on his oath stated that he/she is _____
Title

of _____,
Contractor's Company Name

the Contractor named and referred to within the Contract Documents; that he/she is fully competent and authorized to give this affidavit on behalf of Contractor, and that the attached original insurance certificate truly and accurately reflects the insurance coverage that is now in effect and will be in effect during the periods required by the Contract.

_____
Affiant's Signature

SWORN AND SUBSCRIBED before me on _____.
Date

_____
Notary Public in and for the State of TEXAS

_____
Print or type Notary Public name

My Commission Expires: _____
Expiration Date

END OF SECTION

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San Jacinto River Authority

ADMINISTRATIVE OFFICE
P.O. Box 329 · Conroe, Texas 77305
(T) 936.588.3111 · (F) 936.588.3043

SECTION 00 65 16
CERTIFICATE OF SUBSTANTIAL COMPLETION

		Date of Substantial Completion:	
Project Name:		**Project Number:**	
Project Location:		**Contract Number:**	
Contractor:		**Notice To Proceed Date:**	
Principal Architect/Eng.:		**Contracted Amount:**	
Construction Manager:		**Amount at Completion:**	
Inspector:		**Time to Complete:**	
Punch List Correction Period:	**Days**	**Date of Inspection:**	

Description of Substantially Complete Work:

Issuance and execution of this Certificate of Substantial Completion by the San Jacinto River Authority (SJRA), shall denote that the described Work for the referenced Project has been inspected for compliance to the Project's Contract Documents and the described Work was found to be Substantially Complete. Therefore, the Date of Substantial Completion is established as indicated above.

Items having no impact on the intended and proper implementation, operation, or utilization of the described Work which have been determined as requiring correction or incomplete, are documented on the attached Substantial Completion Punch List. All such items shall be completed within the above stated Punch List Correction Period.

Punch List omissions of Contract Work does not relieve the Contractor of its responsibility to complete the Project Work in accordance with the Contract Documents.

Contract required warranties and guarantee periods shall commence on the Date of Substantial Completion.

Final insurance(s) shall remain in effect until the Project's Date of Final Completion of the Work is established.

Construction Manager:	Print	Signature	**Date:**
Company:			
Principal Architect/Eng.	Print	Signature	**Date:**
Company:			
Contractor:	Print	Signature	**Date:**
Company:			
SJRA Representative:	Print	Signature	**Date:**
SJRA General Manager:	Print	Signature	**Date:**

San Jacinto River Authority

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SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST

		PREPARATION DATE:	
PROJECT NAME:		PROJECT NUMBER:	
PROJECT LOCATION:		PREPARED BY:	
CONTRACTOR:		INSPECTION DATE:	
WORK PORTION:			

INSPECTION ATTENDEES:

NAME	COMPANY	E-MAIL	TELEPHONE

SJRA FIELD REPRESENTATIVE:			DATE:	
	PRINTED	SIGNATURE		
CONTRACTOR *(ACKNOWLEDGE RECEIPT)*:			DATE:	
	PRINTED	SIGNATURE		

SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST (CONTINUED)

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

- End of Punch List –

END OF SECTION

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San Jacinto River Authority

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CERTIFICATE OF PARTIAL SUBSTANTIAL COMPLETION

SECTION 00 65 16.23
CERTIFICATE OF PARTIAL SUBSTANTIAL COMPLETION

		Date of Partial Substantial	
Project Name:		**Project Number:**	
Project Location:		**Contract Number:**	
Contractor:		**Notice To Proceed Date:**	
Principal Architect/Eng.:		**Contracted Amount:**	
Construction Manager:		**Amount at Completion:**	
Inspector:		**Time to Complete:**	
Punch List Correction Period:	**Days**	**Date of Inspection:**	

Description of Substantially Complete Work:

Issuance and execution of this Certificate of Partial Substantial Completion by the San Jacinto River Authority (SJRA), shall denote that the described Work for the referenced Project has been inspected for compliance to the Project's Contract Documents and the described Work was found to be Substantially Complete. Therefore, the Date of Partial Substantial Completion is established as indicated above.

Items having no impact on the intended and proper implementation, operation, or utilization of the described Work which have been determined as requiring correction or incomplete, are documented on the attached Partial Substantial Completion Punch List. All such items shall be completed within the above stated Punch List Correction Period.

Punch List omissions of Contract Work does not relieve the Contractor of its responsibility to complete the Project Work in accordance with the Contract Documents.

Contract required warranties and guarantee periods shall commence on the Date of Partial Substantial Completion.

Final insurance(s) shall remain in effect until the Project's Date of Final Completion of the Work is established.

Construction Manager:	Print	Signature	**Date:**
Company:			
Principal Architect/Eng.:	Print	Signature	**Date:**
Company:			
Contractor:	Print	Signature	**Date:**
Company:			
SJRA Representative:	Print	Signature	**Date:**
SJRA General Manager:	Print	Signature	**Date:**

San Jacinto River Authority

ADMINISTRATIVE OFFICE
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CERTIFICATE OF PARTIAL SUBSTANTIAL COMPLETION

PARTIAL SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST

		PREPARATION DATE:	
PROJECT NAME:		PROJECT NUMBER:	
PROJECT LOCATION:		PREPARED BY:	
CONTRACTOR:		INSPECTION DATE:	
WORK PORTION:			

INSPECTION ATTENDEES:

NAME	COMPANY	E-MAIL	TELEPHONE

SJRA FIELD REPRESENTATIVE:			DATE:	
	PRINTED	SIGNATURE		
CONTRACTOR *(ACKNOWLEDGE RECEIPT)*:			DATE:	
	PRINTED	SIGNATURE		

PARTIAL SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

		PREPARATION DATE:	

PROJECT NAME:		PROJECT NUMBER:	
PROJECT LOCATION:		PREPARED BY:	
CONTRACTOR:		INSPECTION DATE:	
WORK PORTION:			

PARTIAL SUBSTANTIAL COMPLETION INSPECTION PUNCH LIST (CONTINUED)

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

- End of Punch List –

END OF SECTION

SECTION 00 65 19

CONTRACTOR'S CERTIFICATION OF FINAL COMPLETION

CERTIFICATE OF FINAL COMPLETION OF: Ground Storage Tank No. 2 at Water Plant No. 4

Project No.: WDPR0098.1003.2H001

Contract Dated: [*Contract Date*]

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas, on this day personally appeared _____ who, being by me duly sworn, on his oath says that he or she represents _____, the Contractor who has performed a contract with the San Jacinto River Authority ("SJRA") for the construction of the Work described above, and is duly authorized to make this affidavit; that he or she has personally examined the Work described above as required by the Contract documents; that said Work and all items thereof have been completed and all known defects made good; that all surplus material, refuse, dirt and rubbish have been cleaned up and removed or disposed of as directed by the SJRA; that all parts of Work are in a neat, tidy, finished condition and ready in all respects for acceptance by the SJRA; that all gravel or shell roadway surfaces removed during the course of the Work have been replaced in accordance with the Specifications, that rates of pay for all labor employed on said Work have not been below the minimum set out in "Labor Classification and Minimum Wage Scale" in the Contract documents and that within the knowledge of affiant all just bills for labor and material and for the rental or use of any equipment or apparatus, used in, on, or in connection with the Work have been paid in full by the Contractor.

_____
Affiant's Signature

SWORN AND SUBSCRIBED before me on _____
PART 1 - **DATE**

_____
Notary Public in and for the State of TEXAS

_____
Print or type name

My Commission Expires: _____
Expiration Date

THIS IS TO CERTIFY that I have thoroughly inspected the Work performed by the above named Contractor on the above described Contract and find all things in accordance with the Contract documents governing this Work.

_____
Inspector

_____
[*Project Manager or Construction Manager*]

Approved:

_____
[*Title of Approval Authority*], [*Contracting Department*]

END OF SECTION

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SECTION 00 65 19.13

AFFIDAVIT OF BILLS PAID

STATE OF TEXAS

COUNTY OF _____

BEFORE ME, the undersigned authority, on this day personally appeared _____, party to that certain Contract entered into on the____ day of _____, 20__, between **San Jacinto River Authority** (Owner) and_____ for the erection, construction, and completion of certain improvements and/or additions upon the following described premises, to wit:

GROUND STORAGE TANK NO. 2 AT WATER PLANT NO. 4,

CSP NO. 19-0047

Said party being by me duly sworn states upon oath that the said improvements have been erected and completed in full compliance with the above referred to Contract and the agreed plans and specifications therefore.

Deponent further states that he has paid all bills and claims for materials furnished and labor performed on said Contract and that there are no outstanding unpaid bills or legal claims for labor performed or materials furnished upon said job.

This affidavit is being made by the undersigned realizing that it is in reliance upon the truthfulness of the statements contained therein that final and full settlement of the balance due on said Contract is being made, and in consideration of the disbursement of funds San Jacinto River Authority, deponent expressly waives and releases all liens, claims and rights to assert a lien on said premises and agrees to indemnify and hold Owner safe and harmless from and against all losses, damages, costs and expenses of any character whatsoever specifically including court costs, bonding fees and attorney fees, arising out of or in any way relating to claims for unpaid labor or material used or associated with construction of improvements on the above-described premises.

_____

_____

By: _____

Subscribed and sworn to before me, the undersigned authority, on this the _____day of _____, 20__.

_____Notary Public in and for _____ County, Texas.

END OF SECTION

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San Jacinto River Authority

ADMINISTRATIVE OFFICE
P.O. Box 329 · Conroe, Texas 77305
(T) 936.588.3111 · (F) 936.588.3043

SECTION 00 65 19.23
CERTIFICATE OF FINAL COMPLETION

CERTIFICATE OF FINAL COMPLETION

		Date of Final Completion:	
Project Name:		**Project Number:**	
Project Location:		**Contract Number:**	
Contractor:		**Notice To Proceed Date:**	
Principal		**Contracted Amount:**	
Construction Manager:		**Amount at Completion:**	
Inspector:		**Time to Complete:**	**Days**
Punch List Correction Period:	**Days**	**Date of Inspection:**	

Description of Finally Complete Work:

DATE OF FINAL COMPLETION - The Work performed under the Contract was inspected on above indicated Date of Final Completion and found to be complete. The date of final completion of the Work is hereby established as indicated above.

PUNCH LIST - Contractor certified in Document 00 65 19 – Contractor's Certification of Final Completion that all Punch List items were completed or corrected. Failure to identify incomplete work items or requirements of the Contract prior to issuance of this Certificate does not alter the responsibility of Contractor to comply with all provisions of the Contract.

ACCEPTANCE OF THE WORK - Based on inspection and to the best of our knowledge, information and belief, the Work has been completed in accordance with the terms and conditions of the Contract and we recommend acceptance of the Work by the San Jacinto River Authority or their delegated authority.

Construction Manager:	Print	Signature	**Date:**
Company:			
Principal Architect/Eng.:	Print	Signature	**Date:**
Company:			
Contractor:	Print	Signature	**Date:**
Company:			
SJRA Project Manager:	Print	Signature	**Date:**
SJRA General Manager:	Print	Signature	**Date:**

San Jacinto River Authority

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CERTIFICATE OF FINAL COMPLETION

FINAL COMPLETION INSPECTION PUNCH LIST

		PREPARATION DATE:	
PROJECT NAME:		PROJECT NUMBER:	
PROJECT LOCATION:		PREPARED BY:	
CONTRACTOR:		INSPECTION DATE:	
WORK PORTION:			

INSPECTION ATTENDEES:

NAME	COMPANY	E-MAIL	TELEPHONE

SJRA FIELD REPRESENTATIVE:			DATE:	
	PRINTED	SIGNATURE		
CONTRACTOR *(ACKNOWLEDGE RECEIPT)*:			DATE:	
	PRINTED	SIGNATURE		

FINAL COMPLETION INSPECTION PUNCH LIST

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

San Jacinto River Authority

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CERTIFICATE OF FINAL COMPLETION

		PREPARATION DATE:	
PROJECT NAME:		PROJECT NUMBER:	
PROJECT LOCATION:		PREPARED BY:	
CONTRACTOR:		INSPECTION DATE:	
WORK PORTION:			

FINAL COMPLETION INSPECTION PUNCH LIST (CONTINUED)

DESCRIPTION:	DATE COMPLETE:	SIGNED BY:

- End of Punch List –

END OF SECTION

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SECTION 00 65 21

CONDITIONAL WAIVER AND RELEASE UPON PROGRESS PAYMENT

Legal Project Name: _____

SJRA Project No.: _____

Contractor's Company Name ("Contractor"): _____

Address: _____

On receipt by Contractor of a check from the San Jacinto River Authority ("SJRA") in the sum of $_____ payable to Contractor, and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to waive and release any and all rights, claims and causes of action which Contractor may have against SJRA, including but not limited to any and all claims for costs, expenses and damages incurred by Contractor, arising out of or related to all labor, materials, equipment and/or services furnished for incorporation in or use or work on the Project, through the period ending _____ *[end date of current pay period]* (the "Pay Period"), except to the extent of any contractual retainage withheld from Contractor, and except for the following pending claims, if any:

Description of Claim	Amount ($)

Contractor warrants that Contractor has already paid or will use the funds received from this progress payment to promptly pay in full all amounts due the Contractor's laborers, Subcontractors, materialmen, vendors and suppliers for all work, materials, equipment, and/or services provided for or to the above referenced Project through the Pay Period.

Date _____

_____ (Contractor name)

By: _____ (Signature)

_____ (Title)

This instrument was executed and acknowledged before me on this ___ day of _____, 20__, by _____, known to me as the person whose name is subscribed above, as _____ [title] of _____ [company], on behalf of and as the authorized act of said entity.

_____
Notary Public in and for the State of Texas

My Commission Expires: _____

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SECTION 00 65 27

CONDITIONAL WAIVER AND RELEASE UPON FINAL PAYMENT

Legal Project Name: _____

SJRA Project No.: _____

Contractor's Company Name ("Contractor"): _____

Address: _____

On receipt by Contractor of a check from the San Jacinto River Authority ("SJRA") in the sum of $_____ payable to Contractor, and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to waive and release any and all rights, claims and causes of action which Contractor may have against SJRA, including but not limited to any and all claims for costs, expenses and damages incurred by Contractor, arising out of or related to all labor, materials, equipment and/or services furnished for incorporation in or use or work on the Project, except for the following pending claims, if any:

Description of Claim	Amount ($)

Contractor warrants that Contractor has already paid or will use the funds received from this payment to promptly pay in full all amounts due the Contractor's laborers, Subcontractors, materialmen, vendors and suppliers for all work, materials, equipment, and/or services provided for or to the above referenced Project.

Date _____

_____ (Contractor name)

By: _____ (Signature)

_____ (Title)

This instrument was executed and acknowledged before me on this ___ day of _____, 20__, by _____, known to me as the person whose name is subscribed above, as _____ [title] of _____ [company], on behalf of and as the authorized act of said entity.

_____
Notary Public in and for the State of Texas

My Commission Expires: _____

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SECTION 00 72 00
GENERAL CONDITIONS OF THE CONTRACT

Table of Contents

ARTICLE 1 – DEFINITIONS

UNLESS OTHERWISE STATED IN THE CONTRACT DOCUMENTS, WORDS WHICH HAVE WELL-KNOWN TECHNICAL OR CONSTRUCTION INDUSTRY MEANINGS ARE USED IN THE CONTRACT DOCUMENTS IN ACCORDANCE WITH SUCH RECOGNIZED MEANINGS.

Whenever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

1.001 **Addendum:** Written instruments issued by the Contract Awarding Authority which clarify, correct or change the bidding requirements or the Contract Documents prior to the Due Date. "Addenda" is the plural form of Addendum.

1.002 **Agreement:** Document signed by the Parties and binding the Parties, containing the name of Contractor, title and location of the Project, original Contract Time Requirements, Original Contract Amount, enumeration of documents included in the Contract and other provisions.

1.003 **Allowance:** A not-to-exceed amount which is established between the Owner and the Contractor as part of the Contractor's Bid/Proposal when the precise scope of a particular line item has not been defined to a level which is adequate for the Contractor to provide definitive line item pricing for that particular scope of Work. The use of any Allowances by the Contractor in any Bid/Proposal will be subject to the Owner's sole approval. Additional Allowances or adjustments can be added to any Bid/Proposal upon the agreement of the Owner and Contractor.

1.004 **Alternative Dispute Resolution:** The process by which a disputed Claim may be settled if the Owner and the Contractor cannot reach an agreement between themselves, as an alternative to litigation.

1.005 **Application for Payment:** Is the Contractor's monthly pay application, the form of which must be acceptable to the Owner.

1.006 **Bid/Proposal:** A complete, properly signed response to an Invitation for Bid/Proposal that, if accepted, would bind the Bidder/Offeror to perform the resultant Contract.

1.007 **Bidder/Offeror:** A person, firm, or entity that submits a Bid/Proposal in response to an Invitation for Bids/Proposals. Any Bidder/Offeror may be represented by an agent after submitting evidence reasonably satisfactory to Owner demonstrating the agent's authority to bind the Bidder/Offeror. The agent cannot certify as to his own agency status.

1.008 **Bid/Proposal Documents:** The Advertisement or Invitation for Bids/Proposals, Instructions to Bidders/Offerors, the Bid/Proposal Form, the Contract Documents and Addenda.

1.009 **Bonds:** Performance Bond, Payment Bond, Maintenance Bond, and other Surety instruments executed by Surety. When in singular form the term refers to an individual instrument.

1.010 **Calendar Day:** Any day of the week; no days being excepted. Work on Saturdays, Sundays, and/or Legal Holidays shall be as approved by and coordinated with Owner.

1.011 **Change Directive:** A written directive to Contractor, signed by Owner, ordering a change in the Work that is within the general scope of the Contract and consisting of additions, deletions, or other revisions and stating a proposed basis for adjustment, if any, in the Contract Amount or Contract Time Requirements, or both. A Change Directive may be used in the absence of total agreement on the terms of a Change Order. A Change Directive can change the Contract Amount or Contract Time Requirements, and the parties may reasonably expect that the

change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order.

1.012 Change Orders: Written agreements entered into between Contractor and Owner authorizing an addition, deletion, or revision to the Contract, issued on or after the Execution Date of the Contract.

1.013 CMT Consultant: Owner's consultant responsible for the testing of construction materials engineering, and the verification testing services necessary for acceptance of the Work by the Owner as required by Section 2267.058(a) of the Texas Government Code.

1.014 Claim: A written demand or written assertion by the Owner or the Contractor seeking, as a matter of right, an adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The Party making the Claim has the responsibility to substantiate the Claim.

1.015 Commissioning: This is the process of verification, preliminary testing, starting up and functional operations testing of all equipment and systems which are part of the Project. The term "commissioning" shall specifically include the drafting, review and verification of all test plans and test reports for all equipment and systems which are part of the Project.

1.016 Construction Documents: Means the Plans or Drawings and the Specifications and such other documents incorporated into the Contract Documents that set out the Contractor's scope of work to be performed under the Contract and/or the technical requirements for the design and construction of the Work.

1.017 Contractor: Means the individual, firm, corporation, or other business entity identified as such in the Agreement, including its successors and its authorized representatives, with whom Owner has entered into the Contract for performance of the Work. The Contractor may also be referred to as the "Bidder" or "Offeror" in the Contract Documents, both of which will be understood to mean the "Contractor" as identified in the Agreement.

1.018 Construction Phase: Means the implementation and execution of the Work required by the Contract Documents, commencing with the Notice to Proceed for the Work.

1.019 Contract: The binding legal agreement between the Owner and the Contractor including all documents that have been incorporated into the agreement between Owner and Contractor for performance of the Work, as evidenced by the Contract Documents, and into which these General Conditions of the Contract (General Conditions) have been incorporated.

1.020 Contract Amount: The monetary amount stated in the Agreement as it may be adjusted by Change Order or Change Directive, payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents.

1.021 Contract Awarding Authority: The SJRA Board of Directors. When authorized by the SJRA Board of Directors, the SJRA General Manager may enter into Contracts on behalf of the SJRA.

1.022 Contract Documents: Those items so designated in the Agreement. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of physical subsurface, geotechnical or environmental conditions are not Contract Documents.

1.023 Contract Time Requirements: Means those requirements for the timely performance of the Work as set forth in the Agreement, including Milestones and the required dates for Mechanical Completion, Substantial Completion and Final Completion.

1.024 Cost of the Work: Has the meaning set forth in Article 11.5.

1.025 Critical Path: The longest series of tasks that runs consecutively from the beginning to the end of the Work, as determined by duration and workflow sequence. This longest path determines how quickly the Work can be completed, given appropriate resources.

1.026 Day: Means that twenty-four hour period measured from midnight to the next midnight. When any period is referred to in days, it will be computed to exclude the first and include the last day of such period.

1.027 Defective: Means with respect to any Work, failing to conform in any respect to any one or more requirements of the Contract Documents.

1.028 Delay: Means a delay, disruption, hindrance, interference, acceleration, recovery effort, or loss of productivity or efficiency, or any other impact whatsoever with respect to the Critical Path of the Work.

1.029 Discrepancies: Means any error, omission, conflict, inconsistency, discrepancy, or lack of clarity in the Contract Documents discovered by the Contractor or that should reasonably have been discovered by the Contractor in fulfilling its obligations arising from the Contract and based upon its applicable standard of care as a Contractor and not as a design professional. The Discrepancy must be determinable by the Contractor through an evaluation of one or more drawings or specifications which are part of the Construction Documents, the above-grade Site conditions, geotechnical reports, surveys or other information provided to Contractor by Owner or any combination thereof.

1.030 Division 01: Means the General Requirements (Division One) of the Specifications made a part of the Construction Documents, whether such Specifications are set out in a separate document or are part of the Project Manual.

1.031 Document Control: This is the process of generating, transmitting, receiving, recording, filing and distributing documents and records generated by the Project Team Members and others during the execution of the Project. The process may utilize an electronic or paper format, or both.

1.032 Drawings: Those portions of the Contract Documents which are graphic and pictorial representations of the scope, extent and character of the Work to be furnished and performed by Contractor and which have been approved by Owner. Drawings may include plans, elevations, sections, details, schedules and diagrams. Shop Drawings are not Drawings.

1.033 Due Date: The date and time specified for receipt of Bids/Proposals or any other required submittal from the Contractor.

1.034 Equal: The terms "equal" or "approved equal" shall have the same meaning.

1.035 Execution Date: Date of last signature of the parties to the Agreement.

1.036 Field Order: A written authorization by the Owner for a minor variation in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Amount or Contract Time Requirements and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

1.037 Final Completion: The point in time when Owner determines that all Work has been completed and the Contract fully performed except for those obligations that survive final payment.

1.038 Force Account: A basis of payment for the direct performance of Work with payment based on the Cost of the Work and consideration for overhead and profit, as set forth in Section 11.5.

1.039 Force Majeure: For purposes of this Contract, events of "force majeure" shall consist of the following, to the extent that they are beyond the reasonable control of Contractor and also cause Delay to the Critical Path of the Project: acts of God, acts of war, terrorist acts, civil unrest, riots, labor disputes (excluding

disputes with laborers on the Project), unavoidable material shortages, fire or other casualty loss (not attributable to the acts or omissions of Contractor or any Subcontractor of any tier), newly announced or enacted governmental restrictions, or acts or inactions of governmental agencies other than the Owner and outside of the Owner's responsibility and control.

1.040 Hazardous Conditions: Are any materials, wastes, substances, and chemicals deemed to be hazardous under applicable Legal Requirements or the handling, storage, remediation, or disposal of which are regulated by applicable Legal Requirements.

1.041 Not used.

1.042 Legal Requirements: Are all applicable federal, state, and local laws, codes, ordinances, rules, regulations, orders, and decrees of any governmental or quasi-governmental entity having jurisdiction over the Project or Site, the practices involved in the Project or Site or any Work.

1.043 Legal Holidays:

.1 The following are recognized by the Owner:

Holiday Observed	Date
New Year's Day	January 1
Martin Luther King Day	Third Monday in January
Presidents' Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4
Labor Day	First Monday in September
Veterans Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving
Christmas Eve	December 24
Christmas Day	December 25

.**2** If a Legal Holiday falls on Saturday, it will be observed on the preceding Friday. If a Legal Holiday falls on Sunday, it will be observed on the following Monday.

1.044 Major Subcontractor: Means a Subcontractor of the Contractor whose Subcontract amount with the Contractor exceeds or is reasonably expected to exceed the sum of $50,000.00.

1.045 Manufacturer: An individual or entity who produces goods, materials, or equipment for use or sale and has a direct contract with Contractor or Supplier or any Subcontractor or Sub-Subcontractor to furnish materials or equipment to be incorporated in the Work.

1.046 Master Project Schedule: Is the most recent version of the Contractor's Project Schedule which has been formally accepted by the Owner.

1.047 Mechanical Completion: Means when the specified Work has been delivered, constructed, installed, and Contractor has successfully completed all required local functional testing, obtained Manufacturers' certificates of proper installation, and completed operations readiness testing such that all improvements and equipment are ready for performance testing.

1.048 Milestones: Means a significant event specified in the Owner's Project Schedule or the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.049 Modification: Means a written amendment to the Contract, including but not limited to (1) a Change Order, or (2) a Change Directive.

1.050 **Notice to Proceed:** A Written Notice given by Owner to Contractor fixing the date on which the Contract Time Requirements will commence to run by establishing Date of Commencement of the Work covered by the Written Notice and on which Contractor shall start to perform Contractor's obligations under the Contract Documents for such Work.

1.051 **Owner:** The San Jacinto River Authority (the "SJRA" or the "Owner"), a public entity, organized and existing under the laws of the State of Texas, acting through the SJRA Board of Directors, the SJRA General Manager or his/her designee, officers, agents or employees to administer design and construction of the Project.

1.052 **Owner's Independent Contractor:** A contractor who has been employed separately by the Owner and is not a Subcontractor of the Contractor.

1.053 **Owner's Project Schedule:** Means the dates indicated in the Instructions to Bidders/Offerors and all Contract Time Requirements.

1.054 **Owner's Representative:** The designated representative or representatives of the Owner. Owner's Representative may be designated from the Owner's staff, the Principal Architect/Engineer, an Owner's Independent Contractor(s), or an Owner's consultant(s) employed for the purpose of representing the Owner on a given Project or Projects.

1.055 **Partial Occupancy or Use:** Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work, provided Owner and Contractor have, with respect to such part of the Work, accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, utilities, corrective work, insurance and warranties.

1.056 **Pre-construction Conference:** Is the required meeting between the Owner and the Contractor before Work can be initiated in the field. Contractor will have made all of the required submittals prior to the date of the Pre-construction Conference in accordance with Section 2.4.2.

1.057 **Preliminary Project Schedule:** Is the initial Contractor's Schedule for the Work required under Section 2.4.2 and must conform to and be integrated with the Milestones contained in the Owner's Project Schedule for the Work and is subject to Owner's approval.

1.058 **Principal Architect/Engineer (Engineer)**: The Owner's design professional identified as such in the Contract. The terms "Principal Architect/Engineer" and "Engineer", as indicated with initial capital letters, mean the same entity, as defined in the Agreement. References to Principal Architect/Engineer in these General Conditions shall refer to the Owner's Principal Architect/Engineer (Engineer), except as otherwise expressly provided herein. Nothing contained in the Contract Documents shall create any contractual or agency relationship between the respective Principal Architect/Engineer and Contractor. References can be singular or plural and will apply to all of the Principal Architects or Engineers as may be applicable.

1.059 **Project:** Total construction, of which the Work performed under Contract may be the whole or part, and which may include construction by the Owner or by Owner's Independent Contractors.

1.060 **Project Manual:** That portion of the Contract Documents which may include the following: introductory information; bidding requirements, Contract forms, Agreement, General Conditions, Supplemental General Conditions; General Requirements; Specifications; Drawings; Project Safety Manual; and Addenda.

1.061 **Project Schedule:** Is the Contractor's most recent schedule submitted to the Owner.

1.062 **Project Team:** Means the Owner, the Owner's Representative, the Contractor, the Principal Architect/Engineer, any consultants of the Principal Architect/Engineer designated by the Owner, any Owner's Independent Contractors, and any Owner's consultants employed for the purpose of programming, design, and construction of the Project. The constitution of the Project Team may vary at different stages of the Work. The Project Team will be designated by Owner and may be modified from time to time by Owner.

1.063 **Not used.**

1.064 **Recovery Schedule:** Means a short duration schedule implemented to bring the Work back on schedule to achieve the Contract Time Requirements for the Project.

1.065 **Rental Rate Blue Book:** Is the document published by EquipmentWatch which identifies the rental rates for equipment in the construction industry.

1.066 **Resident Project Representative:** The authorized representative of the Owner's staff, the Principal Architect/Engineer, or an Owner's consultant who may be assigned to the Site or any part thereof. Not all Projects will utilize a Resident Project Representative.

1.067 **Schedule of Values:** Is a schedule, prepared and maintained by the Contractor, allocating portions of the Contract Amount to various portions of the Work, including a tabulation of all of the costs of the various Subcontracts and materials which in the aggregate make up the Contract Amount. The Schedule of Values shall be subject to Owner's approval and, after such approval, be used as the basis for reviewing the Contractor's Applications For Payment.

1.068 **Scope of Work:** Is the entire Work which is included within the Contract for this Project. This term can also be used to describe the subset of Work which is included within a particular Trade Subcontract.

1.069 **Shop Drawings:** All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled for the Work by or for Contractor, subcontractor or supplier and submitted by Contractor as required by the Contract Documents.

1.070 **Site:** Is the land or premises on which the Project is located.

1.071 **Specifications:** Those portions of the Contract Documents furnished by Owner through its respective Principal Architects/Engineers consisting of written technical descriptions as applied to the Work, which set forth to Contractor, in detail, the requirements which must be met by all materials, equipment, construction, systems, standards, workmanship, and services as applied to the Work and certain administrative requirements and procedural matters.

1.072 **Start-Up:** This is the subset of Commissioning at which time the Project equipment and / or systems are placed in full operation in preparation for the operational testing phase of the Project.

1.073 **Stipulated Sum:** Single lump sum amount stated for the completion of the Work or a portion thereof required by this Contract.

1.074 **Substantial Completion:** The stage in the progress of the Work when the Work, or designated portion thereof, is sufficiently complete in accordance with the Contract Documents so Owner can occupy or utilize the Work for its intended use, as evidenced by a Certificate of Substantial Completion approved by Owner, as further defined in Article 14.07.

1.075 **Subcontractor (or Trade Subcontractor):** An individual, firm, corporation, or other business entity having a direct contract with the Contractor for the performance of a portion of the Work under the Contract. A Subcontractor includes a supplier of tools, equipment or materials as well as an individual or entity renting tools or equipment to the Contractor. For purposes of this

Contract, unless designated otherwise, the term "Subcontractor" shall include all Sub-Subcontractors and Suppliers in contractual privity to the Subcontractor.

1.076 Sub-Subcontractor: An individual, firm, corporation, or other business entity who has a direct or indirect contract with a Subcontractor of any tier to perform a portion of the Work, to furnish tools, equipment or materials, or to rent tools or equipment. For purposes of this Contract, unless designated otherwise, the term "Sub-Subcontractor" shall include all lower tier subcontractors and Suppliers in contractual privity to the Sub-Subcontractor.

1.077 Superintendent: The representative of Contractor authorized in writing to receive and fulfill instructions from the Owner's Representative, and who shall supervise and direct construction of the Work.

1.078 Supplemental General Conditions: The part of the Contract Documents which amends or supplements the General Conditions, but only to the extent provided therein. Not all Projects will utilize Supplemental General Conditions. All General Conditions which are not so amended or supplemented remain in full force and effect.

1.079 Supplier: An individual or entity having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment or products, or services to be incorporated in the Work by Contractor or any Subcontractor.

1.080 Surety: Corporate entity that is bound by one or more Bonds, and is responsible for the completion of the Work, including during the correction period, and for payment of debts incurred by Contractor or Subcontractors for work, services, labor, materials or equipment provided in connection with the Work. Surety shall include any co-surety or reinsurer, as applicable.

1.081 Underground Improvements: Is defined in Section 4.2.3 of these General Conditions.

1.082 Unit Price: An amount stated in the Contract for an individual, measurable item of work, which, when multiplied by actual quantity incorporated into the Work, amounts to full compensation for completion of the item, including work incidental to it.

1.083 Unit Price Quantities: Quantities indicated in the Contract that are approximations made by the Owner for contracting purposes.

1.084 Unit Price Work: Is any Work which is to be executed based upon a Unit Price for that Work which has been agreed upon in advance between the Parties in accordance with Section 11.6 of these General Conditions.

1.085 Unusual Inclement Weather: Is defined in Section 12.2 of these General Conditions.

1.086 Value Analysis: Means the systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the Project, reliably, without sacrificing safety, necessary quality, or environmental attributes of the Project.

1.087 Work: The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents, including all labor, products, equipment, material, supervision, insurance, temporary facilities and services provided by Contractor to fulfill Contractor's obligations. The Work may constitute the whole or a portion of the Project.

1.088 Working Day: Any day of the week, not including Saturdays, Sundays, or Legal Holidays in which conditions under the Contractor's control will permit work for a continuous period of not less than seven (7) hours during Working Hours. Upon agreement with Owner, work on Saturdays, Sundays and/or Legal Holidays may be allowed and will be considered a Working Day.

1.089 Working Hours: Those hours in which the Work shall be performed. Except as otherwise authorized in writing by Owner's, all Work shall be done between 7:00 a.m. and 6:00 p.m. However, emergency work may be done without prior permission as indicated in Section 6.11.07. Night Work may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for the prosecution and control of the night Work.

1.090 Written Notice: Written communication between Owner and Contractor. Written Notice shall be deemed to have been duly served if delivered in person to Owner's Representative or Contractor's duly authorized representative, or if delivered at or sent by registered or certified mail with proper postage affixed to the attention of Owner's Representative or Contractor's duly authorized representative at the last business address known to the party giving notice, or by facsimile to the facsimile number known to the party giving notice, provided any notice delivered by facsimile after 5:00PM shall be deemed delivered on the next business day.

ARTICLE 2 - PRELIMINARY MATTERS

2.1 Delivery of Contract, Bonds, Insurance, etc.: After written notification to Contractor of anticipated award of Contract, and at least ten (10) days prior to the SJRA Board of Directors Meeting at which a contract award is anticipated, Contractor shall deliver to Owner original, hard copies of the signed Agreement, unsigned Bond forms, required evidence of insurance, including without limitation, all certificates of insurance and endorsements, signed disclosure of interested parties (Form 1295), signed Conflict of interest Questionnaire, and signed and notarized Verification Company Does Not Boycott Israel, as identified in the Bid/Proposal Documents. Within three (3) days of Contractor's receipt of the fully executed Agreement, the Contractor shall deliver the original, hard copy fully executed Bonds to Owner. The requirements of this Section 2.1 apply regardless of whether or not the Agreement is also executed using electronic signatures or transmitted electronically. Any violation of this Section 2.1 by Contractor shall render the Contract voidable by Owner.

2.2 Copies of Documents: Owner shall furnish to Contractor up to ten (10) copies of the Contract Documents unless otherwise specified. Additional copies will be furnished, upon request, at a cost to be specified by the Owner.

2.3 Commencement of Contract Time Requirements; Notice to Proceed: The applicable Contract Time Requirements will begin to run on the day indicated in the Notice to Proceed for the Work covered in such Notice.

2.4 Before Starting Construction:

2.4.1 No Work shall be done at the Project Site prior to the Pre-construction Conference without Owner's written approval. Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents to check and verify pertinent figures shown thereon and compare them accurately to all applicable field measurements and conditions and other information known to Contractor and other information made available to Contractor by Owner. Contractor shall promptly report in writing to Owner's Representative any conflict, error, ambiguity or Discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Owner's Representative before proceeding with any Work affected thereby. Contractor shall be liable to Owner for failure to report any conflict, error, ambiguity or

Discrepancy in the Contract Documents about which Contractor knew or reasonably should have known.

2.4.2 Successful completion of the Work within the applicable Contract Time Requirements is of primary importance. **Time is of the essence to this Contract.** Therefore, the Contractor hereby agrees to submit to the Owner's Representative for review and approval, or acceptance, as appropriate, all information required by this section, including a Preliminary Project Schedule for the Work within thirty (30) days from date of the Owner's issuance of the Notice To Proceed with the Work or at the scheduled Pre-construction Conference, whichever is later. The Owner's Representative will schedule the Pre-construction Conference upon the timely submittal of the required documents, unless the allowable time for providing the required submittals is extended by written mutual agreement. Prior to the date scheduled for the Pre-construction Conference, the Contractor will submit the following to the Owner:

.01 A proposed Preliminary Project Schedule (the "Preliminary Project Schedule") for the Work developed using the scheduling software authorized in Section 6.03 of the General Conditions, unless otherwise approved by Owner, to confirm that all Work will be completed within the respective Contract Time Requirements. The Preliminary Project Schedule must satisfy the requirements of Section 6.03 of these General Conditions and must be prepared in accordance with Division 01 - Section 01 32 16, Construction Progress Schedules. Such Preliminary Project Schedule shall also conform to the Owner's Project Schedule. This Preliminary Project Schedule must contain sufficient detail to indicate that the Contractor has properly identified required Work elements and tasks, has provided for a sufficient and proper workforce and integration of Subcontractors and Suppliers, has provided sufficient resources and has considered the proper sequencing of the Work required to result in a successful Project that can be completed within the Contract Time Requirements. The Project Schedule and Schedule of Values shall be developed together to permit the Work progress to be accurately reflected in the Contractor's Applications for Payment.

.02 An organizational chart showing the principals and management personnel who will be involved with the Work, including each one's responsibilities for the Work;

.03 A complete listing of the Contractor's key employees proposed for the Work. List each one by name and job title, and show length of employment with Contractor.

.04 Emergency contact telephone numbers for the Project Manager and the project Superintendent.

.05 A discussion and confirmation of the Contractor's commitment to health, safety and environment by providing a copy of its Health, Safety and Environmental Policies, employee's safety handbook and the safety records for the past three years of Contractor's proposed project manager and Superintendent;

.06 A preliminary schedule of Shop Drawings and sample submittals;

.07 A preliminary Schedule of Values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. At a minimum, the schedule of values

shall be broken out by trade and split between materials and labor as commented on and accepted by Owner. Such prices will include overhead and profit applicable to each item of Work;

.08 A letter designating Contractor's Superintendent and project manager, and a confirmation of past project experience for the Contractor's Superintendent and project manager specifically applicable to the Work;

.09 A letter designating the "Competent Person(s)" on general safety and excavation safety measures along with certifications or other documentation of the safety representative's qualifications;

.10 If applicable, an excavation safety system plan;

.11 If applicable, a plan illustrating proposed locations of temporary facilities;

.12 A letter designating the Texas Registered Professional Land Surveyor for layout of the Work, if the Work requires the services of a licensed surveyor.

2.4.3 Neither the rejection, acceptance, comment on nor the approval of any of the submittals required in Section 2.4.2, above, will constitute either the adoption, affirmation, or direction of the Contractor's means and methods of the performance of the Work which remain the sole responsibility of the Contractor. Owner shall not be responsible for, and will not have control or charge of, construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and shall not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. Owner shall not be responsible for or have control or charge over the acts or omissions of Contractor, Subcontractors or any of their agents or employees or any other persons performing any of the Work.

2.5 Pre-construction Conference: Prior to commencement of Work at the Site, Contractor must attend a Pre-construction Conference with Owner's Representative and others required by Owner, and participate in an inspection of the Project Site if required by Owner.

2.6 Initially Acceptable Schedules: Unless otherwise provided in the Contract Documents, Contractor shall obtain approval of Owner of the Preliminary Project Schedule submitted in accordance with Section 2.4.2.01 before the first progress payment will be made to Contractor. The Preliminary Project Schedule must provide for an orderly progression of the designated portion of the Work to completion within the Contract Time Requirements, including any specified Milestones, and shall permit the Work progress to be accurately reflected in the Contractor's Applications for Payment. Approval of the Preliminary Project Schedule by Owner will not impose on Owner responsibility or liability for the sequencing, scheduling or progress of the Work, nor shall it constitute interference with, nor shall it relieve Contractor from Contractor's full responsibility for the Work. Contractor's schedule of Shop Drawings and sample submissions shall provide adequate time, in Owner's opinion, for properly reviewing and processing the required submittals. Contractor's Schedule of Values must conform to the requirements set forth in the Contract. The process of approving Preliminary Project Schedule and updates to the Master Project Schedule shall not constitute a warranty by the Owner that any non-Contractor milestones or activities will occur as set out on the Preliminary Project Schedule or the Master Project Schedule, or approval of the logic set out in the Preliminary Project Schedule

or Master Project Schedule. Approval of the Preliminary Project Schedule, the Master Project Schedule or any updates thereto does not constitute a warranty by the Owner to furnish any Owner-furnished information or services any earlier than Owner would otherwise be obligated to furnish that information or services under the Contract Documents. Failure of the Work to proceed in the sequence scheduled by Contractor shall not serve as any basis for a Claim for additional compensation or adjustment of the Contract Time Requirements.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent: The intent of the Contract Documents is to include all information necessary for the proper execution and timely completion of the Work by Contractor. The Contractor will execute the Work described in and reasonably inferable from the Contract Documents as necessary to produce the results intended by the Contract Documents.

3.1.1 The Contract Documents are complementary in nature, and what is shown in one location on the Drawings or Specifications shall be construed to apply to all other similar locations of the Drawings and Specifications. In the event of any internal inconsistency in either the Drawings or Specifications, or with each other, the Owner shall resolve such inconsistency and Contractor shall perform in accordance with the Owner's determination. In the determination of the Contract Amount, the Contractor has provided for such further development consistent with the Contract Documents and reasonably inferable therefrom. It is the intent and understanding of Contractor that the Contract Amount includes the construction of completed and tested Work by the Contractor, including all devices, fasteners, materials or other work not shown in the Drawings and Specifications but which are reasonably inferable therefrom and any and all incidental accessories necessary to make the Work complete and operable in all respects (even if not specified in the description of the Work, but necessary for proper installation and operation of the Work under the Drawings and Specifications), all of which shall be included in the Contract Amount.

3.1.2 The expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a contractor familiar with the Project and exercising the care, skill and diligence of the Contractor required by the Contract Documents. Such further development does not include such things as changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order or Change Directive. The Contract Documents shall be interpreted with the understanding that a common sense approach will be utilized as necessary so that the Contract Documents produce the intended results for the benefit of the Owner as follows:

.1 The Contract Documents are intended to be complimentary and interpreted in harmony so as to avoid conflict. Words and phrases will be interpreted in a manner consistent with construction and design industry standards. What is required by any Contract Document shall be required by all of them;

.2 In the event of any inconsistency, conflict or ambiguity between or among the Contract Documents that cannot be harmonized so as to avoid conflict, the Contract Documents shall take precedence in the

following order: Modifications, documents amending, modifying or supplementing the Contract Documents pursuant to Article 3.3 of the General Conditions, the Agreement, Exhibits to the Agreement, the Supplemental Conditions (if any), the General Conditions, Instructions to Bidders/Offerors, Notice to Proceed, Addenda, Specifications, Drawings, Contractor's Bid/Proposal, Documentation submitted by Contractor prior to Notice of Award and attached to the Agreement, Performance, Payment and Maintenance Bonds; and

.3 The definitions of terms herein shall apply equally to the singular and plural forms of the terms defined. Whenever the context may require, any pronoun shall include the corresponding masculine, feminine and neuter forms. The words "include", "includes" and "including" shall be deemed to be followed by the phrase "without limitation". Unless the context requires otherwise (a) any definition of or reference to any agreement, instrument or other document herein shall be construed as referring to such agreement, instrument or other document as from time to time amended, supplemented or otherwise modified (subject to any restrictions on such amendments, supplements or modifications set forth herein), (b) any reference herein to any Party shall be construed to include such Party's successors and assigns (subject to the restrictions contained herein), and (c) the words "herein", "hereof" and "hereunder", and words of similar import, shall be construed to refer to the entirety of the Contract Documents and not to any particular provision, unless the context clearly dictates otherwise. No provision of this Agreement shall be interpreted or construed against any Party because such Party or its legal representative drafted such provision.

3.1.3 Standards, Specifications, Codes, Laws, and Regulations

.1 Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Legal Requirements, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Legal Requirements in effect at the time of opening of Bids/Proposals (or on the Effective Date of the Agreement if there were no Bids/Proposals) and as amended, modified, codified or reenacted, in whole or in part, and in effect from time to time, except as may be otherwise specifically stated in the Contract Documents.

.2 No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or the Principal Architect/Engineer, or any of their related entities any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.2 Reporting and Resolving Discrepancies: If, during the performance of the Work, Contractor discovers any Discrepancy within the Contract Documents or

between the Contract Documents and any provisions of any Legal Requirements or of any such standard, specification, manual or code or instructions of any Supplier, Contractor shall report it to Owner's Representative in writing at once, and Contractor shall not proceed with the Work affected thereby until a clarification, an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Section 3.3.1 or Section 3.3.2 below. Contractor shall be liable to Owner for failure to report any such Discrepancy that Contractor knew about or should reasonably have discovered in fulfilling its obligations arising from the Contract.

3.3 Clarifying, Amending and Supplementing Contract Documents:

3.3.1 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

.1 Change Order.
.2 Change Directive.

3.3.2 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work that do not affect the Contract Amount or Contract Time Requirements may be authorized, in one or more of the following ways:

.1 Field Order.
.2 Shop Drawing or sample approved in accordance with the Contract Documents.
.3 Written interpretation or clarification issued in accordance with the Contract Documents.

3.4 Reuse of Documents Prohibited: Contractor and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with Owner: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of Principal Architect/Engineer or Principal Architect/Engineer's consultant, and (ii) shall not reuse any of such Drawings, Specifications, other documents or copies on extensions of the Project or any other project without written consent of Owner and Principal Architect/Engineer. Contractor may retain one (1) set of such documents for its records.

3.5 Not Used.

3.6 Electronic Data: Owner utilizes Microsoft SharePoint or similar document management software (the "Program") for its projects. Contractor will be provided access to the Program solely for purposes of Contractor's performance of its obligations under the Contract, at no cost to Contractor. The Program may be used to handle management, distribution and submission of all Project documents (including without limitation drawings, specifications, submittals, RFIs, schedules, etc.). Contractor must access the Program for all such Project documents, unless otherwise directed in writing by Owner. Contractor is responsible for all of the content contained in the Program related to the Project, including but not limited to all periodic updates, revisions and additions to the Project documents contained therein. All Project documents contained in the Program shall be deemed delivered to Contractor. Contractor is responsible for ensuring and maintaining compatibility of

Contractor's computer systems with the Program. Contractor shall take all necessary precautions to prevent any unauthorized access to the Program and the Project documents contained therein, and to prevent any virus or malware infiltration of the Program. **CONTRACTOR SHALL COMPLY WITH ALL MICROSOFT OR OTHER SIMILAR DOCUMENT MANAGEMENT SOFTWARE VENDOR TERMS AND CONDITIONS APPLICABLE TO CONTRACTOR'S USE OF THE PROGRAM, AND SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS OWNER FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LIABILITY, LOSS, COST AND EXPENSE, INCLUDING BUT NOT LIMITED TO ATTORNEYS' FEES, INCURRED AS A RESULT OF ANY CONTRACTOR BREACH OF SUCH TERMS AND CONDITIONS (COLLECTIVELY "CLAIMS" AS USED IN THIS SECTION 3.6), EVEN IF SUCH CLAIMS ARE CAUSED IN PART BY, BUT NOT TO THE EXTENT CAUSED BY, THE NEGLIGENCE OR FAULT, THE BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR THE BREACH OF CONTRACT OF OWNER, ITS AGENT OR EMPLOYEE, OR ANY THIRD PARTY UNDER THE CONTROL OR SUPERVISION OF OWNER, OTHER THAN CONTRACTOR OR ITS AGENT, EMPLOYEE OR SUBCONTRACTOR OF ANY TIER**. Any use, interpretation, conclusion or information obtained or derived from such Program information and documents will be at the user's sole risk. If there is a conflict or inconsistency between the Program information or documents and any hard copies furnished to Contractor, Contractor shall promptly notify Owner and Principal Architect/Engineer in writing, and shall not rely upon such Program information or documents or the hard copies furnished to Contractor until such conflict or inconsistency is resolved in writing by Owner or Principal Architect/Engineer. When distributing documents in electronic media format, Owner makes no representations as to compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those which are used by Owner or the data's creator.

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

4.1 Availability of Lands: The Owner will provide access to all land and interests in land required for the Work and will notify Contractor of any known restrictions in such access. Contractor may make a Claim if, after having received seventy-two hours' prior written notice, the Owner fails to provide timely access to the Work. Contractor is solely responsible for and must obtain any additional temporary construction facilities, stockpiling or storage sites not otherwise provided by the Owner.

4.1.1 In the event that Owner has agreed to provide any special licenses or easement(s) relating to the Work and in the event that Delays in the Work that are the responsibility of the Contractor cause the Work to be Delayed to the point that the ending date of such a license or easement has been exceeded, the Contractor shall reimburse the Owner for any additional costs and/or expenses incurred by Owner (including but not limited to reasonable attorneys' fees) in endeavoring to extend or renew the duration of any such license or easement in order to facilitate the completion of the Work.

4.2 Subsurface and Physical Conditions:

4.2.1 Contractor specifically represents that it has carefully examined the plans, the geotechnical report, if any, and the Site of the proposed Work and is thoroughly familiar with all of the conditions surrounding construction of the Project, having had the opportunity to conduct any and all additional inquiry, tests and investigation that he/she deems necessary and proper, to satisfy itself as to conditions, including but not limited to subsurface conditions, at the Site of the Work, and to inform itself by its independent research, tests and investigations of the difficulties to be encountered and to judge for itself the accessibility of the Work and all attending circumstances affecting the cost of doing the Work or time required for its completion. Contractor acknowledges the receipt of the geotechnical report, if any, and agrees that the report is not a guarantee of specific Site conditions which may vary between boring locations and over time, and is not a Contract Document. Contractor may not rely upon or make any Claim against Owner with respect to any Contractor interpretation of or conclusion drawn from any data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings. Contractor shall make no claims against the Owner and shall bear all risk of losses, if any, resulting on account of the amount and character of the Work, or because the conditions under which the Work must be done vary or differ from conditions or information contained in the Contract Documents, or are different from what were estimated or anticipated by it.

4.2.2 Except as provided in Section 4.2.5 below, Contractor must notify Owner in writing as soon as reasonably possible, but no later than three (3) calendar days, if unforeseen conditions are encountered at the Site which are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or other information provided by Owner to Contractor or (ii) unknown physical conditions of an unusual nature, that differ materially from those normally encountered in the type of Work being performed under this Contract. Contractor may not disturb the conditions until Owner conducts an investigation of such conditions. Upon receipt of notice from the Contractor, the Owner's Representative will promptly investigate such conditions with the Principal Architect/Engineer.

4.2.3 Notwithstanding any other provision of this Contract, Contractor is solely responsible for the location and protection of any and all underground utilities, pipelines, facilities and improvements, whether public or private, and whether utility_distribution, supply or collection systems, or lines connecting customers to utility distribution, supply or collection systems, and including but not limited to all electric, telecommunication, gas, water, storm sewer and sanitary sewer lines, and all pipes, conduits, cables, wires, manholes, vaults, tanks, and tunnels (collectively "Underground Improvements"). Contractor shall notify "One Call" and shall retain a private underground locator service, and shall exercise due care to locate, mark, uncover and otherwise protect all Underground Improvements in the construction zone and any of Contractor's Work or storage areas. Contractor's responsibility for the location and protection of Underground Improvements is primary and non-delegable. **Contractor shall defend and indemnify Owner from and against any losses, Claims, expenses, costs or penalties (including fines that may be levied against Owner) that may result from damage to any Underground Improvements in the Work area.** Owner reserves the right to repair any damage Contractor causes to such Underground Improvements

at Contractor's expense or to offset the cost of such repairs against funds then or thereafter due Contractor pursuant to the Contract. If any Underground Improvements are damaged by Contractor, Contractor shall give verbal notice to the Owner's Representative within one (1) hour and written notice within twenty-four (24) hours after such damage occurs.

4.2.4 Contractor shall take reasonable precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of Owner and Archeology Division, Texas Historical Commission. When such objects are uncovered unexpectedly, Contractor shall stop all Work in close proximity and immediately notify the Owner's Representative and Archeology Division, Texas Historical Commission of their presence. Contractor shall reference Texas Water Development Board Emergency Conditions for cultural resources in the event of accidental discoveries. Contractor shall not disturb them until written permission and permit to do so is granted by the governing authorities and Owner. All primitive rights to antiquities uncovered on Owner's property shall remain property of State of Texas, Archeology Division, Texas Historical Commission in accordance with the Texas Natural Resources Code. If it is determined by Owner, in consultation with Archeology Division, Texas Historical Commission, that exploration or excavation of primitive records or antiquities on Project Site is necessary to avoid loss, Contractor shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in Contractor's cost of, or time required for, performance of the Work, the Contract Amount and/or Contract Time Requirements will be equitably adjusted.

4.2.5 Environmental Conditions: Contractor shall immediately stop all Work and must notify Owner in writing as soon as reasonably possible, but no later than one (1) calendar day after any significant environmental conditions are encountered at the Site which are or may be subject to any Legal Requirements. Contractor shall reference Texas Water Development Board Emergency Conditions for threatened and endangered species in the event of accidental discoveries. Contractor shall not disturb the conditions until Owner conducts an investigation. Owner's Representative and Principal Architect/Engineer will promptly investigate such conditions. If it is determined that such conditions are subject to Legal Requirements, did not result from any Hazardous Conditions brought to the Site by Contractor or any Subcontractor, and cause an increase or decrease in the Contractor's cost of or time required for performance of any part of the Work, Owner's Representative will recommend an equitable adjustment in the Contract Amount or Contract Time Requirements, or both. If it is determined that such conditions are not subject to Legal Requirements or resulted from any Hazardous Conditions brought to the Site by Contractor or any Subcontractor, Owner's Representative will notify Contractor in writing of such findings and the Contract Amount and Contract Time Requirements will not be adjusted. Contractor may dispute such a determination in accordance with Article 16.

4.3 Reference Points: Unless otherwise specified, primary control lines and bench marks suitable for use in layout will be furnished by Owner. Lay out of the Work shall be performed in accordance with the requirements of Division 01. Controls, bench marks and property boundary markers shall be carefully preserved by

Contractor by use of flags, staffs or other visible devices and in case of destruction or removal by Contractor, any Subcontractor or their employees, such controls and bench marks shall be replaced by a Texas Registered Professional Land Surveyor at Contractor's expense. Any SJRA survey monuments damaged by Contractor will be reestablished by Owner at Contractor's expense.

4.4 Hazardous Conditions:

4.4.1 Contractor shall not be responsible for any Hazardous Conditions uncovered or revealed at the Site which were not shown, indicated or identified in the Contract Documents to be within the scope of the Work, and which were not brought onto the Site by the Contractor or the Subcontractors. Contractor shall immediately notify Owner's Representative of any such suspected Hazardous Conditions encountered at the Site before or during performance of the Work, and shall stop Work immediately in the affected area, and take all necessary precautions to avoid disturbance of the Hazardous Conditions.

4.4.2 Contractor shall be responsible for any Hazardous Conditions brought to the Site by Contractor, Subcontractor, Suppliers or anyone else for whom Contractor is responsible.

4.4.3 No asbestos-containing materials or lead-based paint shall be incorporated into the Work or brought on the Project Site without prior written approval of Owner. The Contractor shall not knowingly use, specify, request or approve for use any asbestos containing materials or lead-based paint without the Owner's written approval. When a specific product is specified, the Contractor shall endeavor to verify that the product does not include asbestos containing material or lead-based paint.

4.4.4 Refer to Section 1.040 Hazardous Conditions definitions and to Division 01 for procedures related thereto.

.1 Not used.

.2 Upon receiving notice of the presence of suspected Hazardous Conditions, Owner shall take the necessary measures required to ensure that the Hazardous Conditions are remediated or rendered harmless. Such necessary measures shall include Owner retaining qualified independent consultants to (i) ascertain whether Hazardous Conditions have actually been encountered, and, if they have been encountered, (ii) prescribe the remedial measures that Owner must take either to remove the Hazardous Conditions or render the Hazardous Conditions harmless.

.3 Contractor shall be obligated to resume Work at the affected area of the Project only after Owner or its qualified independent consultant provides written certification that (i) the Hazardous Conditions have been removed or rendered harmless and (ii) all necessary approvals have been obtained from all government and quasi-government entities having jurisdiction over the Project or Site. The Contractor shall be responsible for continuing the Work in the unaffected portion of the Project and Site.

.4 Contractor will be entitled, in accordance with these General Conditions, to an adjustment in its Contract Amount and/or Contract Time Requirements to the extent Contractor’s cost of performance is

actually increased and/or the Critical Path of the Work has been delayed by the presence of Hazardous Conditions discovered at the Site.

.5 Notwithstanding anything in the Contract Documents to the contrary, Owner, its officers, directors, agents and employees, and the Owner's Representative, the Principal Architect/Engineer, the Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees and agents are not responsible for Hazardous Conditions introduced to the Site by Contractor, Subcontractors or anyone for whose acts they may be liable. Contractor shall be responsible for use, storage and remediation of any Hazardous Conditions brought to the Site by Contractor, Subcontractors, Suppliers or anyone else for whom Contractor is responsible. **Contractor shall defend, indemnify and hold harmless Owner and Owner's officers, directors, employees and agents and the Owner's Representative, the Principal Architect/Engineer, the Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees and agents from and against any and all claims, losses, damages, liabilities and expenses, including attorneys' fees and court costs, arising out of or resulting from Hazardous Conditions introduced to the Site by Contractor, Subcontractors or anyone for whose acts they may be liable. Notwithstanding the foregoing, if Subchapter C of Chapter 151 of the Texas Insurance Code applies to the Contract, the obligation to defend, indemnify and hold harmless set forth in this Section 4.4.4.5 shall not apply to the extent prohibited by Subchapter C of Chapter 151 of the Texas Insurance Code.**

ARTICLE 5 - BONDS AND INSURANCE

5.1 Surety and Insurance Companies: All Bonds and insurance required by the Contract Documents shall be obtained from solvent surety or insurance companies that are duly admitted and licensed by the State of Texas and authorized to issue bonds or insurance policies for the limits and coverages required by the Contract Documents. Bonds shall be in a form acceptable to Owner and shall be issued by a surety which complies with the requirements of Chapter 3503 of the Texas Insurance Code. The Surety must obtain reinsurance for any portion of the risk that exceeds 10% of the Surety's capital and surplus. For bonds exceeding $100,000, the Surety must also hold a certificate of authority from the U.S. Secretary of the Treasury or have obtained reinsurance from a reinsurer that is authorized as a reinsurer in Texas and holds a certificate of authority from the U.S. Secretary of the Treasury and has an A.M. Best rating of A-, X or better.

5.2 Workers' Compensation Insurance Coverage:

5.2.1 Definitions:

.1 Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the division, or a coverage agreement (DWC Form-81, DWC Form-82, DWC Form-83, or DWC Form-84), showing statutory workers'

compensation insurance coverage for the person's or entity's employees providing services on the Project, for the duration of the Project.

.2 Duration of the Project - includes the time from the beginning of the Work on the Project until the Contractor's/person's Work on the Project has been completed and accepted by Owner.

.3 Persons providing services on the Project includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the Project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, Subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the Project.

.4 Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

5.2.2 Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the Project, for the duration of the Project.

5.2.3 Contractor must provide a certificate of coverage to Owner prior to being awarded the Contract.

5.2.4 If the coverage period shown on the Contractor's current certificate of coverage ends during the Duration of the Project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with Owner showing that coverage has been extended.

5.2.5 Contractor shall obtain from each person providing services on the Project, and provide to Owner:

.1 A certificate of coverage, prior to that person beginning Work on the Project, so Owner will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

.2 No later than seven (7) days after receipt by Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the Duration of the Project.

5.2.6 Contractor shall retain all required certificates of coverage for the Duration of the Project and for one (1) year thereafter.

5.2.7 Contractor shall notify Owner in writing by certified mail or personal delivery, within ten (10) days after Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

5.2.8 Contractor shall post on each Project Site a notice, in the text, form and manner prescribed by the Texas Department of Insurance, Division of Workers' Compensation, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

5.2.9 Contractor shall contractually require each person with whom it contracts to provide services on the Project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the Project, for the Duration of the Project;

.2 Provide to Contractor, prior to that person beginning Work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project, for the Duration of the Project;

.3 Provide Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the Duration of the Project;

.4 Obtain from each other person with whom it contracts, and provide to Contractor: a) a certificate of coverage, prior to the other person beginning Work on the Project; and b) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the Duration of the Project;

.5 Retain all required certificates of coverage on file for the Duration of the Project and for one (1) year thereafter;

.6 Notify Owner in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and

.7 Contractually require each person with whom it contracts, to perform as required by these Section 5.2.9.1 through Section 5.2.9.7, with the certificates of coverage to be provided to the person for whom they are providing services.

5.2.10 By signing this Contract or providing or causing to be provided a certificate of coverage, Contractor is representing to Owner that all employees of the Contractor who will provide services on the Project will be covered by workers' compensation coverage for the Duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the division. Providing false or misleading information may subject Contractor to administrative penalties, criminal penalties, civil penalties or other civil actions.

5.2.11 Contractor's failure to comply with any of these provisions is a breach of the Contract by Contractor which entitles Owner to declare the Contract void if

Contractor does not remedy the breach within ten (10) days after receipt of notice of breach from Owner.

5.3 Additional Insurance Requirements:

5.3.1 Contractor And Subcontractor Provided Insurance: Contractor and Subcontractors shall obtain and maintain insurance coverages described in Sections 5.3.1.01 through 5.3.1.08 and, to the extent applicable, Sections 5.3.1.09 through 5.3.1.11 through the end of the warranty period (with the exception of Builders' Risk, which is required to remain in effect at least until final payment) or such longer periods of time as may be set forth herein; except that Subcontractors' limits of coverage for Commercial General Liability shall be no less than $1,000,000 per occurrence and $2,000,000 in the aggregate, Subcontractors shall not be required to maintain separate Builder's Risk Insurance, Subcontractors shall not be required to maintain Environmental Impairment Liability or Pollution Liability Insurance unless their Scope of Work involves Hazardous Conditions in which event such Subcontractors shall maintain such insurance with limits of coverage not less than $1,000,000 per occurrence and $2,000,000 in the aggregate, Subcontractors shall not be required to maintain Professional Liability coverage unless their Scope of Work includes professional services in which event such Subcontractors shall maintain such insurance with limits of coverage not less than $1,000,000 per occurrence and in the aggregate, and Subcontractors' limits of coverage for Umbrella Liability shall be no less than $3,000,000. All insurance secured by Contractor, Subcontractors and Sub-Subcontractors pursuant to Owner's requirements under this provision shall be in accordance with Article 5 of the General Conditions and Section 5.3.1.01 as follows.

5.3.1.01 General Requirements.

.01 Contractor shall carry insurance in the types and amounts indicated below for the Duration of the Project or such longer periods of time set forth below, and shall include coverage for items owned by Owner in the care, custody and control of Contractor prior to and during construction and the warranty period.

.02 Contractor shall forward Certificates of Insurance evidencing the coverage and limits of insurance required herein to Owner with copies to each additional insured and loss payee listed in the Supplemental Conditions (if any), before the Contract is executed. Contractor shall also provide copies of policy endorsements and excerpts from policies to evidence the required coverages. Contractor shall not commence Work until the required insurance is obtained and until such insurance has been reviewed and approved by Owner. Approval of insurance by Owner shall not relieve or decrease the liability of Contractor hereunder and shall not be construed to be a limitation of liability on the part of Contractor. Contractor must also forward new Certificates of Insurance to Owner whenever a previously identified policy period has expired as verification of continuing coverage.

.03 Contractor's insurance coverage is to be written by companies licensed to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of A-, X or better, except for pollution liability or environmental impairment

liability insurance which shall be written by companies with A.M. Best ratings of A- or better.

.04 All endorsements naming the Owner as an additional insured, waivers of subrogation in favor of Owner, and notices of cancellation endorsements as well as the Certificates of Insurance shall specify Owner's name and address as: the San Jacinto River Authority, 1577 Dam Site Road, Conroe, Texas 77304.

.05 The "other" insurance clause shall not apply to the Owner where the Owner is an additional insured shown on any policy. Insurance policies required by the Contract shall be primary and non-contributing with respect to any other insurance coverage maintained by or available to the Owner and/or other additional insureds. The policies shall be endorsed to provide severability of interests.

.06 If underlying insurance policies are not written with coverage limits for at least the amounts specified below, Contractor shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage and have the same inception and termination dates as the primary coverage.

.07 Owner shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies. Failure of Contractor to provide certified copies, as requested, is a material breach of the Contract.

.08 Owner reserves the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by Owner based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as Contractor.

.09 All insurance policies required to be maintained will contain a provision or endorsement stating that the coverage afforded will not be cancelled until at least 30 days' prior written notice has been provided to the Contractor and to the Owner. Contractor shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

.10 Contractor shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. The amounts of all deductibles or self-insured retentions shall be disclosed on the Certificates of Insurance. Any deductible or self-insured retention in excess of $25,000 is subject to the written approval of Owner.

.11 Contractor shall provide Owner thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages required by the Contract.

.12 If Owner-owned property is being transported or stored off-site by Contractor, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect Owner's property.

.13 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of

Contractor. The inclusion of required minimum insurance limits in this Contract shall not be construed as limiting the Owner's or other additional insured's rights under any policy with higher limits. The minimum insurance limits set forth in this Contract shall be deemed to be amended to any higher limits actually contained in Contractor's insurance policies.

.14 The Contractor hereby waives its rights of recovery from the Owner, its officers, directors, agents and employees, and the Owner's Representative, the Principal Architect/Engineer, the Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees and agents with regard to all causes of property and/or liability loss covered by insurance required by this Contract, and shall cause a waiver of subrogation endorsement to be provided in favor of the Owner, its officers, directors, agents and employees, and the Owner's Representative, the Principal Architect/Engineer, the Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees and agents on all insurance coverage carried by the Contractor, whether required herein or not.

.15 Failure to obtain and maintain the required insurance shall constitute a material breach of, and default under, this Contract. If Contractor shall fail to remedy such breach, Contractor will be liable for any and all costs, liabilities, damages and penalties resulting to Owner from such breach, unless a written waiver of the specific insurance requirement(s) is provided to Contractor by Owner. In the event of any failure by Contractor to comply with the provisions of this Contract, Owner may, without in any way compromising or waiving any right or remedy at law or in equity, on notice to Contractor, purchase such insurance, at Contractor's expense, provided that Owner shall have no obligation to do so and if Owner shall do so, Contractor shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages.

.16 Additional insured status shall be provided in favor of the Owner, its officers, directors, agents and employees, and the Owner's Representative, the Principal Architect/Engineer, the Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees and agents on all insurance policies other than Workers' Compensation, Professional Liability and Builder's Risk, on ISO forms CG 20 10 10 01 and CG 20 37 10 01 or their combined equivalent. It is the intent of the parties to this Contract that this Additional Insured status shall include coverage for completed operations and for the additional insureds' concurrent and sole negligence. Notwithstanding the foregoing, if Subchapter C of Chapter 151 of the Texas Insurance Code applies to the Contract, this additional insured obligation shall not require or provide coverage the scope of which is prohibited under Subchapter C of Chapter 151 of the Texas Insurance Code.

.17 Contractor's obligations under this Contract to defend, indemnify and/or hold harmless Owner or other parties shall not be limited in any way by any insurance required of Contractor by this Contract or otherwise provided or maintained by Contractor. Any insurance obligations of Contractor under this Contract are

independent from Contractor's obligations under this Contract to defend, indemnify and/or hold harmless Owner or other parties.

5.3.1.02 Business Automobile Liability Insurance: Provide coverage for all owned, non-owned and hired vehicles. The policy shall provide coverage in the following types and amounts:

.1 A minimum combined single limit of $1,000,000 per occurrence for bodily injury and property damage.
.2 A minimum combined single limit of $1,000,000 minimum per occurrence for bodily injury and property damage.
.3 The policy shall contain the following endorsements in favor of Owner:
  .a Waiver of Subrogation endorsement; and
  .b 30 day Notice of Cancellation endorsement; and
  .c Additional Insured endorsement.

5.3.1.03 Workers' Compensation And Employers' Liability Insurance: Coverage shall meet or exceed statutory limits and all other benefits outlined in the Texas Workers' Compensation Act (Section 401). The minimum policy limits for Employers' Liability Insurance coverage shall be $500,000 bodily injury per accident, $500,000 bodily injury by disease policy limit and $500,000 bodily injury by disease each employee.

.1 Contractor's policy shall cover all States in which Work is performed and apply to the State of Texas and shall include these endorsements in favor of Owner:
  .a Waiver of Subrogation; and
  .b 30 day Notice of Cancellation.

5.3.1.04 Commercial General Liability Insurance: Provide coverages with minimum limits as follows: combined bodily injury and property damage limit of $2,000,000 minimum per occurrence and $5,000,000 aggregate. The Contractor's policy shall include coverage for:

.1 Blanket contractual liability coverage for liability assumed under the Contract and all contracts relative to this Project; and
.2 Completed Operations/Products Liability for at least three years after Substantial Completion; and
.3 Explosion, Collapse and Underground (X, C & U) coverage; and
.4 Independent Contractors coverage; and
.5 Aggregate limits of insurance per project; and
.6 Additional insureds as required in 5.3.1.01.16; and
.7 30 day notice of cancellation in favor of Owner; and
.8 Waiver of Transfer of Recovery Against Others in favor of all required additional insureds; and
.9 Primary and non-contributing endorsement.

5.3.1.05 Builder's Risk Insurance: Contractor shall maintain Builder's Risk Insurance or Installation Insurance on an all-risk physical loss form in the Contract Amount plus the value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Work at the site on a replacement cost basis without optional deductibles. Coverage shall include, without limitation, insurance against

the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, explosion, tornado, malicious mischief, collapse, earthquake, flood, surface water, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Principal Architect/Engineer's and Contractor's services and expenses required as a result of any insured loss. Coverage shall continue until final payment for the Work is made by the Owner. Coverage shall allow for partial occupancy/use by the Owner. Owner shall be an additional named insured on the policy. Policy must include expenses incurred in the repair or replacement of any insured property, including but not limited to fees and charges of the Principal Architect/Engineer and any other engineers and architects and their respective subconsultants. If off-site storage is permitted by the Owner, coverage shall include materials in transit and storage in an amount sufficient to protect property being transported or stored. Any losses covered by the Builder's Risk or Installation Insurance shall be adjusted by the Owner.

5.3.1.06 Environmental Impairment Liability or Pollution Liability Insurance:
Contractor shall comply with the following insurance requirements in addition to those specified above:

.1 Provide an Environmental Impairment Liability policy with minimum limits of $2,000,000 each occurrence and $5,000,000 aggregate. Coverage shall contain a "per project" aggregate, 30 day notice of cancellation to Owner and waiver of subrogation in favor of Owner. Coverage to include non-owned disposal sites. Coverage shall include clean-up costs, bodily injury, property damage and defense costs.

.2 Policy shall contain proper endorsement wording to comply with Federal or TCEQ requirements. Policy will also cover vessels and marine operations. Contractor shall submit complete copies of the policy providing pollution liability coverage to Owner.

5.3.1.07 Professional Liability Insurance: For Work which requires professional engineering or architectural or professional survey services to meet the requirements of the Contract, including but not limited to excavation safety systems, traffic control plans, and construction surveying, the Contractor or Subcontractors, responsible for performing the professional services shall provide Professional Liability Insurance with a minimum limit of $1,000,000 each occurrence and $3,000,000 aggregate to pay on behalf of the assured all sums which the assured shall become legally obligated to pay as damages by reason of any negligent act, error, or omission committed in connection with professional services provided for or in connection with the Work of this Contract.

5.3.1.08 Umbrella Liability: Umbrella Liability with a limit of $5,000,000, with the Owner as an additional insured and with waiver of subrogation and 30 day notice of cancellation. The Umbrella Liability policy shall follow form, be excess over and be no less broad than all coverages described above (with the exception of Workers' Compensation, Professional Liability and Pollution Liability), shall include a drop-down provision and

contain a per job aggregate. This policy shall have the same inception and expiration dates as the Commercial General Liability insurance required above. Contractor shall maintain such insurance in identical coverage, form and amount, including required endorsements, for at least three (3) years following Date of Substantial Completion of the Work to be performed under the Contract.

5.3.1.09 Protection and Indemnity: Protection and Indemnity coverage for any over water operations, vessels, barges, divers. This policy shall have limits of $1,000,000 each occurrence, $2,000,000 aggregate and policy endorsed to provide

5.3.1.10 Excess P&I: Excess P&I in the amount of $20,000,000 each occurrence with additional insured, waiver of subrogation and 30 day notice of cancellation to the Owner.

5.3.1.11 Marine: Contractor and/or any Subcontractors shall have appropriate workers compensation insurance to provide coverage for USL&H and Jones Act exposures.

5.3.2 Waiver of Rights

5.3.2.1 All policies purchased in accordance with Section 5.3.1.05 shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional named insureds thereunder. Owner and Contractor waive all rights of recovery for damages against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, the Principal Architect/Engineer, the Principal Architect/Engineers Consultants and Subconsultants and Owner's Representative and any named insured or additional named insured or loss payee to the extent (a) of losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work and (b) that such losses and damages are actually paid by such policies or other property insurance applicable to the Work None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as adjuster or recipient thereof or otherwise payable under any such policy.

5.3.3 Receipt and Application of Insurance Proceeds

5.3.3.1 Any insured loss under the policies of insurance required by Section 5.3.1.05 will be adjusted with Owner and made payable to Owner for the named insureds, additional named insureds, and loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Section 5.3.3.2. Owner shall deposit any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof, to the extent of loss payments received, covered by an appropriate Change Order.

5.3.3.2 Owner shall have power to adjust and settle any loss with the builder's risk or other property insurers.

5.3.4 Partial Utilization, Acknowledgment of Property Insurer:

5.3.4.1 If Owner desires to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Section 14.08, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Section 5.3.1.05 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, and the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

5.4 Bonds:

5.4.1 General:

.1 Contractor shall furnish performance, payment, and one-year maintenance Bonds, each in an amount at least equal to the Contract Amount as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents, as well as a second year maintenance Bond, in an amount equal to ten percent (10%) of the Contract Amount. The one-year maintenance Bond shall remain in effect until completion of the correction period specified in Section 13.7.1. The second year maintenance Bond shall remain in effect until 2-years from the date of Substantial Completion. Contractor shall also furnish such other Bonds as are required by the Contract Documents.

.2 Bonds shall be executed on forms furnished by Owner, as included in the Specifications. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each Bond.

.3 If the Surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it is placed into receivership, Contractor shall within ten (10) days thereafter substitute other Bonds and Surety, each of which must be acceptable to Owner.

.4 The Performance Bond and Payment Bond shall be issued in an amount of one hundred percent (100%) of the Contract Amount as security for the faithful performance and/or payment of all Contractor's obligations under the Contract Documents. All Bonds, including but not limited to the Performance Bond and Payment Bond shall be issued by a solvent corporate surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by Owner pursuant to applicable law. Any surety duly authorized to do business in Texas may write Performance and Payment Bonds on a project without reinsurance to the limit of ten percent (10%) of its capital and surplus. Such a surety must reinsure any obligations over the ten percent (10%) limit.

5.4.2 Performance Bond:

.1 Contractor shall furnish Owner with a Performance Bond in the form set out in the Contract Documents.

.2 The Performance Bond shall include the one (1) year warranty correction period obligation from the date of Substantial Completion of the Work.

5.4.3 Payment Bond:

.1 Contractor shall furnish Owner with a Payment Bond in the form set out in the Contract Documents.

5.4.4 One-Year Maintenance Bond:

.1 Contractor shall furnish Owner with a One-Year Maintenance Bond in the form set out in the Contract Documents.

5.4.5 Second-Year Maintenance Bond:

.1 Contractor shall furnish Owner with a Second-Year Maintenance Bond in the form set out in the Contract Documents.

.2 The Second-Year Maintenance Bond shall be in an amount equal to ten percent (10%) of the Contract Amount, and shall remain in effect until 2-years from the date of Substantial Completion.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence:

6.01.1 Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. Contractor shall be responsible to see that the completed Work strictly complies with the Contract Documents.

6.01.2 Contractor shall have an English-speaking, competent Superintendent on the Work at all times that Work is in progress. The Superintendent will be Contractor's representative on the Site and shall have the authority to act on the behalf of Contractor. All communications given to the Superintendent shall be as binding as if given to Contractor. Contractor's Superintendent and Project Manager shall provide cellular telephone numbers and emergency and home telephone number(s) at which one or the other may be reached if necessary when Work is not in progress. Telephone or cellular phone number(s) shall be to a live person having responsible authority for the Work and not an answering machine or answering service. The Superintendent must be an employee of the Contractor, unless such requirement is waived in advance in writing by the Owner. If the Contractor proposes a management structure with a Project Manager supervising, directing, and managing construction of the Work in addition to or in substitution of a Superintendent, the requirements of these

Construction Documents with respect to the Superintendent shall likewise apply to any such Project Manager:

.1 Contractor shall present the resume of the proposed Superintendent to the Owner's Representative showing evidence of experience and successful superintendence and direction of Work of a similar scale and complexity. If, in the opinion of the Owner, the proposed Superintendent does not have sufficient experience in line with the Work, he/she will not be allowed to be the designated Superintendent for the Work.

.2 The Superintendent shall not be replaced without prior Written Notice to Owner's Representative. If Contractor deems it necessary to replace the Superintendent, Contractor shall provide the necessary information for approval, as stated above, on the proposed new Superintendent.

.3 A qualified substitute Superintendent may be designated in the event that the designated Superintendent is temporarily away from the Work, but not to exceed a time limit acceptable to the Owner's Representative.

.4 Contractor shall replace the Superintendent upon Owner's request in the event the Superintendent is unable to perform to Owner's satisfaction.

6.02 Labor, Materials and Equipment:

6.02.1 Contractor shall maintain a work force adequate to accomplish the Work within the Contract Time Requirements. Contractor agrees to employ only orderly and competent workers, skillful in performance of the type of Work required under this Contract. Contractor, Subcontractors, Sub-Subcontractors, and their employees may not use or possess any alcoholic or other intoxicating beverages, illegal drugs or controlled substances while on the job or on Owner's property, nor may such workers be intoxicated, or under the influence of alcohol or drugs, on the job. Subject to the applicable provisions of Texas law, Contractor, Subcontractors, Sub-Subcontractors, and their employees may not use or possess any firearms or other weapons while on the job or on Owner's property. If Owner or Owner's Representative notifies Contractor that any worker or representative of Contractor is incompetent, disorderly, abusive, or disobedient, has knowingly or repeatedly violated safety regulations, has possessed any firearms in contravention of the applicable provisions of Texas law or this Contract, or has possessed or was under the influence of alcohol or drugs on the job, Contractor shall immediately remove such worker or representative, including any officer or owner of Contractor, from performing Contract Work, and may not employ such worker or representative again on Contract Work without Owner's prior written consent. Contractor shall at all times maintain good discipline and order on or off the Site in all matters pertaining to the Project. Contractor shall pay workers no less than the applicable wage rates established for the Contract, and maintain weekly payroll reports as evidence thereof, in accordance with the requirements of Chapter 2258 of the Texas Government Code.

6.02.2 Except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular Working Days and regular Working Hours.

Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without the Owner's prior written consent given after the Contractor has provided 48-hour advanced written notice to the Owner's Representative.

6.02.3 Unless otherwise specified in Division 01, Contractor shall provide and pay for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work, provided the Owner's CMT Consultant shall provide certain inspection services, the Owner shall provide testing of construction materials engineering and the verification testing services necessary for acceptance of the Work by Owner, as required by Section 2267.058(a) of the Texas Government Code. Water supply by contractor shall use metered connection with "backflow" prevention.

6.02.4 All materials and equipment shall be of good quality and new (including new products made of recycled materials, pursuant to Section 361.426 of the Texas Health & Safety Code), except as otherwise provided in the Contract Documents. If required by Owner's Representative, Contractor shall furnish satisfactory evidence (reports of required tests, Manufacturer's certificates of compliance with material requirements, mill reports, etc.) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Manufacturer or Supplier, except as otherwise provided in the Contract Documents.

6.02.5 Substitutes and "Approved Equal" Items:

.1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Manufacturer or Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains words reading that no like, equivalent or "approved equal" item or no substitution is permitted, other items of material or equipment of other Manufacturers or Suppliers may be submitted by Contractor, at Contractor's sole risk, including potential impacts and disruptions to the Critical Path of the Project Schedule, to Principal Architect/Engineer for their review and approval through Owner's Representative under the following circumstances:

(a) "Approved Equal": If in Principal Architect/Engineer's and Owner's sole discretion an item of material or equipment proposed by Contractor is functionally equal and of equivalent type and quality to that named, and sufficiently similar so that no change in related Work, time of performance or Contract Amount will be required, it may be approved by Principal Architect/Engineer and Owner through the submittal process as an "approved equal" item. Contractor shall provide Principal Architect/Engineer and Owner with all necessary documentation required for Principal Architect/Engineer and Owner to make their evaluation, and shall identify the item of material or

equipment proposed by Contractor as a variation in accordance with Section 6.20.5.

(b) Substitute Items: Contractor may submit an item of material or equipment which does not qualify as an "approved equal" item under Subsection 6.02.5.1(a), or may resubmit an item of material or equipment proposed by Contractor and rejected by Principal Architect/Engineer or Owner as an "approved equal" item under Subsection 6.02.5.1(a), as a proposed substitute item. All of Contractor's requests for substitutions must be clearly identified as a "**Request For Substitution**" on the face of the document. Contractor shall submit sufficient information as provided in Division 01 to allow Principal Architect/Engineer and Owner to evaluate the item of material or equipment proposed as a substitute for the item named.

.2 Substitute Construction Methods and Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, Contractor may, at Contractor's sole risk, including potential impacts and disruptions to the Critical Path of the Project Schedule, with prior approval of Principal Architect/Engineer, furnish or utilize a substitute means, method, technique, sequence, or procedure of construction. All such proposed substitutions must be clearly identified as being a "**Substitution**" in all of the Contractor's submittals. Contractor shall submit sufficient information to Owner's Representative to allow Principal Architect/Engineer's, in Principal Architect/Engineer's sole discretion, evaluation of the proposed substitute as an equivalent to that method or procedure expressly called for by the Contract Documents. The procedure for review by Principal Architect/Engineer will be same as that provided for substitute items in Division 01.

.3 Principal Architect/Engineer's Evaluation: Principal Architect/Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Subsections 6.02.5.1(a), 6.02.5.1(b), and 6.02.5.2. Principal Architect/Engineer and Owner will be the judge of acceptability. No "approved equal" or substitute shall be ordered, installed, or utilized until Principal Architect/Engineer's and Owner's review is complete, and any "approved equal" is approved through the submittal process, or any approved substitute is evidenced by either a Change Order, or a Change Directive. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety Bond with respect to any approved substitute. Owner shall not be responsible for any Delay due to review time for any "approved equal" or substitute.

.4 Contractor's Expense: All data and documentation to be provided by Contractor in support of any proposed "approved equal" or substitute item will be at Contractor's expense.

.5 The approval of the Principal Architect/Engineer and/or Owner will not relieve the Contractor from primary responsibility and liability for the suitability and performance of any proposed substitute item, method or procedure and will not relieve Contractor from its primary responsibility and liability for curing Defective Work and performing warranty work, which the Contractor shall cure and perform,

regardless of any claim the Contractor may choose to advance against the Owner, the Principal Architect/Engineer or Manufacturer.

.6 Notwithstanding the foregoing, it is agreed and understood that the Contract Amount shall not be adjusted as a result of the Contractor's use of the cost of any possible substitute or "approved equal" items in calculating its Bid/Proposal price.

6.02.6 Contractor agrees to assign and hereby assigns to Owner any rights it may have to bring antitrust suits against its Manufacturers or Suppliers for overcharges on materials incorporated in the Project growing out of illegal price fixing agreements. Contractor further agrees to cooperate with Owner should Owner wish to prosecute suits against Manufacturers or Suppliers for illegal price fixing.

6.03 Project Schedule Requirements: Unless otherwise provided in Division 01, Contractor shall adhere to the Owner's Project Schedule as provided by the Owner, which shall be further developed by the Contractor to become first the Contractor's Preliminary Project Schedule and then, upon acceptance by the Owner, become the Master Project Schedule, as it may be adjusted from time to time as provided below:

6.03.1 Preliminary Project Schedule: Within thirty (30) days from the issuance of a Notice To Proceed by the Owner, the Contractor shall submit to the Owner's Representative a Preliminary Project Schedule to be used as the Contractor's baseline schedule for the Project. This Preliminary Project Schedule shall be initially based on and shall include and be consistent with all of the Milestones contained in Division 01, Work Covered By Contract Documents Specification, and shall be presented in a form reasonably acceptable to the Owner. The Preliminary Project Schedule shall be a Critical Path Method (CPM) schedule depicting all significant activities which will occur on the Project; the durations for all major items of Work to be performed; the start and finish dates of such activities; the Contract Time Requirements as set out in the Contract Documents; and the precedence logic of such activities. The Contractor's Preliminary Project Schedule shall include, at a minimum:

.1 Duration and milestone dates for all equipment, materials delivery, and operations efforts that may affect the timely completion of the Project.

.2 Duration and milestone dates for each anticipated construction activity.

.3 Pre-purchase of materials and equipment with a "long lead" time.

.4 Permitting and regulatory milestones.

.5 Dates associated with the activities leading to delivery milestones from others including for offsite roadways and utilities.

6.03.2 The Contractor shall coordinate the Preliminary Project Schedule with the Contractor's Submittal Schedules for Shop Drawings and Samples as required by Division 01 of the Project Manual. The Contractor's Submittal Schedule must provide an adequate duration for reviewing and processing the required Submittals acceptable to Owner and the Principal Architect/Engineer.

6.03.3 The Contractor shall provide Owner with an electronic version (by disk or CD) of the Preliminary Project Schedule and of each subsequent Master

Project Schedule, including all subsequent electronic schedule revisions and updates, created without password protection, in latest version of Microsoft Project (.MPT, .MPX or .MPD suffix) or a format approved by Owner. Failure to furnish Owner, Owner's Representative, and Principal Architect/Engineer with a revised Project Schedule in one of the above formats within ten (10) days of receipt of a written request shall constitute a breach of the Contract by Contractor, and shall be considered to be adequate cause for termination of the Contractor by Owner.

6.03.4 Master Project Schedule: Once the Contractor's Preliminary Project Schedule has been accepted by Owner, it shall become the Master Project Schedule (Baseline Schedule) for the Project. The Contractor shall update the Master Project Schedule monthly or more often by the submission of a revised Master Project Schedule or when circumstances develop which make it beneficial to the Project, or as may be required by Owner. Once the most recently revised Master Project Schedule has been accepted by Owner, the Master Project Schedule shall be considered to have been updated. The updated Master Project Schedule shall then be distributed by the Contractor to Owner's staff, the Principal Architect/Engineer, each consultant, and other appropriate parties. The Master Project Schedule shall be reviewed at the monthly team meeting at a summary level, including for a three month look-ahead and anticipated Project completion.

6.03.5 Changes to the Master Project Schedule: A copy of the accepted Master Schedule shall be maintained unaltered. The Contractor shall thereafter submit to Owner's Representative an updated Project Schedule each month with its Application for Payment, to reflect actual progress that has been made and to forecast future progress of the Work. The monthly Project Schedule update shall be based upon the accepted Master Project Schedule. Contractor shall submit to Owner's Representative for review and acceptance by Owner any proposed changes or adjustments in its monthly Project Schedule that modify either the Master Project Schedule or the previous month's approved Project Schedule. Any such proposed adjustments must be substantiated with a written narrative containing an explanation of any changes to the underlying logic of the subject schedule. Contractor's proposed changes to the schedule must show how the Contractor will consistently advance the progress of the Work in accordance with the Critical Path of the Work and the Contract Time Requirements, including all required contractual Milestones. Such adjustments will conform generally to the Master or monthly Project Schedule then in effect and additionally will comply with any provisions of Division 01 applicable thereto.

6.03.6 Proposed adjustments indicated by the Project Schedule that will change the Contract Time Requirements, including Milestones, shall be submitted in accordance with the requirements of Article 12. Any such proposed adjustments must be substantiated with documentation of any changes to the underlying logic of the Master Project Schedule. Such adjustments may only be made by a Change Order or Change Directive in accordance with Article 12.

6.03.7 Contractor shall keep a current schedule of submittals that coordinates with the Master Project Schedule, and shall submit the initial schedule of

submittals to Owner's Representative for acceptance along with the Preliminary Project Schedule.

6.04 Concerning Subcontractors, Suppliers and Others:

6.04.1 Assignment: Contractor shall retain direct control of and give direct attention to the fulfillment of this Contract. Contractor shall not assign, transfer, or convey this Contract or any portion thereof, or any right, title or interest in, to or under same, or any causes of action or claims for damages arising under this Contract or any breach thereof, without the prior written consent of Owner. In addition, without Owner's written consent, the Contractor will not subcontract the performance of the entire Work or the supervision and direction of the Work.

6.04.2 Award of Subcontracts for Portions of the Work: Contractor shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom Owner may have reasonable objection. Owner will communicate such objections by Written Notice. If Owner requires a change without good cause of any Subcontractor, person or organization previously accepted by Owner, the Contract Amount shall be increased or decreased by the difference in the cost caused by any such change, and an appropriate Change Order shall be issued. Contractor shall not substitute any Subcontractor, person or organization that has been accepted by Owner, unless the substitute has been accepted in writing by Owner. No acceptance by Owner of any Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of Owner to reject Defective Work. Contractor shall comply with the applicable requirements set forth in the Bid/Proposal Documents and Contract Documents with respect to Subcontractors and the subcontracting process.

6.04.3 Contractor shall enter into written agreements with all Subcontractors and Suppliers which specifically bind the Subcontractors, Manufacturers and Suppliers to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Principal Architect/Engineer. The Owner reserves the right to specify that certain requirements shall be adhered to by all Subcontractors, Manufacturers and Suppliers as indicated in other portions of the Contract Documents and these requirements shall be made a part of the agreements between Contractor and Subcontractors, Manufacturers and Suppliers.

6.04.4 Contractor shall be fully responsible to Owner for all acts and omissions of the Subcontractors, Manufacturers, or Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Manufacturer, or Supplier or other person or organization any contractual relationship between Owner and any such Subcontractor, Supplier, Manufacturer or other person or organization, nor shall it create any obligation on the part of Owner or Principal Architect/Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Manufacturer, or Supplier or other

person or organization except as may otherwise be required by laws and regulations.

6.04.5 Contractor shall be solely responsible for efficiently scheduling and coordinating the Work of Subcontractors, Manufacturers, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor in order to avoid any Delays or inefficiencies in the prosecution of the Work. Contractor shall require all Subcontractors, Manufacturers, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner's Representative through Contractor.

6.04.6 The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing or delineating the Work to be performed by any specific trade.

6.04.7 Contractor shall pay each Subcontractor, Manufacturer and Supplier their appropriate share of payments made to Contractor not later than ten (10) Calendar Days from Contractor’s receipt of payment from Owner.

6.04.8 To the extent allowed by Texas law, the Owner shall be deemed to be a third party beneficiary to each subcontract and may, if Owner elects, following a termination of the Contractor, require that the Subcontractor(s) perform all or a portion of unperformed duties and obligations under its subcontract(s) for the benefit of the Owner, rather than the Contractor; however, if the Owner requires any such performance by a Subcontractor for the Owner’s direct benefit, then the Owner shall be bound and obligated to pay such Subcontractor the reasonable value for all Work performed by such Subcontractor to the date of the termination of the Contractor, less previous payments to Contractor for such Subcontractor’s work, and for all Work performed by Subcontractor thereafter. In the event that the Owner elects to invoke its right under this section, Owner will provide written notice of such election to the terminated Contractor and the affected Subcontractor(s).

6.05 Patent Fees and Royalties:

6.05.1 Contractor shall be responsible at all times for compliance with applicable patents or copyrights encompassing, in whole or in part, any design, device, material, or process utilized, directly or indirectly, in the performance of the Work or the formulation or presentation of its Bid/Proposal.

6.05.2 Contractor shall pay all royalties and license fees and shall provide, prior to commencement of Work hereunder and at all times during the performance of same, for lawful use of any design, device, material or process covered by letters patent or copyright, suitable legal agreement with the patentee, copyright holder, or their duly authorized representative, whether or not a particular design, device, material, or process is specified by Owner.

6.05.3 Contractor shall defend Owner in all suits or claims for infringement of any patent or copyright and shall indemnify and save Owner harmless from any loss or liability, direct or indirect, arising with respect to Contractor's process in the formulation of its Bid/Proposal or the performance of the

Work or otherwise arising in connection therewith, with the exception that the Contractor will not be responsible to defend or indemnify the Owner for such loss or liability when a particular design, process or product of a particular Manufacturer or Manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Principal Architect/Engineer, unless Contractor knew or reasonably should have known of the patent or copyright violation and failed to notify Owner of same. Owner reserves the right to provide its own defense to any suit or claim of infringement of any patent or copyright in which event Contractor shall, to the extent provided in this Subsection, indemnify and save harmless Owner from all costs and expenses of such defense as well as satisfaction of all judgments entered against Owner.

6.05.4 Owner shall have the right to stop the Work and/or terminate this Contract at any time in the event Owner discovers that Contractor's work methodology includes the use of any infringing design, device, material or process.

6.06 Permits, Fees: Contractor shall obtain and pay for all construction permits, licenses and fees required for prosecution of the Work. However, Owner or Owner's Representative will obtain and pay for the following permits, licenses and/or fees:

.1 Site Development Permit; and
.2 Initial Corp of Engineer Permits (404, Letter of Permission only, if applicable).

6.07 Laws and Regulations:

6.07.1 Contractor shall give all notices and comply with all Legal Requirements applicable to furnishing and performing the Work, including arranging for and obtaining any required inspections, tests, approvals or certifications from any governmental entity or public body having jurisdiction over the Work or any part thereof. Except where otherwise expressly required by applicable laws and regulations, neither Owner, Owner's Representative, nor Principal Architect/Engineer shall be responsible for monitoring Contractor's compliance with any Legal Requirements.

6.07.2 Maintaining clean water, air and earth or improving thereon shall be regarded as of prime importance. Contractor shall plan and execute its operations in compliance with all applicable Legal Requirements concerning control and abatement of water pollution and prevention and control of air pollution.

6.07.3 If Contractor performs any Work knowing or having reason to know that it is contrary to applicable Legal Requirements, Contractor shall bear all claims, costs, losses and damages arising therefrom; however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with all Legal Requirements, but this does not relieve Contractor of the Contractor's obligations under the terms of the Contract.

6.07.4 This Work is subject to the Texas Pollution Discharge Elimination System (TPDES) permitting requirements for the installation and maintenance of temporary and permanent erosion and sediment controls and storm water pollution prevention measures throughout the construction period.

Contractor's responsibilities are as follows.

.01 Contractor must prepare a Storm Water Pollution Prevention Plan (SWPPP), or make modifications if SWPPP is already completed and as required, prior to filing the NOI form.

.02 Contractor must file a Notice of Intent (NOI) form with the TCEQ at least two (2) days prior to start of construction activity and pay for the permit. The required NOI form is available from the Internet at https://www.tceq.texas.gov/assets/public/permitting/waterquality/forms/20022.pdf.
The form shall be mailed or submitted online to the TCEQ. If submitting online, the web address is https://www3.tceq.texas.gov/steers/. If Contractor has not already registered to use the TCEQ online application submittal service, it will take up to ten (10) working days to receive a user name and password. Contractor shall take this timeframe into consideration if applying online. A Time Extension shall not be granted for this timeframe. The mailing address is:

Texas Commission on Environmental Quality
Stormwater Processing Center (MC-228)
P.O. Box 13087
Austin, TX 78711-3087

For overnight mail: Stormwater Processing Center (MC-228)
12100 Park 35 Circle
Austin, TX 78753

.03 Contractor must mail a copy of the completed Notice of Intent (NOI) form to the local Municipal Separate Storm Sewer Systems (MS4) representative.

.04 Contractor must obtain a signed certification statement from all Subcontractors responsible for implementing the erosion and sediment control measures. This statement shall indicate that the Subcontractor understands the permit requirements. The certified statement forms shall be attached to and become part of the SWPPP.

.05 Contractor must post a notice near the main entrance of the Work with the following information.

.1 The TPDES permit number for the Work or a copy of the NOI if a permit number has not yet been assigned,

.2 The name and telephone number of a local contact person,

.3 A brief description of the Work, and

.4 The location of the SWPPP if the Site is inactive or does not have an on-site location to store the plan.

.5 If posting this information near a main entrance is infeasible due to safety concerns, the notice must be posted in a local public building. If the Work is linear (pipeline, highway, etc.), the notice must be placed in a publicly accessible location near where construction is actively underway and moved as

necessary. For linear Work, multiple postings of the information may be required by Owner (e.g. postings at both ends of the Work).

.06 Contractor must maintain all erosion and sediment control measures and other protective measures identified in the SWPPP in effective operating condition.

.07 Contractor must retain weekly inspection reports and be available for audit by the Owner, the TCEQ or the EPA.

.08 Contractor must perform inspections every seven (7) calendar days and after every ½ inch rainfall event, noting the following observations on an inspection form provided by Owner:

.1 Locations of discharges of sediment or other pollutants from the Site.

.2 Locations of storm water / erosion / sedimentation controls that are in need of maintenance.

.3 Locations of storm water / erosion / sedimentation controls that are not performing, failing to operate, or are inadequate.

.4 Locations where additional storm water / erosion / sedimentation controls are needed.

.09 Contractor must maintain at Work Site at all times a copy of the SWPPP (with all updates, as described below) and inspection reports.

.10 Contractor must update the SWPPP as necessary to comply with TPDES permitting requirements, which includes noting changes in erosion / sedimentation controls and other best management practices that are part of the SWPPP and which may be necessary due to the results of inspection reports.

.11 Contractor must file a Notice of Termination with the TCEQ within thirty (30) days of final stabilization on all portions of the Work Site. Form is available from Owner or on the Internet at: https://www.tceq.texas.gov/assets/public/permitting/waterquality/forms/10443.docx.

The notice shall be mailed to:

Texas Commission on Environmental Quality
Storm Water & General Permits Team;

.12 Upon completion of the Work, the Contractor must provide copies of all TPDES records to Owner.

6.07.6 Contractor shall abide by all Legal Requirements including, but not limited to, the Endangered Species Act.

6.07.7 Contractor warrants and represents that: (i) Contractor does not have any contracts with and does not provide supplies or services to any organization designated as a foreign terrorist organization by the United States secretary of state as authorized by 8 U.S.C. Section 1189 (a "Foreign Terrorist Organization"); or (ii) the United States government has affirmatively declared Contractor to be excluded from its federal sanctions regime relating to Sudan, its federal sanctions regime relating to Iran, or any federal sanctions regime relating to a Foreign Terrorist Organization.

6.08 Taxes:

6.08.1 Contractor shall pay only those sales, consumer, use and other similar taxes required to be paid by Contractor in accordance with the laws and

regulations of the State of Texas in the performance of this public works contract.

6.08.2 Owner is an exempt organization as defined by Chapter 11 of the Property Tax Code of Texas and is thereby exempt from payment of Sales Tax under Chapter 151, Limited Use Sales, Excise and Use Tax, Texas Tax Code, and Article 1066 (C), Local Sales and Use Tax Act, Revised Civil Statutes of Texas.

6.08.3 In addition, if the Project is construction of a water or wastewater system certified by the Texas Commission on Environmental Quality as a regional system, equipment, services and supplies used solely to construct the Project are exempted from taxes imposed by Chapter 151, Limited Sales, Excise and Use Tax, Texas Tax Code.

6.09 Use of Premises:

6.09.1 Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor assumes full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of or in connection with the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. Any such settlement shall not include any admission of liability on the part of Owner and shall be subject to Owner's approval, which approval shall not be unreasonably withheld.

6.09.2 Contractor shall defend, indemnify and hold harmless the Owner, the Owner's Representative, the Principal Architect/Engineer, Principal Architect/Engineer's Consultants and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages (including court costs and reasonable attorneys' fees) arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Owner's Representative, Principal Architect/Engineer or any other party indemnified hereunder arising out of the Work except to the extent such claims, costs, losses or damages are caused by negligence or fault, breach or violation of a statute, ordinance, governmental regulation, standard or rule or breach of contract of the Owner, the Owner's Representative, the Principal Architect/Engineer, Principal Architect/Engineer's Consultants or any third party under the control or supervision of them other than Contractor or its agent or employee or Subcontractors of any tier.

6.09.3 During the progress of the Work and on a daily basis, Contractor shall keep the premises free from any accumulations of waste materials, rubbish and other debris resulting from the Work. Contractor shall provide such personnel, waste containers and or equipment necessary to maintain an

orderly, clean and safe work site. Contractor shall keep all streets, access streets, driveways, and areas of public access, walkways, and other designated areas clean and open at all times. At the completion of the Work, Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall have the Site clean and ready for occupancy by Owner at Substantial Completion of the Work. Contractor shall, at a minimum, restore to original condition all property not designated for alteration by the Contact Documents. If the Contractor fails to clean up or restore at the completion of the Work, Owner may do so and the cost thereof will be charged against the Contractor.

6.09.4 Contractor shall not load or permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.10 Record Documents: Contractor shall maintain in a safe place at the Site, or other location acceptable to Owner, one (1) record copy of all red line Record Drawings, Specifications, Addenda, Change Orders, Change Directives, Field Orders and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents together with all final samples and all final Shop Drawings and submittals will be available to Owner, Owner Representative, and Principal Architect/Engineer for reference during performance of the Work. Upon Substantial Completion of the Work, these record documents, samples, Shop Drawings and submittals shall become the property of the Owner and shall be neatly labeled and organized per the Owner's direction and promptly delivered in containers acceptable to the Owner, to Owner's Representative. Record drawings must also include an electronic format that is either ".dwg" or ".dxf".

6.11 Safety and Protection:

6.11.01 Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Prior to commencement of the Work, Contractor shall submit a site security plan for approval by Owner. By reviewing the plan or making recommendations or comments, Owner will not assume liability nor will Contractor be relieved of liability for damage, injury or loss. Contractor shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

.1 all persons on the Work Site or who may be affected by the Work;
.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
.3 other property at the Site or adjacent thereto, including, but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Improvements not designated for removal, relocation or replacement in the course of construction.

6.11.02 The Contractor will provide a Safety Manager for this Project. The Safety Manager will be responsible for the safety of the entire Work and the prevention of accidents in connection with the Work. The Safety Manager

shall be competent and qualified to perform his/her duties, including but not limited to having received all appropriate Occupational Safety and Health Act of 1970, as amended ("OSHA") and other safety training, and experienced in managing safety programs on construction projects comparable in scope and complexity.

6.11.03 Specific Duties of the Contractor's Safety Manager: This person will ensure compliance with all provisions of the Contract Documents, OSHA, other governmental agencies, industry safety requirements and standards. The Contractor Safety Manager will prepare and enforce a site-specific safety plan for the Work.

.1 Additional duties of the Contractor's Safety Manager shall include the following:

- **(a)** Be responsible for safety over-sight of the entire Work.
- **(b)** Review and direct immediate action to correct all substandard safety conditions.
- **(c)** Be responsible for providing any necessary additional safety personnel with support in carrying out the duties and responsibilities of that position.
- **(d)** Conduct regular supervisory safety meetings, including the discussion of observed unsafe work practices or conditions, a review of accidents experienced and corrective actions, and encouragement of safety suggestions from employees.
- **(e)** Investigate all accidents and implement immediate corrective action.
- **(f)** Cooperate with the insurance carrier(s) and Owner's safety personnel.
- **(g)** Provide timely reports in writing of any observed unsafe conditions or practices, or violations of job security regarding safety issues and take corrective actions.
- **(h)** Report all injuries and accidents in a timely manner to the Contractor and safety personnel in accordance with Contract Documents, federal, state and local laws and regulations.
- **(j)** Ensure that the necessary competent safety persons are on Site as required in the Contract.
- **(k)** Comply with insurance carriers requirements in all accident investigation and reporting procedures.
- **(m)** Coordinate safety activities with insurance carriers, and take necessary steps to promptly implement safety recommendations or directives issued thereby.
- **(n)** Be responsible for the availability and proper use of all necessary safety equipment including personal protective equipment and apparel for the employees.
- **(p)** Ensure that adequate first-aid supplies are available at the Work Site and that personnel are qualified and identified to administer first-aid as required.
- **(r)** Be on the Site at all times while Work is in progress. If the Safety Manager has to leave the Site, the Contractor is required to provide an alternate competent and qualified Safety Manager.

.2 The Contractor Safety Manager shall stop Work as necessary in the event of imminent danger or in situations where they deem

necessary to protect a person from injury or prevent property damage.

6.11.04 Contractor shall comply with all applicable Legal Requirements, including but not limited to all laws and regulations of any governmental entity or public body having jurisdiction for 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. Contractor shall notify owners of adjacent property and of Underground Improvements, and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by Contractor or any Subcontractor, Supplier or any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except to the extent of damage or loss attributable to errors or omissions in the Drawings or Specifications, or to the acts or omissions of Owner, the Owner's Representative, or the Principal Architect/Engineer, or Principal Architect/Engineer's Consultant or anyone employed by any of them or anyone for whose acts any of them may be liable other than Contractor or its agent, or employee, or Subcontractors of any tier). Contractor's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and Owner's Representative has issued a notice to Owner and Contractor in accordance with Article 14 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion). Without limitation, Contractor shall comply with the following specific provisions:

.1 It shall be the duty and responsibility of Contractor and all of its Subcontractors to be familiar with and comply with 29 USC Section 651, et seq., the Occupational Safety and Health Act of 1970, as amended ("OSHA") and to enforce and comply with all provisions of this Act.

.2 The Contractor and all of its Subcontractors shall comply with all applicable requirements of Subpart P of Part 1926 of 29 C.F.R, OSHA Safety and Health Standards, Texas Health and Safety Code Section 756.023, as amended, and shall submit a unit price for the particular excavation safety systems to be utilized by the Contractor for all excavations which exceed a depth of five feet (5').

6.11.05 Before commencing any excavation which will exceed a depth of five feet (5'), the Contractor shall prepare and employ detailed drawings and specifications regarding the safety systems to be utilized. Said plans and specifications shall include a certification from a registered Texas professional engineer indicating full compliance with the OSHA provisions cited above.

6.11.06 **Hazard Communication Programs:** Contractor shall be responsible for coordinating any exchange of safety data sheets or other hazard communication information required to be made available to or exchanged

between or among employers at the Site in accordance with applicable laws and regulations.

6.11.07 Emergencies:

.1 In emergencies affecting the safety or protection of persons or the Work at the Site or adjacent thereto, Contractor, without special instruction or authorization from Owner, Owner Representative, or Principal Architect/Engineer, is obligated to act reasonably to prevent threatened damage, injury or loss and to mitigate damage or loss to the Work. Contractor shall give Owner's Representative telephone notification as soon as reasonably practical and a prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Directive or Change Order will be issued to document the consequences of such action.

.2 Authorized agents of Contractor shall respond immediately to call-out at any time of any day or night when circumstances warrant the presence on Project Site of Contractor or his agent to protect the Work or adjacent property from damage, injury or loss, or to take such action or measures pertaining to the Work as may be necessary to provide for the safety of the public. Should Contractor and/or its agent fail to respond and take action to alleviate such an emergency situation, Owner may direct other forces to take action as necessary to remedy the emergency condition, and Owner will deduct any cost of such remedial action from the funds due Contractor under this Contract, or Contractor shall reimburse Owner for same on demand.

.3 In the event there is an accident involving injury to any individual or damage to any property on or near the Work, Contractor shall provide to Owner's Representative verbal notification within one (1) hour and written notification within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports, police accident reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner's Representative, for Owner's and Principal Architect/Engineer's records, within forty-eight (48) hours of the event. Contractor shall cooperate with Owner on any Owner investigation of any such incident.

6.12 Continuing the Work: Contractor shall carry on the Work and adhere to the Project Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as Owner and Contractor may otherwise agree in writing.

6.13 Contractor's General Warranty and Guarantee:

6.13.1 Contractor warrants and guarantees to Owner that all Work will conform to the drawings and specifications, be performed in a good and workmanlike manner in accordance with the Contract Documents and will not be Defective and that the whole and entire Work will function and operate as

expressed or required by the Contract Documents. This warranty will survive the termination or expiration of the Contract. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

.1 abuse, modification or improper maintenance or operation by persons other than Contractor, Subcontractors or Suppliers; or
.2 normal wear and tear under normal usage.

6.13.2 Nothing in this warranty is intended to limit any Manufacturer's warranty which provides Owner with greater warranty rights than set forth in this Section or the Contract Documents. Further, nothing in this warranty shall be limited by the Contractor's obligation to cure defects within any specific corrective or warranty period as required in the Contract Documents, including Section 13.7 below.

6.13.3 Contractor's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

.1 observations by Owner's Representative, Owner's CMT Consultant, and/or Principal Architect/Engineer;
.2 recommendation of any progress or final payment by Owner's Representative;
.3 the issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;
.4 use or occupancy of the Work or any part thereof by Owner;
.5 any acceptance by Owner or any failure to do so;
.6 any review of a Shop Drawing or sample submittal;
.7 any inspection, test or approval by others;
.8 any correction of Defective Work by Owner; or
.9 progress payments or final payment by Owner.

6.13.4 Except as otherwise agreed in writing by the Parties, partial occupancy or use of some or all of the Work or any part thereof shall not commence the corrective period under Section 13.7 below.

6.13.5 Independent from Contractor's warranty and corrective work obligations, Contractor shall be responsible for maintenance of the Work prior to Owner's occupancy or use of same, such that the Work shall be capable of being started-up and operated as designed without any additional maintenance, or any repair or replacement of, or additional work or services on, the equipment, materials or systems.

6.13.6 Not used.

6.14 INDEMNIFICATION BY CONTRACTOR:

6.14.1 Contractor shall defend, indemnify and hold harmless (collectively, "Indemnify") Owner, the Owner's Representative, the Principal Architect/Engineer, Principal Architect/Engineer's Consultants and Subconsultants and their respective officers, directors, partners, employees,

agents and other Consultants (the "INDEMNIFIED PARTIES") from and against all claims, costs, losses, demands, injuries, liabilities, damages, causes of action and expenses (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs) arising out of or resulting from the Work, provided that any such claim, cost, loss, demand, injury, liability, damage or cause of action:

.1 Is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and

.2 Is caused in whole or in part by any negligent act or omission of Contractor, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, even if caused in part by any negligence or omission of one or more of the INDEMNIFIED PARTIES; save and except that Contractor's obligation to Indemnify shall not apply to the extent such claims, costs, losses, demands, injuries, liabilities, damages, causes of action or expenses are caused by negligence or fault, breach or violation of a statute, ordinance, governmental regulation, standard or rule or breach of contract of an Indemnified Party or any third party under the control or supervision of an Indemnified Party other than Contractor or its agent or employee or Subcontractors of any tier.

6.14.2 Notwithstanding Subsection 6.14.1, **CONTRACTOR AGREES TO AND SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS (COLLECTIVELY "INDEMNIFY") OWNER, THE OWNER'S REPRESENTATIVE, THE PRINCIPAL ARCHITECT/ENGINEER, PRINCIPAL ARCHITECT/ENGINEER'S CONSULTANTS AND SUBCONSULTANTS AND THEIR RESPECTIVE OFFICERS, DIRECTORS, PARTNERS, MEMBERS, EMPLOYEES, AGENTS AND OTHER CONSULTANTS (COLLECTIVELY THE "INDEMNIFIED PARTIES" OR INDIVIDUALLY AN "INDEMNIFIED PARTY") FROM AND AGAINST ANY AND ALL CLAIMS, COSTS, LOSSES, DEMANDS, INJURIES, LIABILITIES, DAMAGES, AND CAUSES OF ACTION, INCLUDING BUT NOT LIMITED TO ALL EXPENSES OF LITIGATION, COURT COSTS AND ATTORNEYS' FEES (COLLECTIVELY, IN THIS SUBSECTION 6.14.2, "EMPLOYEE CLAIMS"), FOR BODILY INJURY OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF ANY TIER (COLLECTIVELY "EMPLOYEE" FOR THE PURPOSE OF THIS SECTION 6.14.2), ACTUALLY OR ALLEGEDLY OCCASIONED BY, CONTRIBUTED TO OR ARISING OUT OF, IN WHOLE OR IN PART, THE WORK OR THIS CONTRACT, INCLUDING BUT NOT LIMITED TO CLAIMS DUE TO NEGLIGENCE, GROSS NEGLIGENCE, BREACH OF WARRANTY, BREACH OF CONTRACT, VIOLATION OF ANY STATUTE, RULE OR REGULATION OR OTHER ACT OR OMISSION BY CONTRACTOR, ITS EMPLOYEES, AGENTS OR ANY SUBCONTRACTOR OF CONTRACTOR OF ANY TIER, OR THEIR RESPECTIVE AGENTS OR EMPLOYEES, OR ANY OTHER PARTY FOR WHOSE ACTS CONTRACTOR IS LIABLE. CONTRACTOR'S OBLIGATION TO INDEMNIFY SHALL APPLY EVEN IF SUCH EMPLOYEE CLAIMS ARE ACTUALLY OR ALLEGEDLY CAUSED IN WHOLE OR IN PART BY THE ACTS, OMISSIONS, OR NEGLIGENCE OF AN**

INDEMNIFIED PARTY, EVEN IF SUCH NEGLIGENCE OR OTHER ACTS OR OMISSIONS ARE ACTIVE OR PASSIVE, DIRECT OR INDIRECT, SOLE OR CONCURRENT. THIS INDEMNITY AGREEMENT IS INTENDED TO INDEMNIFY THE INDEMNIFIED PARTIES FROM THE CONSEQUENCES OF THEIR OWN NEGLIGENCE, AS PROVIDED ABOVE.

6.14.3 The indemnification obligation under Section 6.14.1 and 6.14.2 shall not be limited in any way by any insurance required by or provided in connection with this Contract or otherwise, or by any limitation on the amount or type of damages, or compensation or benefits payable by or for Contractor or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.14.4 Notwithstanding anything in Section 6.14.1 or 6.14.2 to the contrary, the obligations of Contractor under Section 6.14.1 and 6.14.2 shall not extend to the liability of a registered architect, a licensed engineer, or an agent, servant or employee of a registered architect or a licensed engineer, for damage that is caused by or results from defects in plans, designs or specifications prepared, approved or used by the architect or engineer, or negligence of the architect or engineer in the rendition or conduct of professional duties called for or arising out of the construction contract and the plans, designs or specifications that are a part of the construction contract; and arises from personal injury or death, property injury, or any other expense that arises from personal injury, death, or property injury.

6.14.5 In the event Contractor fails to follow Owner's directives concerning use of the Site, scheduling or course of construction, or engages in other conduct which results in damage to property based on inverse condemnation or otherwise, then and in that event, Contractor shall indemnify Owner against all costs and claims resulting therefrom except to the extent such costs or claims are caused by negligence or fault, breach or violation of a statute, ordinance, governmental regulation, standard or rule or breach of contract of Owner or any third party under the control or supervision of Owner other than Contractor or its agent or employee or Subcontractors of any tier.

6.14.6 Subject to the limitation as set out in Section 6.14.4, in the event Contractor's negligence or breach of contract results in Delay in the progress of the Work or the performance of services being done by others on the Site or otherwise with regard to the Project (including Owner's separate contractors, design professionals, and consultants) so as to result in loss for which Owner becomes liable to such others, then Contractor shall indemnify Owner from and reimburse Owner for such loss, except to the extent such loss is caused by negligence or fault, breach or violation of a statute, ordinance, governmental regulation, standard or rule or breach of contract of Owner or any third party under the control or supervision of Owner other than Contractor or its agent or employee or Subcontractors of any tier.

6.15 Not used.

6.16 Not used.

6.17 Notice of Claim: Should Contractor suffer injury or damage to person or property because of any error, omission or act of Owner or of any of Owner's employees or agents or others for whose acts Owner is liable, a Claim must be made to Owner within five (5) calendar days of the event giving rise to such injury or damage. The provisions of this Section 6.17 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

6.18 Liquidated Damages or Economic Disincentives: Contractor and its Surety shall be liable for liquidated damages or economic disincentives as provided in the Contract for the failure of the Contractor to timely complete the Work within the Contract Time Requirements.

6.19 Commissioning: The Contractor will be responsible to provide all of the required commissioning of the mechanical, electrical, instrumentation, and proprietary equipment and systems for the Project. This is the process of verification, preliminary testing, starting up and functional operations testing of all such equipment and systems which are part of the Project. The term "commissioning" shall specifically include the drafting, review and verification of all test plans and test reports for all equipment and systems which are part of the Project. The verification, testing, start-up and commissioning of the mechanical, electrical, instrumentation, and proprietary equipment and systems for the Project can be performed by the Contractor's personnel or it can be part of a subcontract work package with the Contractor managing and supervising that Scope of Work.

6.19.1 At least ninety (90) days prior to the planned dates for the initiation of the preliminary testing of any mechanical, electrical, instrumentation, and proprietary equipment and systems for the Project, or within a time-frame agreed upon at the Pre-Construction Meeting, the Contractor shall prepare and submit an overall Project Testing and Commissioning Program for Owner, Owner's Representative, and Principal Architect/Engineers' review and approval.

6.19.2 Project Testing and Commissioning Program: The Project Testing and Commissioning Program shall cover all aspects of the Project and shall contain as a minimum, all of the following information:

.1 Equipment Test Plans: An individual Equipment Test Plan configured for each piece of mechanical, electrical, instrumentation, and proprietary equipment and items on the entire Project that identifies how each piece of such equipment or item is to be verified, tested and commissioned including what functional elements must be demonstrated and precisely how those functional elements will be demonstrated to be operational to the Owner, Owner's Representative, and the Principal Architects/Engineers.

6.20 Shop Drawings & Submittals: The Contractor shall be required to provide submittals, samples and Shop Drawings to the Owner's Representative for transmittal to the Principal Architect/Engineer for approval in accordance with the Schedule of Submittals and section 01 33 00 of Division 01 Submittals.

6.20.1 Each submittal shall be identified in a format and in quantities as may be required by the Owner and section 01 33 00 of Division 01 Submittals. Contractor shall utilize Owner's standard forms unless otherwise approved in writing by the Owner.

6.20.2 Where a Shop Drawing or sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Principal Architect/Engineer's review and approval of the pertinent submittal will be at the sole risk and expense of Contractor.

6.20.3 Before submitting each Shop Drawing or sample, Contractor shall have:

.1 reviewed and coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents;

.2 determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

.3 determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

.4 determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

6.20.4 Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's preparation, review and approval of that submittal.

6.20.5 With each submittal, Contractor shall give Principal Architect / Engineer specific written notice of any variations that the Shop Drawing or sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or sample submittal; and, in addition, by a specific notation made on each Shop Drawing or sample submitted to Principal Architect / Engineer for review and approval of each such variation.

6.20.6 Principal Architect/Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Principal Architect/Engineer. Engineer's review and approval will be only to evaluate whether the items covered by the submittals appear that they will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

6.20.7 Principal Architect/Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of

construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

6.20.8 Principal Architect/Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Section 6.20.5 and Principal Architect/Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or sample. Principal Architect / Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Section 6.20.3.

6.20.9 Contractor shall make corrections required by Principal Architect / Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Principal Architect/Engineer on previous submittals.

6.21 Operation & Maintenance Manuals: The Contractor shall be required to provide Operations & Maintenance Manuals for all mechanical, electrical, instrumentation, and proprietary equipment and items being installed as part of the Work. The Contractor must compile all specified instructions, maintenance manuals and operating data as defined under this section and in the Specifications. The compilation and assembly of the Operations & Maintenance Manuals for the Work can be performed by the Contractor's personnel or it can be part of a subcontract work package with the Contractor managing and supervising that Scope of Work. The Contractor shall strictly adhere to all of the requirements for the assembly, formatting and printing of the O&M Manuals as more thoroughly defined in the Contract Documents.

6.22 Training of Owner's Personnel: The Contractor shall be required to provide training of the Owner's designated personnel for all mechanical, electrical, instrumentation, and proprietary equipment and items being installed on the Project. The Contractor must provide this training as defined under this section, Division 01 and the Specifications. The training of the Owner's designated personnel for all mechanical, electrical, instrumentation, and proprietary equipment and items being installed on the Project can be performed by the Contractor's personnel or it can be part of a subcontract work package with the Contractor managing and supervising that Scope of Work.

ARTICLE 7 - OTHER WORK

7.1 Owner may perform other work related to the Project at the Site by Owner's own forces, or let other contracts for the other work, or have other work performed by utility owners. Contractor and Owner agree to and shall use best efforts to cooperate and coordinate the Work with others performing work and other work related to the Project in order to avoid conflicts and Delays in the Work.

7.2 Contractor shall afford Owner's Independent Contractors and each utility owner (and Owner, if Owner is performing the additional work with Owner's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and

storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, Contractor shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the advance written consent of Owner's Representative and the other contractors whose work will be affected. Unless expressly so consented to by such parties, Contractor shall promptly remedy damage caused by Contractor to completed or partially completed construction or to property of the Owner or separate contractors.

7.3 If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Owner's Representative in writing any Delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.4 Owner shall provide for coordination of the activities of the Owner's own forces and of Owner's Independent Contractors with the Work of Contractor, who shall cooperate with them. Contractor shall participate with Owner's Independent Contractors and Owner's Representative in reviewing their construction schedules when directed to do so. On the basis of such review, Contractor shall make any revisions to the Project Schedule agreed upon as necessary after a joint review. The agreed upon construction sequences shall then constitute the Project Schedules to be used by Contractor, separate contractors and Owner until subsequently revised.

7.5 Contractor shall coordinate the activities of all Subcontractors. If Owner performs other work on the Project or at the Site with Owner's Independent Contractors, Contractor agrees to reasonably cooperate and coordinate its activities with those of such separate contractors so that the Project can be completed in an orderly and coordinated manner without unreasonable disruption.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.1 Prior to the start of construction, Owner will designate in writing a person or entity to act as Owner's Representative during construction. The Owner shall retain the right to communicate directly with the Contractor. However, except as otherwise provided in these General Conditions, the Owner shall issue communications to Contractor through the Owner's Representative. Owner's Representative will be responsible for providing Owner–supplied information and approvals. Owner's Representative will also endeavor to provide Contractor with prompt notice if it observes a failure on the part of the Contractor to fulfill its contractual obligations, including any errors, omissions or defects in the performance of the Work; however, failure of the Owner's Representative to provide Contractor with such notice shall not relieve Contractor of any of its responsibilities under the Contract Documents.

8.2 Owner and Owner's Representative will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto. Owner and Owner's Representative are not responsible for any

failure of Contractor to comply with Legal Requirements applicable to furnishing or performing the Work. Owner and Owner's Representative are not responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of Owner or Owner's Representative to discover, or object to or condemn any Defective Work or material shall not relieve Contractor from the obligation to properly and fully perform the Contract.

8.3 Owner and Owner's Representative are not responsible for the acts or omissions of Contractor, or of any Subcontractor, any Manufacturer or Supplier, or of any other person or organization performing or furnishing any of the Work. Contractor acknowledges and agrees that Owner's or Owner's Representative's direction to perform Work in accordance with the approved Master Project Schedule is not a demand for acceleration or a dictation of Contractor's means or methods.

8.4 Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness. The Owner or Owner's Representative shall have a reasonable amount of time to investigate Site conditions, review submittals, analyze requests for changes, and to make other decisions in the orderly administration of the Contract. Contractor must notify the Owner and/or Owner's Representative in writing, if the time for the investigation, review, analysis of any submittals, required for changes or otherwise required for Owner's decision, impacts in any way the Critical Path of the approved Master Project Schedule.

8.5 Furnishing of Services and Information

8.5.1 Owner may provide, at its own cost and expense, for Contractor's information and use, any of the following, all of which are not binding on Owner, are not Contract Documents, are not warranted or represented in any manner to accurately show the conditions at the Site of the Work, and shall not be the basis for any Claim for damages, additional compensation or extension of time should the actual conditions in the course of the Work vary or differ from conditions or information contained in or inferable from them:

.1 Surveys describing the property, boundaries, topography and reference points for use during construction, including existing service and utility lines;
.2 Geotechnical studies describing subsurface conditions, and other surveys describing other latent or concealed physical conditions at the Site;
.3 Temporary and permanent easements, zoning and other requirements and encumbrances affecting land use, or necessary to permit the proper design and construction of the Project and enable Contractor to perform the Work;
.4 A legal description of the Site;
.5 As-built and record drawings of any existing structures at the Site; and
.6 Environmental studies, reports and impact statements describing the environmental conditions, including Hazardous Conditions, known by the Owner to be in existence at the Site.

ARTICLE 9 – PRINCIPAL ARCHITECT/ENGINEER'S STATUS DURING CONSTRUCTION

9.1 Principal Architect/Engineer's Authority and Responsibilities:

9.1.1 The duties and responsibilities and the limitations of authority of Principal Architect/Engineer during construction, as set forth in the Contract Documents, may be assigned or assumed by the Owner, but shall not be extended without written consent of Owner and/or Principal Architect/Engineer. The assignment of any authority, duties or responsibilities to Principal Architect/Engineer under the Contract Documents, or under any agreement between Owner and Principal Architect/Engineer, or any undertaking, exercise or performance thereof by Principal Architect/Engineer, is intended to be for the sole and exclusive benefit of Owner and not for the benefit of Contractor, Subcontractor, Supplier, or any other person or organization, or for any surety or employee or agent of any of them.

9.1.2 Principal Architect/Engineer will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. Principal Architect/Engineer is not responsible for any failure of Contractor to comply with Legal Requirements applicable to the furnishing or performing the Work. Principal Architect/Engineer is not responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of Principal Architect/Engineer to discover, or object to or condemn any Defective Work or material shall not relieve Contractor from the obligation to properly and fully perform the Contract.

9.1.3 Principal Architect/Engineer is not responsible for the acts or omissions of Contractor, or of any Subcontractor, any Manufacturer or Supplier, or of any other person or organization performing or furnishing any of the Work.

9.1.4 If Owner and Principal Architect/Engineer agree, Principal Architect/Engineer will review the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by Article 14, but only to determine generally that their content appears to comply with the requirements of, and in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with, the Contract Documents.

9.1.5 The limitations upon authority and responsibility set forth in this Section 9.1 shall also apply to Principal Architect/Engineer's Consultants, Resident Project Representative and assistants.

9.2 Visits to Site: If Owner and Principal Architect/Engineer agree, Principal Architect/Engineer will make visits to the Site at intervals appropriate to the various stages of construction as requested by the Owner or the Owner's Representative and as Principal Architect/Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Principal Architect/Engineer will endeavor for the benefit of Owner to determine, in general, if the Work is

proceeding in accordance with the Contract Documents. Principal Architect/Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Principal Architect/Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, Principal Architect/Engineer will keep Owner and Owner's Representative informed of the progress of the Work and will endeavor to guard Owner against Defective Work. Principal Architect/Engineer's visits and on-site observations are subject to all the limitations on Principal Architect/Engineer's authority and responsibility set forth in Section 9.1 above.

9.3 Resident Project Representative: If Owner and Principal Architect/Engineer agree, Principal Architect/Engineer may furnish a Resident Project Representative to assist Principal Architect/Engineer in providing more continuous observation of the Work. Owner may designate another representative or agent to represent Owner at the Site who is not a Principal Architect/Engineer, Principal Architect/Engineer's consultant, agent or employee.

9.4 Clarifications and Interpretations: Principal Architect/Engineer may determine that written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) are necessary. Such written clarifications or interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents, will be issued by the Principal Architect/Engineer after consultation with the Owner, and the Contractor will comply with same. If Contractor believes that a written clarification or interpretation alters the Scope of Work and justifies an adjustment in the Contract Amount or the Contract Time Requirements, Contractor may make a Claim as provided in Article 11 or 12.

9.5 Rejecting Defective Work: Principal Architect/Engineer will recommend that Owner disapprove or reject Work which Principal Architect/Engineer believes fails to conform to a requirement of the Contract Documents or believes will not produce a completed Project that conforms to the Contract Documents, or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

9.6 The Principal Architect/Engineer shall not have the authority to issue changes in the field without the express written approval of the Owner.

9.7 Shop Drawings: Refer to Division 01 for Principal Architect/Engineer's authority concerning Shop Drawings.

ARTICLE 10 - CHANGES IN THE WORK

10.1 Changes:

10.1.1 Without invalidating the Contract and without providing notice to any Surety, Owner may, at any time or from time to time, order additions, deletions or revisions in the Work. Such changes in the Work will be authorized by Change Order, Change Directive or Field Order. In the event that the Owner and the Contractor are unable to negotiate the terms of a Change Order for the performance of additional Work, the Owner may, at its election, perform such additional Work with its own forces or an

Independent Contractor and such work will be considered "Other Work" in accordance with Article 7 or issue a Change Directive.

10.1.2 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in the Change Order, Change Directive or Field Order. Contractor's proposals for changes in the Contract Amount and/or Contract Time Requirements shall be submitted within ten (10) Calendar Days as requested by the Owner, including estimated impacts to the approved Master Project Schedule if any. Owner will review each proposal and promptly respond to Contractor. After initial review of Contractor's proposal by Owner, Contractor shall provide any supporting data requested by Owner, including but not limited to any Subcontractor or Supplier proposal, within seven (7) Calendar Days, unless Owner grants an extension.

10.1.3 Contractor shall not be entitled to an increase in the Contract Amount or an extension of the Contract Time Requirements with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in Sections 3.3.1 and 3.3.2, except in the case of an emergency as provided in Section 6.11.15 or in the case of uncovering Work as provided in Section 13.4.

10.1.4 Except in the case of an emergency as provided in Section 6.11.15, a Change Order or Change Directive is required before Contractor commences any activities associated with a change in the Work which, in Contractor's opinion, will result in a change in the Contract Amount and/or Contract Time Requirements. Any Work performed prior to Contractor's receipt of a Change Order or Change Directive, will be at Contractor's sole risk and expense, including potential cost impacts and any Delay to the Critical Path of the Master Project Schedule.

10.1.5 Not used.

10.1.6 Contractor shall provide to the Owner's Representative's all Contractor documentation/records deemed necessary by Owner or Owner's Representative to evaluate the Contractor's Claim including, but not limited to certified payroll, receipts, bills of lading, invoices, schedules, contractor daily reports, and equipment logs. Other documents, if any, shall be provided pursuant to the Contract Documents.

10.2 Change Orders:

10.2.1 Owner and Contractor shall execute appropriate written Change Orders covering:

.1 a change in the Work, subject to limitations in Article 10 and elsewhere in the Contract;
.2 the amount of the adjustment in the Contract Amount, if any; and
.3 the extent of the adjustment in the Contract Time Requirements, if any.

10.2.2 An executed Change Order shall constitute a settlement of and represent the complete, equitable, and final amount of adjustment in the Contract

Amount and/or Contract Time Requirements owed to Contractor or Owner as a result of the occurrence or event causing the change in the Work encompassed by the Change Order.

10.3 Change Directives:

10.3.1 Owner may, by written Change Directive, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Amount and Contract Time Requirements being adjusted as the Owner may deem necessary. A Change Directive may be used in the absence of complete and prompt agreement on the terms of a Change Order, or as otherwise may be deemed to be necessary by the Owner. Where practicable, any items or elements of changed Work that may be agreed upon, prior to the performance of Work under this Article, will be included in a separate Change Order.

10.3.2 If the Change Directive provides for an adjustment to the Contract Amount, the adjustment shall be based on one of the methods provided in Article 11.4.1.

10.3.3 A Change Directive signed by Contractor indicates the agreement of Contractor with the proposed basis of adjustment in the Contract Amount and Contract Time Requirements as described within that Change Directive. Such agreement shall be effective immediately and shall be recorded later by preparation and execution of an appropriate Change Order.

10.3.4 The Contractor is not obligated to execute a Change Directive, but that Change Directive still constitutes valid direction to the Contractor from the Owner. The refusal by the Contractor to accept the terms incorporated within a Change Directive does not invalidate the content of the Change Directive or undermine in any manner the Owner's right to provide the directive contained within that Change Directive. Upon receipt of a Change Directive, Contractor shall promptly proceed with the change in the Work involved, provided, prior to the commencement of any Work under this section, the Contractor must submit its proposed Work plan, anticipated schedule, and a list of its work force and equipment proposed to be used in such Work for Owner's approval. Upon such approval, Contractor must promptly commence and make continuous progress in the Change Directive Work. The Owner reserves the right to withhold payment for low production or lack of progress.

10.3.5 The Owner will allow the Contractor to bill for all portions of a Change Directive for which the Work has been successfully completed, if and to the extent the Change Directive provides for an adjustment to the Contract Amount.

10.4 Field Order:

10.4.1 Owner may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Amount or the Contract Time Requirements and are compatible with the design concept of the completed Project as a functioning whole as intended by the Contract Documents. These minor variations shall be accomplished

by written Field Order and shall be binding on Owner and on Contractor who shall perform the Work involved promptly. Contractor shall promptly acknowledge in writing the receipt of a Field Order.

10.4.2 If Contractor believes that a Field Order justifies an adjustment in the Contract Amount and/or Contract Time Requirements, Contractor shall make a prompt written request to Owner for a Change Order or Change Directive. Any request by Contractor for an adjustment in Contract Amount and/or Contract Time Requirements must be made in writing prior to the Contractor or the Contractor's Subcontractors beginning the Work covered by the Field Order.

10.5 Limitation on Damages for Delay:

10.5.1 Contractor shall receive no compensation or damages for Delays except when, and only to the extent that, Contractor demonstrates to the reasonable satisfaction of Owner that direct and unavoidable extra cost to Contractor is caused by: (a) Change Orders or Change Directives (not attributable to Contractor's failure to comply with the Contract Documents or other fault or negligence) that Delay the Work; or (b) specific orders given by Owner to stop or suspend Work (not attributable to Contractor's failure to comply with the Contract Documents or other fault or negligence) that Delay the Work; or (c) failure of Owner to:

.1 provide permits or material, which is to be furnished by Owner, or
.2 provide access to the Work,
and only to the extent that such circumstances continue after the Contractor furnishes Owner with written notice of such failure, such circumstances are not attributable to Contractor's failure to comply with the Contract Documents or other fault or negligence, and such failure causes Delay;
(a "Compensable Delay").

10.5.2 When extra compensation or damages are claimed for a Compensable Delay, Written Notice and support shall be delivered to the Owner as Provided in Section 12.1.1, and a written statement thereof shall be presented by Contractor to Owner's Representative for Owner's Representative and Owner's review and consideration. Contractor's application for extra compensation or damages shall, however, be subject to review and approval by the Owner. In no event other than a Compensable Delay shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delays, including without limitation: consequential damages, lost opportunity costs, lost profits, unabsorbed home office overhead or other similar damages, and Contractor hereby expressly waives and releases any and all rights to claim or recover any such compensation or damages. The Owner's exercise of any of its rights or remedies under the Contract Documents (including without limitation ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference in the Contractor's performance of the Work.

10.5.3 In the event of a Compensable Delay, Contractor's sole and exclusive remedy (other than as provided in Section 10.5.4) shall be recovery of Contractor's General Conditions Costs for the period of time during any Working Day that Contractor is prevented from performing Work on the Critical Path, and Contractor hereby expressly waives and releases any and all rights to claim or recover any other compensation or damages arising out of or related to a Compensable Delay. "General Conditions Costs" consist only of actual and direct costs necessarily incurred by the Contractor and which Contractor was unable to mitigate despite the exercise of reasonable diligence, for standby costs of facilities, machinery, and equipment on Site ("Standby Equipment Costs"), and "Jobsite Overhead" as defined below, calculated as follows:

.1 Standby Equipment Costs will not be claimable, due or paid for periods when the facilities, machinery or equipment would have otherwise been idle. Claims for Standby Equipment Costs time are limited to no more than eight (8) hours per twenty-four (24) hour day, forty (40) hours per week, and one hundred seventy-six (176) hours per month. Standby Equipment Costs will be payable at 50 percent (50%) of the applicable Blue Book Rental Rates and calculated by dividing the monthly rate by one hundred seventy-six (176), multiplying the result by the number of standby hours, and multiplying that number by the regional adjustment factor and the rate adjustment factor contained in the Blue Book. Operating costs will not be claimable or payable.

.2 Jobsite Overhead will be claimable and payable based on actual costs that the Contractor will be required to document. "Jobsite Overhead" is defined as the wages or salaries of the Contractor's on-Site administrative and supervisory personnel (when unable to perform other services for Contractor), and reasonable office expenses incurred at the Site office, and will not include any element of home office labor, employees or overhead expenses.

10.5.4 Except as otherwise provided in this Section 10.5, an extension of the Contract Time Requirements, to the extent permitted under Article 12, shall be the sole remedy of the Contractor for any claimed Delays, or loss, costs, expenses or damages incurred as a result of same.

10.5.5 This Section 10.5 is intended as a limitation on damages available to Contractor and as a defense in favor of Owner against damages not compensable in accordance with its terms, in both cases pursuant to Section 271.155 of Subchapter I of Chapter 271 of the Texas Local Government Code. Contractor and Owner agree that such limitation and defense shall apply even if Owner is found to have breached the Contract.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

11.1 The Contract Amount is stated in the Contract and, including authorized adjustments, is the total amount payable by Owner to Contractor for performance of the Work in accordance with the Contract Documents.

11.2 Contractor agrees and acknowledges that, unless otherwise permitted by law, the original Contract Amount may not be increased by more than twenty-five percent (25%).

11.3 The Contract Amount shall only be changed by a Change Order or Change Directive. Any Claim by Contractor for an adjustment in the Contract Amount shall be made by Written Notice delivered to Owner promptly (but in no event later than fifteen (15) calendar days) after the start of the occurrence or 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 within thirty (30) calendar days after Written Notice of Claim is delivered by Contractor, and shall represent that the adjustment claimed covers all known amounts to which Contractor is entitled as a result of said occurrence or event. If Owner and Contractor cannot otherwise agree, all Claims by Contractor for adjustment in the Contract Amount shall be determined as set out in Article 16.

11.4 Determination of Value of Change Order or Change Directive Work:

11.4.1 The value of any Work covered by a Change Order or Change Directive for an adjustment in the Contract Amount will be determined by one of the following methods:

.1 by application of unit prices contained in the Contract Documents or subsequently agreed upon to the quantities of the items involved.
.2 by a mutually agreed lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
.3 by a cost which has been determined in a manner agreed upon by the Parties and mutually acceptable fixed or percentage fee; or
.4 as provided in Subsection 11.5.

11.4.2 No cost will be included in the Change Order or Change Directive for the Contractor's time spent preparing the Change Order or responding to the Change Directive, nor will costs be included for the time to negotiate the Change Order or Change Directive costs for machinery, tools, or equipment as described in Subsection 11.5.3.

11.4.3 Before using the method described in Section 11.4.1.4, Owner and Contractor agree to attempt to negotiate a Change Order or Change Directive using the methods identified in Sections 11.4.1.1 through 11.4.1.3, as appropriate, to determine the adjustment in the Contract Amount.

11.5 Determination of Value of Change Order or Change Directive Work When No Agreement: If none of the methods defined in Sections 11.4.1.1, 11.4.1.2 or 11.4.1.3 can be agreed upon before a change in the Work is commenced which will result in an adjustment in the Contract Amount, then the change in the Work will be performed by Change Directive, and the appropriate adjustment determined using the Force Account method set forth below in Subsections 11.5.1 through 11.5.6. The "Cost of the Work" consists only of those items specified in Subsections 11.5.1 through 11.5.5, below.

11.5.1 For all personnel, Contractor or Subcontractors will be entitled to reimbursement for wages or salaries and employee benefit costs for extra Work performed using the employees' actual wages or salaries and a forty percent (40%) burden rate. No charge for additional superintendence will be permitted unless considered necessary and ordered by Owner;

11.5.2 Contractor will be entitled to the actual cost, including freight charges, of the materials used and installed on such Work. In case material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount;

11.5.3 For machinery, trucks, power tools, or other similar equipment (the "equipment") agreed to be necessary by Owner and Contractor, Contractor will be entitled to reimbursement for actual rental costs;

11.5.4 Contractor will be entitled to the actual cost of Contractor's premiums for Bond(s) and insurance on the extra Work, based on invoices from Surety and insurance carriers. Contractor shall provide Owner's Representative or Owner with invoices from Surety and insurance carriers indicating such cost when requested by Owner's Representative or Owner;

11.5.5 Contractor will be entitled to reimbursement for actual, direct additional General Conditions Costs, but without duplication of any costs otherwise recoverable under this Subsection 11.5, reasonably and necessarily incurred by Contractor in the performance of the extra Work and which can be reasonably demonstrated to the Owner to be necessary to implement the changed Work; and

11.5.6 Contractor will be entitled to allowances for overhead and profit as stated below.

.1 The maximum allowance for overhead and profit on increases due to Change Orders and Change Directives:

	Overhead	Profit
To Contractor for change in the Work performed by Subcontractors:	10 percent	0 percent
To first tier Subcontractors for change in the Work performed by its Subcontractors:	10 percent	0 percent
To Contractor and Subcontractor for change in the Work performed by their respective firms:	10 percent	5 percent

.2 For changes in the Work performed by Contractor and Subcontractors, allowance for overhead and profit will be applied to an amount equal to cost of all additions less cost of all deletions to the Work. Allowance for overhead to Contractor and first tier Subcontractors on changes performed by Sub-Subcontractors are applied to an amount equal to the sum of all increases to the Work by applicable Sub-Subcontractors, less any decreases in such Sub-subcontractors' Work.

11.5.7 If Owner deletes Work or makes a change which results in a net decrease in the Contract Amount, the Owner is entitled to a credit calculated in accordance with Subsections 11.4.1.1 through 11.4.1.4.

11.5.8 The compensation, as herein provided for, shall be received by Contractor and any affected Subcontractor as payment in full for Work done by Change Directive and will include use of small tools, and total overhead expense and profit. Contractor shall maintain in accordance with generally accepted accounting principles a documented, itemized accounting, evidencing the expenses and savings, including overhead and profit, associated with such changes, both for expenses and savings, in the performance of the Work resulting from the change. Contractor shall submit to Owner's Representative records of Work done by Change Directive at the end of each day, which records will be made upon forms provided for this purpose by Owner, and Contractor shall request that Contractor and Owner's Representative compare records of Work done by Change Directive at the end of each day. Any record of such comparison shall be signed by both Owner's Representative and Contractor, with one copy being retained by Owner and one by Contractor. Refusal by Contractor to sign these records within two (2) working days of presentation does not invalidate the accuracy of the record.

11.6 Unit Price Work:

11.6.1 The following Sections 11.6.1 through 11.6.7 apply only to those elements of the Work which are identified in the Contract Documents as being "Unit Price Work".

11.6.2 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Amount will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as set forth in the Bid/Proposal. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids/Proposals and determining an initial Contract Amount. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Owner's Representative. Owner's Representative will review with Contractor the determinations on such matters before rendering a written decision thereon (by recommendation of payment on an Application for Payment or otherwise).

11.6.3 When "plan quantity" is indicated for a Bid/Proposal item, Contractor shall be paid the amount specified in the Contract Documents without any measurements.

11.6.4 Contractor agrees each Unit Price includes amounts for all overhead and profit associated with performing the units of Work for which the Unit Prices applies.

11.6.5 A Major Item is any individual Bid/Proposal item in the Bid/Proposal that has a total cost equal to or greater than five percent (5%) of the original Contract Amount or $50,000, whichever is greater, computed on the basis of Bid/Proposal quantities and Contract Unit Prices.

11.6.6 Owner or Contractor may make a Claim for an adjustment in the Contract Amount in accordance with Article 11 if:

.1 the actual quantity of any Major Item should become as much as twenty five percent (25%) more than or twenty five percent (25%) less than that in the Bid/Proposal; or

.2 Contractor presents documentation contesting accuracy of a "plan quantity" and Owner verifies actual quantity and determines the "plan quantity" is in error by five percent (5%) or more;

11.6.7 Provided, however, in the event a Major Item is reduced by twenty-five percent (25%) or more relative to the quantity amount in the Bid/Proposal, no additional Article 11.5.6 profit or overhead will be added, if, due to other additions in the Work, the net value of the Contract Amount is not reduced.

ARTICLE 12 - CHANGE OF CONTRACT TIMES

12.1 Requisites for Changes in Contract Time Requirements:

12.1.1 The Contract Time Requirements (including Milestones) may only be changed by Change Order duly executed by both Contractor and Owner or by Change Directive. Any Claim for an adjustment of the Contract Time Requirements (including Milestones) or adjustment of the Contract Amount due to any Compensable Delay as provided in Section 10.5 shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than five (5) calendar days after the start of the occurrence or event giving rise to the Delay) and stating the general nature of the Delay. Notice of the extent of the Delay and any requested adjustment of the Contract Amount due to any Compensable Delay as provided in Section 10.5, with supporting data, shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed is the entire adjustment to which claimant is entitled as a result of said occurrence or event. If Owner and Contractor cannot otherwise agree, all Claims for adjustment in the Contract Time Requirements (including Milestones) and/or adjustment of the Contract Amount due to any Compensable Delay as provided in Section 10.5 shall be determined in accordance with and subject to the requirements of Article 16. Notwithstanding anything in the Contract Documents to the contrary, no Claim for an adjustment in the Contract Time Requirements (including Milestones) and/or adjustment of the Contract Amount due to any Compensable Delay as provided in Section 10.5 will be valid if not submitted in accordance with the requirements of this Article.

12.1.2 When Contractor is at fault and Owner stops the Work so that corrections in the Work can be made by Contractor, no extensions of time will be allowed.

12.1.3 In the event of a Delay attributable to Force Majeure, an extension of the Contract Time Requirements (including Milestones) in an amount equal to the time lost due to such Delay shall be Contractor's sole and exclusive remedy for such Delay. "Force Majeure" is circumstances beyond the control of both Owner and Contractor, and not attributable to the fault or negligence of Contractor, any Subcontractor or any other party for whose acts Contractor is liable, and includes an Act of God, war, riot, terrorism, civil commotion, sovereign conduct, industry-wide delays or disruptions in

manufacture or delivery of materials or equipment required for the Work, and Unusual Inclement Weather and the direct effects thereof such as standing water or loss of Site power. In such an event, Contractor shall take all commercially reasonable action to mitigate the Delay, and Owner and Contractor will meet no later than three (3) business days after cessation of the event to establish a proposed new Project Schedule for the Project. Any claimed Force Majeure Delay attributable to industry-wide delays or disruptions in manufacture or delivery of materials or equipment required for the Work shall be supported by the following documentation:

(a) By copies of purchase orders for Delayed item(s) indicating date ordered by Contractor/Subcontractor and date of purchase order receipt by Supplier;

(b) If item(s) require Shop Drawings or other submittal information in accordance with the Contract Documents, by providing records of dates Contractor forwarded submittal(s) to Owner's Representative, dates Owner or Principal Architect/Engineer returned submittal(s) to Contractor, and dates submittal(s) were forwarded to Manufacturer or Supplier;

(c) By copies of document(s) from Manufacturer or Supplier, on Manufacturer's or Supplier's letterhead, indicating date(s) item(s) would be ready for shipment and/or actual shipment date(s);

(d) By copies of correspondence between Contractor / Subcontractor and Manufacturer or Supplier indicating Contractor / Subcontractor's efforts to expedite item(s); and

(e) If item(s) are being purchased by a Subcontractor, by providing correspondence, meeting notes, etc., that reflect Contractor's efforts with the Subcontractor to expedite delivery of the item(s).

12.1.4 The Contractor will only be entitled to an extension of time for Delays that can be demonstrated by the Contractor through critical path analysis as causing Delay, and only for any Delay caused by Force Majeure, Changes ordered in the Work by the Owner through Change Order or Change Directive which justify additional time, or other Delays as described in Section 10.5. No extension of time shall relieve Contractor or Surety on its performance Bond from all of Contractor's obligations hereunder which shall remain in full force and effect.

12.2 Weather Delays:

12.2.1 Contractor may be granted an extension of time because of"Unusual Inclement Weather", as defined below. However, the Contractor will not be granted an extension of time for "Normal Rain Days", as defined below.

12.2.2 "Unusual Inclement Weather" is defined as a rain event, or extreme temperatures, high winds, hail or lightning, which occurs at the Site and is of sufficient magnitude to prevent Contractor from performing units of Work critical to maintaining the Master Project Schedule on a day when Work is scheduled to be performed and is otherwise capable of being performed, and which is beyond the Normal Rain Days as defined in Section 12.2.3 below.

12.2.3 Baseline Rain Day Determination. "Normal Rain Days" are based on U.S. Weather Bureau Records available for the most immediate area of the Site of the Work, and are included in Owner's Project Schedule, are not a justification for an extension of time, and are broken down by the number of calendar days in each month as follows:

January	7 days	July	6 days
February	6 days	August	7 days
March	7 days	September	6 days
April	7 days	October	7 days
May	8 days	November	6 days
June	8 days	December	6 days

12.2.4 Not used.

12.2.5 Rainfall will be measured with the Owner's Representative's approval at the Site using an approved rain gauge or with the Owner's Representative's approval at the nearest operational public weather data collection facility to the Site.

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

13.1 Notice of Defects: All Defective Work may be rejected, corrected or accepted as provided in Article 13. Contractor must give Owner, Owner's Representative, and Principal Architect/Engineer prompt notice of any Defective Work of which Contractor has actual knowledge. Prompt notice of all Defective Work of which Owner, Owner's Representative, Owner's CMT Consultant, or Principal Architect/Engineer has actual knowledge may be given to Contractor. Payment may be withheld by the Owner for identified Defective Work until such time as the Owner, Owner's Representative, or Principal Architect/Engineer has determined the Defective Work has been corrected such that it complies with all applicable Contract requirements.

13.2 Access to Work: Owner, Owner's Representative, Owner's CMT Consultant, Principal Architect/Engineer, Principal Architect/Engineer's Consultants, other representatives and personnel of Owner, independent testing laboratories and governmental agencies having jurisdiction will have access to the Work at reasonable times for observing, inspecting and testing. Contractor shall provide them proper and safe conditions for such access, and advise them of Contractor's site safety procedures and programs so that they may comply therewith as applicable.

13.3 Tests and Inspections:

13.3.1 Contractor shall give at least twenty-four (24) hours advance notice of readiness of the Work for all required inspections, tests or approvals, and shall coordinate and cooperate with inspection and testing personnel to facilitate the required inspections or tests.

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

.1 for inspections, tests or approvals covered by Section 13.3.3 and 13.3.4 below;

.2 for costs incurred with tests or inspections conducted pursuant to Section 13.4.3 below shall be paid as provided in Section 13.4.3;
.3 for reinspecting or retesting Defective Work; and
.4 as otherwise specifically provided in the Contract Documents.

All testing laboratories shall meet the requirements of ASTM E-329.

13.3.3 If Legal Requirements require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of any governmental entity or public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith and furnish Owner's Representative the required certificates of inspection or approval.

13.3.4 Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's, Owner's CMT Consultant's, Owner's Representative's, and Principal Architect/Engineer's review of materials or equipment to be incorporated in the Work, or of materials, mix designs or equipment submitted for review prior to Contractor's purchase thereof for incorporation in the Work.

13.4 Uncovering Work:

13.4.1 If any Work that is to be inspected, tested or approved is covered by Contractor without prior written concurrence of Owner's Representative, or if any Work is covered contrary to the written request of Owner's Representative, Contractor must, if requested by Owner's Representative, uncover and recover the Work at Contractor's expense, except as provided in Section 13.4.2.

13.4.2 Uncovering Work as provided in Section 13.4.1 shall be at Contractor's expense unless Contractor has given Owner's Representative timely notice of Contractor's intention to cover the same and Owner's Representative has not acted within five (5) working days of receipt of such notice.

13.4.3 If Owner's Representative considers it necessary or advisable that permissibly covered Work be observed, inspected or tested, Contractor shall uncover, expose or otherwise make available for observation, inspection or testing that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is Defective, Contractor shall pay or otherwise bear all claims, costs, losses and damages arising out of or resulting from such uncovering, exposure, observation, inspection and testing and satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others). If, however, such Work is not found to be Defective, Contractor shall, subject to Section 13.4.1, be allowed an increase in the Contract Amount or an extension of the Contract Time Requirements (including Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction.

13.5 Owner May Stop the Work:

13.5.1 If the Work is Defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty or obligation on the part of Owner to exercise this right for the benefit of Contractor or any Surety or other party.

13.5.2 If Contractor fails to correct Defective Work or submit a plan that is satisfactory to Owner for taking corrective action, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated, or Owner may take any other action permitted by this Contract. A notice to stop the Work, based on defects, shall not stop Calendar or Working Days charged against the Contract Time Requirements.

13.6 Correction or Removal of Defective Work: If required by Owner, Contractor shall promptly, as directed, either correct all Defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Owner or Owner's Representative, remove it from the Site and replace it with Work that is not defective. Contractor shall correct or remove and replace Defective Work, or submit a plan of action detailing how the deficiency will be corrected, within the time frame identified in the notice of Defective Work. Contractor shall pay all claims, costs, losses and damages arising out of or resulting from such correction or removal (including but not limited to all costs of repair or replacement of Work of others, and all costs of reinspecting and/or retesting such Defective Work).

13.7 Corrective period:

13.7.1 If within one (1) year after the date of Substantial Completion or such longer period of time as may be prescribed by Legal Requirements or by the terms of any applicable special guarantee or express warranty required by the Contract Documents or by any specific provision of the Contract Documents (including but not limited to Section 14.11.2), any Work, including Work performed after the Substantial Completion date, is found to be Defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

(a) correct such Defective Work, or, if it has been rejected by Owner, remove it from the Site and replace it with Work that is not Defective, and

(b) satisfactorily correct or remove and replace any damage to other Work or the work of others, or damage to other property, whether personal or real property, resulting from the correction, removal or replacement of such Defective Work.

Such one (1) year or longer period will renew and recommence for Work requiring correction upon the completion of correction of such Work.

13.7.2 If Contractor does not promptly comply with the terms of Owner's corrective action instructions, or in an emergency where Delay would result in unreasonable risk of loss or damage, Owner may have the Defective Work corrected or the rejected Work removed and replaced, and all claims, costs,

losses and damages arising out of or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid or otherwise borne by Contractor.

13.7.3 In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the corrective period for that item will still start to run from the date of Substantial Completion of the Work.

13.7.4 If correction of Defective Work will affect the function or use of the facility, Contractor shall not proceed with correction of Defective Work without prior coordination with and approval of Owner.

13.7.5 The obligations of the Contractor to perform warranty and corrective work will survive the acceptance of the Work and any termination of the Contract.

13.7.6 Owner will utilize the "Warranty Item Form" a copy of which is attached hereto for the purpose of providing written notice of defects discovered during the corrective period. Contractor will acknowledge receipt of the notice by dating, signing, completing and returning the form to Owner when the defect is corrected, including such information on or attached to the form to describe the nature of the repairs or corrections that were made. If the defect cannot be corrected within seven (7) Calendar Days of receipt of notice, Contractor shall promptly provide a written explanation to Owner (or Owner's Representative) describing the repairs or other correction needed and the time required to complete the repairs or other correction.

13.7.7 Establishment of the required period for correction of Work as described in Subsection 13.7.1 above relates only to the specific obligation of the Contractor to correct defects in Work discovered during the corrective period, and has no relationship to the time within which any obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to any failure by Contractor to have complied with its obligations under the Contract Documents.

13.7.8 All Manufacturer and extended Manufacturer warranties shall be assigned to Owner as a condition of Final Completion.

13.8 Acceptance of Defective Work: If, instead of requiring correction or removal and replacement of Defective Work, Owner decides to accept it, Owner may do so. Contractor shall pay or otherwise bear all claims, costs, losses and damages attributable to Owner's evaluation of and determination to accept such Defective Work. If any such acceptance occurs prior to recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents and compensating Owner for the diminished value of the Defective Work. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner after a calculation by Owner of the diminution in value of the Defective Work.

13.9 Owner May Correct Defective Work: If Contractor fails within a reasonable time after Written Notice of Owner to correct Defective Work, or to remove and replace rejected Work, or if Contractor fails to perform the Work in accordance with

the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven (7) calendar days' Written Notice to Contractor, correct any such deficiency. If, in the sole discretion of the Owner, significant progress has not been made by Contractor during this seven (7) calendar day period to correct the deficiency, the Owner may exercise any actions necessary to remedy the deficiency. In exercising the rights and remedies under this paragraph, Owner may proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work, and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, its agents and employees, Owner's other contractors, Principal Architect/Engineer and Principal Architect/Engineer's consultants access to the Site or any such offsite storage facility to enable Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by Owner in exercising such rights and remedies will be paid or otherwise borne by Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's Defective Work. Contractor shall not be allowed an extension of the Contract Time Requirements (including Milestones), or entitled to make any claim for damages resulting from any Delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies hereunder.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Application for Progress Payment:

14.01.1 No more often than once a month, Contractor shall submit to Owner or if directed by Owner, to Owner's Representative, for review an Application for Payment, in a form acceptable to Owner, filled out and signed by Contractor covering the Work completed as of the last day of the month for which an Application for Payment is being made. Application for Payment shall be accompanied by such supporting documentation as is required by the Contract Documents. The Application for Payment shall constitute Contractor’s representation that the Work has been performed in accordance with the Contract Documents, has progressed to the point represented in the Application for Payment, and that title to all Work has passed or will pass to Owner free and clear of all claims, encumbrances, and security interests upon the incorporation of the Work into the Project, or upon Contractor’s receipt of payment, whichever occurs earlier.

14.01.2 Such applications shall not include requests for payment on account of changes in the Work which have been properly authorized by Change Directives, if the Change Directive does not provide for an adjustment to the Contract Amount, or if the changes in the Work are not yet included in Change Orders.

14.01.3 Such applications shall not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or Manufacturer or Supplier because of a dispute or other reason.

14.01.4 If payment is requested on the basis of materials or equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall be accompanied by such bills of sale, data and other information satisfactory to Owner and Owner's Representative substantiating Owner's title to such materials or equipment or otherwise protecting Owner's interests therein. Payment on account of such materials or equipment will not include any amount for Contractor's overhead or profit or relieve Contractor of its obligation to protect and install such materials or equipment in accordance with the requirements of the Contract and to correct or restore damaged or Defective Work and shall in no event exceed eighty five percent (85%) of the line item valuation for such materials or equipment in the Schedule of Values. If materials or equipment are stored at another location, at the direction of the Owner they shall be stored in a bonded and insured facility, accessible to Owner's Representative and Principal Architect/Engineer, CMT Consultant, and Owner, and shall be clearly marked as property of Owner. Contractor shall insure such materials and equipment while so stored and in transit to the Site. Title to materials delivered to the Site of the Work or a staging area will pass to Owner upon payment by Owner without the necessity for further documentation. Risk of loss for all such materials and equipment will not pass to Owner until final payment.

14.01.5 In making progress payments, ten percent (10%) of the approved amount shall be retained until final completion and acceptance of the Contract Work. However, if the Owner at any time after fifty percent (50%) of the work has been completed finds that satisfactory progress is being made, Owner may authorize any of the remaining progress payments to be made in full. Also, if the Contractor has achieved Substantial Completion of the Work and the Owner finds the amount retained to be in excess of the amount adequate for the protection of the Owner, Owner, at its sole discretion, may release to the Contractor all or a portion of such excess amount. The Owner is not obligated to pay interest on amounts retained except as provided in the Agreement. The interest rate to be paid on such retainage shall be the rate of interest paid by the Owner's depository bank on interest bearing accounts of similar amounts during the period of time interest accrues as provided herein.

14.01.6 Applications for Payment shall include the following documentation:

- **.1** an updated Project Schedule and narrative;
- **.2** an Affidavit of all bills paid to Subcontractors and Suppliers in the Monthly Subcontractor Payment Reporting Form included in the Specifications;
- **.3** conditional waivers and releases from Contractor upon progress and final payments, in the forms included in the Specifications; and
- **.4** a Contractor's Monthly Report;

14.02 Contractor's Warranty of Title: Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner free and clear of all claims no later than the time of payment to Contractor.

14.03 Review of Applications for Progress Payment:

14.03.1 Contractor shall submit its Application for Payment to the Owner's Representative not later than three (3) days after the first day of each month. The Owner's Representative will, within seven (7) calendar days after receipt of each Application for Payment, either indicate a recommendation for payment and forward the Application for Payment for processing by Owner, or return the Application for Payment to Contractor indicating Owner's Representative's reasons for refusing to recommend payment. In the latter case, Contractor shall make the necessary corrections and resubmit the Application for Payment.

14.03.2 Owner's Representative's recommendation of any payment requested in an Application for Payment will constitute a representation by Owner's Representative, based upon Owner's Representative's on-site observations of the executed Work and on Owner's Representative's review of the Application for Payment and the accompanying schedules and other information, that to the best of Owner's Representative's knowledge, information and belief:

.1 the Work has progressed to the point indicated; and
.2 the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for unit price Work, and to any other qualifications stated in the recommendation).

14.03.3 By recommending any such payment, Owner's Representative will not be deemed to have represented that:

.1 exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work;
.2 examination has been made to ascertain how or for what purpose Contractor has used money previously paid on account of the Contract Amount;
.3 Contractor's construction means, methods, techniques, sequences or procedures have been reviewed; or
.4 that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment from Contractor.

14.04 Decisions to Withhold Payment:

14.04.1 Owner may withhold or nullify the whole or part of any payment to such extent as may be necessary on account of:

.01 Defective Work not remedied;
.02 third party Claims filed or reasonable evidence indicating probable filing of such Claims;
.03 failure of Contractor to timely or properly make payments to Subcontractors or for labor, materials or equipment;

.04 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Amount;

.05 damage to Owner or another contractor for which Contractor is responsible;

.06 reasonable evidence that the Work will not be completed within the Contract Time Requirements, and that the unpaid balance would not be adequate to cover actual or liquidated damages or economic disincentives for the anticipated Delay;

.07 failure of Contractor to submit a Schedule of Values in accordance with the Contract Documents;

.08 failure of Contractor to submit a submittal schedule in accordance with the Contract Documents;

.09 failure of Contractor to submit and update the construction Project Schedule in accordance with the Contract Documents;

.10 failure of Contractor to maintain a record of changes on drawings and documents;

.11 failure of Contractor to maintain weekly payroll reports and, as applicable, provide copies of reports in a timely manner upon request of Owner;

.12 Contractor's neglect or unsatisfactory prosecution of the Work, including failure to clean up;

.13 property damage claims that are the responsibility of the Contractor; or

.14 failure of Contractor to comply with any provision of the Contract Documents.

14.04.2 When the above reasons for withholding payment are remedied or no longer exist, Contractor shall resubmit a statement for withheld amounts. Payment will be made within forty-five (45) calendar days of receipt by the Owner of an approved Application for Payment, subject to Article 14.05 and Government Code, Section 2251.025(b).

14.05 Delayed Payments: Owner shall endeavor to, but shall not be obligated to, make payment to Contractor within thirty (30) calendar days of receipt of an Application for Payment in acceptable form, including all supporting documents and information required. However, Contractor agrees that should Owner fail to make payment to Contractor of the sum due on any such Application for Payment within forty-five (45) calendar days after the day on which Owner received the Application for Payment, then Owner will pay to Contractor, in addition to the sum due on such Application for Payment, interest thereon at the rate specified in Government Code, Section 2251.025(b) from date due until fully paid, which shall fully liquidate and shall be Contractor's sole and exclusive remedy for any injury to or damages incurred by Contractor arising out of such delay in payment.

14.06 Arrears: No money shall be paid by Owner upon any claim, debt, demand or account whatsoever, to any person, firm or corporation who is in arrears to the Owner for taxes; and the Owner shall be entitled to counterclaim and automatically offset against any such debt, claim, demand or account in the amount of taxes so in arrears and no assignment or transfer of such debt, claim, demand or account after said taxes are due, shall affect the right of Owner to so offset said taxes, and associated penalties and interest if applicable, against the same.

14.07 Substantial Completion:

14.07.1 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify Owner's Representative and request a determination as to whether the Work or designated portion thereof is substantially complete. If Owner, Owner's Representative or the Principal Architect/Engineer does not consider the Work substantially complete, Owner's Representative will notify Contractor giving reasons for that position. After performing any required Work, Contractor shall then submit another request for Owner's Representative to determine Substantial Completion. If Owner considers the Work substantially complete, Owner's Representative will prepare and deliver a certificate of Substantial Completion which shall establish the date of Substantial Completion, shall include a punch list of items to be completed or corrected before final payment, shall establish the time within which Contractor shall complete or correct the punch list items, and shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, warranties, corrective periods, and insurance.

Failure to include an item on the punch list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If a Certificate of Occupancy or Certificate of Compliance is required by governmental entities or public authorities having jurisdiction over the Work, said certificate shall be issued before the Work or any portion thereof is considered to have achieved Substantial Completion. The certificate of Substantial Completion shall be signed by Owner and Contractor to evidence acceptance of the responsibilities assigned to them in such certificate.

.1 For water and wastewater lines construction, Substantial Completion means, in addition to the definition at Section 1.072, that the Work, including all testing and disinfection, have been completed and accepted and the line(s) placed into service. A certificate of Substantial Completion may not be issued. Work that remains after Substantial Completion could include the final pavement of roadways, adjustment of structures to final grade and re-vegetation. Owner’s Representative will issue a notice specifying what portion of the Work is partially completed for the purpose of payment and what Work remains to be done on the portion being accepted as having achieved Substantial Completion.

.2 For water and wastewater lines construction that includes roadway construction and/or reconstruction, a certificate of partial Project Substantial Completion may be given for the Work described and deemed substantially complete per Article 14.07.1.1, exclusive of any Project roadway construction and/or reconstruction. Having received a certificate of partial Substantial Completion on the water and wastewater lines construction, a certificate of Substantial Completion of the entire or balance of the Project may be given when the roadway construction and/or reconstruction is found to be substantially complete as per Article 14.07.1.3. The requirements of Article 14.08 Partial Utilization, shall also apply.

.3 For roadway construction and/or reconstruction, Substantial Completion means, in addition to the definition at Section 1.072, that the Work, including the final surface course, all permanent traffic control devices (pavement markings, signs, etc.), punch list items, and final cleanup has been completed, accepted, and placed into service, and, any street lighting conduit that has been installed, lowered or relocated must be inspected for usability by, and must have received written approval from, the Owner as well as having been completed, accepted, and placed into service. A certificate of Substantial Completion may not be issued. Work that remains after Substantial Completion could include final clean up. The Owner's Representative will issue a notice specifying what portion of the Work is partially completed for the purpose of payment and what Work remains to be done on the portion being accepted as having achieved Substantial Completion.

.4 Substantial Completion shall also comprise the completion of Work associated with the Project so that the utilities, systems, equipment, and/or facilities are operating properly and functioning per their intended use, as designed. Work that can be completed between Substantial Completion and Final Completion includes finish work such as cleanup, finish painting, landscape repairs, and final documentation. However, Contractor shall provide all Owner required equipment and system operation and maintenance training and Manufacturer certifications, and shall submit all spare parts and final O&M Data in order for Substantial Completion to be deemed achieved.

14.07.2 Owner shall have the right to exclude Contractor from the Work after the date of Substantial Completion, but Owner will allow Contractor reasonable access to complete or correct items on the punch list and perform and complete warranty or corrective work.

14.07.3 Unless otherwise provided in the Contract Documents, for all periods prior to the issuance of a Certificate of Substantial Completion for the Project or for any designated area within the Project, the Contractor shall be responsible for the cost of all temporary and permanent utility charges necessary to maintain the progress and quality of the construction Work which is under the Contractor's control.

14.07.4 Unless otherwise provided in the Contract Documents, for all periods prior to the issuance of a Certificate of Substantial Completion for the Project or for any designated area within the Project, the Contractor shall be responsible for the cost of all temporary structural support systems necessary for the safe execution of the Work. Such systems shall be the sole responsibility of the Contractor.

14.08 Partial Utilization: Use by Owner, at Owner's option, of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) Owner and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work in accordance with the following:

14.08.1 Owner at any time may request Contractor to permit Owner to use any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor shall certify to Owner's Representative that such part of the Work is substantially complete and request Owner's Representative to issue a notice specifying what portion of the Work is substantially complete for the purpose of payment and what Work remains to be done on the portion being accepted. Contractor at any time may notify Owner's Representative that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a notice specifying what portion of the Work is substantially complete for the purpose of payment and what Work remains to be done on the portion being accepted. The provisions of Sections 14.7.1 and 14.7.2 will apply with respect to notice specifying what portion of the Work is substantially complete for the purpose of payment and what Work remains to be done on the portion being accepted.

14.08.2 Such partial utilization must be authorized to the extent required by any governmental entities or public authorities having jurisdiction over the Work.

14.08.3 Warranty and corrective period requirements for such partial utilization shall be in accordance with Section 13.7.3 above.

14.09 Final Inspection: Upon Written Notice from Contractor that the entire Work or an agreed portion thereof is complete, Owner will make a final inspection with Contractor and provide Written Notice of all particulars in which this inspection reveals that the Work is incomplete or Defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies. Owner's Representative, Principal Architect/Engineer, CMT Consultant and other third party consultants and any other governmental entity or public authority with jurisdiction over the Project may assist Owner in the inspection and testing of the Work and Contractor agrees to and shall cooperate with any such consultants or authorities with respect to any such inspections and tests.

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14.10 Final Application for Payment: Contractor may make application for final payment following the procedure for progress payments after Contractor has completed all such corrections to the satisfaction of Owner (and Owner's Representative) and delivered the following documents:

14.10.01 Affidavit by Contractor certifying the payment of all debts and claims;

14.10.02 Architect's/Engineer's Certificate of Completion;

14.10.03 Three (3) complete final operating and maintenance manuals, each containing maintenance and operating instructions, schedules, guarantees, and other documentation required by the Contract Documents;

14.10.04 Record documents (as provided in Section 6.10);

14.10.05 Complete releases or waivers (satisfactory to Owner) of all claims arising out of or filed in connection with the Work;

14.10.06 Certificate evidencing that insurance required by the Contract, if any, will remain in force after final payment and through the warranty and corrective periods and any longer period of time required by the Contract;

14.10.07 Non-Use of Asbestos Affidavit (After Construction) and lead based paints;

14.10.08 TPDES records in accordance with Section 6.07.4;

14.10.09 Consent of Surety, if any, to final payment; and

14.10.10 Any other documentation required by the Contract Documents.

14.11 Final Payment and Acceptance:

14.11.1 If, on the basis of observation of the Work during construction, final inspection, and review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Owner's Representative and Owner are satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled and there are no outstanding claims, Owner's Representative will recommend the final Application for Payment and thereby notify the Owner, who, if it accepts such recommendation, will pay to Contractor the balance due Contractor under the terms of the Contract. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation, Owner has the right to require Contractor to execute and deliver to Owner a re-vegetation letter with a reasonable fiscal amount posted via an irrevocable, callable on demand letter of credit issued by a financial institution acceptable to Owner and at no cost to Owner to ensure completion of this item, as a condition of final payment. This Work must be accomplished within one hundred twenty (120) Calendar Days of the date of Final Completion of the Work. When the permanent erosion control has been established, Owner will initiate an inspection for final acceptance of the erosion controls. If the re-vegetation is not completed within the one hundred twenty (120) Calendar Days, Owner, at its option, may draw upon and complete the Work using the proceeds of the postedre-vegetation letter of credit.

14.11.2 Owner will issue a certificate of Final Completion to Contractor which establishes the Final Completion date. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation, and Contractor has executed the above-described re-vegetation letter of credit to ensure completion of this item, the Owner will issue a certificate of conditional acceptance to Contractor which establishes the Final Completion date.

14.11.3 Final payment is considered to have taken place when Contractor or any of its representatives negotiates Owner's final payment check, whether

labeled final or not, for cash or deposits the check in any financial institution for its monetary return.

14.12 Waiver of Claims by Contractor: The making and acceptance of final payment will constitute A waiver of all claims by Contractor against Owner other than those previously made in writing and still unsettled at the time of the final payment.

14.13 Contractor's Payment Obligations Contractor will pay the Subcontractors, in accordance with its contractual obligations to such parties, all the amounts Contractor has received from Owner on account of their work. Contractor will impose similar requirements on the Subcontractors to pay those parties with whom they have contracted. Contractor will defend and indemnify Owner from and against any claims for payment by any such parties.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 Owner May Suspend Work Without Cause: At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than one hundred twenty (120) calendar days by Written Notice to Contractor, or such longer period of time as agreed to in writing by Owner and Contractor. Contractor shall promptly resume the Work upon Owner's written direction to proceed. Contractor shall be allowed an adjustment in the Contract Amount or an extension of the Contract Time Requirements, or both, directly attributable to any such suspension if Contractor makes an approved Claim therefor as provided in Articles 10.5 and 12.1.

15.2 Owner May Terminate Without Cause: Upon seven (7) calendar days' Written Notice to Contractor, Owner may, without cause and without prejudice to any right or remedy of Owner, elect to terminate the Contract. In such case, Contractor shall be paid (without duplication of any items):

15.2.1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;

15.2.2 for reasonable demobilization costs;

15.2.3 for reasonably anticipated profits on completed and accepted Work not previously paid and not included in separate pay items calculated to date of termination but not for anticipated profit on unperformed Work or unabsorbed overhead, or lost opportunity; and

15.2.4 for all costs reasonably incurred in settlement of terminated contracts with Subcontractors, Manufacturers, Suppliers and others, including for reasonably anticipated profits on completed and accepted Work not previously paid and not included in separate pay items calculated to date of termination but not for anticipated profit on unperformed Work or unabsorbed overhead, or lost opportunity. Contractor agrees to negotiate in good faith with Subcontractors, Manufacturers, Suppliers and others to mitigate its and Owner's costs.

15.3 Owner May Terminate With Cause:

15.3.1 Upon the occurrence of any one or more of the following events (each, a "default"):

.1 if Contractor persistently fails to perform the Work in accordance with the Contract Documents;
.2 if Contractor disregards Legal Requirements;
.3 if Contractor disregards the authority of Owner or Owner's Representative;
.4 if Contractor makes fraudulent statements;
.5 if Contractor fails to maintain a work force adequate to accomplish the Work within the Contract Time Requirements;
.6 if Contractor fails to make adequate progress and endangers successful completion of the Contract; or
.7 if Contractor otherwise breaches any provision of the Contract Documents;

Owner may, after giving Contractor (and the performance bond Surety, if any) seven (7) calendar days Written Notice, terminate in whole or in part the Contract or the Contractor's right to perform Work. Owner, at its option, may proceed with negotiation with Surety for completion of the Work. Alternatively, Owner may exclude Contractor from the Site and take possession of the Work (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount exceeds all claims, costs, losses and damages sustained by Owner arising out of or resulting from the Contractor's default and Owner's completion of the Work, including attorneys' fees and other expenses and additional Owner's Architect/Engineer fees and other expenses in connection with such completion, Owner shall pay Contractor only for the value of unpaid, conforming Work performed by Contractor prior to such termination up to but not more than such excess. If such claims, costs, losses and damages exceed such unpaid balance, Contractor or Surety shall pay the difference to Owner upon demand. In the event that a termination for cause is found to be wrongful, the termination shall be deemed converted to a termination without cause as set forth in Section 15.2 and Contractor's remedy for wrongful termination shall be exclusively limited to the recovery of the payments permitted for termination without cause as set forth in Section 15.2.

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

15.4 Contractor May Stop Work or Terminate: If through no act or fault of Contractor, the Work is suspended for a period of more than one hundred and twenty (120) calendar days by Owner or under an order of court or other governmental entity or public authority, or such longer period of time as agreed to in writing by Owner and Contractor, or (except during disputes) Owner's

Representative fails to forward to Owner for processing any properly prepared and submitted Application for Payment within seven (7) calendar days after it is submitted, or (except during disputes) Owner fails for forty-five (45) calendar days after it is submitted to pay Contractor any sum finally determined by Owner to be due, then Contractor may, upon forty-five (45) calendar days' Written Notice to Owner, and provided Owner does not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Section 15.2. The provisions of this Section 15.4 are not intended to preclude Contractor from making a Claim under Articles 11 and 12 for an increase in Contract Amount or Contract Time Requirements or otherwise for expenses or damage directly attributable to Contractor's stopping Work pursuant to this Section.

15.5 Discretionary Notice to Cure: In its sole discretion, Owner may, but is not required to, provide a Notice to Cure to Contractor and its Surety to cure an event of default described in Section 15.3.1 above and/or an anticipatory breach of contract and, if required by Owner, the Contractor and Surety shall attend a meeting with Owner, regarding the Notice to Cure, the event of default, and/or the anticipatory breach of contract. If issued, the Notice to Cure will set forth the time limit by which the cure is to be completed or commenced and diligently prosecuted. Upon receipt of any Notice to Cure, Contractor shall prepare a report describing its program and measures to accomplish the cure of the event of default and/or anticipatory breach of contract within the time required by the Notice to Cure. The Contractor's report must be delivered to Owner at least three (3) days prior to any requested meeting with the Owner and Surety.

15.6 Bankruptcy: If Contractor declares bankruptcy or is adjudged bankrupt or makes an assignment for the benefit of creditors or if a receiver is appointed for the benefit of creditors or if a receiver is appointed by reason of Contractor's insolvency, Contractor may be unable to perform this Contract in accordance with the Contract requirements. In such an event, Owner may demand Contractor or its successor in interest provide Owner with adequate assurance of Contractor's ability to perform in accordance with the terms and conditions of the Contract. If Contractor fails to provide adequate assurance of performance to Owner's reasonable satisfaction within ten (10) days of such a request, Owner may terminate the Contract or the Contractor's right to perform Work for cause or without cause, pursuant to Sections 15.2 or 15.3 above. If Contractor fails to provide timely adequate assurance of its performance and actual performance, Owner may prosecute the Work with its own forces or with other contractors on a time and material or other appropriate basis and the cost of which will be charged against the Contract balance or otherwise borne by Contractor.

15.7 Duty to Mitigate: In the event of any termination or suspension under this Contract, the Contractor agrees to and shall take all reasonable actions to mitigate its damages and any and all claims for damages which may be asserted against the Owner.

15.8 Responsibility during Demobilization: While demobilizing, the Contractor will take all necessary and reasonable actions to preserve and protect the Work, the Site and other property of the Owner or others at the Site.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Filing of Claims:

16.1.1 All Claims by Contractor shall be made by Written Notice delivered to Owner within fifteen (15) calendar days after the start of the occurrence or 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 in writing within thirty (30) calendar days after Written Notice of Claim is delivered by Contractor and shall represent that the adjustment claimed covers all known monetary amounts and/or extensions of time to which Contractor is entitled.

16.1.2 Within thirty (30) calendar days of receipt of notice of the amounts and/or time extensions sought by the Claim with supporting data, Owner's Representative and Contractor shall meet to discuss the Claim, after which a written offer of settlement or written notification of no settlement offer may be made to Contractor. If Contractor is not satisfied with any proposal presented, Contractor shall have thirty (30) calendar days in which to: (i) submit additional supporting data requested by the other party along with a written request to re-evaluate the Claim; (ii) modify the initial Claim; or (iii) request Alternative Dispute Resolution.

16.2 Alternative Dispute Resolution:

16.2.1 If a dispute exists concerning a Claim, the parties agree to use the following procedure prior to pursuing any other available remedies except that nothing herein shall preclude the Owner from seeking injunctive or other extraordinary relief in a court of competent jurisdiction prior to the completion of the following procedure. Owner reserves the right to include the Owner's Representative, Principal Architect/Engineer and/or the CMT Consultant as a party. Similarly, Contractor agrees to participate at its own cost in similar dispute resolution procedures for any dispute between Owner and any such other parties, and Contractor agrees to require its Subcontractors to participate in the following procedures in any dispute between Owner and Contractor, upon Owner's written request, if in Owner's sole discretion the participation of Contractor and/or any Subcontractor is necessary to the resolution of any such dispute.

16.2.2 Negotiating with Previously Uninvolved Personnel: Either party may make a written request for a meeting to be held between representatives of each party within fourteen (14) Calendar Days of the request or such later period that the parties may agree to. Each party shall endeavor to include, at a minimum, one (1) previously uninvolved senior level decision maker (an owner, officer, or employee of each organization) with the authority to negotiate and settle the dispute on behalf of their organization. If a previously involved senior level decision maker is unavailable due to the size of the Contractor's organization or any other reason, the Contractor shall nonetheless provide an appropriate senior level decision maker for the meeting. The purpose of this and any subsequent meetings will be good faith negotiations and resolution of the matters constituting the dispute. Negotiations shall be concluded within thirty (30) Calendar Days of the first meeting, unless mutually agreed otherwise. This step may be waived by a written agreement signed by both parties, in which event the parties may proceed directly to mediation as described below.

16.2.3 Mediation:

.1 If the procedure described in 16.2.2 proves unsuccessful or is waived pursuant to its terms, the parties shall initiate the mediation process. Owner and Contractor agree to select within thirty (30) calendar days a mediator trained in mediation skills, and experienced in the mediation of construction disputes, to assist with resolution of the dispute. Owner and Contractor agree to act in good faith in the selection of the mediator and to give all due consideration to qualified individuals nominated to act as mediator. Should the parties fail to agree on a mediator within thirty (30) calendar days of initiation of the mediation process, the parties agree to ask the American Arbitration Association to select a qualified individual, which selection shall be binding on the parties. If the dispute is technical in nature, the mediator appointed by the American Arbitration Association shall be qualified by at least ten (10) years' experience in construction, engineering, and/or public works projects. If a party refuses to participate in the selection of a mediator or refuses to attend a scheduled mediation, the other party may pursue other remedies available to it.

.2 Mediation is a forum in which an impartial person, the mediator, facilitates communication between parties to promote reconciliation, settlement, or understanding among them. The parties hereby agree that mediation, at a minimum, shall provide for (i) conducting an on-site investigation, if appropriate, by the mediator for fact gathering purposes, (ii) a meeting of all parties for the exchange of points of view and (iii) separate meetings between the mediator and each party to the dispute for the formulation of resolution alternatives. The parties agree to participate in mediation in good faith for up to thirty (30) calendar days after the date of the first mediation session, unless mutually agreed otherwise. Should the parties fail to reach a resolution of the dispute through mediation, then the parties may pursue other remedies available to them.

ARTICLE 17 – MISCELLANEOUS

17.1 Computation of Times: When any period of time is measured in the Contract Documents in days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or legal holiday, such day will be omitted from the computation.

17.2 Venue; Choice of Law: Venue for any suit at law or in equity involving the Contract or the parties' relationship created by it shall lie exclusively in Montgomery County, Texas. The Contract and any disputes arising out of it shall be construed in accordance with and governed by the laws of the State of Texas, without regard to its conflict of laws principles. Any claims or causes of action arising under or in conjunction with this Contract shall be brought in a court of competent jurisdiction in Montgomery County, Texas. In the event of litigation relating to this Contract or the performance or nonperformance of Work hereunder, the Contractor and the Owner voluntarily and irrevocably consent to the jurisdiction of the applicable courts in Montgomery County, Texas, and hereby waive any argument that such a forum is inconvenient.

17.3 Extent of Contract: This Contract represents the entire and integrated agreement between the Owner and Contractor with respect to the subject matter hereof and supersedes all prior and contemporaneous negotiations, representations or agreements, whether written or oral, and each party disclaims any reliance upon any such prior or contemporaneous negotiation, representation or agreement.

17.4 Remedies Cumulative: Except as limited by this Contract, remedies provided for herein are cumulative, and in addition to and not in lieu of those provided by law or available in equity.

17.5 Severability: If any word, phrase, clause, sentence or provision of the Contract, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, void, invalid or unenforceable, then such word, phrase, clause, sentence or provision shall be deemed severed herefrom and the remainder of this Contract shall remain in full force and effect.

17.6 Independent Contractor: The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. Contractor is an independent contractor and Contractor's work and services shall be those of an independent contractor. Without limiting the generality of the foregoing, Contractor agrees and understands that the Contract does not grant any rights or privileges to any employee of Contractor, its Subcontractors or Suppliers which are established for employees of Owner.

17.7 Prohibition of Gratuities: Owner may, by Written Notice to Contractor, terminate the Contract without liability if Owner determines that gratuities were offered or given by Contractor or any agent or representative of Contractor to any officer or employee of Owner with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such Contract. In the event the Contract is terminated by Owner pursuant to this provision, Owner shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by Contractor in providing such gratuities, to the extent Contractor attempted to charge Owner for same or included any such costs in the Contract Amount.

17.8 Prohibition Against Personal Interest in Contracts: No officer, employee, independent consultant, or elected official of Owner who is involved in the development, evaluation, or decision-making process of the performance of any solicitation shall have a financial interest, direct or indirect, in the Contract resulting from that solicitation. Any violation of this provision shall render the Contract voidable by Owner.

17.9 Owner's Right to Audit:

17.9.1 "Records" means all records generated by or on behalf of Contractor and each Subcontractor and Supplier of Contractor, whether paper, electronic, or other media, which are in any way related to performance of or compliance with this Contract, including, without limitation:

.01 accounting records;
.02 written policies and procedures, contractor daily diaries, and pay reports;

.03 subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.);
.04 original estimates and estimating work sheets;
.05 correspondence;
.**06** Change Order files (including documentation covering negotiated settlements);
.07 back charge logs and supporting documentation;
.08 general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends;
.09 subcontracts, purchase orders or other agreements between Contractor and any Subcontractor or Manufacturer, or Supplier;
.10 records necessary to evaluate Contract compliance, Change Order pricing, and any Claim submitted by Contractor or any of its payees;
.11 SWP3 Documentation;
.12 job cost reports; and
.13 any other Contractor record that may substantiate any charge or claim related to this Contract.

17.9.2 Contractor shall allow Owner's agent or its authorized representative to inspect, audit, and/or reproduce, or all three, all Records generated by or on behalf of Contractor and each Subcontractor and Manufacturer or Supplier, upon Owner's written request. Further, Contractor shall allow Owner's agent or authorized representative to interview any of Contractor's employees, all Subcontractors and all Manufacturers and Suppliers, and any of their respective employees.

17.9.3 Contractor shall retain all its Records, and require all its Subcontractors and Manufacturers and Suppliers to retain their respective Records, during the performance of this Contract and for three (3) years after final payment or any termination, until all audit and litigation matters that Owner has brought to the attention of Contractor are resolved, or as otherwise required by law, whichever is longer. Owner's right to inspect, audit or reproduce Records, or interview employees of Contractor or its respective Subcontractors or Manufacturers and Suppliers exists during the performance of this Contract, and for three (3) years after final payment or any termination, until all audit and litigation matters that Owner has brought to Contractor's attention are resolved, or as otherwise required by law, whichever is longer, and at no cost to Owner.

17.9.4 Contractor must provide sufficient and accessible facilities during its normal business hours for Owner to inspect, audit or reproduce Records, or all three, and to interview any person about the Records.

17.9.5 Contractor shall insert these requirements in each written contract between Contractor and any Subcontractor, Manufacturer or Supplier and require each Subcontractor, Manufacturer and Supplier to comply with these provisions.

17.10 Survival of Obligations: All representations, indemnifications, warranties and guarantees made in, required by or provided pursuant to the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Contract.

17.11 No Waiver: The waiver of any provision of this Contract will not be deemed to be a waiver of any other provision of this Contract. No provision of this Contract will be deemed waived whatsoever unless expressly provided in writing, nor will a waiver of any default be deemed a waiver of any subsequent defaults of the same type. The failure at any time to enforce this Contract, whether the default is known or not, shall not constitute a waiver of or estoppel against the right to do so.

17.12 Condition Precedent to Right to Sue: Notwithstanding anything in the Contract Documents to the contrary, the Contractor must have provided at least 90 days prior written notice of a claim for damages as a condition precedent to the right to sue on the Contract.

17.13 WAIVER OF THE RIGHT TO JURY TRIAL. OWNER AND CONTRACTOR HEREBY, KNOWINGLY, IRREVOCABLY AND INTENTIONALLY WAIVE ANY RIGHTS EITHER PARTY MAY HAVE TO A TRIAL BY JURY IN RESPECT TO ANY CLAIM, CAUSE OF ACTION, PROCEEDING OR COUNTER CLAIM BASED UPON THE CONTRACT DOCUMENTS, OR ARISING OUT OF, UNDER OR IN CONNECTION WITH THE CONSTRUCTION OF THE WORK OR ANY COURSE OF CONDUCT, COURSE OF DEALING, STATEMENTS (WHETHER VERBAL OR WRITTEN) OR ACTIONS OF ANY PARTY. HOWEVER, THIS WAIVER OF JURY TRIAL SHALL NOT APPLY TO LITIGATION WHICH MAY BE INITIATED BY ANY THIRD PARTIES.

17.14 Attorneys' Fees and Costs. If Contractor brings any suit against Owner and Contractor does not prevail in such suit, Contractor shall be liable for all attorneys' fees and costs incurred by Owner as a result of such suit. "Prevail" as used in this Section 17.14 means the Contractor recovers a judgment against Owner for at least eighty percent (80%) of all relief sought by Contractor in Claims against Owner in the Written Notice(s) as provided in Section 16.1.1 above, and the judgment is greater than any relief offered to Contractor by Owner in any written settlement offer.

END OF GENERAL CONDITIONS TERMS

WARRANTY ITEM NO. _____

(PROJECT NAME)

The General Conditions of the Contract require that Defects be corrected within seven (7) days after written notice is received.

TO: _____
name/ address / telephone / fax / email

ATTENTION OF: _____

FROM: _____
project manager name / address / telephone / fax / email

PROJECT: _____
name / location / CIP ID number

END DATE OF WARRANTY OR CORRECTIVE PERIOD:_____

_____

SUBJECT:_____

[ ] If checked, the defect requires immediate attention. The Contractor has been called.
[ ] If checked, the Owner has been asked to consult with the Contractor on the defect.

PLEASE CORRECT THE FOLLOWING ITEM(S):

DATE OF REQUEST_____ **SIGNATURE** _____
Project Manager

[ ] _____Phone No._____

[ ] _____Phone No._____

[ ] _____Phone No._____

RESPONSE FROM Contractor: DATE CORRECTION WAS MADE:_____

The Contractor must endeavor to correct the defect within seven (7) calendar days after written notice is received. If the defect cannot be corrected by that time, Contractor shall provide a written explanation to the Owner describing the repairs or other correction needed and the time required to complete the repairs or corrections.

Description of corrections made:

DATE OF REPLY:_____SIGNATURE:_____

PRINTED NAME:_____

When the repair/correction is complete, the contractor should return a copy to each of the following:

[ ] _____Phone No._____

[ ] _____Phone No._____

[ ] _____Phone No._____

END OF SECTION

4812-4844-0915, v. 1-6602-9900, v. 4-6602-9900, v. 3-6602-9900, v. 2

SECTION 00 73 43

WAGE SCALE FOR CONSTRUCTION

PART 1 - GENERAL

1.1 Contractor and its Subcontractors must pay the general prevailing wage rates for building construction for each craft or type of worker or mechanic employed in the execution of any building construction or repair under the Contract in accordance with Chapter 2258 of the Texas Government Code. The San Jacinto River Authority (“SJRA”) has determined the prevailing wage rate in the locality in which the work is being performed, which is set forth in Exhibit "A".

1.2 In bidding, Contractor warrants and represents that it has carefully examined the classifications for each craft or type of worker needed to execute the Contract and determined that such classifications in Exhibit "A" include all necessary categories to perform the work under the Contract.

1.3 If Contractor believes that an additional classification for a particular craft or type of worker is necessary to perform work under the Contract, it must submit with its bid a request to the San Jacinto River Authority to use an additional labor classification not listed in Exhibit "A" and specify the proposed new classification. The SJRA shall determine whether a proposed classification is already covered in Exhibit "A", and, if it is, specify which classification is appropriate. The SJRA’s decision is conclusive. If the SJRA decides that a new classification is necessary, it will determine the appropriate prevailing wage rate for any resurveyed, amended, new, or additional craft or type of worker not covered by Exhibit "A". Such determination must be decided in accordance with procedures established by the SJRA, and in compliance with Chapter 2258 of the Texas Government Code.

1.4 Contractor must not use any labor classification not covered by Exhibit "A" until such classification is established and approved for use by the SJRA.

A Contractor or Subcontractor who violates Chapter 2258 of the Texas Government Code must pay to the SJRA $60 per each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates set forth in Exhibit "A".

1.5 The SJRA may withhold money required to be withheld under Chapter 2258 of the Texas Government Code from the final payment to Contractor or earlier payments if the SJRA makes a determination that there is good cause to believe that Contractor has not complied with these provisions and Chapter 2258 of the Government Code, in which case the SJRA may withhold the money at any time subsequent to the finding by the SJRA.

1.6 Contractor and Subcontractors must keep records as required by Chapter 2258 of the Government Code, and specifying:

(1) the name and classification of each worker employed under the Contract; and

(2) the actual per diem wages paid to each worker, and the applicable hourly rate.

The records must be open at all reasonable hours for inspection by the officers and agents of the SJRA.

1.7 The prevailing wage rate does not prohibit the payment of more than the rates stated.

1.8 The hourly cost of salary for non-exempt workers for labor in excess of 40 hours per worker per week, shall be calculated at 1.5 times the worker's base pay, plus 1.0 times fringe benefits, for the applicable craft and level.

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EXHIBIT "A"

LABOR CLASSIFICATIONS AND PREVAILING WAGE RATES
FOR
CONSTRUCTION
2019

Heavy Construction Projects

County Name: Montgomery and Waller Counties
Wages based on DOL General Decision: TX1900063 01/04/2019 TX63

CLASSIFICATION	RATE	FRINGES
Sprinkler Fitter (Fire Sprinklers)	$29.03	$15.84
Carpenter	$14.38	
Ironworker, reinforcing	$11.29	
Laborers:		
Common Montgomery County	$8.83	$0.94
Common Waller County	$8.97	$0.88
Landscape	$7.35	
Mason Tender Cement	$9.96	
Pipelayer Montgomery County	$10.04	
Pipelayer Waller County	$10.07	
Cement Mason / Concrete Finisher	$11.37	$1.13
Electrician	$18.40	$1.34
Formbuilder / Formsetter	$13.35	$1.17
Pipefitter	$17.00	$0.04
Power Equipment Operator:		
Backhoe	$13.25	
Bulldozer Montgomery County	$13.12	
Bulldozer Waller County	$12.46	
Crane	$14.91	$0.58
Excavator	$16.74	
Front End Loader Montgomery County	$12.30	$0.57
Front End Loader Waller County	11.75	$0.92
Grader	$12.20	$1.48
Tractor	$12.38	$1.51
Truck Driver Montgomery County	$11.82	$0.92
Truck Driver Waller County	12.28	$0.98
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		

Heavy Construction Projects- Flood Control Only

County Name: Brazoria, Fort Bend, Galveston, Harris, Montgomery and Waller Counties
Wages based on DOL General Decision: TX190046 01/04/2019 TX46

CLASSIFICATION	RATE	FRINGES
Asphalt Distributer	$9.47	
Asphalt Paving Machine	$10.05	
Asphalt Raker	$8.28	
Asphalt Shoveler	$7.45	
Batching Plant Weigher	$11.11	
Broom or Sweeper Operator	$8.01	
Bulldozer	$9.91	
Carpenter	$10.35	
Concrete Curbing Mach.	$8.80	
Concrete Finisher-Paving	$9.87	
Concrete Finisher-Structures	$9.86	
Concrete Finishing Machine	$11.79	
Concrete Joint Sealer	$10.50	
Concrete Paving Float	$9.30	
Concrete Paving Saw	$10.01	
Concrete Paving Spreader	$9.32	
Concrete Rubber	$9.00	
Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel	$11.35	
Crusher or Screening Plant Operator	$11.00	
Electrician	$16.15	
Flagger	$7.25	
Form Builder (Structures)	$9.96	
Form Liner – Paving & Curb	$9.03	
Form Setter (Paving/Curb)	$8.86	
Form Setter – Structures	$9.05	
Foundation Drill Operator, Crawler Mounted	$12.59	
Foundation Drill Operator, Truck Mounted	$12.73	
Front End Loader	$9.29	
Labor Common	$7.45	
Labor – Utility	$8.53	
Lineperson	$7.50	
Manhole Builder (Brick)	$8.49	
Mechanic	$11.38	
Milling Machine Operator	$10.43	
Mixer	$7.94	
Motor Grader:		
Fine Grade	$11.11	
Other	$10.67	
Oiler	$9.56	

Painter - Structures	$14.00	
Pavement Marking Machine	$7.45	
Piledriver	$10.96	
Pipe Layer	$8.49	
Reinforcing Steel Setter Paving	$12.50	
Reinforcing Steel Setter Structures	$12.47	
Roller, Pneumatic, Self Propelled	$7.96	
Roller, Steel Wheel Other Flatwheel or Tamping	$7.61	
Roller, Steel Wheel Plant Mix Pavements	$9.25	
Scraper	$8.69	
Servicer	$9.51	
Sign Erector	$10.06	
Sign Installer	$7.45	
Slipform Machine Operator	$9.20	
Spreader Box Operator	$9.08	
Steelworker Structural	$10.35	
Tractor – Crawler Type	$10.12	
Tractor – Pneumatic	$8.99	
Traveling Mixer	$9.35	
Trenching Machine, Heavy	$13.56	
Trenching Machine, Light	$10.50	
Truck Driver Lowboy Float	$11.29	
Truck Driver Single Axle Heavy	$8.76	
Truck Driver Single Axle, Light	$8.15	
Truck Driver Tandem Axle Semi-Trailer	$8.00	
Wagon Drill, Boring Machine	$10.15	
Welder	$10.43	
Work Zone Barricade	$7.45	
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		

Highway Construction Projects (for Paving Projects)

County Name: Montgomery County and Harris County
Wages based on DOL General Decision: TX190038 01/04/2019 TX38

CLASSIFICATION	RATE	FRINGES
Cement Mason/Concrete Finisher (Paving and Structures)	$12.98	
Electrician	$27.11	
Form Builder/Form Setter:		
Paving & Curb	$12.34	
Structures	$12.23	
Laborer:		
Asphalt Raker	$12.36	
Flagger	$10.33	
Laborer, Common	$11.02	
Laborer, Utility	$11.73	
Pipelayer	$12.12	
Work Zone Barricade Servicer	$11.67	
Painter (Structures)	$18.62	
Power Equipment Operator:		
Asphalt Distributor	$14.06	
Asphalt Paving Machine	$14.32	
Broom or Sweeper	$12.68	
Concrete Pavement Finishing Machine	$13.07	
Concrete Paving, Curing, Float, Texturing Machine	$11.71	
Concrete Saw	$13.99	
Crane, Hydraulic 80 Tons or Less	$13.86	
Crane, Lattice boom 80 tons or less	$14.97	
Crane, Lattice boom over 80 Tons	$15.80	
Crawler Tractor	$13.68	
Excavator, 50,000 pounds or less	$12.71	
Excavator, Over 50,000 pounds	$14.53	
Foundation Drill, Crawler Mounted	$17.43	
Foundation Drill, Truck Mounted	$15.89	
Front End Loader 3 CY or less	$13.32	
Front End Loader, Over 3CY	$13.17	
Loader/Backhoe	$14.29	
Mechanic	$16.96	
Milling Machine	$13.53	
Motor Grader, Fine Grade	$15.69	
Motor Grader, Rough	$14.23	
Off Road Hauler	$14.60	
Pavement Marking Machine	$11.18	
Piledriver	$14.95	
Roller, Asphalt	$11.95	

Roller, Other	$11.57	
Scraper	$13.47	
Spreader Box	$13.58	
Servicer	$13.97	
Steel Worker:		
Reinforcing Steel	$15.15	
Structural Steel Welder	$12.85	
Structural Steel	$14.39	
Truck Driver:		
Low Boy Float	$16.03	
Single Axle	$11.46	
Single or Tandem Axle Dump	$11.48	
Tandem Axle Tractor w/Semi Trailer	$12.27	
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		

Heavy Construction Projects Including Water and Sewer Lines (Does Not Include Flood Control)

County Name: Harris County
Wages based on DOL General Decision: TX180042 01/05/2018 TX42

CLASSIFICATION	RATE	FRINGES
Sprinkler Fitter (Fire Sprinklers)	$29.03	$17.52
Carpenter	$14.04	
Cement Mason / Concrete Finisher	$12.50	$1.17
Electrician	$17.00	$0.04
Formbuilder / Formsetter	$13.84	$1.17
Ironworker, reinforcing	$11.28	
Laborers:		
Common	$8.94	
Landscape	$7.35	
Mason Tender Cement	$9.94	
Pipelayer	$10.14	
Pipefitter	$17.00	$0.04
Power Equipment Operator:		
Backhoe	$13.47	
Bulldozer	$12.58	
Crane	$15.33	$0.57
Excavator	$16.37	
Front End Loader	$12.16	
Grader	$12.20	$1.48
Tractor	$15.00	
Truck Driver	$12.02	$1.02
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		

Building Construction Projects- (Does not include single family homes or apartments up to and including 4 stories)

County Name: Harris County

Wages based on DOL General Decision: TX180303 01/12/2018 TX303

CLASSIFICATION	RATE	FRINGES
Asbestos Worker/Heat & Frost Insulator (Duct, Pipe and Mechanical System Insulation)	$23.26	$12.92
Boilermaker	$28.00	$22.35
Carpenter (Excludes Acoustical Ceiling Installation, Drywall Hanging, Form Work and Metal Stud Installation)	$23.05	$8.78
Electrician:		
Excludes Low Voltage Wiring and Installation of Alarms	$32.25	$9.14
Alarm Installation Only	$17.97	$3.37
Low Voltage Wiring Only	$18.00	$1.68
Elevator Mechanic	$41.28	$32.645+a+b
Power Equipment Operator:		
Cranes	$34.85	$9.85
Ironworker:		
Structural	$23.27	$7.12
Ornamental	$23.27	$7.12
Reinforcing	$12.14	
Glazier	$23.27	$7.12
Plasterer	$19.92	$1.00
Plumber	$34.90	$10.54
Pipefitter (Including HVAC Pipe Installation)	$34.10	$11.71
Sprinkler Fitter (Fire Sprinklers)	$29.03	$15.84
Sheet Metal Worker:		
Exludes HVAC Duct and Unit Installation	$27.72	$13.70
HVAC Duct Installation Only	$27.72	$13.70
HVAC Unit Installation Only	$20.05	$2.24
Acoustical Ceiling Mechanic	$17.27	$3.98
Bricklayer	$18.87	
Caulker	$15.36	
Cement Mason/Concrete Finisher	$13.93	
Drywall Finisher/Taper	$16.27	$3.66
Drywall Hanger and Metal Stud Installer	$17.44	$3.93
Floor Layer (Carpet)	$20.00	
Form Worker	$12.77	
Insulator – Batt. Installation Only	$14.87	$0.73
Laborer:		
Common or General	$11.76	
Mason Tender - Brick	$13.47	
Mason Tender – Cement/Concrete	$10.48	
Pipelayer	$12.94	

Roof Tearoff	$11.28	
Landscape and Irrigation	$9.52	
Lather	$19.73	
Operator:		
Backhoe/Excavator/Trackhoe	$13.94	
Bobcat/Skid Steer/Skid Loader	$13.93	
Bulldozer	$22.75	
Drill	$16.22	$0.34
Forklift	$16.00	
Grader/Blade	$13.37	
Loader	$13.55	$0.94
Mechanic	$17.52	$3.33
Paver (Asphalt, Aggregate, and Concrete)	$16.03	
Roller	$16.00	
Painter (Brush, Roller and Spray, Exludes Drywall Finishing/Taping	$17.24	$4.41
Roofer	$15.40	
Tile Finisher	$12.00	
Tile Setter	$16.17	
Truck Driver:		
1/Single Axle Truck	$14.18	
Dump Truck	$12.39	$1.18
Flatbed Truck	$19.65	$8.57
Semi-Trailer Truck	$12.50	
Water Truck	$12.00	$4.11
Waterproofer	$14.39	
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		
a. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.		

Building Construction Projects- (Does not include single family homes or apartments up to and including 4 stories)

County Name: Montgomery County
Wages based on DOL General Decision: TX190262 01/04/2019 TX62

CLASSIFICATION	RATE	FRINGES
Asbestos Worker/Heat & Frost Insulator (Duct, Pipe and Mechanical System Insulation)	$24.15	$13.29
Boilermaker	$28.00	$22.35
Carpenter:		
Excludes Acoustical Ceiling Installation, Drywall Hanging, Form Work and Metal Stud Installation	$18.81	$2.10
Batt. Installation Only	$14.87	$0.73
Electrician:		
Excludes Low Voltage Wiring and Installation of Alarms	$32.25	$9.14
Alarm Installation Only	$17.97	$3.37
Low Voltage Wiring Only	$18.00	$1.68
Elevator Mechanic	$41.28	$32.645+a+b
Power Equipment Operator:		
Cranes	$34.85	$9.85
Ironworker:		
Structural	$27.15	$5.66
Ornamental	$23.77	$7.12
Reinforcing	$12.10	
Glazier	$19.12	$4.41
Plasterer	$19.92	$1.00
Plumber	$35.60	$11.04
Pipefitter:		
Including HVAC Pipe Installation	$33.30	$12.26
Excludes HVAC Pipe Installation	$26.73	$11.13
Sprinkler Fitter (Fire Sprinklers)	$22.17	$9.70
Sheet Metal Worker:		
Exludes HVAC Duct and Unit Installation	$27.72	$13.70
HVAC Duct Installation Only	$20.17	$4.77
HVAC Unit Installation Only	$19.67	$2.24
Acoustical Ceiling Mechanic	$16.41	$3.98
Bricklayer	$19.86	
Caulker	$15.36	
Cement Mason/Concrete Finisher	$13.37	
Drywall Finisher/Taper	$16.30	$3.71
Drywall Hanger and Metal Stud Installer	$17.45	$3.96
Floor Layer (Carpet)	$20.00	
Form Worker	$13.13	
Insulator – Batt. Installation Only	$14.87	$0.73
Laborer:		
Common or General	$10.20	

Mason Tender - Brick	$13.37	
Mason Tender – Cement/Concrete	$10.50	
Pipelayer	$12.94	
Roof Tearoff	$11.28	
Landscape and Irrigation	$9.49	
Lather	$19.73	
Operator:		
Backhoe/Excavator/Trackhoe	$16.17	
Bobcat/Skid Steer/Skid Loader	$13.93	
Bulldozer	$20.77	
Drill	$16.22	$0.34
Forklift	$15.64	
Grader/Blade	$13.37	
Loader	$13.55	$0.94
Mechanic	$17.52	$3.33
Paver (Asphalt, Aggregate, and Concrete)	$16.03	
Roller	$16.00	
Painter (Brush, Roller and Spray, Exludes Drywall Finishing/Taping	$16.77	$4.51
Roofer	$15.40	
Tile Finisher	$12.00	
Tile Setter	$16.17	
Truck Driver:		
1/Single Axle Truck	$14.95	$5.23
Dump Truck	$12.39	$1.18
Flatbed Truck	$19.65	$8.57
Semi-Trailer Truck	$12.50	
Water Truck	$12.00	$4.11
Waterproofer	$14.39	
Welders – Receive rate prescribed for craft performing operation to which welding is incidental.		
a. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.		
b. Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day; and Veterans Day		

END OF SECTION

SECTION 01 11 13

WORK COVERED BY CONTRACT DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Definitions.
2. Work Covered by Contract Documents.
3. Cash Allowances.
4. Owner-Furnished Products.
5. Document Management Software.
6. Work Sequence.
7. Work Guidelines.
8. Coordination of Work.
9. Contractors Use of Premises.
10. Contract Clarification.
11. Utility Lines.
12. Warranty.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 SUBMITTALS (NOT USED)

1.4 DEFINITIONS

A. Mobilization Area: For Work at facilities, an area, defined on the Contract Drawings, for Contractor staging and storage of construction equipment, tools, products, and spare parts.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

Work of the contract is for the construction of Ground Storage Tank No. 2, addition of flow switch to the flow and pressure control station, and modifications

to Ground Storage Tank No. 1 (Alternate Bid Items). This work is to be performed at the San Jacinto River Authority's Water Plant No. 4 in The Woodlands, Texas. Work included in this contract is detailed below.

A. Work, in general, consists of furnishing, installing and constructing all structures, equipment, and materials, including appurtenances, as indicated on the PLANS.

B. Mobilization requirements as specified in Technical Specifications and including items listed below:

   1. Furnishing performance, payment and maintenance bonds in accordance with the Contract Documents.

   2. Arrange and pay for equipment delivery to site.

   3. Receive and unload equipment at site.

   4. Handle, store, install, and remove equipment required to perform work as required by this specification section.

C. Furnish and install a new 2,000,000 gallon prestressed concrete ground storage tank.

D. Install all yard piping, electrical, instrumentation and ancillary equipment for a complete in place installation, as shown on PLANS and detailed in Technical Specifications.

E. Site work at plant site, including site grading, excavation and fill, clearing and grubbing, site storm drainage, structures and sewers, storm water pollution prevention control facilities, miscellaneous structures, and all appurtenances as shown on PLANS and detailed in Technical Specifications.

F. Site Restoration, including restoring land surface and grass to as good or better condition than existed prior to work. Clean-Up project site and hydro-mulch seed all areas disturbed as a result of construction.

G. Demobilization requirements as specified in Technical Specifications and Contract Documents.

H. In addition, the CONTRACTOR shall include costs for the following items in the Base Bid Price:

   1. Furnish and install all subsidiary items as necessary to provide a complete and operational facility, including all temporary facilities necessary to keep the existing facility components operational throughout construction.

   2. Perform tests on installed equipment and installed lines as required by Technical Specifications.

I. Refer to Specification Section 01 74 19, Construction Waste Management and Disposal for additional information on material disposal.

J. Contractor is responsible for the safety of his personnel. These specifications do not extend to or include designs or systems pertaining to the safety of the contractor or its employees, agents, or representatives in the performance of this work. The seal of the licensed engineer hereon does not extend to any such safety systems that may now or hereafter be incorporated in the specifications. The contractor shall prepare or obtain the appropriate safety systems.

1.6 CASH ALLOWANCES

A. Contractor's cost for administering services, overhead, profit and other expenses contemplated for the allowance shall be included in the Contract Price and not in the allowance.

1.7 OWNER-FURNISHED PRODUCTS

A. Items furnished by the Owner for installation and final connection by Contractor:

1. The Owner will provide warning stickers, decals and/or medallions as required for proposed utility line markers, flushing hydrants, and project signs.

B. Contractor's Responsibilities:

1. Arrange and pay for product delivery to site.
2. Receive and unload products at site; jointly with Owner's Representative, inspect for completeness or damage.
3. Handle, store, install, and finish products.
4. Repair or replace damaged items.

1.8 DOCUMENT MANAGEMENT SOFTWARE

A. Contractor and the Owner's Representative shall be given the applicable number of Document Management System usernames and passwords.

B. Contractor shall use the Owner's internet based document management system to transmit its documents to the Owner's Representative, including but not limited to Requests for Information (RFIs), shop drawing submittals, applications for payment, and letters of correspondence. Refer to Specification Section 01 33 00 – Submittals. The document management software should be able to automatically notify all team members of a submittal upload regardless of the originator, i.e. contractor, Principal Architect/Engineer, Owner's Representative, or Owner. Notification of new uploads should go to all team members regardless if they are the Principal Architect/Engineer or not, i.e. sub-consultants for construction management & inspection, but are not tasked as the Principal Architect/Engineer.

C. A minimum of one (1) and a maximum of three (3) accounts on the document management system will be provided by the Owner. Additional accounts may be requested by the Contractor.

D. Each account will allow one (1) user to access the document management system. Training on the document management system will be provided by the Owner as requested by the Contractor at a mutually agreed upon date and location.

1.9 WORK SEQUENCE

A. Construct Work in phases during the construction period. Coordinate construction schedule and operations with the Owner's Representative. Subcontractors shall coordinate its activities and operations with the Contractor.

B. Construction of this project may require using multiple crews working concurrently in order to complete the project within the specified Contract Time. At no time will multiple crews be allowed to work in consecutive traffic control phases during construction.

C. Due to overall project complexity and numerous active utility interface requirements, submit a sequence of construction of water lines for review by the Owner's Representative. Proposed sequence of construction shall address proposed method and timing of all major construction activities to be undertaken.

D. Data for all facilities and utilities shown were taken from available plans, record drawings, and/or utility maps made available from several sources. Actual field locations of facilities and utilities may vary from that shown on the Drawings. Contractor shall make a complete and independent verification of utility locations prior to submittal of subsequent shop drawings. Unless otherwise approved by the Owner's Representative, work shall not continue at locations where there is a conflict with existing utilities.

E. Construction disturbing traffic shall be conducted during off-peak hours, 9:00 a.m. to 4:00 p.m. weekdays and/or weekends 7:00 p.m. Friday to 4:00 a.m. Monday, dependent upon provisions of Texas Department of Transportation. Exception to these times, if necessary, shall be sought during the permit application process. Continue work in areas using same construction schedule during consecutive days and/or weekends until work is completed.

1.10 WORK GUIDELINES

A. Maintain local driveway access to public schools, residential and commercial properties adjacent to work areas at all times. Provide temporary driveway access in accordance with Specification Sections 01 55 26 – Traffic Control and 01 14 19 – Use of Premises. Coordinate work and schedule with impacted business owners, schools, and residents in conjunction with the Owner's Representative, well in advance of commencing the Work in the area(s) of the impacted entities.

B. Contractor shall adhere to each privately owned and operated utility company's construction guidelines when constructing the proposed Work adjacent-to or across each such entities wet or dry utility. Contractor to coordinate with such utilities for guidelines.

C. Contractor shall coordinate its Work with the respective pipeline companies' at all proposed utility crossings. See appropriate Contract Drawings for additional and /or related information.

D. Obtain right-of-entry agreement(s), insurance, crossing permit(s), and other documentation as required or deemed necessary by each utility or pipeline company or other such entity at no additional cost to the Owner.

E. Contractor shall coordinate its Work schedule with those utility companies who require a representative of their company to be present (onsite) during the construction adjacent-to or across their wet or dry utility.

F. Site restoration at all crossings shall be performed immediately upon completion of the Work. Restoration shall be performed in accordance with all applicable Specification Sections and utility company requirements.

G. Hand dig within one (1) foot of underground service lines (public or private).

H. Contractor shall bear the sole responsibility for damage to existing utilities resulting from its construction activities. The Contractor shall be responsible for the repair of damaged utilities, at no additional cost to the Owner.

I. Work associated with hydrostatic testing, disinfection, flushing, or cleaning of the new facility shall not begin without prior approval from the Owner's Representative.

1.11 COORDINATION OF WORK

A. Coordinate activity schedule and extend full cooperation to other Contractors who have responsibilities either concurrent with, proceeding, or following this project's duration along the work site. Ensure availability of access to selected portions of this project area to others and provide appropriate information for planning purposes to other Contractors. No compensation or time extension will be allowed as a result of conflicting construction activities.

B. Comply with coordination requirements outlined in Specification Section 01 14 19 – Use of Premises.

C. Coordinate with the GRP Division regarding work on any of their assets including but not limited to Flow and Pressure Control Station Modifications and Surface Water PLC.

D. Dial 811 to contact either Texas 811 or Lone Star 811 One-Call all three (3) One-Call centers in the state of Texas a minimum of forty-eight (48) hours prior to construction within twenty-five (25) feet of a private pipeline.

Contact numbers for such centers are as follows:

1. TESS (Texas) One Call (800) 344-8377.
2. Texas One-Call (800) 245-4545.
3. Texas (Lone Star) One Call (800) 669-8344.

E. Existing structures adjacent to the proposed alignment shall be closely monitored prior to, during, and for a month length of time after construction is complete in all areas. Several conditions including, but not limited to, soil type, construction methods, weather conditions, surrounding construction, personnel experience, and supervision may impact the amount of ground movement within and surrounding the alignment. Contractor shall survey and adequately document the condition and elevation of existing structures adjacent to the proposed alignment. Monitoring program for proposed trenchless construction operations should be developed in accordance with trenchless construction Specification Sections.

F. All work shall be performed to the lines, grades, elevations, and locations shown on the Drawings.

G. Prevent overstress or damage of any structure and any part or member of it during construction. This applies to new and existing facilities, utilities, and structures affected by construction operations. Contractor shall monitor and record the effect of its construction operations on new and existing facilities, utilities and structures and provide engineered temporary supports and connections as required to assure the safety and stability of the same to prevent overstress of any part.

H. Prior to commencing any Work involving state or local agencies, agency stipulated notifications shall be made by the Contractor.

I. Work shall include the restoration of existing drainage swale systems within TXDOT rights-of-way. Contractor shall restore ground cover to areas damaged during construction. Within residential areas, provide block sod. Perform block sodding or hydro-mulch per Specification Sections.

J. Contractor Work performed within all rights-of-way shall be performed in accordance with the respective entities' standards. Contractor to coordinate with such entities to obtain required standards.

1.12 CONTRACTOR USE OF PREMISES

A. Comply with all requirements outlined in Specification Section 01 14 19 – Use of Premises.

1.13 CONTRACT CLARIFICATION

A. Should clarification of the Contract Documents be requested, request clarification before proceeding with Work by submitting a Request for Information (RFI). Such requests shall be preceded by a diligent investigation of the Contract Documents. Include evidence of such investigation(s) in all requests for clarification.

1.14 UTILITY LINES

A. All utilities represented on the Drawings are shown as an approximate location and are based on the best information available during project design. Contractor shall field-verify the exact location of all utilities prior to commencing construction. The Contractor shall be responsible for any and all damage to these utilities, caused or resulting from their failure to locate, protect and/or maintain these utilities during construction.

1.15 WARRANTY

A. Comply with the warranty requirements stipulated in Contract Document General Conditions and the warranty requirements of the various specification sections of this project manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 14 19

USE OF PREMISES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for:
    a. Contractor Responsibilities
    b. Temporary Utilities
    c. Limits of Construction
    d. Storage Sheds and Buildings
    e. Working Times
    f. Site Access Times
    g. Notification to Adjacent Occupants
    h. Safety Requirements
    i. First Aid Equipment
    j. Fire Protection
    k. Security Measures
    l. Protection of Utilities, Pipelines, and Property
    m. Surface Restoration
    n. Traffic Control and Use of Public Rights of Way
    o. Contractor’s Roads and Parking
    p. Coordination with Facility Owner’s Operations
    q. Contractor's Field Office
    r. Principal Architect/Engineer's Field Office
    s. Project Photographs
    t. Special Considerations Related to Adjacent Properties and Facilities
    u. Historical and Archaeological Sites

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and General Conditions of the Contract.

2. Division 01 – General Requirements.
3. Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 – Submittals for the requirements for the mechanics and administration of the submittal process.

B. Contractors Safety Program.

C. All proposed notifications to adjacent occupants.

D. Planning requests for temporary Owner's facility shutdowns.

1.4 CONTRACTOR RESPONSIBITIES

A. Comply with applicable requirements specified in other sections of Project Specifications.

B. Comply with procedures for access to the site and Contractor's use of rights-of-way.

C. Maintain and operate temporary construction facilities and temporary systems to assure continuous service of Owner's and other adjacent existing facilities.

D. Modify and extend temporary systems as Work progress requires.

E. Completely remove materials and equipment when no longer required.

F. Restore existing facilities used for temporary services to original or better condition, or as specified.

G. Prior to installation of material, equipment and/or other work, verify with subcontractors, material or equipment manufacturers, and installers that the substrate or surface to which those materials will attach is acceptable for installation of those materials or equipment. (Substrate is defined as any building or construction surfaces to which materials or equipment are attached to, or required prior to installation i.e., floors, walls, ceilings, soils, utilities, site grading, and backfill etc.).

H. Correct unacceptable substrate until acceptable for installation of equipment or materials.

1.5 TEMPORARY UTILITES

A. Obtaining Temporary Service:

1. Make arrangements with utility service companies for temporary services, unless provided by Owner.
2. Abide by rules and regulations of utility service companies and/or authorities/agencies/entities having jurisdiction.
3. Be responsible for utility service costs and permits until Work is substantially complete, or de-mobilization from site. Included services are fuel, power, light, heat, and any other utility services necessary for execution, completion, testing, and initial operation of Work.
4. Be responsible for providing approved metering devices, as necessary, for any temporary utilities.

B. Water:

1. Contractor to provide water required for performance of Work, specified tests of piping, equipment, devices, or other equipment, and for other uses as necessary.
2. Provide and maintain adequate supply of potable water for consumption by Contractor personnel and Owner's Representatives.
3. Provide necessary approved metering devices and backflow preventers.

C. Electricity and Lighting:

1. Provide electrical service required for Work, including testing of Work. Provide power for lighting, operation of equipment, and other use as necessary.
2. For projects on existing sites, electric power service to be provided includes temporary power service or generator(s) to maintain Owner's operations during scheduled shutdown(s). Coordinate all temporary shutdowns with Owner and Owner's Representative(s).
3. Minimum lighting level shall be ten (10) foot-candles for open areas; twenty (20) foot-candles for stairs and shops. Provide minimum of one (1) 300 watt lamp for each 200 square feet of work area.

D. Heat and Ventilation:

1. Provide temporary heat as necessary for protection or completion of Work.
2. Provide temporary heat and ventilation to assure safe working conditions. Maintain enclosed areas at minimum of 50°F.

E. Telephone:

1. Provide emergency telephone service (including call waiting and call

forwarding) at Project Site for use by Contractor personnel, Owner, Owner's Representative, and others performing work or furnishing services at the site.

F. Sanitary Facilities:

1. Provide and maintain sanitary facilities for persons on job site. Comply with regulations of State and local departments of health.
2. Enforce use of sanitary facilities by construction personnel at job site. Enclose sanitary facilities. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause nuisance or health problem. Haul sewage and waste off-site and properly dispose of in accordance with all applicable regulations.
3. Locate toilets near Work site, within 500 feet of working activities for line work projects and secluded from view as best as possible. Keep toilets clean and supplied throughout course of Work. Locate toilets a minimum of 100 feet from all water wells.

1.6 LIMITS OF CONSTRUCTION

A. Construction operations and storage areas are limited to Owner's property, permanent easements, temporary construction easements (TCE), and/or the Limits of Construction or Construction Limits as indicated on the Contract Drawings.

B. Unauthorized use of areas, or trespassing on land outside of defined limits, is not permitted.

C. Make arrangements, at no cost to the Owner, for Contractor's temporary use of any private properties which may be needed by Contractor for performance of Work. Contractor and Contractor's surety shall indemnify and hold harmless the Owner and Owner's Representatives against claims or demands arising from use of properties outside the Limits of Construction. Submit notarized copy of any separately negotiated agreement(s) between private property owner(s) and Contractor prior to use of area.

D. Where Limits of Construction are shown on Contract Drawings to extend to a property or Right-of-Way line, keep equipment, materials, and stockpiles a minimum of 5 feet from boundary, or existing fence lines.

E. Where utility alignment is within an esplanade and Limits of Construction are shown to extend to edge of the esplanade, keep equipment, materials, and stockpiles a minimum of 5 feet from back of curb.

F. There are unique terms and conditions associated with the various public and private easements, rights-of-entry, encroachment and crossing documents (collectively, the easement documents) which may be site specific. Contractor

shall familiarize itself with all easement Documents. Easement documents are available from the Owner on a case by case basis upon request.

G. The Contractor, at its sole expense, shall be responsible for complying with all terms and conditions of all easement documents and the easement rights described therein for this project.

H. Contractor shall safely, properly, and adequately assume and perform all of the duties, indemnities, responsibilities, and liabilities of the Owner under the easement documents.

I. Contractor, at its cost, shall provide all insurance required by the easement documents. All land included within the tracts covered by the easement documents and easements described herein shall be restored to its original condition prior to Substantial Completion of the construction (including, without limitation, repair or replacement of pavement, concrete, signs, fencing, trees, sidewalks, landscaping, shrubbery, and grass) unless otherwise specified in the Contract Documents.

1.7 STORAGE SHEDS AND BUILDINGS

A. Provide adequately ventilated, watertight storage facilities with floor above ground level for protection of materials and equipment susceptible to weather damage.

B. Store materials in neat and orderly manner. Store materials and equipment to permit easy access for identification, inspection, and inventory.

C. Storage of materials not susceptible to weather damage may be on blocks off ground.

D. Storage of all fuels and chemicals shall be in designated areas by Contractor.

E. Refer to Specification Section 01 65 50 – Product Delivery, Storage, and Handling for additional requirements.

F. Fill and grade site for temporary structures to provide positive drainage away from Work area, but not to impact adjacent property owners.

G. Restrict total length of distributed materials along route of construction up to 1,000 linear feet as approved in writing by Owner's Representative.

H. Avoid obstructing drainage ditches or inlets. When obstruction is unavoidable due to requirements of Work, provide grading and temporary drainage structures to maintain unimpeded drainage flow. Failure of the Contractor to maintain proper site drainage shall prohibit it from making a claim against the Owner for monetary or time damages due to drainage impacts.

1.8 WORKING TIMES

A. Construction shall be conducted during working hours as indicated in

Specification Section 00 72 00 – General Conditions of the Contract, unless otherwise amended by a supplemental specification or agreement to the General Conditions of the Contract, and approved by Owner.

1.9 SITE ACCESS TIMES

A. Contractor to coordinate all site access, including deliveries, outside of working hours with Owner's Representative. Neither Owner nor Owner's Representatives shall sign for any Contractor deliveries. Refer to Specification Section 01 65 50 – Product Delivery, Storage, and Handling.

B. Contractor shall coordinate with Owner to not interfere with Owner's facility operations.

1.10 NOTIFICATION OF ADJACENT OCCUPANTS

A. Notify individual occupants in areas to be affected by Work of proposed construction activities and schedule using a standardized notification form letter and/or door hanger. Notification shall be made not less than 72 hours or more than 2 weeks prior to performance of work within 200 feet of homes or businesses. Coordinate all notifications with Owner's Representative.

B. Include in notification the names and telephone numbers of two Contractor representatives for resident contact available on 24-hour call. Describe precautions that Contractor will take to protect private property and identify potential inconveniences and disruptions to resident's access and utilities.

C. For Contractor's convenience, Owner's Representative will provide an example notice at the pre-construction meeting. In addition to other requirements of this specification regarding notification to adjacent occupants, Contractor's notice is generally to follow the form and content of the example notice.

D. Submit proposed notification(s) to Owner for approval prior to distribution. Provide notice(s) in languages as appropriate (i.e., double sided notice. Notice on one side shall be written in English and flip side shall be written in Spanish).

1.11 SAFETY REQUIREMENTS

A. Beware of overhead power lines existing in area and in close proximity to project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, submit a request to the appropriate utility provider to de-energize or move conflicting overhead power line(s).

B. Submit Contractor's Safety Program in accordance with Specification Section 01 33 00 – Submittals. Include Site Safety and Site Security in accordance with Specification Section 00 72 00 – General Conditions of the Contract. Include documented response to trench safety requirements as specified in Specification Section 00 31 32.10 – Trench Safety Geotechnical Information.

C. Conduct operations in strict accordance with the Contractor's Safety Program, in accordance with applicable Federal, State, and local safety codes and statutes, and with good construction practice. Establish and maintain procedures for safety of all work, personnel, and equipment involved in Project.

D. Observe and comply with Texas Occupational Safety Act (Art. 5182a, V.C.S.) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and health standards under Williams-Steiger Occupational Safety and Health Act of 1970, and to other legislation enacted for safety and health of Contractor employees. Safety and health standards apply to subcontractors and their employees as well as to Contractor and its employees.

E. Observance of and compliance with regulations is solely and without qualification responsibility of Contractor without reliance or superintendence of or direction by the Owner or Owner's Representative. Immediately advise Owner's Representative of investigation or inspection by Federal Safety and Health Inspectors of Contractor or subcontractor's work or place of work on job site under this Contract, and after investigation or inspection, advise Owner's Representative of results. Submit one copy of accident reports to Owner's Representative within 10 days of occurrence.

F. Protect areas occupied by workmen using best available devices for detection of lethal and combustible gases. Test devices frequently to assure functional capability. Constantly observe infiltration of liquids into Work area for visual or odor evidences of contamination, and immediately take appropriate steps to seal off entry of contaminated liquids into Work area.

G. Implement safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment, and other safety equipment, as specified or detailed on the Contract Drawings.

H. Maintain required coordination with Police and Fire Departments during entire period covered by Contract.

I. In safety plan, include project safety analysis. Itemize major tasks and potential safety hazards. Plan to eliminate hazards or protect workers and public from each hazard.

1.12 FIRST AID EQUIPMENT

A. Provide first aid kit throughout construction period. List telephone numbers for hospitals, and ambulance services in each first aid kit.

B. Have at least one person thoroughly trained in first aid and cardiopulmonary resuscitation (CPR) procedures present on site whenever Work is in progress. Contractor to conform to protocols and requirements for training and protection

against “blood borne pathogens.”

1.13 FIRE PROTECTION

A. Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Contractor’s Safety Program.

1.14 SECURITY MEASURES

A. Protect all Work materials, equipment, and property from loss, theft, damage, and vandalism. Perform duty to protect property of the Owner used in connection with performance of Work.

B. If existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to existing.

1.15 PROTECTION OF UTILITIES, PIPELINES, AND PROPERTY

A. Utilize Utility Coordinating Committee One Call System (telephone number, (713) 223-4567), which must be called 48 hours in advance to locate utilities. Toll free telephone number is 1-800-669-8344, Texas (Lone Star) One Call System.

B. Notify Woodlands Joint Powers Association (WJPA) IN WRITING AND BY PHONE AT 855-426-7283 at least 48 hours in advance of any field activities.

C. Prevent damage to existing utilities during construction. Utilities shown on Drawings are at approximate locations. Pre-locate, by whatever means may be required (metal detection equipment, probes, excavation, survey), underground utilities before excavating in accordance with the Critical Locations investigation described in Specification Section 31 21 33 – Trenching, Backfilling and Compacting for Utilities. Perform investigative work and repairs required after investigation. Contractor is responsible for damages caused by failure to locate and preserve these underground utilities. Give owners of utilities a minimum of five (5) days’ notice before commencing Work in area, for locating utilities during construction and for making adjustments or relocation of utilities when they conflict with proposed Work. Include cost for temporary relocation of utilities necessary to accommodate construction in unit costs for utility construction unless otherwise noted on Drawings. Bypassing of sanitary waste to storm drainage facilities is not allowed. Utility service laterals are not shown on Drawings. Contractor shall anticipate that service lines exist and repair them when damaged due to construction activity. No separate payment will be made for repair work. Include payment in unit prices for work in appropriate sections.

D. Contractor shall adhere to each privately owned and operated utility company’s construction guidelines when working adjacent-to or across each such entities wet or dry utility.

E. Prior to abandonment of any utility indicated on the Drawings, make arrangements with Owner's Representative and utility owner to terminate service, remove meters, valves, appurtenances, transformers, and/or poles, as required.

F. Utility Outages and Shutdowns: Provide a notification to the Owner's Representative and private utility companies (when applicable) a minimum of 48 hours, excluding weekends and holidays, in advance of required utility shutdown. Shutdown planning and coordination activities shall commence a minimum of 2-weeks prior to scheduled shutdown. Coordinate all work as required.

G. Protect and prevent damage to existing crossing, parallel, and adjacent pipelines during construction in accordance with Specification Section 01 11 13 – Work Covered by Contract Documents.

H. When excavating near product pipelines and prior to start of excavation, request that representative of pipeline company come to the construction site(s) to meet representatives of Contractor and Owner's Representative to discuss actual procedures that will be used. Request that pipeline company's representative probe and locate pipelines in at least three locations: one at each side of proposed excavation and one at centerline of proposed Work. Representative of the pipeline company and Owner's Representative must be present to observe activities of Contractor at all times when excavation is being conducted within 15 feet of existing pipelines.

I. Protection of the Work, and Public and Private Property

1. Take precautions, provide programs, and take actions necessary to protect the Work, and public and private property from damage.
2. Do not alter condition of properties adjacent to and along Limits of Construction.
3. Do not use ways, means, methods, techniques, sequences, or procedures that result in damage to adjacent properties or improvements.
4. Restore properties damaged by Contractor outside of designated Limits of Construction at no cost to Owner.
5. Take action to prevent damage, injury, or loss, including, but not limited to, the following:
    a. Store materials, supplies, and equipment in orderly, safe manner that will not interfere with progress of Work or work of others.
    b. Provide suitable storage for materials subject to damage by exposure to weather, theft, breakage, or otherwise.
    c. Place upon Work or any part thereof only safe loads.

d. Frequently clean up refuse, rubbish, scrap materials, and debris created by construction operations, keeping Project site safe and orderly.

e. Provide safe barricades and guard rails to protect pedestrian and vehicular traffic around openings, scaffolding, temporary stairs and ramps, excavations, elevated walkways, and other hazardous areas.

6. Assume full responsibility for preservation of public and private property on or adjacent to the Limits of Construction. When direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of Work by Contractor, restore to condition equal to or better than that existing before damage was done.

7. Perform daily clean up in affected construction areas in order to restore site to existing or better conditions. Areas should be free of debris, scrap material, dirt, mud, and other items identified by Owner's Representative. Do not leave buildings, roads, streets, or other construction areas unclean. If deemed necessary by the Owner's Representative, Contractor shall employ street sweeping/cleaning equipment to maintain area streets. Such services shall be identified as a separate line item in the Contractor's Schedule of Values (SOV), and payment shall be based upon the Owner's approval of effectiveness and frequency of provided services.

J. Barricades and Warning Signals:

1. Where Work is performed on or adjacent to any roadway, right-of-way, or public place, furnish and erect barricades, fences, lights, warning signs, and danger signals, and take other precautionary measures, for protection of persons or property and of the Work.

2. Paint barricades to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade.

3. Erect sufficient barricades to keep vehicles and pedestrians from entering the area under construction.

4. Maintain barricades, signs, lights and provide watchmen until Project is accepted by the Owner or the site has been completely restored to its preconstruction condition.

5. Whenever Work creates encroachment on public roadways, station flagmen to manage traffic flow in accordance with approved traffic control plan. Refer to Specification Section 01 55 26 – Traffic Control.

K. Protection of Existing Structures:

1. Underground Structures:

a. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, manholes, boxes, chambers,

electrical signal and communication conduits, tunnels, and other existing subsurface installations located within or adjacent to limits of Work.

b. Known underground structures including water, sewer, electric, and telecommunication services are shown on Contract Drawings. This information is not guaranteed to be correct or complete.

c. Explore ahead of trenching and excavation work and sufficiently uncover obstructing underground structures to determine their location, to prevent damage to them, and to prevent interruption of utility services. Restore underground structures to original conditions at no additional cost if damaged during construction.

d. Locate and protect private lawn sprinkler systems which may exist within site. Repair or replace damaged systems to condition existing at start of Work, or better.

e. Necessary changes in location of Work may be made by the Owner to avoid unanticipated underground structures.

f. If permanent relocation of underground structures or other subsurface installations is required and not otherwise provided in Contract, the Owner will direct Contractor in writing to perform Work, which is paid for under provisions for changes as described in Specification Section 00 72 00 - General Conditions of the Contract.

2. Surface Structures: Surface structures are defined as existing buildings, structures and other constructed installations above ground surface. Included with structures are their foundations and any extensions below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities visible above ground surface.

3. Existing Condition Survey: Contractor shall survey and adequately document the condition and elevation of existing structures adjacent to the proposed alignment. Monitoring program for proposed trenchless construction operations shall be developed in accordance with trenchless construction Specification Sections.

4. Protection of Underground and Surface Structures:

a. Support in place and protect from direct or indirect damage underground and surface structures located within or adjacent to limits of Work.

b. Prevent overstress or damage to any structure and any part or member of structures during construction. This applies to new and existing facilities, utilities, and structures affected by construction operations. Contractor shall monitor and record the effect of its construction

operations on new and existing facilities, utilities, and structures, and shall provide engineered temporary supports and connections as required to assure the safety and stability of the structures and prevent overstress of any part. Employ a registered Professional Engineer licensed in the State of Texas to design temporary supports to assure safety and integrity of structures and facilities.

c. Install temporary supports carefully and as required by party owning or controlling structure. Before installing structure supports, satisfy Owner's Representative that methods and procedures have been approved by owner of structure.

d. Avoid moving or changing property of public utilities or private corporations without prior written consent of responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within limits of this Project for purpose of maintaining their properties, or of making changes or repairs to their property that may be considered necessary by performance of this Contract.

e. Notify owners and/or operators of utilities and pipelines adjacent to the Work of the nature of construction operations and dates when operations will be performed. When construction operations are required in immediate vicinity of existing structures, pipelines, or utilities, give minimum of 5 working days advance notice. Probe and flag location of underground utilities prior to commencement of excavation. Keep flags in place until construction operation reaches and uncovers utility.

f. Assume risks attending presence or proximity of underground and surface structures within or adjacent to Work including but not limited to damage and expense for direct or indirect damage caused by Contractor's Work to structure. Immediately repair damage.

L. Protection of Installed Products:

1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to final completion of Work.

2. Control traffic to prevent damage to equipment, materials, and surfaces.

3. Provide coverings to protect equipment and materials from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and passage of materials in subsequent work.

1.16 SURFACE RESTORATION

A. Restore site to the condition which existed before construction in accordance with Specification Section 01 74 23 – Restoration of Site, unless otherwise noted in Contract Documents.

B. For projects not having well defined phases, the total linear footage of project rights-of-way and/or easements that may be disturbed at any given time, shall be limited to no more than fifty (50) percent of the total project linear footage or 1,000 linear feet, whichever is less. Accordingly, disturbed areas shall be restored in accordance with Specification Section 01 74 23 – Restoration of Site prior to proceeding with Work that would exceed the fifty (50) percent total project disturbed length or 1,000 linear feet, whichever is less.

1.17 TRAFFIC CONTROL AND USE OF PUBLIC RIGHTS OF WAY

A. Comply with traffic regulation in accordance with Specification Section 01 55 26 - Traffic Control, and approved traffic control plan(s).

B. Provide barricades and signs in accordance with Section VI of the State of Texas Manual on Uniform Traffic Control Devices.

C. Obtain necessary permits and Owner's approval when the nature of Work requires closing an entire street. Obtaining permits required for street closure are the Contractor's responsibility. Avoid unnecessary inconvenience to abutting property owners. Avoid closing more than two (2) consecutive intersections at one time, except by permission of Owner.

D. Notify Owner's Representative at least 48 hours prior to closing a street or street crossing. It is the Contractor's responsibility to obtain all required permits for street closures in advance.

E. Maintain 10-foot-wide minimum access lane for emergency vehicles, including access to fire hydrants, at all times.

F. Remove surplus materials and debris and open each 500 lineal foot length of roadway for public use when work within that length is complete.

G. Contractor shall provide and install signs indicating entrances to businesses whose normal entry is impaired or detoured as a result of construction. Proposed signs shall be submitted to the Owner's Representative for approval prior to manufacture and installation.

H. Final acceptance of any portion of Work is not based on return of roadway to public use.

I. Avoid obstructing driveways or entrances to private property.

J. Provide temporary access or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across drives or entrances.

K. Contractor shall bear the sole responsibility for damage to existing traffic cables resulting from its construction activities. The Contractor shall be responsible for the repair of damaged traffic cables including the re-cabling of the entire intersection if required, at no additional cost to the Owner.

L. Construct and maintain temporary detours, ramps, and/or roads to provide for normal public traffic flow when use of public roads or streets is closed by necessities of Work. Contractor shall obtain all required roadway closure or detour permits in advance of commencing the proposed temporary detour, ramps, and/or roadway Work.

M. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that will damage existing roadway surface. Contractor shall repair or replace damaged roadway not scheduled for removal and/or replacement at no additional cost to the Owner. Repairs or replacement shall be in conformance with the roadway owner's requirements.

N. Provide daily sweeping of hard-surface roadways to remove soils tracked onto public roadways.

1.18 CONTRACTORS ROADS AND PARKING

A. Prevent interference with traffic on existing roads.

B. Construct and maintain temporary access roads and parking areas.

C. Designate temporary parking areas to accommodate Contractor's and Owner's Representative personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Owner's Representative.

D. Minimize use by construction traffic of existing streets and driveways.

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

F. Do not inhibit the ability of the Owner's personnel to access, operate, and maintain existing facilities during construction.

1.19 COORDINATION WITH FACILITY OWNER'S OPERATIONS

A. Definition: A "shutdown" is when a portion of the normal operation of Owner's facility, whether equipment, systems, piping, or conduit, has to be temporarily suspended or taken out of service to perform the Work.

B. Work that may interrupt normal operations shall be accomplished at times convenient to, and approved by Owner.

C. Except for necessary shutdowns, perform the Work such that Owner's facilities remain in continuous satisfactory operation during the Project. Schedule and conduct the Work such that the Work does not:

1. Impede Owner's production or processes,
2. Create potential hazards to public health or wellbeing,
3. Create potential hazards to operating equipment and personnel,
4. Reduce the quality of Owner's facilities' product(s) or effluent, or

5. Cause odors or other nuisances.

D. Coordinate shutdowns with Owner. When possible, combine activities into a single shutdown to minimize impacts on Owner's operations and processes.

E. Submit a shutdown plan to the Owner and Principal Architect/Engineer a minimum of 30 days prior to a planned shutdown. Shutdown plan shall consist of the following:

1. For each shutdown, submit an inventory of labor and materials required to perform the shutdown and activities, an estimate of time required to accomplish the complete shutdown including time for Owner to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.

F. Work that requires shutdown of a ground storage tank at a facility, or any other Work that requires a shutdown of more than 4 hours, shall be coordinated with the Owner's Representative. Contractor shall obtain the written approval from the Owner's Representative prior to any necessary shutdowns.

1. Only one ground storage tank at any facility may be taken out of service at a given time. Subject to the Owner's approval, the Contractor may submit in writing a request to have more than one ground storage tank out of service at a given time, which will be coordinated with the Owner's operations.

2. A ground storage tank may only be taken out of service for a maximum of 2 days. Contractor shall coordinate with the Owner's Representative and obtain the written approval from the Owner's Representative prior to any necessary shutdowns.

G. After acceptance of shutdown planning submittal and prior to starting the shutdown, provide written notification to Owner of date and time each shutdown is to start. Provide written notification submitted to the Owner's Representative at least 72 hours in advance of each shutdown.

H. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown. Demonstrate to Owner's satisfaction that Contractor has complied with these requirements before commencing the shutdown.

I. If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.

J. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor.

K. Shutdowns of Electrical Systems: Comply with Laws and Regulations, including the National Electric Code. Contractor shall lock out and tag circuit breakers and switches operated by Owner and shall verify that affected cables and wires are de-energized to ground potential before shutdown Work is started. Upon completion of shutdown Work, remove the locks and tags and notify Owner that facilities are available for use.

1.20 CONTRACTOR'S FIELD OFFICE

A. At Contractor's cost, and upon approval from Owner, Contractor may provide their own field office and temporary facilities, parking areas, equipment and material storage areas. Contractor shall be responsible for all permits, permissions, leases, utilities and maintenance of its facilities. Contractor shall maintain his temporary facilities in a clean, neat and orderly manner. Facilities for the Owner's Representative will be provided by the Owner. All Contract and progress meetings will be held at the Owner's facilities as identified at the pre-construction conference.

B. Store materials in neat and orderly manner. Place materials and equipment to permit easy access for identification, inspection, and inventory.

C. Furnish and Locate:

1. Locate temporary field office within reasonable driving distance of the project site.
2. Provide office space ready for operation within 10 days after Notice to Proceed.
3. Construct all-weather, hard-surfaced parking spaces. Provide all-weather surfaced walk between parking spaces and field office.

D. Minimum Construction:

1. Structurally sound foundation and superstructure.
2. Completely weather tight with insulated roof, walls, and 7 foot ceiling (minimum).
3. Stairs or walkway with handrail and covered entrance platform (minimum 4 feet by 4 feet) with mud scraper at door.
4. Resilient floor covering.
5. Screened windows with area equal to approximately 10 percent of floor area sufficient for light, view, and ventilation. Provide each window with operable sash and burglar bars.
6. Secure, lockable exterior doors with dead-bolt cylinder locks.

E. Minimum Services:

1. Exterior light at entrance.

2. Interior lighting of 75 foot-candles minimum at desk-top height.
3. Automatic heating to maintain 65°F in winter.
4. Automatic cooling to maintain 75°F in summer.
5. Electric power service.
6. Telephone service including three lines—one for voice, one for Internet, and one for fax, if necessary.
7. Sanitary facilities in field office with one water closet and one lavatory and medicine cabinet.
8. Mailing address.

F. Minimum Furnishings:

1. One 5-drawer desk.
2. Two swivel-desk chairs with casters.
3. One plan table.
4. One plan rack to hold drawings.
5. One, 4-drawer legal file cabinet complete with 50 legal-size hanging folders and two full sized carriers.
6. One marker board with cleaner, eraser, and markers.
7. Two waste baskets.
8. One tack board, 30 inches by 36 inches.
9. One all-purpose fire extinguisher.
10. Six protective helmets (hard hats) with ratchet adjustment for use by Owner's Representatives and/or Principal Architect/Engineer.
11. Conference table and chairs to accommodate ten persons.
12. Plain-paper fax machine.
13. Telephone instrument separate from fax machine.
14. Computer(s) equipped with MS Office 2007 or newer software.

G. Provide adequate bookcase space for one set of Contract Documents for ready reference.

H. Designate field office as non-smoking facility.

I. At this office, maintain complete field file of Shop Drawings, posted Drawings and Specifications, and other files of field operations including provisions for maintaining "As Built Drawings."

1.21 PRINCIPAL ARCHITECT/ENGINEER'S FIELD OFFICE

A. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.

1.22 PROJECT PHOTOGRAPHS

A. Refer to Specification Section 01 32 36.01 – Project Photographs

1.23 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND FACILITIES

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

B. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.

1. Provide daily sweeping of hard-surface roadways to remove soils tracked onto roadway.

1.24 HISTORICAL AND ARCHAEOLOGICAL SITES

A. If, during the course of construction, evidence of deposits of historical or archeological interest are found, the Contractor shall cease operations affecting the find and shall notify Owner.

1. No further disturbance of the deposits shall ensue until the Contractor has been notified by Owner that Contractor may proceed.
2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to Owner.
3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find shall be determined in accordance with changed or extra work provisions of the Contract Documents.
4. The site has been previously investigated and has no known history of historical or archaeological finds.

B. Refer to Specification Section 00 72 00 – General Conditions of the Contract including paragraph 4.2.4.

1.25 WARRANTY (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE

A. Maintain temporary facilities in a clean, neat, and orderly manner including maintenance of all-weather surface driveway and parking areas, buildings and furnishings, and equipment or materials furnished and supplied as part of any temporary field office or storage yard for duration of Contract.

B. Provide regular janitorial services for any temporary field office for duration of Contract. Janitorial services consist of twice weekly sweeping and mopping of floors and trash removal, weekly cleaning of restrooms, and weekly dusting of furniture and equipment.

C. Provide soap and water, paper towels, toilet paper, cleansers, and other necessary consumables to properly maintain any temporary field office and all temporary toilet facilities.

D. At this office, maintain complete field file of Shop Drawings, posted Drawings and Specifications, and other files of field operations including provisions for maintaining "As Built Drawings."

E. Immediately repair damage, leaks, or defective service.

F. Remove any field office provided under this contract from site upon acceptance of the entire work by the Owner.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Authority
2. Unit Quantities Specified
3. Measurement
4. Payment Plus Conditions
5. Nonconformance Assessment
6. Nonpayment for Rejected Products

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Measurement:

1. Measurement by Weight: Reinforcing steel, rolled or formed steel or other metal shapes are measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies are measured by CRSI or AISC Manual of Steel Construction or scale weights.
2. Measurement by Volume:
   a. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.
   b. Excavation and Embankment Materials: Measured by cubic dimension using average end area method.
3. Measurement by Area: Measured by square dimension using mean length and width or radius.
4. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
5. Stipulated Price Measurement: By unit designated in Agreement.
6. Other: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of Work.
7. Measurement by Each: Measured by each instance or item provided.

8. Measurement by Lump Sum: Measure includes all associated work.

B. Payment:

1. Payment Includes: Full compensation for required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or installation of an item of Work; and Contractor's overhead and profit.
2. Total compensation for required Unit Price Work shall be included in Unit Price provided in Proposal. Claims for payment as Unit Price Work, but not specifically covered in list of unit prices contained in Proposal, will not be accepted.
3. Interim payments for stored materials will be made only for materials to be incorporated under items covered in unit prices, unless disallowed in Supplementary Conditions.
4. Progress payments will be based on Owner's Representative's observations and evaluations of quantities incorporated in Work multiplied by unit price.
5. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities determined by Owner's Representative multiplied by unit price for Work which is incorporated in or made necessary by the Work.

1.3 SUBMITTALS (NOT USED)

1.4 AUTHORITY

A. Measurement methods delineated in Specification sections are intended to complement criteria of this section. In event of conflict, the order of governance is: General Conditions, Individual Specifications, 01 22 00 – Unit Prices.

B. Owner's Representative will take measurements and compute quantities accordingly.

C. Assist by providing necessary equipment, workers, and survey personnel.

1.5 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in Agreement are for contract purposes only. Quantities and measurements supplied or placed in Work and verified by Owner's' Representative (GCs 11.6.2) shall determine payment as stated in Specifications Section 00 72 00 - General Conditions of the Contract.

B. When actual Work requires greater or lesser quantities than those quantities indicated in Bid/Proposal, provide required quantities at unit prices contracted as stated in Specifications Section 00 72 00 – General Conditions of the Contract.

1.6 NONCONFORMANCE ASSESSMENT

A. Remove and replace Work, or portions of Work, not conforming to Contract Documents.

B. When not practical to remove and replace Work, Owner's Representative will direct one of the following remedies:

1. Nonconforming Work will remain as is, but Unit Price will be adjusted lower at discretion of Owner's Representative.
2. Nonconforming Work will be modified as authorized by Owner's Representative, and Unit Price will be adjusted lower at discretion of Owner's Representative, when modified Work is deemed less suitable than specified.

C. Specification sections may modify above remedies or may identify a specific formula or percentage price reduction.

D. Authority of Owner's Representative to assess nonconforming work and identify payment adjustment is final.

1.7 NONPAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for the following:

1. Products wasted or disposed of in unacceptable manner.
2. Products determined as nonconforming before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of required Work.
5. Products remaining on hand after completion of Work, unless specified otherwise.
6. Loading, hauling, and disposing of rejected products.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 25 13

PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:

   a. Name of manufacturer.

   b. Name of vendor.

   c. Trade name.

   d. Catalog number.

2. Substitutions are not "or-equals".

3. This Specification Section does not address substitutions for major equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 – General Requirements.

C. Request for Substitution – General:

1. Base all bids on materials, equipment, and procedures specified.

2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.

   a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by Owner’s Representative.

3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:

   a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,

b. Contractor proposes a cost and/or time reduction incentive to the Owner.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 QUALITY ASSURANCE

A. In making request for substitution or in using an approved product, Contractor represents Contractor:

1. Has investigated proposed product, and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
2. Will provide same guarantee for substitute item as for product specified.
3. Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
4. Waives all claims for additional costs related to substitution which subsequently arise.

1.5 DEFINITIONS

A. Product: Manufactured material or equipment.

1.6 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Substitution shall be considered only:

1. After award of Contract.
2. Under the conditions stated herein.

B. Written request through Contractor only.

C. Transmittal Mechanics:

1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01 33 00 – Submittals.

a. Product substitution will be treated in a manner similar to "deviations," as described in Specification Section 01 33 00 – Submittals.

b. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading DESCRIPTION.

1) Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in the following paragraph below.

D. Transmittal Contents:

1. Product identification:
   a. Manufacturer's name.
   b. Telephone number and representative contact name.
   c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
   a. Size.
   b. Composition or materials of construction.
   c. Weight.
   d. Electrical or mechanical requirements.
4. Product experience:
   a. Location of past projects utilizing product.
   b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
   c. Available field data and reports associated with proposed product.
5. Data relating to changes in construction schedule.
6. Data relating to changes in cost.
7. Samples:
   a. At request of Owner’s Representative.
   b. Full size if requested by Owner’s Representative.
   c. Held until substantial completion.
   d. Owner’s Representative not responsible for loss or damage to samples.

1.7 APPROVAL OR REJECTION

A. Written approval or rejection of substitution given by the Owner’s Representative, Principal Architect/Engineer, and the Owner.

B. Owner's Representative reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.

C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

D. Substitution will be rejected if:

1. Submittal is not through the Contractor with his stamp of approval.
2. Request is not made in accordance with this Specification Section.
3. In Owner's Representative opinion, acceptance will require substantial revision of the original design.
4. In the Owner's Representative opinion, substitution will not perform adequately the function consistent with the design intent.

E. Contractor shall reimburse Owner for the cost of the Owner's Representative evaluation whether or not substitution is approved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 63

CHANGE ORDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

Procedures for processing Change Orders, including:

1. Quality Assurance.
2. Responsible Individual.
3. Documentation of Change in Contract Price and Contract Time.
4. Change Procedures.
5. Proposals and Contract Modifications.
6. Work Change Directive.
7. Change Order.
8. Execution of Change Documentation.
9. Correlation of Contractor Submittals.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Introductory Information, Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT (NOT USED)

1.3 SUBMITTALS (NOT USED)

1.4 QUALITY ASSURANCE

A. Reference Standards:

1. Equipment Rental Rates: equipmentwatch.com. Rental Rate is defined as full unadjusted base rental rate for appropriate item of construction equipment.

1.5 RESPONSIBLE INDIVIDUAL

A. Provide letter to the Owner's Representative indicating name, title, address and contact information of individual authorized to execute change documents and who is responsible for informing others in Contractor's employ and Subcontractors of changes to the Work. Information should be provided at the Preconstruction Conference but, no later than 10 calendar days following the Preconstruction Conference.

1.6 DOCUMENTATION OF CHANGE IN CONTRACT PRICE AND CONTRACT TIME

A. Maintain detailed records of changes in Work. Provide full information required for identification and evaluation of proposed changes, and substantiate costs of changes in Work.

B. Document each proposal for change in cost or time with sufficient data to allow evaluation of proposal. Provide additional information upon request of the Owner or the Owner's Representative.

C. Proposals shall include the following minimum information:

1. Quantities of items in original Proposal with additions, reductions, deletions, and substitutions.
2. Quantities and cost of items in original schedule of values with additions, reductions, deletions, and substitutions.
3. Provide unit prices for items not included in original Proposal with supporting information when absent from original Proposal Work.
4. Justification for changes in Contract Time.
5. Additional data upon request.

D. For changes in Work performed on a time-and-materials basis, provide the following additional information:

1. Quantities and description of products and equipment.
2. Taxes, insurance and bonds.
3. Overhead and profit as noted in Document 00 72 00 - General Conditions, Article 11.5.
4. Dates, times, and by whom work was performed.
5. Time records and certified copies of applicable payrolls.
6. Invoices, receipts for products, rented equipment, and subcontracts, similarly documented.

E. For changes in Work performed on a time-and-materials basis, payment for rental equipment will be as follows:

1. Actual invoice cost for duration required to complete extra work without markup for overhead and profit. When extra work comprises only a portion of rental invoice where equipment would otherwise be on site, compute hourly equipment rate by dividing the actual monthly invoice by 176. (One day equals 8 hours and 1 week equals 40 hours.)
2. Do not exceed estimated operating costs given on equipmentwatch.com website for items of equipment. Overhead and profit will be allowed on operating cost.

F. For changes in Work performed on a time-and-materials basis using Contractor-owned equipment, use equipmentwatch.com rates as follows:

1. Contractor-owned equipment will be paid at Rental Rate for duration of time required to complete extra work without markup for overhead and profit. Utilize lowest cost combination of hourly, daily, weekly, or monthly rates. Use 150 percent of Rental Rate for double shifts (one extra shift per day) and 200 percent of Rental Rate for more than two shifts per day. Standby rates shall be 50 percent of appropriate Rental Rate shown on equipmentwatch.com website. No other rate adjustments apply.
2. Do not exceed estimated operating costs given on equipmentwatch.com. Overhead and profit will be allowed on operating cost. Operating costs will not be allowed for equipment on standby.

1.7 CHANGE PROCEDURES

A. Changes to Contract Price or Contract Time can only be made by issuance of Change Order. Issuance of Work Change Directive will be formalized into a Change Order. Changes will be in accordance with requirements of the General Conditions.

B. The Owner's Representative will advise of minor changes in Work not involving an adjustment to Contract Price or Contract Time as authorized by the General Conditions by issuing supplemental instructions.

C. Request clarification of Drawings, Specifications, Contract Documents, or other information by using Request for Information. Response by the Owner's Representative to Requests for Information does not authorize Contractor to perform tasks outside scope of Work. Changes must be authorized as described in this section.

1.8 PROPOSALS AND CONTRACT MODIFICATIONS

A. The Owner or the Owner's Representative may issue a Request for Proposal (RFP), which includes detailed description of proposed change with supplementary or revised Drawings and Specifications. The Owner or the Owner's Representative may also request a proposal in response to a Request for Information. Prepare and submit proposal within 7 days or as specified in the request.

B. Submit request for Contractor changes to Owner's Representative describing proposed change and its full effect on Work, with a statement describing reason for change and effect on Contract Price and Contract Time including full documentation.

C. The Owner may use the Principal Architect/Engineer to review Change Orders.

1.9 WORK CHANGE DIRECTIVE

A. The Owner may issue a signed Work Change Directive instructing Contractor to proceed with a change in Work. Work Change Directive will subsequently be incorporated in Change Order.

B. Document will describe changes in Work and designate method of determining change in Contract Price or Contract Time.

C. Proceed promptly to execute changes in Work in accordance with Work Change Directive.

1.10 CHANGE ORDER

A. Stipulated Price Change Order

1. Stipulated Price Change Order will be based on accepted proposal.

B. Unit Price Change Order

1. Where Unit Prices for affected items of Work are included in Proposal, unit price Change Order will be based on unit prices, subject to the General Conditions.
2. Where unit prices of Work are not pre-determined in Proposal, Work Change Directive or accepted proposal will specify unit prices to be used.

C. Time-and-Material Change Order

1. Provide itemized account and supporting data after completion of change, within time limits indicated for claims in the General Conditions.
2. The Owner will determine change allowable in Contract Price and Contract Time as provided in the General Conditions.
3. Maintain detailed records of work done on time-and-material basis as specified in paragraph 1.4, Documentation of Change in Contract Price and Contract Time.
4. Provide full information required for evaluation of changes and substantiate costs for changes in Work.

1.11 EXECUTION OF CHANGE DOCUMENTATION

A. The Owner or the Owner's Representative will issue Change Orders, Work Change Directives, or accepted proposal for signatures of parties as described in the General Conditions.

1.12 CORRELATION OF CONTRACTOR SUBMITTALS

A. For Stipulated Price Contracts, promptly revise Schedule of Values and Application for Payment forms to record authorized Change Orders as separate line item.

B. For Unit Price Contracts, next monthly estimate of Work after acceptance of a Change Order will be revised to include new items not previously included and appropriate unit rates.

C. Promptly revise progress schedules to reflect change in Contract Time, and to adjust time for other items of work affected by change, and resubmit for review.

D. Promptly enter changes to on-site and record copies of Drawings, Specifications, or Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Measurement and Payment
2. Definition
3. Preparation
4. Submittal

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Introductory Information, Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Submit Schedule of Values in accordance with requirements of Section 01 33 00 – Submittals. Submit at least 10 days prior to submitting first application for progress payment. Submit via SharePoint.

B. Revise Schedule of Values and resubmit for items affected by contract modifications, Change Orders, and Work Change Directives. After changes are reviewed without exception by Authority's Principal Architect/Engineer, make submittal at least 10 days prior to submitting next application for progress payment.

1.4 DEFINITIONS

A. Schedule of Values: Is a schedule, prepared and maintained by the Contractor, allocating portions of the Contract Amount to various portions of the Work, including a tabulation of all of the costs of the various Subcontracts and materials which in the aggregate make up the Cost of the Work. The Schedule of Values shall be subject to Owner's approval and, after such approval, be used as the basis for reviewing the Contractor's Application For Payment.

B. Break down costs to list major products or operations for each line item which has an installed value of more than $5000.

1.5 PREPARATION

A. For stipulated price contracts, subdivide Schedule of Values into logical portions of Work, such as major work items or work in contiguous geographic areas.

B. Schedule and Schedule of Values shall be developed together. At a minimum, the Schedule of Values shall be broken out by trade and split between materials and labor as approved by the Owner. Such Prices will include overhead and profit applicable to each item of work.

C. For lump sum equipment items where submittal of operation/maintenance data and testing are required, include separate item for equipment operation and maintenance data submittal valued at 5 percent of lump sum amount for each equipment item and separate item for testing and adjusting valued at 5 percent of lump sum amount for each equipment item.

D. Round off figures for each listed item to nearest $100 except for value of one item, when necessary, to make total of items in Schedule of Values equal Contract Price for stipulated price contracts or lump sum amount in Schedule of Unit Price Work.

E. Submit Schedule of Values in approved electronic spreadsheet, formatted to print on 11” x 17” paper, to the Owner’s Document Management System.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Specific requirements for the preparation, submittal, updating, status reporting and management of the construction Progress Schedule.

B. Provide Construction Schedules for Work included in Contract in accordance with requirements in this Section. Create Construction Schedule using Critical Path Method (CPM) computer software capable of mathematical analysis of Precedence Diagramming Method (PDM) plans. Provide printed activity listings and bar charts in formats described in this Section.

C. Combine activity listings and bar charts with narrative report to form Construction Schedule submittal for Owner and the Owner's Representatives.

D. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms and Conditions of the Contract.

2. Division 01 - General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. No separate payment will be made for this item. Include the cost of construction scheduling in overhead cost for this project.

1.3 SCHEDULING STAFF

A. Employ or retain services of individual experienced in critical path scheduling for duration of Contract. Individual shall cooperate with Owner's Representative and shall update schedule (Progress Schedule) monthly as required by the Contract's General Conditions, to indicate current status of Work.

1.4 QUALITY ASSURANCE

A. The person preparing and revising the construction Progress Schedule shall be experienced in the preparation of schedules of similar complexity.

B. Within five (5) days from award of the Contract, Contractor shall submit to Owner's Representative the name of the person responsible for the preparation, maintenance, updating and revision of all schedules.

1. Qualifications necessary:

a. At least five (5) years verifiable experience in the preparation and updating of complex construction schedules for projects of similar type, size and complexity.

b. Proficient in the use of Microsoft© Project® 2007.

1.5 DEFINITIONS

A. The following definitions shall apply to this Specification Section:

1. BASELINE SCHEDULE: The initial as-bid, detailed, cost and resource loaded Progress Schedule prepared by the Contractor to define its plan for constructing the Project as required by the Contract Documents, and accepted by the Owner or Owner's Representative as meeting the requirements of the Contract Documents for specified constraints, sequences, milestones and completion dates.
2. PROGRESS SCHEDULE: The initially accepted Baseline Schedule, or subsequently approved Revised Baseline Schedules, updated each month to reflect actual start and finish dates of schedule activities and all time impact events whether caused by Contractor or Owner or factors beyond the control of either party.
3. REVISED BASELINE SCHEDULE: The initially accepted Baseline Schedule revised to reflect only approved changes.
4. WORKING SCHEDULE: A schedule developed from the Progress Schedule, utilizing scheduling software features not allowed for Baseline and Progress Schedules at the Contractor's sole discretion, to indicate the Contractor's plan for executing the Work, and providing for schedule recovery when approved time extensions are not sufficient to provide for timely completion due to Contractor inefficiencies beyond the control of the Owner or outside the risks accepted by the Owner.

1.6 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Scheduler qualifications.
3. Baseline Schedule: Submitted within 30 days after Effective Date of Agreement.
4. Monthly Progress Schedules.
5. Revised Baseline Schedules.
6. Working Schedules.
7. Look-Ahead Schedules.

1.7 GENERAL REQUIREMENTS

A. Contractor shall prepare and submit Baseline and Progress Schedules and updates and revisions to them as specified herein.

1. All scheduling to be performed in Microsoft© Project® 2007.

2. The Baseline and Progress Schedules shall be a calendar day-based and cost-loaded Critical Path Method (CPM) network diagram with supporting data.

B. Disallowed Scheduling Software Features:

1. The following specific features are not allowed to be applied in the Baseline and Progress Schedules:

   a. Resource leveling.

   b. Activity or event constraints, other than those specified by the Contract Documents.

   c. Leads and lags:

      1) Create specific activities with specific durations in-lieu-of leads and lags.

      2) Durations shall have positive values.

   d. Default progress data:

      1) Start and finish dates shall not be automatically updated.

      2) Update with actual start and finish dates documented from field reports.

      3) Work activities shall be updated by actual Work progression, not cash flow driven.

      4) Updating of activity percent complete and remaining duration shall be independent functions, not one parameter calculated from the other.

      5) Out-of-sequence progress shall be accounted for through retained logic, not a default option of progress override.

   e. Multiple calendars.

2. Any float suppression techniques or other software features that corrupts the pure mathematical model calculating the critical path.

   a. The following CPM schedule outputs will be rejected without further review:

      1) Schedules indicating the start of the critical path at a date point or activity beyond the date of Notice to Proceed, or schedules indicating a discontinuous critical path from Notice to Proceed to Contract completion.

      2) Schedules defining critical activities as those on a path or paths having some minimum value of float.

      3) Schedules with multiple critical paths.

      4) Schedules indicating a completion date beyond the contractual completion date.

3. Contractor, at Contractor's sole discretion, may employ the disallowed scheduling software features for Contractor's exclusive use in preparing a Working Schedule.

C. Float Time:

1. Neither the Owner nor the Contractor owns the float; the project owns the float.
2. As such, liability for delay of the project completion date rests with the party actually causing delay to the project completion date.

D. By preparing and submitting the Baseline Schedule, the Contractor represents that it can and intends to execute the Work and portions thereof within the specified times and constraints and that its bid covers the costs associated with the execution of the Work in accordance with the Construction Schedule.

E. Contractor shall provide an electronic copy on CD media for the Baseline Schedule and Progress Schedule and all monthly updates of both to accompany hard copies of the schedules and tabular reports.

1. Electronic submittal shall be in a format compatible with Microsoft© Project® 2007.
2. Contractor shall provide with the schedules, a procedural outline of the system shut-downs and proposed tie-ins, and the Owner's O&M staff, which shall be subject to approval of the Owner.

1.8 SUBMITTAL PACKAGES

A. Baseline Schedule:

1. CPM time-scaled network diagram:
   a. Three (3) prints of each sheet.
   b. Minimum sheet size: 11 IN x 17 IN.
   c. Provide electronic format (CD-ROM).
2. Supporting data:
   a. Three (3) sets of a list of project activities including the following:
      1) Holidays that will be observed during construction.
      2) Number of planned working days and shifts per week.

B. Monthly updates that include the following:

1. Narrative Schedule Report.
2. Revised Baseline Schedule as appropriate.
   a. Update to reflect approved Change Orders occurring since the prior update.

b. If no new approved Change Orders since prior update, provide a narrative report indicating such, and acknowledging the pertinence of the previously approved Baseline Schedule.

3. Updated Progress Schedule.
4. Explanation of changes in logic, duration of activities.
5. The number of opaque reproductions which Contractor requires, plus three (3) copies which will be distributed by the Owner's Representative.
   a. Do not submit fewer than three (3) copies.
6. Provide electronic format (CD-ROM).
7. Upload electronic version (pdf) to SharePoint.

C. Look-Ahead Rolling Schedule:

1. A four-week rolling schedule shall be provided by the Contractor at each progress meeting.
   a. The schedule shall provide an accurate representation of the work performed the previous week and work planned for the current week and subsequent two (2) weeks.
2. The schedule shall be provided in a tabular format with bars representing work duration.
   a. The schedule shall refer to activity ID numbers on the Baseline and Progress Schedules.
   b. Activities that are on the critical path and activities that are behind schedule shall be noted by color, highlight, or underscore.
3. Derived from the Working Schedule, if applicable.

D. Narrative Schedule Report:

1. Schedule reports for Initial Baseline and Revised Baseline Schedules shall include the following minimum data for each activity:
   a. Preceding and succeeding activities.
   b. Activity description and number.
   c. Durations of activities:
      1) Original durations.
      2) Remaining durations.
   d. Earliest start date (by calendar date).
   e. Earliest finish date (by calendar date).
   f. Actual start date (by calendar date).
   g. Actual finish date (by calendar date).
   h. Latest start date (by calendar date).

i. Latest finish date (by calendar date).

j. Float.

k. Percentage of activity completed.

l. Activity constraints specified by the Contract Documents.

m. Type of Tabulation (Initial or Updated).

n. Project Duration.

o. Project Contractual Completion Date.

p. The date of commencement of the Work as stated in the Notice to Proceed.

q. If an updated (revised) schedule, cite the new project completion date and project status and date of revision.

2. Shall be organized in the following sequence with all applicable documents included:

a. Contractor's transmittal letter.

b. Work completed during the period.

c. Identification of unusual conditions or restrictions regarding labor, equipment or material.

d. Description of the current critical path.

e. Changes to the critical path and scheduled completion date since the last schedule submittal.

f. Description of problem areas.

g. Current and anticipated delays:

1) Cause of delay.

2) Impact of delay on other activities, milestones and completion dates.

3) Corrective action and schedule adjustments to correct the delay.

h. Pending items and status thereof:

1) Permits.

2) Change orders.

3) Time adjustments.

4) Non-compliance notices.

i. Reasons for an early or late scheduled completion date in comparison to the contract completion date.

1.9 START-UP, DEMONSTRATION, TRAINING, AND FINAL COMPLETION

A. The Baseline Schedule must include broad-based activities for start-up, operator training, and final completion.

1. The Baseline Schedule may not necessarily contain sufficient detail on all activities listed in Specification Section 01 75 00 – Facility Start Up for start-up and demonstration.
2. At least 90 days prior to any activities, submit a detailed schedule in conformance with the requirements of Specification Section 01 75 00 – Facility Start Up:
   a. Identify task for the substantial completion notification.
   b. Pre-demonstration period:
      1) Identify equipment start-up for all major equipment.
      2) Identify all operator trainings required by individual Specification Sections.
      3) Complete submission of all required submittals.
   c. Demonstration period: Identify the demonstration period for each project classified system.

1.10 SCHEDULING CONFERENCE

A. Contractor shall schedule and Owner's Representative will conduct a scheduling conference with Contractor's project manager and construction scheduler.
   1. Conference must take place within 10 business days after the Preconstruction Conference.
   2. Owner's Representative will review the requirements of this Specification Section and other specified scheduling and sequencing requirements with Contractor.
   3. Baseline Construction Schedule:
      a. Provide five (5) copies of a Baseline Schedule in the form of an arrow or precedence diagram covering the following project phases and activities:
         1) Schedule of Submittals of Shop Drawings and schedule dates for fabrication and delivery of key and long lead time items.
         2) Contractor's submittal information shall show intended submittal dates and shall include, as a minimum, the maximum allowable review period.
         3) The information shall provide sufficient durations for reasonable administration of re-submittals, fabrication and transportation to produce realistic delivery dates for those procurement items.
   4. Owner's Representative shall review the schedule and provide comments.
   5. Provide approval of the schedule or request a meeting to review the schedule with Contractor within seven (7) days of receipt of the schedule.

6. If requested, Contractor shall participate in a review and evaluation of the schedule with Owner's Representative.
7. Any revisions necessary as a result of this review shall be resubmitted for review by Owner's Representative within five (5) business days.

B. Contractor shall submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations.
   1. Contractor shall be prepared to discuss the proposed work plan and schedule methodology that comply with the Contract requirements.
   2. If Contractor proposes deviations to specified construction staging of the project, then the general time-scaled logic diagram shall also display the deviations and resulting time impacts.
   3. Contractor shall be prepared to discuss the proposal.

C. Contractor shall provide the Preliminary Schedule of Values for the work to be performed.
   1. This document must match the total quantities and costs associated with the scheduled tasks.

D. Owner's Representative will review the logic diagram, WBS coding structure, and activity identification system, and provide required Baseline Schedule changes to Contractor for implementation within seven (7) days following the Conference.

E. Scheduling Conference (are required on a weekly basis until agreement to the Baseline Schedule is reached.
   1. Contractor to provide copies of the revised schedule.
   2. Contractor to address specific comments from the previous meeting.
   3. Contractor to revise the narrative as required.

1.11 BASELINE SCHEDULE

A. Schedule shall include, but not be limited to, activities that show the following that are applicable to the project:
   1. Project characteristics, salient features, or interfaces, including those with outside entities that could affect time of completion.
   2. Project start date, scheduled completion date and other milestones.
   3. Work performed by Contractor, subcontractors and suppliers.
   4. Submittal development, delivery, review and approval, including those from Contractor, subcontractors and suppliers.
   5. Procurement, delivery, installation and testing of materials, plants and equipment.
   6. Testing and settlement periods.

7. Utility notification and relocation.
8. Erection and removal of falsework and shoring.
9. Finish work and final cleanup.
10. Project float as the predecessor activity to the scheduled completion date.

B. Schedule shall have not less than 50 activities, unless otherwise authorized by the Owner's Representative.

1. The number of activities shall be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.
2. Schedule activities shall include the following:
   a. A clear and legible description.
   b. Start and finish dates.
   c. A duration of not less than one (1) working day, except for event activities, and not more than 20 working days, unless otherwise authorized by the Owner's Representative.
   d. At least one (1) predecessor and one (1) successor activity, except for project start and finish milestones.
   e. Required constraints: Only contractually required constraints may be inserted into the Baseline Schedule.
   f. Codes for responsibility, stage, work shifts, location and contract pay item numbers.

C. Early Completion Time:

1. Contractor may show early completion time on any schedule provided that the requirements of the contract are met.
2. Contractor may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently or by completing activities earlier than planned.

D. Working durations shall be planned to incorporate the effects of normal weather impacts. See General Conditions Article 12.2 for the "Baseline Rain Day Determination".

1.12 PROGRESS SCHEDULE

A. Develop Progress Schedule based on approved Baseline and Revised Baseline Schedules.

1. All restrictions on use of constraints, leads and lags, resource leveling, etc., shall also apply to Progress Schedules.

B. The Progress Schedule will be updated once per month for monitoring progress.

1. Contractor may submit one (1) additional update per month for its own convenience.

C. Indicate progress by making entries on the most recently accepted version of the network diagram and supporting data to show:

1. Activities completed.
2. Activities started.
3. Remaining duration for each activity started but not yet completed.
4. Percent complete based on value of work in place and value of equipment or material delivered and properly stored.
5. Status of activity due to be completed by the next scheduled progress meeting.

D. Computerized Progress Schedule and percent completion of Work shall be used to verify Contractor's payment requests.

1. Progress payments will not be processed by the Owner's Representative unless the updated Progress Schedule has been submitted concurrently with a pay request and found acceptable by the Owner's Representative.

1.13 REVISIONS TO PROGRESS SCHEDULE

A. Contractor shall submit data for a revised Progress Schedule within five (5) days of the occurrence of any of the following:

1. When contractor-caused delay in completion of any activity or group of activities indicates an overrun of the Contract Time or Control Dates by 30 working days or 10 percent of the remaining duration, whichever is less.
2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of the Work.
3. When the schedule does not represent the actual progress of the Work.
4. When a change order significantly affects the contract completion date.

B. The revised Progress Schedule shall be the basis of a Working Schedule showing:

1. How Contractor intends to return to schedule.
2. How Contractor intends to avoid falling behind schedule on future activities.

C. Show changes on the network diagram and supporting data including:

1. New activities and their duration.
2. Modifications to existing activities.

D. Provide written narrative report as needed to define:

1. Problem areas, anticipated delays, and impact on the current schedule.
2. Corrective action recommended, and its effect.

3. Major changes in scope.
4. Revised projections of progress and completion.

E. Except as provided in the following subparagraphs 1 and 2, the cost of revisions to the Progress Schedule resulting from changes in the Work shall be included in the cost for the change in the Work, and shall be based on the complexity of the revision or Change Order, man-hours expended in analyzing the change, and the total cost of the change.

1. The cost of revision to the Construction Schedule not resulting from authorized changes in the Work shall be the responsibility of the Contractor.
2. The cost of revision to the Construction Schedule for the Contractor's convenience shall be the responsibility of the Contractor.

F. The revised network diagram and supporting data for the Progress Schedule shall be submitted to the Owner’s Representative upon completion of the revisions, but not later than the next progress meeting.

G. Revisions to the Progress Schedule for the Contractor's convenience:

1. Must be approved by the Owner’s Representative before Contractor changes the sequence of Work.

1.14 TIME IMPACT ANALYSIS (TIA)

A. The accepted initial Baseline Schedule or subsequently accepted Revised Baseline Schedule shall be used for TIA.

B. Contractor shall submit a written TIA to the Owner’s Representative with each request for adjustment of Contract Time, or when Contractor or Owner’s Representative consider that an approved or anticipated change may impact the critical path or contract progress.

1. The TIA must be attached to any change order prior to approval of any change to time or cost.

C. The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate.

1. The analysis shall use the Baseline or Revised Baseline Schedule (accepted Baseline Schedule) that has a data date closest to and prior to the event.
2. If the Owner’s Representative determines that the accepted Baseline Schedule used does not appropriately represent the conditions prior to the event, the accepted Baseline Schedule shall be updated to the day before the event being analyzed.
3. The TIA shall include an impact schedule developed from incorporating the event into the accepted Baseline Schedule by adding or deleting activities, or by changing durations or logic of existing activities as appropriate to the nature of the change event.

4. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted Baseline Schedule, the difference between scheduled completion dates of the two (2) schedules shall be equal to the adjustment of Contract Time.

D. Contractor shall submit a TIA in duplicate within 15 working days of receiving a written request for a TIA from the Owner's Representative.

1. Contractor shall allow the Owner's Representative two (2) weeks after receipt to approve or reject the submitted TIA.
2. All approved TIA schedule changes shall be shown on the next update schedule.

E. In the event of a TIA rejection:

1. If a TIA submitted by the Contractor is rejected by the Owner's Representative, the Contractor shall meet with the Owner's Representative to discuss and resolve issues related to the TIA.
2. If agreement is not reached, the Contractor will be allowed 15 days from the meeting with the Owner's Representative to give notice.
3. Contractor shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent update schedules.
4. If agreement is reached at a later date, approved TIA schedule changes shall be shown on the next update schedule.
5. Owner's Representative will withhold remaining payment on the schedule contract item if a TIA is requested by Owner's Representative and not submitted by Contractor within 15 working days.
6. The schedule item payment will resume on the next estimate after the requested TIA is submitted.

a. No other contract payment will be retained regarding TIA submittals.

1.15 NARRATIVE SCHEDULE REPORT

A. Narrative Schedule Report shall list Activities Started This Month; Activities Completed This Month; Activities Continued This Month; Activities Scheduled To Start or Complete Next Month; Problems Encountered This Month; Actions Taken to Solve These Problems.

B. Narrative Schedule Report shall describe changes made to Construction Schedule Logic (i.e., changes in Predecessors and Lags); Activities Added to Schedule; Activities Deleted from Schedule; any other changes made to Schedule other than addition of Actual Start Dates and Actual Finish Dates and changes of Data Date and Remaining Durations for recalculation of mathematical analysis.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01 32 36.01

PROJECT PHOTOGRAPHS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Technical and submittal requirements for project photographs, including:

   a. Measurement and Payment

   b. Project photographs for facility projects.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS:

1. Pre-construction Photographs: Photographs taken, in sufficient numbers and detail, prior to beginning field activities, to show original construction site conditions.

2. Progress Photographs: Photographs, taken throughout the duration of construction at regular intervals from vantage points, approved by the Owner's Representative, that document progress of the Work.

3. Completed Project Photographs: Photographs that document the completed project.

1.4 SUBMITTALS:

1. Refer to Section 01 33 00 – Submittals.

2. Format and Media. Digital photography shall be used for Preconstruction, Progress, and Competed Project Photographs. Submit digital JPEG images for electronic submittals.

   a. Media

      1) Digital Photography. Use at least 6.0 megapixel density for photographs. Submit digital photographic files onto SharePoint site in JPEG format.

3. Submit Preconstruction Photograph digital images. Contractor shall upload digital images to the Owner's SharePoint portal as directed by the Owner's Representative.
4. Submit Progress Photograph digital images.
5. Submit Completed Project Photograph images.
6. Submittal Quantities and Frequencies
   a. Preconstruction photographs: Submit one set of digital images.
      1) Multiple photographs shall be taken of the project site to document existing facilities, parking areas, driveways, surface features such as building, trees and other vegetation or landscaping. This shall be accomplished through the use of a 100 foot interval grid (50 foot grid for sites less than 1 acre) imposed on the site with photos taken at each node point along the grid lines (4 photos per node) or by other means as approved by the Owner's Representative.
   b. Progress Photographs: Submit one set of aerial digital images quarterly with the Application for Payment. Provide four (4) aerial level color photos every quarter from fixed vantage points, with vantage points approved by the Owner's Representative.
   c. Completed Project Photographs:
      1) For Facility Contracts submit two sets of Completed Project Photographs, after Date of Substantial Completion and prior to final payment. Two sets of Completed Project photos shall be taken from four (4) vantage points. Each of the four vantage points pre-approved by the Owner. Vantage points for Finished Photographs will be approved separately from vantage points approved for Progress Photographs.
7. Photographic files become the property of the Owner with all rights of reproduction to the Owner. Do not publish photographs without written consent by the Owner.

B. Quality Assurance:
   1. Contractor shall be responsible for the quality of and timely execution and submittal of photographs.
   2. Contractor shall schedule and coordinate photographer with Owner's Representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanics and administration of the submittal process for:
    a. Shop Drawings.
    b. Samples.
    c. Miscellaneous submittals.
    d. Operation and Maintenance Manuals.
2. General content requirements for Shop Drawings.
3. Content requirements for Operation and Maintenance Manuals.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Sections in Divisions 02 through 48 identifying required submittals.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 DEFINITIONS

A. Shop Drawings:

1. See General Conditions.
2. Product data and samples are Shop Drawing information.

B. Operation and Maintenance (O&M) Manuals:

1. Contain the information required for proper installation and maintenance of building materials and finishes.
2. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

C. Miscellaneous Submittals:

1. Submittals other than Shop Drawings and O&M Manuals.
2. Representative types of miscellaneous submittal items include but are not limited to:
   a. Construction schedule.
   b. Facility Shutdown Plan(s)
   c. HVAC test and balance reports.
   d. Installed equipment and systems performance test reports.
   e. Manufacturer's installation certification letters.
   f. Instrumentation and control commissioning reports.
   g. Warranties.
   h. Service agreements.
   i. Construction photographs.
   j. Record Documents.
   k. Cost breakdown (Schedule of Values).
   l. Safety Plan(s).

1.5 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:

1. Submitted and approved within 20 days of receipt of Notice to Proceed.
2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

B. Shop Drawings: Submittal and approval prior to 50 percent completion.

C. Operation and Maintenance Manuals and Completed Equipment Record Sheets: Initial submittal within 60 days after date Shop Drawings are approved.

1.6 PREPARATION OF SUBMITTALS

A. General:

1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Owner’s Representative’s or Principal Architect/Engineer’s sole opinion, are illegible will be returned without review.

B. Shop Drawings:

1. Scope of any submittal and shop drawing transmittal:

a. Submit shop drawings utilizing Owner's standard Submittal Transmittal Form.

b. Limited to one (1) Specification Section.

c. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Section.

2. Numbering letter of transmittal:

a. Include a series number, "xx", beginning with "01" and increasing sequentially with each additional transmittal.

b. Assign consecutive series numbers to subsequent transmittals.

3. Describing transmittal contents:

a. Provide listing of each component or item in submittal capable of receiving an independent review action.

b. Identify for each item:

1) Manufacturer and Manufacturer's Drawing or data number.

2) Contract Document tag number(s).

3) Unique page numbers for each page of each separate item.

4) Use divider sheets with labeled tabs to separate independent items within a single submittal.

c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.

4. Contractor stamping:

a. General:

1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.

a) Contractor's signature and date shall be wet ink signature. Is an electronic signature acceptable as most submittals are uploaded to SharePoint as a .PDF electronic document?

b) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated under General Conditions Paragraph 6.20.4."

2) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.

a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.

b) Use divider sheets with labeled tabs to separate independent items within a single submittal.

b. Electronic stamps:

1) Contractor may electronically embed Contractor's review and approval stamp to either the Submittal Transmittal Form or a separate index sheet preceding each independent item in the submittal.

2) Contractor's signature and date on electronically applied stamps shall be wet ink signature. Is an electronic signature acceptable as most submittals are uploaded to SharePoint as a PDF electronic document?

5. Resubmittals:

a. Number with original root number and a suffix letter starting with "A" on a new Submittal Transmittal Form.

b. Do not increase the scope of any prior transmittal.

c. Account for all components of prior transmittal.

1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate (See also 1.6, this Section).

a) Do not include submittal information for items listed with prior "A" or "B" in resubmittal.

2) Indicate items to be resubmitted “at a later date” for any prior "C" or "D" Action item not included in resubmittal.

a) Obtain Principal Architect/Engineer’s approval to exclude items.

6. For 8-1/2 x 11 In, 8-1/2 x 14 In, and 11 x 17 In hard copy size sheets, provide three (3) copies of each page for Principal Architect/Engineer’s plus the number required by the Contractor. In today’s electronic environment, is subsection No. 6 necessary to be included in the contract documents?

a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed four (4) hard copies.

b. All other hard copy size sheets:

1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.

2) Utilize mailing tube; do not fold.

3) The Principal Architect/Engineer will mark and return the reproducible to the Contractor through the Owner’s Representative for his reproduction and distribution.

7. Electronic submittals utilizing web based document management system (SharePoint®):
   a. Shop drawing submittals shall be produced (scanned) in Adobe Acrobat's Portable Document Format (PDF) Version 10.0 or higher.
   b. Do not password protect and/or lock the PDF document.
   c. Create one (1) PDF document (PDF file) for each submittal.
   d. Drawings or other graphics must be converted to PDF format and made part of the singe (one [1]) PDF document.
      1) Scanning to be used only where actual file conversion is not possible.
   e. Limit PDF document size to 10MB.
   f. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.
   g. Images only shall be scanned at a resolution of 300 dpi or greater.
      1) Perform Optical Character Recognition (OCR) capture on all images.
      2) Achieve OCR with the "original image with hidden text" option.
      3) Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
   h. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.
      1) Normally three (3) levels deep (i.e., "Chapter," "Section," "Sub-section").
   i. Thumbnails must be generated for each PDF file.
   j. Set the opening view for PDF files as follows:
      1) Initial view: Bookmarks and Page.
      2) Magnification: Fit in Window.
      3) Page layout: Single page.
      4) Set the file to open to the cover page of the submittal with bookmarks to the left, and the first bookmark linked to the cover page.
   k. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.
   l. File naming conventions:
      1) File names shall use a "nine dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the Shop Drawing Root series number and Z is an ID number used to designate the associated volume.

a) Example 1:

(1) Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:

(a) Pump 1 = 43 21 21-01-1.pdf.

(b) Pump 2 = 43 21 21-02-1.pdf.

b) Example 2:

(1) Control system submitted as one (1) Shop Drawing but separated into two (2) shop drawing submittals:

(a) Volume 1 = 40 90 00-01-1.pdf.

(b) Volume 2 = 40 90 00-01-2.pdf.

8. Provide clear space (3 In Sq.) for Principal Architect/Engineer stamping of each component defined in the PREPARATION OF SUBMITTALS Article – Contractor Stamping.
9. Contractor shall not use red color for marks on transmittals.
   a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
   b. Outline Contractor marks on reproducible transparencies with a rectangular box.
10. Transmittal contents:
   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Owner's Representative and the Principal Architect/Engineer.
   b. Identify equipment or material use, tag number, Drawing detail reference, weight, and other Project specific information.
   c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
   d. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 In pages.
      1) Clearly mark (indicate) exact item or model and all options proposed.
   e. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.

1) Arrange data and performance information in format similar to that provided in Contract Documents.

2) Provide, at minimum, the detail specified in the Contract Documents.

f. Provide warranty information.

g. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

11. Samples:

a. Identification:

1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, standard Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.

2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.

b. Include application specific brochures, and installation instructions.

c. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.

d. Resubmit samples of rejected items.

C. Miscellaneous Submittals:

1. Prepare in the format and detail specified in Specification requiring the miscellaneous submittal.

D. Operation and Maintenance Manuals:

1. Owner's use of manufacturer's Operation and Maintenance materials:

a. Materials are provided for Owner's use, reproduction and distribution as training and reference materials within Owner's organization.

1) Applicable to hard copy or electronic media.

2) Applicable to materials containing copyright notice as well as those with no copyright notice.

b. Notify manufacturer of this intended use of materials provided under the Contract.

2. Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.

a. Identify resubmittals with the original number plus a suffix letter starting with "A."

3. Submittal format:

   a. Interim submittals: Submit two (2) paper copies until manual is approved.

   b. Final submittals:

      1) Within 30 days of receipt of approval, submit one (1) additional paper copy and two (2) electronic copies to the Owner's Document Management System (SharePoint) in Portable Document Format (PDF).

         a) Compact discs to be secured in jewel cases.

      2) Electronic copies will be reviewed for conformance with the approved paper copy and the electronic copy (PDF) requirements of this Specification.

      3) Non-conforming CDs will be returned with comments.

         a) Provide final CDs within 30 days of receipt of comments.

4. Paper copy submittals:

   a. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 In size heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.

      1) Provide binders with titles inserted under clear overlay on front and on spine of each binder.

         a) As space allows, binder titles shall include, but not necessarily be limited to, Project Name, related Specification Number, Equipment Name(s) and Project Equipment Tag Numbers.

      2) Provide a Cover Page for each manual with the following information:

         a) Manufacturer(s).

         b) Date.

         c) Project Owner and Project Name.

         d) Specification Section.

         e) Project Equipment Tag Numbers.

         f) Model Numbers.

         g) Principal Architect/Engineer.

         h) Contractor.

      3) Provide a Table of Contents or Index for each manual.

4) Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.

5) Provide plastic sheet lifters prior to first page and following last page.

b. Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 In or 11 x 17 In size.

1) Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.

2) Identify vinyl envelopes with Drawing numbers.

c. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.

1) Delete or cross out information that does not specifically apply to the Project.

5. Electronic copy submittals:

a. Electronic copies of the approved paper copy Operation and Maintenance Manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version 10.0 or higher.

b. Do not password protect and/or lock the PDF document.

c. Create one (1) PDF document (PDF file) for each equipment O&M Manual.

d. Drawings or other graphics must be converted to PDF format and made part of the one (1) PDF document.

1) Scanning to be used only where actual file conversion is not possible.

e. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

f. Images only shall be scanned at a resolution of 300 dpi or greater.

1) Perform Optical Character Recognition (OCR) capture on all images.

2) Achieve OCR with the "original image with hidden text" option.

3) Word searches of the PDF document must operate successfully to demonstrate OCR compliance.

g. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.

1) Normally three (3) levels deep (i.e., "Chapter," "Section," "Sub-section").

h. Thumbnails must be generated for each PDF file.

i. Set the opening view for PDF files as follows:

1) Initial view: Bookmarks and Page.

2) Magnification: Fit in Window.

3) Page layout: Single page.

4) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.

j. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.

k. File naming conventions:

1) File names shall use a "ten dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.

a) Example 1:

(1) Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:

(a) Pump 1 = 43 21 21-01-1.pdf.

(b) Pump 2 = 43 21 21-02-1.pdf.

b) Example 2:

(1) Control system submitted as one (1) Shop Drawing but separated into two (2) O&M volumes:

(a) Volume 1 = 40 90 00-01-1.pdf.

(b) Volume 2 = 40 90 00-01-2.pdf.

l. Labeling:

1) As a minimum, include the following labeling on all CD-ROM discs and jewel cases:

a) Project Name.

b) Equipment Name and Project Tag Number.

c) Project Specification Section.

d) Manufacturer Name.

e) Vendor Name.

m. Binding:

1) Include labeled CD(s) in labeled jewel case(s).

a) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.

b) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

6. Operation and Maintenance Manuals for Materials and Finishes:
   a. Building Products, Applied Materials and Finishes:
      1) Include product data, with catalog number, size, composition and color and texture designations.
      2) Provide information for re-ordering custom manufactured products.
   b. Instructions for Care and Maintenance:
      1) Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
   c. Moisture Protection and Weather Exposed Products:
      1) Include product data listing, applicable reference standards, chemical composition, and details of installation.
      2) Provide recommendations for inspections, maintenance and repair.
   d. Additional requirements as specified in individual product specifications.
7. Operation and Maintenance Manuals for Equipment and Systems:
   a. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:
      1) Major equipment.
      2) Equipment powered by electrical, pneumatic or hydraulic systems.
      3) Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.
      4) Valves and water control gates.
   b. Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:
      1) Fully completed type-written copies of the associated Equipment Record(s), Exhibits A1, A2 and A3, shall be included under the first tab following the Table of Contents of each Operation and Maintenance Manual.
         a) Each section of the Equipment Record must be completed in detail.
            (1) Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.

b) For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.

c) Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.

d) Electronic copies of the Exhibits may be obtained by contacting the Project Manager.

2) Equipment function, normal operating characteristics, limiting operations.

3) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.

4) Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.

5) Lubrication and maintenance instructions.

6) Troubleshooting guide.

7) Parts lists:

a) Comprehensive parts and parts price lists.

b) A list of recommended spare parts.

c) List of spare parts provided as specified in the associated Specification Section.

8) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.

9) Test data and performance curves.

10) As-constructed fabrication or layout Drawings and wiring diagrams.

11) Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.

12) Additional information as specified in the associated equipment or system Specification Section.

1.7 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Samples and Operation and Maintenance Manuals:

1. Transmit all submittals via Owner's Document Management System (SharePoint).
2. Transmit all paper submittals to the address provided below.

AECOM

19219 Katy Freeway, Suite 100

Houston, TX 77094

Attn: Michael Rolen

3. Utilize SJRA Standard Submittal Transmittal Form (to be provided by Owner) to transmit all Shop Drawings, Samples and Operation and Maintenance Manuals.
4. All submittals must be from Contractor.
   a. Submittals will not be received from or returned to subcontractors.
   b. Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.
5. Provide submittal information defining specific equipment or materials utilized on the Project.
   a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

B. Miscellaneous Submittals:
1. Transmit under Contractor's standard Submittal Transmittal Form or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit to the address provided below.

AECOM

19219 Katy Freeway, Suite 100

Houston, TX 77094

Attn: Michael Rolen

4. Provide copy of Submittal Transmittal without attachments to Owner's Representative.

C. Expedited Return Delivery:
1. Include prepaid express envelope or airbill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
2. Inclusion of prepaid express envelope or airbill does not obligate Owner’s Representative or Principal Architect/Engineer to conduct expedited review of submittal.

D. Fax Transmittals:

1. Permitted on a case-by-case basis to expedite review when approved by Principal Architect/Engineer.
2. Requires hard copy transmittal to immediately follow.
   a. Principal Architect/Engineer will proceed with review of fax transmittal.
   b. Principal Architect/Engineer 's approval or rejection comments will be recorded and returned on hard copy transmittal.
3. Provisions apply to both:
   a. Initial transmittal contents.
   b. Supplemental information required to make initial transmittal contents complete.

1.8 PRINCIPAL ARCHITECT/ENGINEER 'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
   a. NO EXCEPTION.
   b. EXCEPTIONS AS NOTED.
   c. REVISE & RESUBMIT
   d. REJECTED - RESUBMIT.
   e. ACKNOWLEDGE RECEIPT.
   f. FOR INFORMATION PURPOSES ONLY.
   g. SUPPLEMENTARY INFORMATION.
2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
   a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.
3. In relying on the representation on the Contractor’s review and approval stamp, Owner and Principal Architect/Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
   a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
      1) Review and approval will be limited to the single item described on the transmittal letter.
      2) Other items identified in the submittal will:
         a) Not be logged as received by the Principal Architect/Engineer.

b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.

c) Be submitted by the Contractor as a new series number, not as a re-submittal number.

b. Principal Architect/Engineer, at Principal Architect/Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.

1) Unless Contractor notifies Principal Architect/Engineer in writing that the Principal Architect/Engineer's revision of the Submittal Transmittal Form item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.

a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.

b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.

5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:

a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).

1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.

a) Correct and resubmit items so marked.

b. Items marked "A" or "B" will be fully distributed.

c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.

1) This is at the sole discretion of the Principal Architect/Engineer.

2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."

3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations: Requirements for the submittal of calculations in the individual Specification Sections shall be satisfied through the submittal of a certification sealed by the Principal Architect/Engineer that the calculations have been performed. Certification will be received for information purposes only and will be returned stamped "D. ACKNOWLEDGE RECEIPT ".
8. Transmittals of submittals which the Principal Architect/Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Acknowledge Receipt" (Principal Architect/Engineer 's Review Not Required).
9. Samples may be retained for comparison purposes.
    a. Remove samples when directed.
    b. Include in bid all costs of furnishing and removing samples.
10. Approved samples submitted or constructed, constitute criteria for judging completed work.
    a. Finished work or items not equal to samples will be rejected.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

EXHIBIT A1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name					Specification Section:
Equipment Name					Year Installed:
Project Equipment Tag No(s).					
Equipment Manufacturer				Project/ Order No.	
Address				Phone	
Fax	Web Site		E-mail		
Local Vendor/Service Center					
Address				Phone	
Fax	Web Site		E-mail		

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.				Serial No.				
Make				Model No.				
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

EXHIBIT A2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP						
	D	W	M	Q	S	A	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *						
	D	W	M	Q	S	A	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours

EXHIBIT A3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

END OF SECTION

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SECTION 01 35 05

ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Addresses:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices. No separate payment will be made for this item. Include the cost of same in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Prior to the start of any construction activities submit:
   a. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.
   b. A drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation.
   c. Submit manufacturer's catalog sheets and other product data on dispensing equipment, pump, and aboveground fuel storage tanks, indicating capacity and dimensions of tank.
   d. Submit drawings to show location of tank protection area and driveway. Indicate nearest inlet or channelized flow area. Clearly dimension distances and measurements.
   e. Submit list of spill containment equipment, and quantities thereof, located at fueling area.

1.4 ENVIRONMENTAL CONTROLS

A. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions at construction site and adjacent areas.

B. Work to minimize impact to surrounding environment. Adopt construction procedures that do not cause unnecessary excavation and filling of terrain, indiscriminate destruction of vegetation, air or stream pollution, nor harassment or destruction of wildlife.

C. Recognize and adhere to environmental requirements of Project. Limit disturbed areas to boundaries established by Contract. Avoid pollution of "on-site" streams, sewers, wells, or other water sources.

D. Burning of rubbish, debris, or waste materials is not permitted.

1.5 POLLUTION CONTROL

A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations.

B. Provide equipment and personnel to perform required emergency measures to contain spillage, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off-site, and replace with suitable compacted fill and topsoil.

C. Provide systems for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.
2. Prevent harmful dispersal of pollutants into atmosphere.

D. Use equipment that conforms to current Federal, State, and local laws and regulations.

E. Install or otherwise implement positive controls to prevent hazardous materials migrating from Work area.

1.6 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.

B. Employ methods and use materials which will not adversely affect conditions at site or on adjoining properties.

1.7 NOISE CONTROL

A. Noise limits measured at the SJRA property line are:

1. 65 decibels between 7 a.m. and 10 p.m.
2. 58 decibels from 10 p.m. to 7 a.m.

B. Noise limits may not exceed 65 decibels without prior approval by the Owner. Noise limits above 85 decibels will not be approved.

C. Provide vehicles, equipment, and construction activities that minimize noise to greatest degree practicable. Conform noise levels to latest OSHA standards. Do not permit noise levels to interfere with Work or create nuisance in surrounding areas.

D. Conduct construction operations during daylight hours except as approved by Owner's Representative.

E. Select construction equipment to operate with minimum noise and vibration. When in opinion of Owner's Representative, objectionable noise or vibration is produced by equipment, rectify conditions without additional cost to Owner. Sound Power Level (PWL) of equipment shall not exceed 85 dbA (re: 10-12 watts) measured 5 feet from piece of equipment. Explicit equipment noise requirements are specified with equipment specifications.

1.8 DUST CONTROL

A. Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval of Owner's Representative, to control amount of dust generated.

1.9 WATER RUNOFF AND EROSION CONTROL

A. Comply with Texas Pollutant Discharge Elimination System (TPDES) permit when required.

B. In addition to TPDES requirements:

1. Provide methods to control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to Work, site, or adjoining properties.
2. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff courses so as to prevent erosion, sedimentation or damage.
3. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
4. Dispose of drainage water in manner to prevent flooding, erosion, or other damage to portion of site or to adjoining areas and in conformance with environmental requirements.
5. Retain existing drainage patterns external to construction site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as needed to control conditions.
6. Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.

    a. Minimize area of bare soil exposed at one time.

b. Provide temporary control measures, as berms, dikes, and drains.

7. Construct fills and waste areas by selective placement to eliminate erosion of surface silts or clays.
8. Inspect earthwork periodically to detect evidence of start of erosion. Apply corrective measures as required to control erosion.

1.10 QUALITY ASSURANCE

A. Person conducting visual examination for pollutant shall be fully knowledgeable about the TPDES Construction General Permit, detecting sources of storm water contaminants, inspection of aboveground storage tank and appurtenances for leakage, and the day-to-day operations that may cause unexpected pollutant releases.

PART 2 - PRODUCTS

2.1 ABOVEGROUND FUEL STORAGE TANK

A. Tank Assembly: Must be listed with UL 1709 and UL 2085.

B. Inner Steel Storage Tank: Follow UL 142, with minimum thickness of ⅛-inch welded construction.

C. Tank Encasement: Either concrete or steel to provide minimum of 110 percent containment of inner tank capacity. Provide 5-gallon overspill containment pan for tank refueling.

D. Dispenser Pump: For submersible pump, UL listed emergency shut-off valve to be installed at each dispenser. For suction pump, UL listed vacuum-activated shut-off valve, with shear section, is to be installed at each dispenser. Fuel may not be dispensed from tank by gravity flow or by pressurization of tank. Means must be provided to prevent release of fuel by siphon flow.

E. Representative Manufacturers: Convault, Fireguard, Ecovault, SuperVault, or equal.

2.2 CONCRETE

A. Provide concrete with minimum strength of 4,000 psi at 28 days.

2.3 AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials, free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to following gradation requirements.

Sieve Size	**Percent Retained**
(Square Mesh)	(By Weight)
2-1/2"	0
2"	0 - 20
1-1/2"	15 - 50
3/4"	60 - 80
No. 4	95 - 100

PART 3 - EXECUTION

3.1 INSTALLATION

A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

B. No clearing and grubbing or rough cutting permitted until erosion and sediment control systems are in place, other than site Work specifically directed by Owner's Representative to allow soil testing and surveying.

C. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control systems.

D. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Owner's Representative to remove and discard existing system.

E. Regularly inspect and repair or replace damaged components of erosion and sediment control systems as specified in this Section. Unless otherwise directed, maintain erosion and sediment control systems until project area stabilization is accepted by the Owner. Remove erosion and sediment control systems promptly when directed by Owner's Representative. Discard removed materials off site.

F. Remove and dispose sediment deposits at designated spoil site for Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at location not in or adjacent to stream or flood plain. Assume responsibility for off-site disposal. Spread sediment evenly throughout site, compacted and stabilized. Prevent sediment from flushing into a stream or drainage way. If sediment has been contaminated, dispose of in accordance with existing federal, state, and local rules and regulations.

G. Assume responsibility for collecting, storing, hauling, and disposing of spoil, silt, and waste materials as specified in this or other Specifications and in compliance with applicable federal, state, and local rules and regulations.

H. Employ protective measures to avoid damage to existing trees to be retained on project site. Conduct construction operations under this Contract in conformance with erosion control practices described in Drawings and this or other Specifications.

I. Prepare spill response and containment procedures to be implemented in event of significant materials spill. Significant materials include but are not limited to: raw materials; fuels; materials such as solvent, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under Section 101(14) of CERCLA; chemical required to be reported pursuant to Section 313 of Title III of SARA; fertilizers; pesticides, and waste products such as slag, ashes and sludge that have potential to be released with storm water discharges. Spill containment procedures shall be kept on-site or in construction field office.

J. Spill containment equipment appropriate to size of operation is to be located in close proximity of fueling area. Such equipment includes, but not limited to, suitable waste containers for significant materials, drip pans, booms, inlet covers, or absorbent.

K. Properly label significant materials or waste containers used for construction activities and stored on-site overnight.

L. Install, maintain, and inspect erosion, sediment control measures and practices as specified in Drawings and in this or other Specifications

M. Land Protection:

1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition.

    a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.

2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.

3. Restore all disturbed areas including borrow and haul areas and establish permanent type of locally adaptable vegetative cover.

4. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes immediately upon completion of final grading.

5. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.

6. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Owner's Representative.
    a. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.
7. Utilize, as necessary, erosion control methods to protect side and backslopes, minimize and the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete.
    a. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Owner's Representative.
    b. Physically retard the rate and volume of run-on and runoff by:
        1) Implementing structural practices such as diversion swales, terraces, straw bales, silt fences, berms, storm drain inlet protection, rocked outlet protection, sediment traps and temporary basins.
        2) Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
        3) Providing Construction sites with graveled or rocked access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.
8. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.

N. Solid Waste Disposal:

1. Collect solid waste on a daily basis.
2. Provide disposal of degradable solid waste to an approved solid waste disposal site.
3. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Owner's Representative and regulatory agencies.
4. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

O. Fuel and Chemical Handling:

1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.

2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
4. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

P. Control of Dust:

1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
   a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.
   b. The use of chemical agents such as calcium chloride must be approved by the State of Texas DOT.
2. Utilize methods and practices of construction to eliminate dust in full observance of agency regulations.
3. The Owner's Representative will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.

Q. Burning:

1. Do not burn material on the site.
2. If the Contractor elects to dispose of waste materials by burning, make arrangements for an off-site burning area and conform to all agency regulations.

R. Control of Noise:

1. Control noise by fitting equipment with appropriate mufflers.

S. Completion of Work:

1. Upon completion of work, leave area in a clean, natural looking condition.
2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.

T. Historical Protection:

1. If during the course of construction, evidence of deposits of historical or archaeological interests is found, cease work affecting find and notify Owner's Representative.

a. Do not disturb deposits until written notice from Owner's Representative is given to proceed.

2. The Contractor will be compensated for lost time or changes in construction to avoid the find based upon normal change order procedures.

3.2 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENT CONTROL SYSTEMS

A. When topsoil is specified as a component of another Specification, conduct erosion control practices described in this Specification during topsoil placement operations.

B. When placing topsoil, maintain erosion and sediment control systems consisting of swales, grade stabilization structures, berms, dikes, waterways, and sediment basins.

C. Maintain grades which have been previously established on areas to receive topsoil.

D. After areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading topsoil, loosen subgrade by discing or by scarifying to a depth of at least 2 inches to permit bonding of topsoil to subsoil. Compact by passing bulldozer up and down slope, tracking over entire surface area of slope to create horizontal erosion control slots.

E. No sod or seed shall be placed on soil which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

3.3 DUST CONTROL

A. Implement dust control methods to control dust creation and movement on construction sites and roads and to prevent airborne sediment from reaching receiving streams or storm water conveyance systems, to reduce on-site and off-site damage, to prevent health hazards, and to improve traffic safety.

B. Control blowing dust by using one or more of following methods:

1. Mulches bound with chemical binders such as Carasol, Terratack, or equal.
2. Temporary vegetative cover.
3. Spray-on adhesives on mineral soils when not used by traffic.
4. Tillage to roughen surface and bring clods to surface.
5. Irrigation by water sprinkling.
6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales of hay, or similar materials.

C. Implement dust control methods immediately whenever dust can be observed blowing on project site.

3.4 KEEPING STREETS CLEAN

A. Keep streets clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at

construction, staging, storage, and disposal areas. Vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to stabilized construction exit, as needed. Release wash water into a drainage swale or inlet protected by erosion and sediment control measures. Construction exit specified in Section 01 57 13.02 - Stabilized Construction Access.

B. In addition to stabilized construction exits, shovel or sweep pavement to extent necessary to keep street clean. Water hosing or sweeping of debris and mud off of street into adjacent areas is not allowed.

3.5 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose. Locate areas so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid as well as solid waste. Clean and inspect maintenance areas daily.

B. On construction site where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.6 WASTE COLLECTION AND DISPOSAL

A. Formulate and implement a plan for collection and disposal of waste materials on construction site. In plan, designate locations for trash and waste receptacles and establish a collection schedule. Specify and carry out methods for ultimate disposal of waste in accordance with applicable local, state, and federal health and safety regulations. Make special provisions for collection and disposal of liquid wastes and toxic or hazardous materials.

B. Keep receptacles and waste collection areas neat and orderly to extent possible. Waste shall not be allowed to overflow its container or accumulate from day-to-day. Locate trash collection points where they shall least likely be affected by concentrated storm water runoff.

3.7 WASHING AREAS

A. Avoid washing concrete delivery trucks or dump trucks and other construction equipment at locations where runoff shall flow directly into a watercourse or storm water conveyance system. Designate special areas for washing vehicles. Locate these areas where wash water shall spread out and evaporate or infiltrate directly into ground, or where runoff can be collected in temporary holding or seepage basin. Beneath wash areas construct a gravel or rock base to minimize mud production.

3.8 STORAGE OF CONSTRUCTION MATERIALS AND CHEMICALS

A. Isolate sites where chemicals, cements, solvents, paints, or other potential water pollutants are stored in areas where they shall not cause runoff pollution.

B. Store toxic chemicals, materials, pesticides, paints, and acids in accordance with manufacturers' guidelines. Protect groundwater resources from leaching by placing a plastic mat, packed clay, tar paper, or other impervious materials on areas where toxic liquids are to be opened and stored.

3.9 DEMOLITION AREAS

A. Demolition activities which create large amounts of dust with significant concentrations of heavy metals or other toxic pollutants shall use dust control techniques to limit transport of airborne pollutants. However, retain water or slurry used to control dust contaminated with heavy metals or toxic pollutants on site, and prevent runoff directly into watercourses or storm water conveyance systems. Carry out methods of ultimate disposal of these materials in accordance with applicable local, state, and federal health and safety regulations.

3.10 SANITARY FACILITIES

A. Provide construction sites with adequate portable toilets for workers in accordance with applicable health regulations.

3.11 PESTICIDES

A. Use and store pesticides during construction in accordance with manufacturers' guidelines and with local, state, and federal regulations. Avoid overuse of pesticides which could produce contaminated runoff. Take great care to prevent accidental spillage. Never wash pesticide containers in or near flowing streams or storm water conveyance systems.

3.12 CONSTRUCTION METHODS

A. Provide fuel tank protection area and driveway as shown on Drawings.

B. Do not locate fueling area in or near channelized flow area or close to storm sewer conveyance system. Provide sufficient space to allow installation of other erosion and sediment controls to protect those areas.

C. Clear and grub fueling area to remove unsuitable materials. Place geotextile fabric as permeable separator to prevent mixing of coarse aggregate with underlying soil. Overlap fabric minimum of 6 inches. Place coarse aggregate on top of geotextile fabric to minimum depth of 8 inches.

D. Grade protection area and driveway to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system. Provide driveway to fuel tank area with minimum width of 15 feet for one-way traffic and 30 feet for two-way traffic.

E. Place aboveground storage tank on top of cast-in-place or pre-cast foundation. Base size and thickness of foundation on size and weight of tank to be used, with minimum thickness of 6 inches. Enclose concrete foundation by 5-inch by 5-inch concrete curb and extend minimum of 1 foot beyond tank and dispenser assemblies, so that leak and drip can be contained within concrete foundation.

F. Slope concrete foundation minimum of 1 percent toward 6-inch wide by 12-inch long by 4-inch deep sump pit. Install minimum of 2-inch pipe inside sump pit with valve on outside of curb to allow draining of concrete foundation.

G. Install portable concrete Jersey Barrier around concrete foundation. Provide minimum clearance of 2 feet from edge of foundation. In lieu of Jersey barrier, install 4-inch diameter steel pipe bollards around foundation. Bury bollards minimum of 3 feet deep, 3 feet above ground, and 4 feet on center, encased in 12-inch wide concrete foundation.

3.13 MAINTENANCE

A. Inspections shall be conducted by designated health and safety officer qualified to conduct health and safety inspections.

B. Inspect stabilized areas after every storm event and at least once a week. Provide periodic top dressing with additional coarse aggregate to maintain required depth. Repair and clean out damaged control measures used to trap sediment.

C. Inspect fuel tank foundation's bermed area after every storm event and at least once a week. Visually examine storm water contained in tank's bermed foundation area for oil sheen or other obvious indicators of storm water pollution. Properly dispose of storm water when pollutant is present. Record visual examination of storm water discharge in Report noting date and time of examination, name of examiner, observations of water quality, and volume of storm water discharged from bermed area. Keep Report with other storm water pollution control inspection reports on site, in readily accessible location.

3.14 TEMPORARY FUELING AREA CLOSURE

A. Dispose of temporary vehicle and equipment fueling area by removal of sediment and erosion controls properly off site. Owner's Representative will inspect top soils in fueling area and immediate vicinity for evidence of fuel leaks. If Owner's Representative determines that sufficient pollutants have been released, remove soil and properly dispose off site. Other remediation methods may be required.

END OF SECTION

SECTION 01 45 16.32

CONTRACTOR'S QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Measurement and Payment
2. Quality Assurance/Control of Installation
3. References
4. Manufacturer's Field Services and Reports

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality at no additional cost to the Owner.

B. Comply fully with manufacturers' installation instructions, including each step in sequence.

C. Request clarification Owner's Representative before proceeding when manufacturers' instructions conflict with Contract.

D. Comply with specified standards as minimum requirements for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce specified level of workmanship.

1.5 REFERENCES

A. Obtain copies of standards and maintain at job site when required by individual Specification sections.

1.6 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification sections or as required by Owner's Representative, provide material or product suppliers' or manufacturers' technical representative to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, operator training, test, adjust and balance of equipment as applicable and to initiate operation, as required. Conform to minimum time requirements for start-up operations and operator training when defined in Specification sections.

B. At Owner's Representative's request, submit qualifications of manufacturers' representative to Owner's Representative 15 days in advance of required representatives' services. Representative is subject to approval by Owner's Representative.

C. A manufacturers' representative is to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to a manufacturer's written instructions. Submit report within 14 days of observation to Owner's Representative for review.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing laboratory services
2. Requirements of this section apply to testing laboratories employed by the Contractor for approval of manufactured products, materials, including mix designs and quality control of materials
3. Requirements of this section also apply to testing laboratories employed by the Owner for approval of materials and the constructed Work on site.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposal Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Reference Standards

1. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
2. ASTM D 3666 – Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
3. ASTM D 3740 – Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
4. ASTM E 329 – Standard Specification for Minimum Requirements for Agencies Engaged the Testing and/or Inspection of Materials Used in Construction.
5. ISO/IEC 17025 – General Requirements for the Competence of Calibration and Testing Laboratories.

1.4 RELATED REQUIREMENTS

A. To test products and materials and provide certifications as identified in Part 2 Products, in the individual Specification sections, the Contractor shall either

1. Select, employ and pay for services of an independent testing laboratory or laboratories, or
2. Cause its suppliers to perform required inspection and testing using an independent testing laboratory or a qualified in-house laboratory.

B. Owner's Representative may, at its option, observe or witness any and all testing of materials and products which are to be utilized in the construction of the Work as they are being tested by the Contractor's laboratories.

C. Owner will select, employ, and pay for services of an independent testing laboratory to perform inspection and testing identified in Part 3 of individual Specification sections.

D. Employ and pay for services of independent testing laboratory or laboratories to perform inspection and testing identified in Part 2 of individual Specification sections.

E. Employment of testing laboratory by Owner does not relieve the Contractor of obligation to perform the Work in accordance with requirements of Contract Documents.

F. Owner's Representative schedules and monitors Owner's testing laboratory. Provide minimum 24 hours notice of testing to Owner's Representative to avoid delay of the Work.

1.5 QUALIFICATION OF LABORATORY

A. Meet laboratory qualification requirements of ASTM E 329 and applicable requirements of ASTM C 1077, ASTM D 3666, and ASTM D 3740.

B. Meet ISO/IEC 17025 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.

C. If laboratory subcontracts are part of testing services, such work will be placed with laboratory complying with requirements of this Section.

1.6 LABORATORY

A. Owner's testing laboratory will provide and distribute copies of laboratory reports to the distribution list provided by Owner's Representative at the preconstruction conference. Distribution will include download to the Owner's electronic document management system (SharePoint) for the Project.

B. Keep one copy of each laboratory report at site field office for duration of project.

C. Contractor's testing laboratory will provide and distribute copies of laboratory test reports for materials to be incorporated into this Work to the distribution list

provided by Owner's Representative at the preconstruction conference. Distribution will include download to the Owners electronic document management system (Sharepoint) for the Project

D. Laboratories will email material supplier, Contractor, and Owner's Representative no later than close of business on working day following test completion and review, reports which indicate failing test results.

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge requirements of Contract.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume duties of Contractor or the Owner

D. Laboratory has no authority to stop the Work.

1.8 SUBMITTALS (NOT USED)

1.9 CONTRACTOR RESPONSIBILITIES

A. Provide safe access to the Work and to manufacturer's facilities for Owner's Representative, and for testing laboratory personnel.

B. Provide testing laboratory with copy of construction schedule and copy of each update to construction schedule.

C. Notify Owner's Representative and testing laboratory during normal working hours of the day previous to expected time for operations requiring inspection and testing services. When Contractor fails to make timely prior notification, then do not proceed with operations requiring inspection and testing services.

D. Notify Owner's Representative 24 hours in advance when Specification requires presence of Owner's Representative for sampling or testing.

E. Request and monitor testing as required to provide timely results and avoid delay to the Work. Where specified, provide samples to laboratory in sufficient time to allow required test to be performed in accordance with specified test methods before intended use of material.

F. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested; to obtain and handle samples at site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.

G. Arrange with laboratory through Owner's Representative. Payment for additional testing will be made in accordance with Specification Section 00 72 00 - General Conditions of the Contract:

1. Retesting required for failed tests
2. Retesting for nonconforming Work
3. Additional sampling and tests requested beyond specified requirements

4. Insufficient notification of cancellation of tests for Work scheduled but not performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONDUCTING TESTING

A. Conform laboratory sampling and testing specified in individual Specification sections to latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by Owner's Representative.

B. Requirements of this section also apply to those tests for approval of materials, for mix designs and for quality control of materials as performed by employed testing laboratories.

END OF SECTION

SECTION 01 51 36.01

PROCEDURE FOR WATER VALVE ASSISTANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

Operation of valves. Owner employees will operate existing valves. Contractor's employees may operate new valves included in the Project prior to acceptance by the Owner.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements

1.2 MEASUREMENT AND PAYMENT

A. No separate payment will be made for this item. Include the cost of valve operation and valve assistance in Unit Price bid for valves and water mains.

1.3 PROCEDURE

A. Contractor to coordinate with Owner’s Representative for valve assistance.

1.4 SUBMITTALS

A. Submit request for work order planning meetings in accordance with Section 01 33 00 – Submittals.

1.5 CANCELLATION

A. The Owner may cancel a scheduled valve assistance appointment at no extra cost to either party. Cancellation may be caused by bad weather, preparation work taking longer than anticipated or unforeseen delays by one or more of the three parties.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 55 26

TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes traffic control requirements for signs, signals, control devices, flares, lights, as well as construction parking control, English-speaking flag persons, peace officers, designated haul routes and bridging of trenches and excavations.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposal Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Traffic Control and Regulation. Measurement is on a lump sum basis for traffic control and regulation, including submittal of traffic control plan if different from plan shown on Drawings, provision of traffic control devices, and provision of equipment and personnel as necessary to protect Work and public. Amount invoiced shall be based on Schedule of Values submitted for traffic control and regulation.

B. Payment for traffic control is on a lump sum basis and shall be authorized by Owner's Representative in three parts. Partial payments shall be made according to following schedule:

1. Payment of 25 percent traffic control amount shall be authorized when permanent control devices and necessary temporary markings, sufficiently deployed along job site as required to maintain progress of Work, are installed at job site and approved. This limiting percentage shall be prorated based upon extent of Contractor's setup.
2. Payment of 50 percent traffic control amount shall be authorized when the Work commences. This limiting percentage shall be prorated based upon linear footage of pavement replaced, as measured along centerline axis of utility.
3. Payment of 25 percent traffic control amount shall be authorized when the Work is complete and unnecessary permanent and temporary control devices removed. This limiting percentage shall be prorated based upon extent of restoration.
4. Flagmen. No separate payment. Include in price for Traffic Control.

1.3 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Traffic control plan responsive to the current Texas Manual on Uniform Traffic Control Devices (TMUTCD) sealed by Registered Professional Engineer is incorporated into Drawings. If Contractor proposes to implement traffic control without modification to plan provided, submit a letter confirming decision. If Contractor proposes to implement traffic control different than plan provided, submit a traffic control plan in conformance with TMUTCD sealed by Registered Professional Engineer.

C. Submit copies of approved lane closure permits.

D. For both traffic control plan and flag person use, submit Schedules of values within 30 days following notice to proceed. Refer to Specification Section 01 29 73 – Schedule of Values.

E. Provide information and records regarding use of qualified flagmen to verify use of “peace officers” as flagmen in compliance with Contract and Texas law, including but not limited to, Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

F. Provide information and records regarding use of qualified flagmen to verify Contractor’s use of “certified flagmen” as flagmen is in compliance with Contract.

1.4 FLAGMEN

A. Use flagmen, qualified as described under Paragraph 1.4.B, Uniformed Peace Officers, and Paragraph 1.4.C, Certified Flagmen, to control, regulate, and direct even flow and movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual who has full-time employment as peace officer and receives compensation as flagman for private employment as individual employee or independent contractor. Private employment may be either employee-employer relationship or on an individual basis. Flagman may not be in employ of another peace officer and may not be a reserve peace officer.

1. Peace officer is defined as:

   a. Sheriffs and their deputies

   b. Constables and deputy constables

   c. Marshals or police officers of an incorporated city, town, or village

   d. As otherwise provided by Article 2.12, Texas Code of Criminal Procedure, as amended

2. Individual who has full-time employment as a peace officer is one who is actively employed in a full-time capacity as a peace officer working, on average, a minimum of 32 paid hours per week, being paid a rate of pay not less than prevailing minimum hourly wage rate set by federal Wage and Hour Act and entitled to full benefits of participation in retirement plan,

vacation, holidays, and insurance benefits. A reserve peace officer does not qualify, under this definition, as a peace officer.

C. Certified Flagman: Individual who receives compensation as flagman and meets the following qualifications and requirements:

1. Formally trained and certified in traffic control procedures.
2. Required to wear distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices
3. English speaking, with Spanish as advantageous, but not required, primary, or secondary language.
4. Paid as Certified Flagman, equivalent to hourly wage rate set for Rough Carpenter under Specification Section 00 73 43 – Wage Scale for Construction.
5. Required to carry proof of training/certification and photographic identification card issued by training institute to allow Owner's Representative to easily determine necessary full-time traffic control is actually provided when and where construction work encroaches upon traffic lanes.

PART 2 - PRODUCTS

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with Texas State Manual on Uniform Traffic Control Devices.

B. Traffic Barriers, Cones and Drums, Flares and Lights: As approved by local jurisdictions.

PART 3 - EXECUTION

3.1 PUBLIC ROADS

A. Abide by laws and regulations of governing authorities when using public roads. If Work requires public roads be temporarily impeded or closed, obtain approvals from governing authorities and pay permits before starting any Work. Coordinate activities with Owner's Representative.

B. Maintain 10-foot-wide, all-weather lane adjacent to Work areas for use of emergency vehicles. Keep all-weather lane free of construction equipment and debris.

C. Cover or remove the permanent signs and construction signs that are incorrect or that do not apply to the current situation for a particular phase. Do not mount signs on drums or barricades, except those listed in the latest Barricades and Construction standard sheets.

D. Place positive barriers to protect drop-off conditions greater than 1 FT within the clear zones that remain overnight.

E. Construction activities not to obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by the Owner.

F. Maintain local driveway access to residential and commercial properties adjacent to Work areas at all times. Use all-weather materials as approved by Owner's Representative when maintaining temporary driveway access to commercial and residential driveways.

G. Cleanliness of Surrounding Streets: Keep streets used for entering and leaving job area free of excavated material, debris, and foreign material resulting from construction operations.

H. Provide Owner's Representative 1-week notice prior to implementing each approved traffic control phase.

I. Notify local schools, churches, bus lines, police department, commercial businesses, and fire department in writing of construction a minimum of 5 working days prior to beginning Work.

J. Remove existing signing and striping that are in conflict with construction activities or may cause driver confusion.

K. Provide safe access for pedestrians along major cross streets.

L. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

M. Do not close more than two consecutive esplanade openings at a time without prior approval by Owner's Representative.

3.2 CONSTRUCTION PARKING CONTROL AND ACCESS

A. Control vehicular parking to prevent interference with public traffic and parking, and access by emergency vehicles.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

D. Contractor and all personnel shall not utilize adjacent private driveways for access to project site unless Contractor receives written approval from landowner(s).

3.3 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals including but not limited to loop detectors, traffic signal conduits, traffic signal wiring, and crosswalk signals required to complete Work. Notify, a minimum of 60 days in advance, the agency concerning control boxes and switchgear. The agency will perform service, programming, or adjustments, to signal boxes and switchgear should this work be required during construction.

B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations. Establish notices, signs, and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from particular cross-over. Use two signs for each cross-over.

E. Replace existing traffic control devices in project area.

F. Owner's Representative may direct Contractor to make minor traffic control sign adjustments to eliminate driver confusion and maintain traffic safety during construction at no additional payment.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. Whenever necessary, bridge trenches and excavation to permit an unobstructed flow of traffic. Provide steel plates that can be laid across construction areas and major drives of commercial businesses.

B. Secure bridging against displacement by using adjustable cleats, angles, bolts, or other devices whenever bridge is installed:

1. On existing bus route.
2. When more than 5 percent of daily traffic is comprised of commercial or truck traffic.
3. When more than two separate plates are used for bridge.
4. When bridge is to be used for more than 5 consecutive days.

C. Install bridging to operate with minimum noise.

D. Adequately shore trench or excavation to support bridge and traffic.

E. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials (premix) to feather edges of plates to minimize wheel impact on secured bridging.

F. Use steel plates of sufficient thickness to support H-20 loading, truck or lane, that produces maximum stress.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION, AND DIRECTION

A. Use flagmen to control, regulate, and direct even flow and movement of vehicular and pedestrian traffic including but not limited to the following conditions:

1. Where multi-lane vehicular traffic must be diverted into single lane vehicular traffic
2. Where vehicular traffic must change lanes abruptly
3. Where construction equipment must enter or cross vehicular traffic lanes and walks
4. Where construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks
5. Where traffic regulation is needed due to rerouting of vehicular traffic around Work site.
6. Other areas of Work where construction activities might affect public safety and convenience.

B. Use and maintain flagmen at points for periods of time as may be required to provide for public safety and convenience of travel.

C. Use of flagmen is for purpose of assisting in regulation of traffic flow and movement and does not relieve Contractor of full responsibility for taking other steps and providing other flaggers or personnel as Contractor may deem necessary to protect Work and public.

3.9 INSTALLATION STANDARDS

A. Work in other phases shall be permitted, provided 1) phases are not continuous to one work is being done in presently, 2) installation of utility occurs in only one phase. Keep work and operation in second phase to an absolute minimum. Perform work in no more than two phases at a time. Authorization to perform work in second phase shall not relieve any responsibility of completing backfilling and paving operations in accordance with Contract.

B. Place temporary pavement with a single lane closure, in accordance with TMUTCD.

C. Reinstall temporary and permanent pavement markings as directed by Owner's Representative. Alternative markings shall be considered when marking manufacturer's weather conditions cannot be met. These alternatives are to be

submitted and approved by Owner's Representative prior to installation. No extra payment will be made for use of alternative markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Designate individual to be responsible for maintenance of traffic handling around construction area. Individual must be accessible at all times to immediately correct any deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings. Give name, address, and telephone number of designated individual to Owner's Representative.

B. Make daily inspections of signs, barricades, drums, lamps, and temporary pavement markings to verify that these are visible, in good working order, and conform with traffic handling plans and directions of Owner's Representative. When not in compliance, immediately bring equipment and materials into compliance by replacement, repair, cleaning, relocation, and realignment.

C. Keep equipment and materials, especially signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Owner's Representative shall decide if damaged or vandalized signs, drums, and barricades can be reused.

END OF SECTION

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SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for tree and plant protection.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unless a separate bid item has been established, no separate payment will be made for tree and plant protection specified herein. Include cost in price bid for related work items.

1.3 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit name and experience of qualified Arborist to Owner's Representative.

1.4 PROJECT CONDITIONS WHEN TREES AND PLANTS ARE IDENTIFIED TO REMAIN

A. Preserve and protect existing trees and plants from foliage, branch, trunk, or root damage that could result from construction operations when trees and plants are identified to remain.

B. Do not allow any vehicular traffic, construction equipment, parking of vehicles or stockpiling of excavated material or construction materials within protected tree root zone areas. Refer to Section 1.6 DEFINITIONS, for Dripline/Root Zone Area definition.

C. Prevent the following types of damage:

1. Compaction of root zone area by equipment, vehicles, foot traffic or materials storage.
2. Suffocating roots by placing soil in excess of three inches (3") within root zone areas, including placement of any select fill or soil with high clay content.
3. Trunk and limb damage resulting from contact with equipment and vehicles.
4. Poisoning by pouring solvents, fuel, and other injurious materials on or near root zone areas or in areas where such materials will leak or wash into root zone areas.

5. Changing soil pH within root zones by depositing concrete, powdered lime or other materials used to stabilize or dehydrate soils.
6. Cutting roots measuring one inch (1") in diameter and larger within protected areas unless required for root pruning.
7. Scorching of foliage, twigs and limbs caused by direct contact with expulsion of hot exhaust from equipment or vehicles.
8. Branch damage due to improper pruning or trimming.
9. Damage from permanently altering drainage patterns near root zones.
10. Trunk and branch damage resulting from nailing or bolting.

1.5 DAMAGE ASSESSMENT

A. When trees other than those designated for removal are destroyed or badly damaged as result of construction operations, remove and replace with same size, species, and variety up to and including 8 inches in trunk diameter. Any tree larger than 8 inches in diameter shall be replaced with 8-inch diameter tree of same species and variety and total contract amount shall be reduced by amount determined from following International Shade Tree Conference formula: 0.7854 x D2 x $38.00 where D is diameter in inches of tree or shrub trunk measured 12 inches above grade.

1.6 DEFINITIONS

A. Dripline/Root Zone Area - The ground area delineated by the branch spread of a single plant or group of plants. This area is considered the most critical area of roots and should be protected, excluding the area within the street located between curbs.

B. Zero Curb Cut - The process in which required street work is conducted without cutting or otherwise disturbing soil located immediately behind the existing curb.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Protection Fencing - Orange, plastic mesh fencing, four feet (4') in height with six feet (6') high steel T-bar posts. Set posts eighteen inches (18") into ground. Stretch fencing material taut prior to securing.

B. Fertilizer - A low salt, slow release fertilizer containing twenty-seven percent (27%) nitrogen, nine percent (9%) phosphorus and nine percent (9%) potassium (potash) or similar.

C. Plastic Vapor Barrier - Polyethylene sheeting at least 6-mil thickness and three feet width to prevent leaching of stabilized material into native soil.

D. Tree Replacements - Shall be as approved by Owner’s Representative as necessary.

PART 3 - EXECUTION

3.1 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

A. Except for trees shown on Drawings or determined by Owner's Representative to be removed or relocated, trees within Project area are to remain in place, protected from damage and maintained by Contractor.

B. If required by the Project specifications, employ a qualified Arborist. The Arborist must be approved by Owner's Representative and shall have a minimum of 5 (five) years of experience in the field of tree protection.

C. Perform the following services as required by construction activities for trees that remain:

1. Trimming

   a. Trees shall be pruned in accordance ANSI A300 (Part 1) - 2001 Pruning Revision of ANSI A300-1995 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. Pruning shall be done by a professional arborist who has received training in proper pruning techniques.

   b. Pruning shall not alter the natural shape or character of the tree or leave holes in the canopy. Trees and shrubs should be pruned for balance as well as to maintain proper form and branching habit.

   c. Cut limbs at branch collar. No stubs should remain on trees. Branch cuts should not gouge outer layer of tree structure or trunk.

2. Root Pruning

   a. When excavating with equipment within the root zone area is unavoidable and roots cannot be preserved, root prune prior to excavation to minimize damage to the portion of the root system that will remain.

   b. Prune roots using a conventional trenching machine. Trench along the proposed edge of excavation limits to a depth of three feet (3'). Do not allow ripping of roots with a backhoe or other equipment.

   c. Following trenching with the machine, re-cut roots measuring one inch (1") in diameter and larger using appropriate sharpened, pruning shears or pruning saws to make a clean, smooth-cut surface. Cut roots flush with edge of soil to limit root exposure.

   d. Backfill trench in a manner that will not allow settling using clean, native soil.

3. Fertilizing and Watering

   a. Trees should be fertilized in accordance with the American National Standard for tree fertilization ANSI A300 (Part 2) - 1998 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (Fertilization).

b. Deep root fertilize all trees that have received disturbance or damage to their root zone area.

c. Fertilize entire root zone area within the dripline of the tree and continue ten feet (10') beyond the dripline.

d. Mixture shall be injected into the top ten inches (10") of soil, under pressure of one hundred and fifty pounds per square inch (150 psi) to two hundred pounds per square inch (200 psi). Mix and apply per product label instructions.

e. Inject one-half gallon (1/2) of solution at a depth of ten inches (10") on spacing of three feet (3') between injection points.

f. Fertilizer shall be mixed in a tank with mechanical agitation.

g. Fertilizer to be added to tank and mixed on site.

h. During periods of inadequate rainfall, water trees once weekly to saturate soil to a depth of six inches (6") to eight inches (8") within root zones. Allow soils to dry between watering. Do not allow soils to remain wet.

4. Water areas currently being served by private sprinkler systems to maintain health of existing landscapes if the affected systems are temporarily taken out of service due to construction activities.

5. Contractor's option with Owner's Representative's permission, shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.2 PROTECTION

A. Construction Methods

1. General

a. Contractor shall attend a pre-construction meeting conducted by the Owner's Representative to review tree preservation requirements and sequence of services for the construction process.

b. Protect tree limbs, trunks and foliage from direct exposure to hot exhaust from equipment and vehicles by providing adequate exhaust pipe deflectors.

c. Cover exposed roots within 24 hours to reduce damage caused by desiccation. Roots may be covered with soil or mulch to help protect them from drying.

d. Protect root zone areas from damage that may result from soil compaction or from noxious materials in solution caused by run-off or spillage during mixing and placement of construction materials, or drainage from stored materials.

e. Minimize cut to two inches (2") below grade when installing silt fence within tree root zones or anchor base of fabric on grade using gravel or staples. Do not cut roots 1" in diameter or larger.

f. Site preparation work and/or construction work shall not begin in any area where tree preservation measures have not been completed and approved by the Owner's Representative.

2. Preparation

a. Contractor shall not allow any vehicular traffic, parking of vehicles or stockpiling of excavated material or construction material within the root zone area of trees to be preserved.

b. When access within protected root zone areas by equipment traffic or frequent foot traffic cannot be avoided, contact Owner's Representative for review prior to entrance. Place a three-quarter inch (3/4") thick layer of plywood on natural grade within root zones to minimize soil compaction. Overlap edges of plywood by six inches (6") to twelve inches (12") to ensure adequate coverage. This is not acceptable bridging for driving over exposed tree roots. Exposed roots should not be driven over.

c. Contractor shall notify Owner's Representative if existing tree locations differ from locations represented on construction drawings. The tree location and dripline/root zone area as observed in the field shall supersede that outlined on construction plans.

3. Tree Protection Fencing

a. Each tree located adjacent to proposed soil excavation shall be protected with a tree protection fence or as designated on the plans. Fence locations shall be approved by Owner's Representative.

b. Contractor shall not remove or relocate tree protection fencing and shall not operate within the limits shown without approval of the Owner's Representative.

c. Fences shall be placed in continuous alignment to protect a tree or group of trees.

d. Posts shall be installed on eight-foot (8') centers at eighteen inches (18") below grade. The fencing shall be continuous between posts, shall be pulled taut prior to securing to posts, and shall be firmly attached to the posts with a minimum of three (3) wire ties.

e. Place fencing in a manner that will not obstruct traffic site lines at curbs, intersections or driveways.

f. Fencing shall be removed only after all work within the immediate area is complete.

g. Contractor shall immediately repair fences if damage occurs at no additional charge to client.

4. Excavation within Root Zone Areas

   a. For excavation within root zone areas, where required for personal safety, provide excavation protection by using vertical-wall-shoring techniques at excavations to minimize excavation width. Do not bench cut or step cut edge where such techniques will encroach on root zone areas.

   b. If roots are encountered and must be severed, roots measuring one inch (1") in diameter and larger shall be cut using a sharpened pruning instrument to leave a smooth, clean-cut surface.

5. Zero Curb Cut and Vapor Barrier Installation

   a. Where existing curb is to be removed within tree root zone areas, do not disturb soil immediately back of curb. Do not allow forms and stakes to disturb roots.

   b. A vapor barrier shall be installed to provide a non-leaching barrier between any stabilized material and/or concrete and tree roots and soils.

   c. Vapor barrier shall be installed vertically to a depth of five inches (5") below limits of stabilized material. Vapor barrier to be extended ten inches (10") above natural grade and ten feet (10') beyond the dripline limits of the tree. Trim vertical vapor barrier to approximately one inch (1") above grade after installation of final grade.

6. Boring/Tunneling

   a. In areas indicated, bore under root systems of trees at a minimum depth of four feet (4') from the top of pipe to the soil surface at natural grade.

   b. Bore pits and receiving pits shall be located outside of protected root zone areas.

   c. Equipment and material shall be positioned outside of protected root zone areas. When access within protected root zone area by equipment traffic or frequent foot traffic cannot be avoided, place a three-quarter inch (3/4") thick layer of plywood on natural grade within root zones to minimize soil compaction, refer to Section 3. 2, A, 2.

7. Trunk Barricading

   a. Install trunk barricading to protect trees in close proximity of moving or mechanical equipment and construction work when work is required within the tree protection fencing as shown on the plans.

   b. Place trunk barricading around entire tree trunks to protect tree trunks located within five feet (5') of construction activities.

   c. Install 2x4's or 2x6's (5-foot to 6-foot lengths) spaced 3 inches (3") apart around the circumference of the tree trunk.

d. Tie in place with 9 to 12 gauge steel wire.

B. Sequence of Tree Protection and Services

1. Fertilize trees affected by construction between the months of October and May.
2. Prune/trim trees for clearance and safety.
3. Root Prune trees.
4. Place tree protection fence and trunk barricades to protect trees. Place fencing prior to any construction activities.
5. Remove tree protection upon completion of project.

C. Existing Stressed and Declining Trees

1. Prior to beginning the construction phase, trees located within the right-of-way should be reviewed and trees that appear to be stressed or declining in health should be documented. Immediately notify the Owner's Representative of any dead and dying trees.

D. Accidental Spills of Toxic Materials

1. Concrete, lime or other chemicals placed or accidentally spilled within root zone protection areas shall be completely removed. Contaminated soil shall be completely removed at the time of the spill and removed by hand shovel. Fresh soil shall be added as necessary to bring the soil level to that of natural grade.

3.3 MAINTENANCE OF NEWLY PLANTED TREES AND REPLANTED TREES

A. Show proof of capacity to water during dry periods.

B. Guarantee trees planted for this Project shall remain alive and healthy at least until end of 1-year warranty period.

1. Within 4 weeks notice from Owner's Representative, replace dead trees or trees that in opinion of Owner's Representative have become unhealthy, unsightly or have lost their natural shape as result of additional growth, improper pruning, maintenance or weather conditions.
2. When tree must be replaced, guarantee period begins on date of tree replacement, subject to Owner's Representative's inspection, for no less than 1 year.
3. Straighten leaning trees and bear entire cost.
4. Dispose of trees rejected by Owner's Representative and bear entire cost.

END OF SECTION

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SECTION 01 57 13.01

TPDES REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

Preparation of Storm Water Pollution Prevention Plan and notifications to TCEQ.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

C. Measure and pay for pollution prevention implementation, including maintenance, inspections, and reporting for all pollution prevention measures on a per month basis.

1.3 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:

1. Disturbs 5 acres or more, or
2. Disturbs less than 5 acres but is part of a larger common plan of development that will disturb 5 acres or more of land.

C. Small Construction Activity: Project that:

1. Disturbs 1 or more acres but less than 5 acres, or
2. Disturbs less than 1 acre but is part of a larger common plan of development that will ultimately disturb 1 or more acres but less than 5 acres.

D. TPDES Operator:

1. The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

1.4 SUBMITTALS (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following Part III of the Construction General Permit.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

3.2 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

A. Fill out, sign, and date TCEQ Form 20022 (3/5/2008) Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000), **ATTACHMENT 1** of this Section 01 57 13.01 – TPDES Requirements.

B. Submit the Notice of Intent by one of the following methods:

1. Submit online at TCEQ ePermits (www6.tceq.state.tx.us/steers) and pay the $225 application fee. Transmit a copy of the electronic certificate provided by TCEQ to Owner's Representative.

2. Send a $325 check and completed TCEQ Form 20022 (3/5/2008) to the Texas Commission on Environmental Quality. Transmit a copy of the check and completed form to Owner's Representative.

C. Owner will complete a separate Owner's copy of TCEQ Form 20022 (3/5/2008) for NOI, and will submit Notice, along with application fee, to the TCEQ.

D. Submission of the Notice of Intent form by Contractor to TCEQ is required a minimum of 7 days before Commencement of Construction Activities.

3.3 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR150000, "Construction Site Notice," **ATTACHMENT 2** of this Section 01 57 13.01 – TPDES Requirements.

B. Transmit the signed Construction Site Notice to Owner's Representative at least 7 days prior to Commencement of Construction Activity.

3.4 CERTIFICATION REQUIREMENTS

A. Fill out TPDES Operator's Information form, **ATTACHMENT 3** of this Section 01 57 13.01 – TPDES Requirements, including Contractor's name, address, and telephone number and the names of persons or firms responsible for

maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information.

B. Contractor and Subcontractors shall sign and date the Contactor's/Subcontractor's Certification for TPDES Permitting, **ATTACHMENT 4** of this Section 01 57 13.01 – TPDES Requirements. Include this certification with other Project certification forms.

C. Submit properly completed certification forms to Owner's Representative for review before beginning construction operations.

D. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form, **ATTACHMENT 5** of this Section 01 57 13.01 – TPDES Requirements; to record maintenance inspections and repairs.

3.5 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to Owner's Representative.

3.6 REQUIRED NOTICES

A. Post the following notices from the effective date of the SWP3 until the date of final site stabilization as defined in the Construction General Permit:

1. Post the TPDES permit number for Large Construction Activity, or a signed TCEQ Construction Site Notice for Small Construction Activity. Signed copies of the Contractor's NOI must also be posted.

2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.

   a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with Owner's Representative to conform to requirements of the Construction General Permit.

   b. If Project is a linear construction project (e.g., road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.

3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.
4. Post a notice of waste disposal procedures in a readily visible location on site.

3.7 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.

C. Prepare description of controls to reduce pollutants generate from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.8 NOTICE OF TERMINATION

A. Submit an NOT, **ATTACHMENT 6** of this Section 01 57 13.01 – TPDES Requirements, to Owner's Representative within 10 days after:

1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
2. Another operator has assumed control over all areas of the site that have not been stabilized; and
3. All silt fences and other temporary erosion controls have either been removed scheduled to be removed as defined in the SWP3, or transferred to a new operator, if the new operator has sought permit coverage.

B. Owner's Representative will complete NOT and submit Contractor's notices to the TCEQ and MS4 entities.

END OF SECTION

ATTACHMENT 1

Notice of Intent (NOI) for an Authorization for Stormwater Discharges Associated with Construction Activity under TPDES General Permit TXR150000

IMPORTANT INFORMATION

Please read and use the General Information and Instructions prior to filling out each question in the NOI form.

Use the NOI Checklist to ensure all required information is completed correctly. **Incomplete applications delay approval or result in automatic denial.**

Once processed your permit authorization can be viewed by entering the following link into your internet browser: http://www2.tceq.texas.gov/wq_dpa/index.cfm or you can contact TCEQ Stormwater Processing Center at 512- 239- 3700.

ePERMITS

Effective September 1, 2018, this paper form must be submitted to TCEQ with a completed electronic reporting waiver form (TCEQ-20754).

To submit an NOI electronically, enter the following web address into your internet browser and follow the instructions: https://www3.tceq.texas.gov/steers/index.cfm

APPLICATION FEE AND PAYMENT

The application fee for submitting a paper NOI is $325. The application fee for electronic submittal of a NOI through the TCEQ ePermits system (STEERS) is $225.

Payment of the application fee can be submitted by mail or through the TCEQ ePay system. The payment and the NOI must be mailed to separate addresses. To access the TCEQ ePay system enter the following web address into your internet browser: http://www.tceq.texas.gov/epay.

Provide your payment information for verification of payment:

- If payment was mailed to TCEQ, provide the following:
  - Check/Money Order Number: Click here to enter text
  - Name printed on Check: Click here to enter text
- If payment was made via ePay, provide the following:
  - Voucher Number: Click here to enter text
  - A copy of the payment voucher is attached to this paper NOI form.

ATTACHMENT 1

RENEWAL (This portion of the NOI is not applicable after June 3, 2018)

Is this NOI for a renewal of an existing authorization? ☐ Yes ☐ No

If Yes, provide the authorization number here: TXR15 Click here to enter text

NOTE: If an authorization number is not provided, a new number will be assigned.

SECTION 1. OPERATOR (APPLICANT)

a) If the applicant is currently a customer with TCEQ, what is the Customer Number (CN) issued to this entity? CN Click here to enter text

(Refer to Section 1.a) of the Instructions)

b) What is the Legal Name of the entity (applicant) applying for this permit? (The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal document forming the entity.)

Click here to enter text

c) What is the contact information for the Operator (Responsible Authority)?

Prefix (Mr. Ms. Miss): Click here to enter text

First and Last Name: Click here to enter text Suffix: Click here to enter text

Title: Click here to enter text Credentials: Click here to enter text

Phone Number: Click here to enter text Fax Number: Click here to enter text

E- mail: Click here to enter text

Mailing Address: Click here to enter text

City, State, and Zip Code: Click here to enter text

Mailing Information if outside USA:

Territory: Click here to enter text

Country Code: Click here to enter text Postal Code: Click here to enter text

d) Indicate the type of customer:

☐ Individual	☐ Federal Government
☐ Limited Partnership	☐ County Government
☐ General Partnership	☐ State Government
☐ Trust	☐ City Government
☐ Sole Proprietorship (D.B.A.)	☐ Other Government
☐ Corporation	☐ Other: Click here to enter text
☐ Estate	

e) Is the applicant an independent operator? ☐ Yes ☐ No

ATTACHMENT 1

(If a governmental entity, a subsidiary, or part of a larger corporation, check No.)

f) Number of Employees. Select the range applicable to your company.

☐ 0- 20 ☐ 251- 500

☐ 21- 100 ☐ 501 or higher

☐ 101- 250

g) Customer Business Tax and Filing Numbers: (**Required** for Corporations and Limited Partnerships. **Not Required** for Individuals, Government, or Sole Proprietors.)

State Franchise Tax ID Number: Click here to enter text.

Federal Tax ID: Click here to enter text.

Texas Secretary of State Charter (filing) Number: Click here to enter text.

DUNS Number (if known): Click here to enter text.

SECTION 2. APPLICATION CONTACT

Is the application contact the same as the applicant identified above?

☐ Yes, go to Section 3

☐ No, complete this section

Prefix (Mr. Ms. Miss): Click here to enter text.

First and Last Name: Click here to enter text. Suffix: Click here to enter text.

Title: Click here to enter text. Credential: Click here to enter text.

Organization Name: Click here to enter text.

Phone Number: Click here to enter text. Fax Number: Click here to enter text.

E- mail: Click here to enter text.

Mailing Address: Click here to enter text.

Internal Routing (Mail Code, Etc.): Click here to enter text.

City, State, and Zip Code: Click here to enter text.

Mailing information if outside USA:

Territory: Click here to enter text.

Country Code: Click here to enter text. Postal Code: Click here to enter text.

SECTION 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

a) If this is an existing permitted site, what is the Regulated Entity Number (RN) issued to this site? RN Click here to enter text.

(Refer to Section 3.a) of the Instructions)

ATTACHMENT 1

b) Name of project or site (the name known by the community where it's located): Click here to enter text

c) In your own words, briefly describe the type of construction occurring at the regulated site (residential, industrial, commercial, or other): Click here to enter text

d) County or Counties (if located in more than one): Click here to enter text

e) Latitude: Click here to enter text Longitude: Click here to enter text

f) Site Address/Location

If the site has a physical address such as 12100 Park 35 Circle, Austin, TX 78753, complete *Section A*.

If the site does not have a physical address, provide a location description in *Section B*. Example: located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1.

Section A:

Street Number and Name: Click here to enter text

City, State, and Zip Code: Click here to enter text

Section B:

Location Description: Click here to enter text

City (or city nearest to) where the site is located: Click here to enter text

Zip Code where the site is located: Click here to enter text

SECTION 4. GENERAL CHARACTERISTICS

a) Is the project or site located on Indian Country Lands?

☐ Yes, do not submit this form. You must obtain authorization through EPA Region 6.

☐ No

b) Is your construction activity associated with a facility that, when completed, would be associated with the exploration, development, or production of oil or gas or geothermal resources?

☐ Yes. Note: The construction stormwater runoff may be under jurisdiction of the Railroad Commission of Texas and may need to obtain authorization through EPA Region 6.

☐ No

c) What is the Primary Standard Industrial Classification (SIC) Code that best describes the construction activity being conducted at the site? Click here to enter text

d) What is the Secondary SIC Code(s), if applicable? Click here to enter text

e) What is the total number of acres to be disturbed? Click here to enter text

f) Is the project part of a larger common plan of development or sale?

ATTACHMENT 1

☐ Yes

☐ No. The total number of acres disturbed, provided in e) above, must be 5 or more. If the total number of acres disturbed is less than 5, do not submit this form. See the requirements in the general permit for small construction sites.

g) What is the estimated start date of the project? Click here to enter text.

h) What is the estimated end date of the project? Click here to enter text.

i) Will concrete truck washout be performed at the site? ☐ Yes ☐ No

j) What is the name of the first water body(ies) to receive the stormwater runoff or potential runoff from the site? Click here to enter text.

k) What is the segment number(s) of the classified water body(ies) that the discharge will eventually reach? Click here to enter text.

l) Is the discharge into a Municipal Separate Storm Sewer System (MS4)?

☐ Yes ☐ No

If Yes, provide the name of the MS4 operator: Click here to enter text.

Note: The general permit requires you to send a copy of this NOI form to the MS4 operator.

m) Is the discharge or potential discharge from the site within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer, as defined in 30 TAC Chapter 213?

☐ Yes, complete the certification below.

☐ No, go to Section 5

I certify that the copy of the TCEQ- approved Plan required by the Edwards Aquifer Rule (30 TAC Chapter 213) that is included or referenced in the Stormwater Pollution Prevention Plan will be implemented. ☐ Yes

SECTION 5. NOI CERTIFICATION

a) I certify that I have obtained a copy and understand the terms and conditions of the Construction General Permit (TXR150000). ☐ Yes

b) I certify that the full legal name of the entity applying for this permit has been provided and is legally authorized to do business in Texas. ☐ Yes

c) I understand that a Notice of Termination (NOT) must be submitted when this authorization is no longer needed. ☐ Yes

d) I certify that a Stormwater Pollution Prevention Plan has been developed, will be implemented prior to construction and to the best of my knowledge and belief is compliant with any applicable local sediment and erosion control plans, as required in the Construction General Permit (TXR150000). ☐ Yes

Note: For multiple operators who prepare a shared SWP3, the confirmation of an operator may be limited to its obligations under the SWP3, provided all obligations are confirmed by at least one operator.

ATTACHMENT 1

SECTION 6. APPLICANT CERTIFICATION SIGNATURE

Operator Signatory Name: Click here to enter text

Operator Signatory Title: Click here to enter text

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature (use blue ink): _____ Date: _____

ATTACHMENT 1

NOTICE OF INTENT CHECKLIST (TXR150000)

Did you complete everything? Use this checklist to be sure!

Are you ready to mail your form to TCEQ? Go to the General Information Section of the Instructions for mailing addresses.

Confirm each item (or applicable item) in this form is complete. This checklist is for use by the applicant to ensure a complete application is being submitted. **Missing information may result in denial of coverage under the general permit.** (See NOI process description in the General Information and Instructions.)

APPLICATION FEE

If paying by check:

☐ Check was mailed **separately** to the TCEQs Cashier's Office. (See Instructions for Cashier's address and Application address.)

☐ Check number and name on check is provided in this application.

If using ePay:

☐ The voucher number is provided in this application and a copy of the voucher is attached.

RENEWAL

☐ If this application is for renewal of an existing authorization, the authorization number is provided.

OPERATOR INFORMATION

☐ Customer Number (CN) issued by TCEQ Central Registry

☐ Legal name as filed to do business in Texas. (Call TX SOS 512- 463- 5555 to verify.)

☐ Name and title of responsible authority signing the application.

☐ Phone number and e- mail address

☐ Mailing address is complete & verifiable with USPS. www.usps.com

☐ Type of operator (entity type). Is applicant an independent operator?

☐ Number of employees.

☐ For corporations or limited partnerships – Tax ID and SOS filing numbers.

☐ Application contact and address is complete & verifiable with USPS. http://www.usps.com

REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

☐ Regulated Entity Number (RN) (if site is already regulated by TCEQ)

☐ Site/project name and construction activity description

☐ County

☐ Latitude and longitude http://www.tceq.texas.gov/gis/sqmaview.html

TCEQ- 20022 Checklist (03/06/2018) Page 1

ATTACHMENT 1

☐ Site Address/Location. Do not use a rural route or post office box.

GENERAL CHARACTERISTICS

☐ Indian Country Lands –the facility is not on Indian Country Lands.

☐ Construction activity related to facility associated to oil, gas, or geothermal resources

☐ Primary SIC Code that best describes the construction activity being conducted at the site. www.osha.gov/oshstats/sicser.html

☐ Estimated starting and ending dates of the project.

☐ Confirmation of concrete truck washout.

☐ Acres disturbed is provided and qualifies for coverage through a NOI.

☐ Common plan of development or sale.

☐ Receiving water body or water bodies.

☐ Segment number or numbers.

☐ MS4 operator.

☐ Edwards Aquifer rule.

CERTIFICATION

☐ Certification statements have been checked indicating Yes.

☐ Signature meets 30 Texas Administrative Code (TAC) §305.44 and is original.

ATTACHMENT 1

Texas Commission on Environmental Quality
General Permit Payment Submittal Form

Use this form to submit your Application Fee only if you are mailing your payment.

Instructions:

- Complete items 1 through 5 below:
- Staple your check in the space provided at the bottom of this document.
- *Do not mail this form with your NOI form.*
- *Do not mail this form to the same address as your NOI.*

Mail this form and your check to either of the following:

By Regular U.S. Mail
Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC- 214
P.O. Box 13088
Austin, TX 78711- 3088

By Overnight or Express Mail
Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC- 214
12100 Park 35 Circle
Austin, TX 78753

Fee Code: GPA General Permit: TXR150000

1. Check or Money Order No: Click here to enter text
2. Amount of Check/Money Order: Click here to enter text
3. Date of Check or Money Order: Click here to enter text
4. Name on Check or Money Order: Click here to enter text
5. NOI Information:

   If the check is for more than one NOI, list each Project or Site (RE) Name and Physical Address exactly as provided on the NOI. **Do not submit a copy of the NOI with this form, as it could cause duplicate permit application entries!**

   If there is not enough space on the form to list all of the projects or sites the authorization will cover, then attach a list of the additional sites.

   Project/Site (RE) Name: Click here to enter text

   Project/Site (RE) Physical Address: Click here to enter text

Staple the check or money order to this form in this space.

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ATTACHMENT 2

CONSTRUCTION SITE NOTICE

FOR THE

Texas Commission on Environmental Quality (TCEQ)

Storm Water Program

TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.D.2** of the TCEQ General Permit Number TXR150000 for discharges of storm water runoff from construction sites. Additional information regarding the TCEQ storm water permit program may be found on the internet at:

http://www.tceq.state.tx.us/permitting/water_quality/stormwater/TXR15_AIR.html

Contact Name and Phone Number:	
Project Description: (Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized)	
Location of Storm Water Pollution Prevention Plan :	

For Construction Sites Authorized Under Part II.D.2. (Obtaining Authorization to Discharge) the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.D.2. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A storm water pollution prevention plan has been developed and implemented according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4 system. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

_____ _____

Signature and Title Date

ATTACHMENT 3

TPDES OPERATOR'S INFORMATION

Owner's Name and Address:

_____
_____
_____
_____
Telephone: _____

Contractor's Names and Addresses:

General Contractor:

_____
_____
_____
_____
Telephone: _____

Site Superintendent:

_____
_____
_____
_____
Telephone: _____

Erosion Control and Maintenance Inspection:

_____
_____
_____
_____
Telephone: _____

Subcontractor's Names and Addresses:

_____	_____
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____

Note: Insert name, address, and telephone number of persons or firms.

ATTACHMENT 4

CONTRACTOR'S / SUBCONTRACTOR'S

CERTIFICATION FOR TPDES PERMITTING

I certify under penalty of law that I understand the terms and conditions of TPDES General Permit No. TXR150000 and the Storm Water Pollution Prevention Plan for the construction site identified as part of this certification.

Signature: _____

Name: (printed or typed) _____

Title: _____

Company: _____

Address: _____

Date: _____

Signature: _____

Name: (printed or typed) _____

Title: _____

Company: _____

Address: _____

Date: _____

Signature: _____

Name: (printed or typed) _____

Title: _____

Company: _____

Address: _____

Date: _____

ATTACHMENT 5

EPA NPDES Construction Inspection Form

The following inspection is being performed in compliance with Part IV.D.4. of the NPDES Region 6 Storm Water Construction General Permit [63 Fed. Reg. 36502] and being retained in accordance with Part V of the Permit. Qualified personnel (provided by the permittee or cooperatively by multiple permittees) shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, placement and effectiveness of structural control measures, and locations where vehicles enter or exit the site. Inspections shall be performed at least once every 14 days and within 24 hours of the end of a storm event of 0.5 inches or greater. Where sites have been temporarily stabilized, runoff is unlikely due to winter conditions, or during seasonal arid periods in arid areas (0-10 inches of rainfall annually) and semi-arid areas (10-20 inches annually) such inspections shall be conducted at least once every month. This form is primarily intended for use with construction projects in Texas and New Mexico. Permittees on Indian Country lands in Oklahoma, Louisiana and Arkansas and some oil and gas facilities in Oklahoma may use this form if they are eligible for this permit. Other facilities need to check with their NPDES authority before using this form.

If you do not know your NPDES Permit Number, contact the NOI Processing Center at (301)495-4145. This form was prepared as an example and it is not a required form for use with the permit. Alternative forms may be used if they contain all of the required information as set forth in the permit. This form and additional information regarding the NPDES Region 6 storm water program may be found on the Internet at http://www.epa.gov/region6/sw/. Any person with a complaint about the operation of this facility in regards to this permit should contact EPA Region 6 at (214)665-7112.

Permit Number(s) covered by this inspection (e.g. owners, developers, general contractor, builders)	
Signature and Certification in accordance with Part VI.G of the permit:	I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. Signature_____Date_____
Date of Inspection	
Inspector Name	
Is there a copy of the permit language with the SWPPP?	• YES • NO
Is the inspector qualified and are the qualifications documented in the SWPPP?	• YES • NO
Is an NPDES storm water construction sign posted at the entrance for all permittees?	• YES • NO

You may want to use EPA Region 6 construction checklist to assure components of the SWPPP are complete. This form, the construction sign, and the checklist are available on the Region 6 NPDES Storm Water Forms and Documents web page which may be found on the internet at http://www.epa.gov/earth1r6/6en/w/formsw.htm In addition to the checklist, you should provide a narrative (see next page) on the existing Best Management Practices and Structural Controls found during each inspection. Any problems identified in an inspection should be corrected within 7 days. The inspection should cover all components of the SWPPP and all potential pollutants. While eroded soil is the primary pollutant of concern, do not forget to inspect for other pollutant sources such as fuel tanks, paints, solvents, stabilization materials, concrete hardner, batch plants, and construction debris. The inspector will need to update the SWPPP to reflect findings of the inspection. The site map should be updated after an inspection to show controls that have been added or removed, to ensure the site map is kept current in accordance with Part IV.C. of the permit.

Revision 4, March 1, 2000

ATTACHMENT 5

Narrative Findings of the inspection:

Observations should include any findings of Best Management Practices or controls that are not in accordance with the SWPPP. If a control is not in place or failed, observe the reason why. A control removed temporarily for work is not necessarily a violation if properly recorded in the SWPPP. If it has been removed, record why it was removed and, if applicable, when it will be reinstalled. If the control has failed, observe the conditions so a conclusion may be made as to wether the control failed for improper maintenance or improper design. The qualified inspector will know when a failed control is inadequate and should be replaced by an improved control mechanism. Qualified inspectors are to have authority to make changes to the SWPPP to assure compliance. Controls that have not been installed should be given a reason why they are not installed and/or a scheduled date for installation if they are designed for a later phase of construction. After the inspection, the SWPPP and its site map should be updated to reflect current conditions of controls and Best Management Practices at the time of the inspection. This includes removing uninstalled controls from the site map or otherwise denoting on the site map if they are no longer installed if the controls have been removed because they are no longer necessary (e.g. stabilization has been achieved in that area).

Revision 4, March 1, 2000

ATTACHMENT 6

TCEQ Office Use Only
Permit No:
CN:
RN:
Region:

Notice of Termination (NOT) for Authorizations under TPDES General Permit TXR150000

IMPORTANT INFORMATION:

Please read and use the General Information and Instructions prior to filling out each question in the form.

Effective September 1, 2018, this paper form must be submitted to TCEQ with a completed electronic reporting waiver form (TCEQ-20754).

ePermits: This form is available on our online permitting system.
Sign up for online permitting at: https://www3.tceq.texas.gov/steers/

What is the permit number to be terminated?

TXR15 _____ TXRCW _____

Section 1. OPERATOR (Permittee)

a) What is the Customer Number (CN) issued to this entity?
CN _____

b) What is the Legal Name of the current permittee?
_____

c) Provide the contact information for the Operator (Responsible Authority).
Prefix (Mr. Ms. or Miss): _____
First and Last Name: _____ Suffix: _____
Title: _____ Credentials: _____
Phone Number: _____ Fax Number: _____
Email: _____
Mailing Address: _____
City, State, and Zip Code: _____
Country Mailing Information, if outside USA: _____

Section 2. APPLICATION CONTACT

This is the person TCEQ will contact if additional information is needed regarding this application.

Is the application contact the same as the permittee identified above?

☐ Yes, go to Section 3.

☐ No, complete section below

ATTACHMENT 6

Prefix (Mr. Ms. or Miss):
First and Last Name: Suffix:
Title: Credentials:
Phone Number: Fax Number:
Email:
Mailing Address:
City, State, and Zip Code:
Country Mailing Information, if outside USA:

Section 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

a) TCEQ issued RE Reference Number (RN): RN
b) Name of project or site as known by the local community:
c) County, or counties if more than 1:
d) Latitude: Longitude:
e) Site Address/Location:

If the site has a physical address such as 12100 Park 35 Circle, Austin, TX 78753, complete Section 3A.

If the site does not have a physical address, provide a location description in Section 3B. Example: located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1.

Section 3A: Physical Address of Project or Site:

Street Number and Name:
City, State, and Zip Code:

Section 3B: Site Location Description:

Location description:

City where the site is located or, if not in a city, what is the nearest city:
Zip Code where the site is located:

Section 4. REASON FOR TERMINATION

Check the reason for termination:

☐ Final stabilization has been achieved on all portions of the site that are the responsibility of the Operator and all silt fences and other temporary erosion controls have been removed, or scheduled for removal as defined in the SWP3.

☐ Another permitted Operator has assumed control over all areas of the site that have not been finally stabilized, and temporary erosion controls that have been identified in the SWP3 have been transferred to the new Operator.

ATTACHMENT 6

☐ The discharge is now authorized under an alternate TPDES permit.

☐ The activity never began at this site that is regulated under the general permit.

Section 5. CERTIFICATION

Signatory Name:

Signatory Title:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature (use blue ink): _____ Date: _____

END OF SECTION

SECTION 01 57 13.02

STABILIZED CONSTRUCTION ACCESS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stabilized construction roads, parking areas, exits and truck washing area requirements.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Measure and pay for stabilized construction roads, parking areas, exits and truck washing area by square yard of aggregate placed in 8-inch layer. No separate payment shall be made for Street Cleaning as Required by Section 10 57 13.01 – TPDES Requirements. Include cost of Work for Street Cleaning under Section in pay items for which Work is a component.

1.3 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Submit manufacturer's catalog sheets and other product data on geotextile fabric.

C. Submit sieve analysis of aggregates conforming to requirements of this Specification.

1.4 REFERENCES

A. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FABRIC

A. Provide woven or non-woven geotextile fabric made of polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have minimum grab strength of 270 psi in any principal direction (ASTM D4632) and equivalent opening size between 50 and 140.

C. Geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide minimum of 6 months of expected usable life at temperature range of 0°F to 120°F.

D. Representative Manufacturers: Mirafi, Inc. or equal.

2.2 COARSE AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall be 3 inch to 5 inch granular material.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. If necessary to keep street clean of mud carried by construction vehicles and equipment, provide stabilized construction roads and exits at construction, staging, parking, storage, and disposal areas. Construct erosion and sediment controls in accordance with requirements shown on Drawings and specified in this Section.

B. No clearing, grubbing or rough cutting permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner's Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within Project site until acceptance of Project or until directed by Owner's Representative to remove and discard existing system.

D. Regularly inspect, repair, or replace components of stabilized construction exits. Unless otherwise directed, maintain stabilized construction roads and exits until project is accepted by the Owner. Remove stabilized construction roads and exits promptly when directed by Owner's Representative. Discard removed materials off site.

E. Remove and dispose of sediment deposits at designated spoil site for Project. If project spoil site is not designated on Drawings, dispose of sediment off site at location not in or adjacent to stream or flood plain. Assume responsibility for offsite disposal. Spread sediment evenly throughout site, compacted and stabilized. Do not allow sediment to flush into stream or drainage way. If sediment has been contaminated, dispose in accordance with existing federal, state, and local rules and regulations.

F. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control systems.

G. Conduct construction operation under this Contract in conformance with erosion control practices described in this and other Specifications.

3.2 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits and truck washing areas when approved by Owner's Representative, of sizes and locations where shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, construct truck washing area. Truck washing shall be done on stabilized areas which drain into drainage system protected by erosion and sediment control measures.

D. Details for stabilized construction exit are shown on Drawings. Construct other stabilized areas to same requirements. Maintain roadway width at least 14 feet for one-way traffic and 20 feet for two-way traffic and sufficiently for ingress and egress. Furnish and place geotextile fabric as permeable separator to prevent mixing of coarse aggregate with underlaying soil. Maximum exposure of geotextile fabric to elements between laydown and cover of 14 days to minimize damage potential.

E. Grade roads and parking areas to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

F. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control measures used to trap sediment. Immediately remove sediment spilled, dropped, washed, or tracked onto public right-of-way.

G. Maintain length of stabilized area as shown on Drawings, but not less than 50 feet. Maintain thickness less than 8 inches. Maintain width less than full width of all points of ingress or egress.

H. Stabilization for other areas shall have same coarse aggregate, thickness, and width requirements as stabilized construction exit, except where shown otherwise on Drawings.

I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.

J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by Owner's Representative. These methods include following:

   1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in application thickness of at least 8 inches.

2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in application thickness of at least 6 inches.
3. Steel Mats - Perforated mats placed across perpendicular support members.

K. Provide street cleaning, such as sweeping or vacuuming, at locations around project site where construction traffic has caused tracking of sediments onto roadways. Do not wash or flush sediments into adjacent drainage systems.

L. Mechanical sweepers shall be vacuum-type or regenerative sweepers. Sweeping speed not to exceed 6 mph. Make two passes.

M. Clean street daily before end of workday. When excess sediments have tracked onto streets, Owner's Representative may direct contractor to clean street as often as necessary. Remove and dispose of sediments properly.

N. Use other erosion and sediment control measures to prevent sediment runoff during period of rains and non-working hours and when storm discharges are expected.

END OF SECTION

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction and maintenance of temporary storm water protection and erosion control devices.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 09 00 – Concrete.
4. Section 31 11 00 – Clearing and Grubbing.
5. Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.
6. Section 31 23 00 – Earthwork.
7. Section 40 20 13 – Pipe: Miscellaneous Steel.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum) Contract. If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM International (ASTM):
   a. A36 – Standard Specification for Carbon Structural Steel.
   b. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   c. D3786 – Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.
   d. D4355 – Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
   e. D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

f. D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

g. D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

h. D6382 – Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

1.4 DEFINITIONS

A. Filter Fabric Fence and Reinforced Filter Fabric Fence: Installed to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment.

B. Straw Bale Fence: Installed to allow surface runoff percolation through straw in sheet-flow manner and to retain and accumulate sediment.

C. Interceptor Dikes and Swales: Constructed to direct surface or channel runoff around the project area or runoff from project area into sediment traps.

D. Drop Inlet Baskets: Installed to allow runoff percolation through the basket and to retain and accumulate sediment.

E. Sediment Traps: Constructed to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

1.5 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturers catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser, and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 CONCRETE

A. Concrete: In accordance with Specification Section 03 09 00 – Concrete.

2.2 AGGREGATE MATERIALS

A. Stone: Use open graded aggregates with minimum diameter of 3 inches, and maximum 5 inches in diameter and less than ½ cubic foot in volume unless otherwise specified. Use clean, hard crushed concrete or stone free from

adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Provide gravel lining in accordance with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities, or as shown on the Drawings.

C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.3 PIPE

A. Inlet Pipes: Galvanized steel pipe in accordance with Section 40 23 13 – Pipe: Miscellaneous Steel or as shown on the Drawings.

B. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.4 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.

B. Grab Strength: 100 psi in any principal direction (ASTM D4632), Mullen burst strength greater than 200 psi (ASTM D3786), and equivalent opening size between 50 and 140 for soils with more than 15 percent by weight passing No. 200 sieve and between 20 and 50 for soils with less than 15 percent by weight passing No. 200 sieve; and maximum water flow rate of 40 gallons per minute per square foot (ASTM D4491).

C. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F. Ultraviolet stability exceed shall exceed 70% after 500 hours of exposure (ASTM D4355).

D. Acceptable Manufacturers: Mirafi, Inc., Synthetic Industries, or approved equal.

2.5 FENCING

A. Wire Fencing: Woven galvanized steel wire, 12½ gauge by 2 inch by 4 inch mesh spacing, minimum 24-inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 by 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 8 inch bury and full height of filter fabric.

2.6 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide

material.

B. Minimum unit weight of 4 ounces per square yard.

C. Minimum grab strength of 100 psi in any principal direction (ASTM D4632)

D. Mullen burst strength exceeding 300 psi (ASTM D3786).

E. Ultraviolet stability exceeding 70 percent (ASTM D4355).

F. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

2.7 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2-inch by 2-inch and single long side of 1-inch by 1-inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1-inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

2.8 STRAW BALE

A. Straw: Standard-baled agricultural hay bound by wire, nylon, or polypropylene rope. Do not use jute or cotton binding.

B. Straw Bale Stakes (applicable where bales are on soil): No. 3 (3/8 diameter) reinforcing bars, deformed or smooth at Contractor's option, length as required for minimum 18-inch bury and full height bales.

PART 3 - EXECUTION

3.1 PREPARATION, INSTALLATION AND MAINTENANCE

A. Provide erosion and sedimentation control systems at the locations shown on Drawings. Construct in accordance with the requirements shown on the Drawings and as specified in this Section.

B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Owner’s Representative to allow installation of erosion and sediment control systems, soil testing, and surveying.

D. Maintain erosion and sediment control systems located within project site until acceptance of project or until directed by Owner’s Representative to remove and discard existing system.

E. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Owner's Representative. Dispose of materials in accordance with Specification Section 01 74 19 – Construction Waste Management and Disposal.

F. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Specification Section 01 74 19 – Construction Waste Management and Disposal. Off-site disposal shall be the responsibility of the Contractor. Sediment to be placed at the project site should be spread, compacted and stabilized in accordance with the Owner's Representative directions. Sediment shall not be allowed to flush into streams or drainage ways. If sediment has been contaminated, it needs to be disposed of in accordance with existing federal, state and local regulations.

G. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Specification Section 31 23 16.01 – Roadway Excavation or Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

H. Conduct all construction operations under this Contract in conformance with erosion control practices described in Specification Section 01 35 05 – Environmental Protection and Special Controls.

I. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.

J. Protect existing trees and plants in accordance with Specification Section 01 56 39 – Temporary Tree and Plant Protection.

K. Conduct all construction operations under this Contract in conformance with the erosion control practices required by State and local law.

3.2 CONSTRUCTION METHODS

A. Filter Fabric Fence (Type 1):

1. Provide filter fabric fence systems at locations specified on the Drawings in accordance with the Drawing detail. Filter fabric fence systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

2. Attach the filter fabric to 2-inch by 2-inch wooden stakes or equivalent steel posts spaced a maximum of 6 feet apart and embedded a minimum of 1 foot. If filter fabric is factory pre-assembled with support netting, then

maximum spacing allowable is 8 feet. The wooden stakes shall be installed at a slight angle toward the source of anticipated runoff.

3. Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow or for V-trench configuration as shown on Drawings. Lay filter fabric along the edges of the trench. Backfill and compact trench.
4. Securely fasten filter fabric to stakes using staples or wire ties at 3 inches on center maximum. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.
5. The filter fabric should be provided in continuous rolls and cut to the length of the required to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6-inch overlap, and sealed securely.
6. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this Item. Remove sediment deposits when silt reaches a depth one-third of the height of the fence or 6 inches, whichever is less.

B. Reinforced Filter Fabric Fence (Type 2):

1. Attach the filter fabric to 2-inch by 2-inch wooden stakes or equivalent steel posts spaced a maximum of 6 feet apart and embedded a minimum of 1 foot. If filter fabric is factory pre-assembled with support netting, then maximum spacing allowable is 8 feet. The wooden stakes shall be installed at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow or for V-trench configuration as shown on Drawings. Lay filter fabric along the edges of the trench. Backfill and compact trench.
3. Use galvanized 2-inch by 4-inch welded fabric for woven wire securely fasten filter fabric material to woven wire fence with tie wires.
4. Securely fasten filter fabric to stakes using staples or wire ties at 3 inches on center maximum. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.
5. The filter fabric should be provided in continuous rolls and cut to the length of the required to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6-inch overlap, and sealed securely.
6. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this

Item. Remove sediment deposits when silt reaches a depth one-third of the height of the fence or 6-inches, whichever is less.

7. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.

C. Triangular Filter Fabric Fence:

1. Attach filter fabric to wire fencing, minimum 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
   a. Toe-in skirt 6-inches with mechanically compacted material;
   b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
   c. Trench-in entire structure 4-inches.
3. Anchor triangular fabric filter fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6-inches to cover segment joints. Fasten joints with galvanized shoat rings.

D. Sediment Traps:

1. Use fill material for embankment free of roots, woody vegetation, oversized stones or rocks, or organic or other objectionable matter. Clear, grub, and strip area under embankment of vegetation and root material.
2. Limit of excavation and outlet length and height shall be as specified on Drawings. Use side slopes of 2H:1V or flatter.
3. Maintain minimum of 6-inches between top of core material and top of stone outlet, minimum of 4-inches between bottom of core material and existing ground and minimum of 1-foot between top of stone outlet and top of embankment.
4. Embed rock minimum of 4-inches into existing ground for stone outlet.
5. For stone outlet, core shall be minimum of 1-foot in height and 1-foot in width and wrapped in triple layer of geotextile fabric.
6. Install stone outlet or outlet pipe and riser as shown on Drawings.
7. Repair or replace damaged trap components. Redress and replace stone as needed to replenish depleted stone. Remove sediment deposit and restore traps to original dimensions when sediment has accumulated to one-half design depth of the trap or 1-foot, whichever is less.

E. Dikes and Swales:

1. Unless otherwise indicated, maintain minimum dike height of 18-inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.
2. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.
3. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.
4. Clear in accordance with Specification Section 31 10 00 – Clearing and Grubbing. Compact embankments in accordance with Specification Section 31 23 00 – Earthwork.
5. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2H:1V or flatter. Clear, grub and strip excavation area of vegetation and root material.

F. Downspout Extenders:

1. Downspout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

G. Pipe Slope Drains:

1. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.
2. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.
3. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.
4. Pipe shall be secured with hold-down grommets spaced 10 feet on center.
5. Place riprap apron with a depth equal to pipe diameter with 2H:1V side slopes.

H. Paved Flumes:

1. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.

2. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.
3. Construct permanent paved flumes in accordance with Drawings.
4. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

I. Level Spreaders:

1. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.
2. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities that will impede normal flow.

J. Inlet Protection Barriers:

1. Place sandbags and filter fabric fences at locations shown on Drawings.
2. Maintain to allow minimal inlet inflow restrictions/blockages during storm events.

K. Drop Inlet Baskets:

1. Fit inlet insert basket into inlet without gaps around insert at locations shown on Drawings.
2. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.
3. Construct top frame of basket with two short sides of 2-inch by 2-inch and single long side of 1-inch by 1-inch, 1/8-inch angle iron. Construct basket hangers of 2-inch by 1/4-inch iron bars. Construct bottom frame of 1-inch by 1/4-inch iron bar or 1/4-inch plate with center 3-inches removed. Use minimum 1/4-inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.
4. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6-inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.
5. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

L. Straw Bale Fences:

1. Place bales in row with ends tightly abutting adjacent bales. Place bales with bindings parallel to ground surface.
2. Embed bale in soil a minimum of 4-inches.

3. Securely anchor bales in place with Straw Bale Stakes driven through bales a minimum of 18-inches into ground. Angle first stake in each bale toward previously laid bale to force bales together.
4. Fill gaps between bales with straw to prevent water from channeling between bales. Wedge carefully in order not to separate bales.
5. Replace with new straw bale fence every two months or as required by Owner's Representative.

M. Brush Berms:

1. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.
2. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.
3. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24-inches minimum and side slopes shall be 2H:1V or flatter.
4. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.3 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Specification Section 01 57 13.02 – Stabilized Construction Access.

B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.4 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.5 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.6 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Specification Section 01 57 13.02 – Stabilized Construction Access. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.7 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized, as directed by Owner's Representative.

B. Dispose of sediments and waste products following Specification Section 01 35 05 – Environmental Protection and Special Controls.

3.8 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 01 57 23.02

CONTROL OF GROUND WATER AND SURFACE WATER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

Control of ground water and surface water.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for this Work is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM D698 – Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3).

B. Federal Regulations29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.4 DEFINITIONS

A. Ground water control includes both dewatering and depressurization of water-bearing soil layers.

1. Dewatering includes lowering water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
2. Depressurization includes reduction in piezometric pressure within strata not controlled by dewatering alone, as required to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage includes keeping excavations free of surface and seepage water.

C. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect work from any source of surface water.

D. Equipment and instrumentation for monitoring and control of ground water control system includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

E. Surface water includes water from rainfall, runoff, the SJRA canal, and all other sources not considered ground water.

1.5 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit prepared method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Specification Section 31 41 00 – Trench Safety System to produce following results:

1. Effectively reduce hydrostatic pressure affecting:

   a. Excavations

   b. Tunnel excavation, face stability, or seepage into tunnels

2. Develop substantially dry and stable subgrade for subsequent construction operations.

3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.

4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata.

5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types, as appropriate.

D. Provide drainage of seepage water and surface water, as well as water from any other source entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with ditches and sump pumping.

E. Provide ditches, berms, pumps, and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Provide adequate number of piezometers installed at proper locations and depths as required to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.

I. Provide environmental monitoring wells installed at proper locations and depths as required to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

1.6 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Submit Ground Water and Surface Water Control Plan for review by Owner's Representative prior to start of any field work. Plan shall be signed by Professional Engineer registered in State of Texas. Submit plan to include following:

1. Results of subsurface investigation and description of extent and characteristics of water bearing layers subject to ground water control.
2. Names of equipment suppliers and installation subcontractors.
3. Description of proposed surface water control systems for bypass of canal flows including location, arrangement, system components, capacity, installation details, and operation and maintenance procedures.
4. Description of proposed ground water control systems indicating arrangement, location, depth, and capacities of system components, installation details and criteria and operation and maintenance procedures.
5. Description of proposed monitoring and control system indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.
6. Installation of a temporary staff gauge upstream of the siphon to monitor canal water surface elevations throughout construction. Staff gauge should be survey accurate and correlate with the project datum and survey control points.
7. Description of proposed filters including types, sizes, capacities, and manufacturer's application recommendations.

8. Certification of design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
9. Operating requirements, including piezometric control elevations for dewatering and depressurization.
10. Excavation drainage methods including typical drainage layers, sump pump application and other necessary means.
11. Surface water control and drainage installations.
12. Proposed methods and locations for disposing of removed water.

C. Submit following records upon completed initial installation:

1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Baseline analytical test data of water from monitoring wells.
4. Initial flow rates.

D. Submit the following records weekly during operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.2, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with control over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because review and permitting process may be lengthy, take early action to pursue and submit for required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

E. Filter water discharged from dewatering systems prior to entering drainage ways.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Use optional equipment and materials as necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review of Owner's Representative through submittals required in Paragraph 1.6, Submittals.

B. Eductors, well points, or deep wells, where used, must be furnished, installed and operated by experienced contractor regularly engaged in ground water control system design, installation, and operation.

C. Equipment must be in good repair and operating order.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

PART 3 - EXECUTION

3.1 GROUND WATER CONTROL

A. Perform subsurface investigation by borings as necessary to identify water bearing layers, piezometric pressures, and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary, to determine draw down characteristics of water bearing layers. Present results in Ground Water and Surface Water Control Plan (See Paragraph 1.6B.1).

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify system lowers ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for prosecution of subsequent operations.

F. Where hydrostatic pressures in confined water bearing layers exist below excavation, depressurize those zones to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in Ground Water and Surface Water Control Plan.

G. Remove ground water control installations.

1. Remove pumping system components and piping when ground water control is no longer required.
2. Remove monitoring wells when directed by Owner's Representative.
3. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonitenon-shrink grout or cement-sand grout along entire shaft length.

H. During backfilling, dewatering may be reduced to maintain water level minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48 hours after placement.

I. Provide uniform diameter for each pipe drain run constructed for dewatering. Remove pipe drain when it has served its purpose. If removal of pipe is impractical, provide grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout when pipe is removed from service.

J. Extent of construction ground water control for structures with permanent perforated underground drainage system may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide means of draining affected portion of underground system, including standby equipment. Maintain drainage system during operations and remove it when no longer required.

K. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.

M. Foundation Beds: Maintain saturation line at least 5 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

3.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. Design, install, and operate all dewatering wells to prevent the removal of native material except as incidental to well development.

B. For aboveground piping in ground water control system, include 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header to visually monitor discharge from each installation.

C. Install sufficient piezometers or monitoring wells to show trench or shaft excavations in water bearing materials are predrained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of Work.

D. Install piezometers or monitoring wells not less than 1 week in advance of beginning associated excavation.

E. Dewatering may be omitted for portions of under drains or other excavations, but only where auger borings and piezometers or monitoring wells show that soil is predrained by existing system and that criteria of ground water control plan are satisfied.

F. Replace installations that produce noticeable amounts of sediments after development.

G. Provide additional ground water control installations, or change methods, in event that installations according to ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specification. Submit revised plan according to Paragraph 1.6B.

3.3 EXCAVATION DRAINAGE

A. May use excavation drainage methods if necessary to achieve well drained conditions. Excavation drainage may consist of layer of crushed stone and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

3.4 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage are operating in area or seepage into tunnel is occurring. Keep system in good condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedule.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make observations, as specified.

D. Remove and grout piezometers inside or outside excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner's Representative. Follow applicable regulations for abandoning piezometers and monitoring wells.

3.5 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also monitor and record water level and ground water recovery. Obtain records daily until steady conditions are achieved, and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner's Representative

determines more frequent monitoring and recording are required. Comply with Owner's Representative direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

C. Observe and record daily water surface elevations upstream of the siphon using the temporarily installed staff gauge.

3.6 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

SECTION 01 65 50

PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for product delivery, storage and handling.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.

1. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

B. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this payment.

C. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Provide Owner project Log Book.

1.4 TRANSPORTATION

A. Make arrangements for transportation, delivery, and handling of equipment and materials required for timely completion of Work.

B. Transport and handle products in accordance with instructions.

C. Consign and address shipping documents to proper party giving name of Project, street number, and city. Shipments shall be delivered to Contractor.

1.5 DELIVERY

A. Scheduling: Schedule delivery of products or equipment as required to allow timely inspection and installation, and to avoid prolonged storage, overburdening of limited storage space, conflicts with other contractors on site. Confirm availability of equipment and personnel for handling products prior to delivery.

B. Packaging: Deliver products or equipment in manufacturer's original unopened and unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS

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

B. For material and equipment specifically indicated or specified to be reused in the work:

1. Use special care in removal, handling, storage and reinstallation, to assure proper function in completed work.

2. Arrange for transportation, storage and handling of products which require offsite storage, restoration or renovation. Pay all costs for such work.

C. When contract documents require that installation of work comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in installation, including two copies to Owner’s Representative. Maintain one set of complete instructions at job site during installation until completion.

D. Provide equipment and components from fewest number of manufacturers as practical, in order to simplify spare parts inventory and allow for maximum interchangeability of components. For multiple components of same size, type, or application, use same make and model of component throughout Project.

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

A. Protection:

1. Protect materials in accordance with manufacturer’s recommendations and requirements of these Specifications.

a. Store products or equipment in location to avoid loss or physical damage to items while in storage.

2. Protect equipment from exposure to elements and keep thoroughly dry.

3. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

B. Storage:

1. Store materials in accordance with manufacturer’s recommendations and requirements of these Specifications.

2. Make necessary provisions for safe storage of materials and equipment. Place loose soil materials, and materials to be incorporated into Work to prevent damage to any part of Work or existing facilities and to maintain free access at all times to all parts of Work and to utility service company installations in vicinity of Work. Keep materials and equipment neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage to provide easy access for inspection.
3. Restrict storage to areas available on construction site for storage of material and equipment as shown on Drawings or approved by Owner's Representative.
4. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of and access to off-site storage locations for inspection by Owner's Representative.
5. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.
6. Store in manufacturers' unopened containers.
7. Neatly, safely, and compactly stack materials delivered and stored along line of Work to avoid inconvenience and damage to property owners and general public, and maintain at least 3 feet from fire hydrant. Keep public, private driveways, and street crossings open.
8. Repair or replace damaged lawns, sidewalks, streets, or other improvements to satisfaction of Owner's Representative. Total length which materials may be distributed along route of construction at one time is 1,000 linear feet, unless otherwise approved in writing by Owner's Representative.

C. Handling:

1. Handle materials in accordance with manufacturer's recommendations and requirements of these Specifications.
2. Coordinate off-loading of materials and equipment delivered to job site. If necessary to move stored materials and equipment during construction, relocate materials and equipment at no additional cost to Owner. Do not allow the off-loading of materials in those parking areas used for crew's personal vehicles.
3. Provide equipment and personnel necessary to handle products by methods to prevent damage to products or packaging.
4. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging products or surrounding areas.
5. Handle products by methods to prevent over bending or over stressing.

6. Lift heavy components only at designated lifting points.
7. Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

3.2 STORAGE FACILITIES

A. Temporary Storage Building (if required):

1. Provide a weatherproof temporary storage building specifically for the purpose of providing for protection of products and equipment.
   a. Size building to accommodate anticipated storage items.
2. Equip building with lockable doors and lighting, and provide electrical service for equipment space heaters and heating or ventilation as necessary to provide storage environments acceptable to specified manufacturers.
3. Provide methods of storage of products and equipment off the ground.
4. Provide this structure within 60 days after Notice to Proceed.
   a. Locate building on-site where shown on the Drawings or in location approved by the Owner's Representative.
   b. Remove building from site prior to startup and demonstration period.

3.3 FIELD QUALITY CONTROL

A. Inspect Deliveries:

1. Inspect all products or equipment delivered to the site prior to unloading.
   a. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

B. Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture conditions are maintained as required by manufacturer or as appropriate for particular items.

END OF SECTION

SECTION 01 71 13

MOBILIZATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for mobilization.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Measurement for mobilization is on lump sum basis.

B. Mobilization payments will be included in periodic progress payment upon written application subject to following provisions:

1. Authorization for payment of 50 percent of Contract Price for mobilization will be made upon receipt and approval by Owner's Representative of the following items, as applicable:
   a. Schedule of Values submittal in accordance with Specification Section 01 29 73 – Schedule of Values.
   b. Trench safety program.
   c. Safety Program/Plan submittal in accordance with the Trench Safety Program/Plan in accordance with Specification Section 31 41 00 – Trench Safety System.
   d. Construction Schedule submittal in accordance with Specification Section 01 32 16 – Construction Progress Schedule.
   e. Preconstruction photographs in accordance with Specification Section 01 32 36.01 – Project Photographs.
   f. Critical Location Report in accordance with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.
   g. Control of groundwater and surface water plan in accordance with Specification Section – 1 57 23.02 – Control of Ground Water and Surface Water, when required.
2. Authorization for payment of remaining 50 percent of Contract Price for mobilization will be made upon completion of Work amounting to 5 percent of Contract Price less mobilization unit price.

C. Mobilization payments will be subject to retainage amounts stipulated in Specification Section 00 72 00 – General Conditions of the Contract.

D. A reduction of 10 percent of mobilization amount bid in Schedule for Unit Price Work will be applied to each Payment Application when Field Office is not properly maintained. Proper maintenance consists of operational plumbing and sanitary facilities, adequate potable water supply, operational telephone and facsimile machine and functional temperature control.

1.3 SUBMITTALS (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 71 32.16

CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for construction surveying.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors.

B. Employ land surveyor acceptable to the Owner, if required.

1.3 MEASUREMENT AND PAYMENT

A. No Separate payment will be made for field surveying. Include cost in unit price for Work requiring field surveying.

1.4 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Submit to Owner's Representative name, address, and telephone number of Surveyor before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by surveyor, that elevations and locations of Work are in conformance with Contract.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain complete and accurate log of control and survey Work as it progresses.

B. Prepare certified survey setting forth dimensions, locations, angles, and elevations of construction and site Work upon completion of foundation walls and major site improvements.

C. Submit Record Documents under provisions of Specification Section 01 78 39 – Project Record Documents.

1.6 EXAMINATION

A. Verify locations of survey control points prior to starting Work.

B. Notify Owner's Representative immediately of any discrepancies discovered.

1.7 SURVEY REFERENCE POINTS

A. Control datum for survey established by provided survey as indicated on Contract Drawings. Inform Owner's Representative in advance of time at which horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to Owner's Representative and minimum delay to Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Owner's Representative 48 hours in advance of need for relocation of reference points due to changes in grades or other reasons.

D. Report promptly to Owner's Representative loss or destruction of reference point.

E. Contractor to replace permanent reference points disturbed by operations, at no additional cost to the Owner.

1.8 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish minimum of two permanent bench marks on site, referenced to established control points. Record locations with horizontal and vertical data on Project Record Documents.

C. Establish elevations, lines, and levels to provide quantities required for measurement and payment and to provide appropriate controls for Work. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading; fill and topsoil placement; utility locations, slopes, and invert elevations
2. Grid or axis for structures
3. Building foundation, column locations, ground floor elevations

D. Periodically verify layouts by same means.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 20

OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for installing and sealing openings and penetrations in construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 05 50 00 – Metal Fabrications.
4. Section 07 92 00 – Joint Sealants.
5. Section 09 91 00 – Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT (NOT USED)

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 318 – Building Code Requirements for Structural Concrete.
2. ASTM International (ASTM):
   a. A36 – Standard Specification for Carbon Structural Steel.
   b. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
   b. 90A – Standard for Installation of Air Conditioning and Ventilating Systems.
4. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

B. Obtain prior approval from Principal Architect/Engineer when any opening larger than 100 SQ IN must be made in existing or newly completed construction.

1.4 DEFINITIONS

A. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.

B. Washdown Areas: Areas having floor drains or hose bibs.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:
   a. Vertical and horizontal location of all required openings and penetrations.
   b. Size of all openings and penetrations.
   c. Opening type.
   d. Seal type.
3. Manufacturer's installation instructions for standard manufactured products.

1.6 PROJECT CONDITIONS

A. Refer to the Project Geotechnical Report for water table levels used for this Project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Pipe Sleeves: Steel, ASTM A53, Schedule 40, black.

B. Pipe Sleeves Penetrating into Corrosive Areas: Stainless steel, 1/4 IN minimum thickness.

C. Backing Rod and Sealant: See Specification Section 07 92 00 – Joint Sealants.

D. Modular Mechanical Seals:

1. Acceptable manufacturers:
   a. Link-Seal.
   b. Approved equal.
2. 316 stainless steel bolts, nuts and washers.

E. Sheet Metal Sleeves: Steel, ASTM A36, 12 GA.

F. Commercial Wall Castings:

1. For unclassified areas both sides of penetration:
   a. Ductile iron, class equal to connecting piping system.

2. For wet/corrosive areas either side of penetration:
    a. Stainless steel, 304L.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Perform HVAC penetrations in accordance with NFPA 90A.

B. Perform electrical penetrations in accordance with NFPA 70, Article 501.

C. Install sleeves and castings in accordance with ACI 318, Chapter #6.

D. Hot dip galvanize in accordance with Specification Section 05 50 00 – Metal Fabrications (or paint in accordance with Specification Section 09 91 00 – Painting and Protective Coatings) all steel sleeves installed.

E. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
    1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.

F. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
    1. In non-washdown areas, install sleeves with ends flush with finished surfaces.

G. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

H. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.

I. Do not cut into or core drill any beams, joists, or columns.

J. Do not install sleeves in beams, joists, or columns.

K. Do not install recesses in beams, joists, columns, or slabs.

L. Field Cutting and Coring:
    1. Saw or core drill with non-impact type equipment.
    2. Mark opening and drill small 3/4 In or less holes through structure following opening outline.
    3. Sawcut opening outline on both surfaces.
        a. Knock out within sawcuts using impact type equipment.
        b. Do not chip or spall face of surface to remain intact.
        c. Do not allow any overcut with saw kerf.

M. Precast-Prestressed Concrete Construction:

1. Do not cut openings nor core drill vertically or horizontally through stems of members.
2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
3. Cast openings and sleeves into flanges of units.
4. Cast openings larger than 6 In in diameter or 6 In maximum dimension in units at time of manufacture.
5. Cast openings smaller than 6 In in diameter or 6 In maximum dimensions in flanges of units at time of manufacture or field cut.

N. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.

O. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.

1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
2. For commercial castings, cast water stop/anchor with wall pipe.
3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
4. For fabricated units, diameter of plate or flange to be 4 In larger than outside diameter of sleeve, pipe or ductwork.
5. For commercial castings, waterstop/anchor size to be manufacturer standard.
6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

P. Where area is blocked out to receive sheet metal sleeve at later date:

1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
    a. Size blockout based on sleeve size required plus 4 to 6 In each side of sleeve for concrete encasement.
    b. Provide #4 dowels at 12 In spacing along each side of blockout with minimum of two (2) dowels required per side.
2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
    a. Size blockout based on sleeve size required plus 2 to 4 In each side of sleeve for concrete encasement.

Q. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

R. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

S. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.

T. Modular Mechanical Seals:

1. Utilize one (1) seal for concrete thickness less than 8 In and two (2) seals for concrete, 8 In thick or greater.
2. Utilize two (2) seals for piping 16 In diameter and larger if concrete thickness permits.
3. Install seals such that bolt heads are located on the most accessible side of the penetration.

U. Backer Rod and Sealant:

1. Install in accordance with Specification Section 07 92 00 – Joint Sealants.
2. Provide backer rod and sealant for modular mechanical seal applications.
   a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.2 SCHEDULES

A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:

1. Provide the following opening and penetration types:
   a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
   b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
   c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
   d. Type D - Commercial type casting or fabrication.
   e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
   f. Type F - Integrally cast pipe, duct or conduit.
   g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of duct, pipe or conduit.
   h. Type H - Core drill.
   i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
2. Provide seals of material and method described as follows.

a. Category 1 - Modular Mechanical Seal.

b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings.

c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.

d. Category 4 - Backer rod and sealant.

e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.

f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.

g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.

3. Furnish openings and sealing materials through new floors, roofs, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.

4. Furnish openings and sealing materials through existing floors, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE FOR NEW CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I (1)	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I (1)	7 Not Req 7	C F I (1)	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H (2) I (1)	4 3 4	F H (2) I (1)	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I (1)	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I (1)	1 Not Req Not Req 1	F I (1)	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H (2)	1 Not Req Not Req 1	C F H (2) I (1)	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req

Through exterior wall above grade	A B C	6 6 6	A B D H (2)	5 5 Not Req 5	C H (2)	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req

SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE FOR EXISTING CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B E	7 Not Req	B (1) E (3) H (2)	7 Not Req 7	B (1) E (3) H (2)	7 Not Req 7
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H (2)	3 3	G H (2)	3 3
Through walls where one side is a hazardous area	B E	7 Not Req	B (1) B (3) E H (2)	7 1 Not Req 7	B (1) (3) E H (2)	7 Not Req 7
Through exterior wall below grade above water table	B	7	B (1) B (3) H (2)	7 1 7	B (1) (3) H (2)	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H (2)	1 Not Req 1	B (1) (3) E H (2)	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry	E	Not Req	E	Not Req	E	Not Req

area						
Through exterior wall above grade	G	6	G (1) (3) H (2)	5 5	G (1) (3) H (2)	5 7
Roof penetrations	G	2	G (1) (3) H (2)	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G (1) (3) H (2)	4 4	G (1) (3) H (2)	4 4

(1) Multiple piping 3 IN and smaller or multiple conduits.

(2) Single pipe 3 IN and smaller or single conduit.

(3) Single pipe or conduit larger than 3 IN.

END OF SECTION

SECTION 01 73 29

DEMOLITION, CUTTING, AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.
4. Section 09 91 00 – Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Indicating manufacturer and type of:
   a. Proposed nonshrink grout.
   b. Epoxy bonding adhesive.
   c. Proposed materials and methods to be used for matching and repairing existing construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General:

1. Salvage items, designated for Owner's salvage, as a functional unit.
2. Clean, list and tag for storage.
3. Protect from damage and deliver to location designated.
4. Salvage each item with auxiliary or associated equipment required for operation.

1.5 PROJECT CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   1. Nonshrink grout:
      a. Supreme Grout by Gifford Hill.
      b. Masterflow 713 Plus by BASF Building Systems.
      c. Sika Grout 212 by Sika.
   2. Epoxy bonding adhesive:
      a. Euco No.452 MV by Euclid Chemical Co.
      b. Sikadur 32, Hi-Mod by Sika Corporation.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Temporary Partitions:
   1. Plywood: 1/2 IN minimum for interior or exterior use.
   2. Paneling: 1/4 IN minimum for interior use.

B. Nonshrink Grout:
   1. Nonmetallic, noncorrosive and nonstaining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion.
      a. Mass expansion not to be created by gas liberation or by other means.
   4. Minimum compressive strength at 28 days to be 6500 psi.
   5. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.

C. Epoxy Bonding Adhesive:

1. Two-component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide temporary partitions as required in public areas.

1. Construct partitions of braced plywood in exterior areas.
2. Adequately braced paneling may be used in interior areas.

B. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.

C. Provide substantial barricades and safety lights as required.

D. Provide temporary dustproof partitions where indicated or necessary.

1. Prevent infiltration of dust into occupied areas.

E. Provide temporary weather protection as necessary.

3.2 INSTALLATION

A. Cutting and Removal:

1. Remove existing work indicated to be removed, or as necessary for installation of new work.
2. Neatly cut and remove materials, and prepare all openings to receive new work.
3. Remove masonry or concrete in small sections.

B. Modification of Existing Concrete:

1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Specification Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.
    a. Protect remaining concrete from damage.
    b. Make openings by sawing through the existing concrete.
    c. Concrete may be broken out after initial saw cuts in the event concrete thickness prevents cutting through.
    d. Where sawing is not possible, make openings by drilling holes around perimeter of opening and then chipping out the concrete.
        1) Holes shall be sufficient in number to prevent damage to remaining concrete.

2) Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of nonshrink grout epoxy bonded to the existing concrete.

3) Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with nonshrink grout.

C. Removal of Existing Anchor Bolts or Other Protruding Elements:

1. Removal within a distance of 8 FT above finished floor or operating level elevation.
2. Removed to a depth of 1/2 IN from finished surface.
3. Fill void with non-shrink grout.

D. Matching and Patching:

1. Walls, ceilings, floors or partitions:
   a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
   b. Match and patch existing construction disturbed during installation of new work.
2. Methods and materials:
   a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
   b. Subject to review of Principal Architect/Engineer.

E. Salvaged Items:

1. Thoroughly dry and clean all metal surfaces.
2. Prime all bare metal in accordance with Specification Section 09 91 00 – Painting and Protective Coatings.
3. Clean and lubricate motors and other moving parts.
4. Brace motors attached to flexible mountings until reinstallation.
5. Dispose of items or materials not designated for Owner's salvage or reuse. Promptly remove from site.
6. Do not store or sell Contractor salvaged items or materials on site.

F. Clean Up: Transport debris and legally dispose of offsite.

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes intermediate and final cleaning of Work, not including special cleaning of closed systems specified elsewhere.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 STORAGE AND HANDLING

A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.5 SCHEDULING

A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents:

1. Compatible with surface being cleaned.
2. New and uncontaminated.
3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CLEANING - GENERAL

A. Prevent accumulation of wastes that create hazardous conditions.

B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.

C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

D. Dispose of degradable debris at an approved solid waste disposal site.

E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by regulatory agencies.

F. Handle materials in a controlled manner with as few handlings as possible.

G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.

H. On completion of work, leave area in a clean, natural looking condition.

1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.

I. Do not burn on-site.

3.2 INTERIOR CLEANING

A. Cleaning During Construction:

1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.

2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.

3. Vacuum clean interior areas when ready to receive finish painting.

a. Continue vacuum cleaning on an as-needed basis, until Substantial Completion.

B. Final Cleaning:

1. Complete immediately prior to Demonstration Period.

2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.

3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.

4. Wash and shine glazing and mirrors.

5. Polish glossy surfaces to a clear shine.

6. Ventilating systems:

a. Clean permanent filters and replace disposable filters if units were operated during construction.

b. Clean ducts, blowers and coils if units were operated without filters during construction.

7. Replace all burned out lamps.
8. Broom clean process area floors.
9. Mop office and control room floors.

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:

1. Construction debris:
   a. Confine in strategically located container(s):
      1) Cover to prevent blowing by wind.
      2) Store debris away from construction or operational activities.
      3) Haul from site minimum once a week.
   b. Remove from work area to container daily.
   c. Site clean-up prior to storm events. Thoroughly clean site of all loose or unsecured items which may become airborne or transported by flowing water during storm events.
2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
   a. The use of chemical weed control substances should be avoided unless prior Owner approval is received.
3. Soils, sand, and gravel deposited on paved areas and walks:
   a. Remove as required to prevent muddy or dusty conditions.
   b. Do not flush into storm sewer system.

B. Final Cleaning:

1. Remove trash and debris containers from site.
   a. Repair areas disturbed by location of trash and debris containers to Owner's satisfaction including but not limited to re-seeding, sod placement, pavement repair, asphalt repair, sidewalk repair, and rut removal and/or fill placement.
2. Clean paved roadways.

3.4 FIELD QUALITY CONTROL

A. Immediately prior to Demonstration Period, conduct an inspection with Owner's Representative to verify condition of all work areas.

END OF SECTION

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for construction waste management and disposal.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. No separate payment will be made for waste material disposal under this Section. Include payment in unit price for related sections.

1.3 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances. Submit a copy of all disposal permits to the Owner's Representative.

C. Submit copy of written permission from property owner(s) outside limits of Project, with description of property, prior to disposal of excess material. Submit written and signed release from property owner upon completion of disposal work. Copies of the permission and release documents are to be submitted to the Owner's Representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

C. Coordinate with the Owner's Representative the loading of salvageable material.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property outside the Project limits when written permission is obtained from property owner. See Paragraph 1.3C above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless the proper permit has been obtained. Remove excess material placed in "100-year Flood Hazard Area" at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition, unless otherwise authorized by the Owner.

END OF SECTION

SECTION 01 74 23

RESTORATION OF SITE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the restoration of sites affected by Utility Work, Roadway Reconstruction or Widening, or Facilities Work. Section does not apply to roadway extension projects.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.
4. Section 32 90 00 – Seeding, Sodding, and Landscaping.
5. Section 32 92 13 – Hydro-Mulching.

1.2 MEASUREMENT AND PAYMENT

A. Measurement for restoration of project site for utilities disturbed by proposed construction for utilities is by linear foot. Site Restoration for utilities will be measured like particular utility as described in appropriate specification. No separate measurement will be made for restoration of branch pipe, valves and other associated work for utilities. Multiple utilities within same right-of-way will be paid on linear foot basis for only one utility.

B. Measurement for restoration of project site disturbed along roadway reconstruction or widening project is by linear foot. Site restoration for roadway reconstruction or widening projects will be measured along the centerline of right-of-way. No separate payment will be made when more than one phase occurs within same right-of-way.

C. Only one payment for site restoration will be made when utility construction coincides with roadway reconstruction or widening.

D. Payment will be made at unit price for Site Restoration, regardless of size or type of pipe, method of construction, paved or unpaved areas, or thickness and width of pavement. Payment for site restoration will be made when restoration is complete within right-of-way, including service connections if applicable. No partial payment will be made.

E. See other appropriate sections for measurement and payment for paving of roads, driveways, shoulders, sidewalks, curbs and gutters.

F. Service Reconnections. Service reconnections are not considered restoration of site improvements and are not paid under this Section.

G. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ANSI Z60.1 – American Standard for Nursery Stock.

1.4 DEFINITIONS

A. Site Restoration is replacement or reconstruction of site improvements to rights-of-way, easements, public property, and private property that are affected or altered by construction operations, with improvements to restore to a condition which is equal to, or better than, that which existed prior to construction operations.

B. Site Improvement includes but is not limited to pavement, curb and gutter, esplanades, sidewalks, driveways, culverts, headwalls, mail boxes, lighting, signage, fences, lawns, irrigation systems, and landscaping.

C. Line Segment. Length of water line, in line junction structure and bends as designated on Drawings, and to end of stubs or termination of pipe.

D. Minimum Trench Width. Allowable trench width for corresponding pipe outside diameter as defined in Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities, unless otherwise indicated on the Drawings.

1.5 SUBMITTALS

A. Conform to requirements of Specification Section 01 33 00 – Submittals.

B. Submit qualifications of nursery or landscaping firm to be used.

1.6 QUALITY ASSURANCE

A. Have trees, landscape shrubs, and plantings performed by qualified personnel.

1.7 SCHEDULING

A. After paving or utility work is completed on line segment and segment is submitted on monthly estimate for payment, complete site restoration for that segment in accordance with 3.1 of this Section, unless extended in writing by Owner's Representative.

B. For utility work requiring testing or post-installation TV inspection, completion of segment is not considered to include testing or TV inspection. Schedule for completion of site restoration is not determined by completion of testing or TV inspection.

1.8 WARRANTY

A. Provide 2-week warranty on plants and sod grasses that die due to shock or damage only.

B. Replace plants that fail during warranty period according to specifications governing original plants.

C. At the end of the warranty period, provide written notification to homeowner(s) stating the underlying property owner, advising that home owner is subsequently responsible for watering, maintaining replaced plants and grasses. Provide copy of notice to Owner's Representative. Notice to include date and time notice was provided, who provided the notice and how was delivered.

D. Damage caused by natural hazards including hail, high winds or storm is not covered by warranty.

E. Existing plant material required to be moved on site are covered under warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seeding and Sodding.

1. Provide sod and mechanically seed as specified in Specification Section 32 90 00 – Seeding, Sodding, and Landscaping. For areas to be seeded, conform to

2. Provide hydro-mulching/seeding in accordance with Specification Section 32 92 13 – Hydro-Mulching.

B. Trees, Shrubs, and Plantings.

1. Provide trees, shrubs, and plants of quantity, size, genus, species, and variety of those being replaced and conforming to recommendations and requirements of ANSI Z60.1 and Specification Section 32 90 00 – Seeding, Sodding and Landscaping.

2. Use balled-and-burlapped nursery stock for tree replacement.

3. Within availability of standard nursery stock, replace each removed tree with one of an equivalent species and size, but with not less than 2½-inch diameter trunk, as measured 1½ feet above natural ground.

PART 3 - EXECUTION

3.1 COORDINATION

A. For water main and sanitary sewer and roadway reconstruction and widening, construction cannot exceed site restoration by more than 50% of total Project length or 1,000 lineal feet, whichever is less, unless otherwise approved by the Owner's Representative. Site restoration must proceed continuously and be sequentially completed in order of work progress. When utility work and reconstruction or widening work occurs within same limits of right-of-way, utility installation cannot exceed pavement improvements by more than 1,000 linear feet, unless otherwise approved by the Owner's Representative. No

intermediate areas can be skipped or left to be completed at a future date, unless otherwise approved by the Owner.

B. For water main and sanitary sewer construction, site restoration associated with wet connections, cut and plugs, salvaging of fire hydrants and sewer reconnections which needs to occur after line is tested, can be restored after 45 days provided site is restored immediately after accomplishing such work. Payment may be withheld for such wet connections, cut and plugs, salvaging of fire hydrants and sewer reconnection work until site restoration is complete.

C. Limit utility installation to maximum of two project site locations for projects involving multiple subdivisions or locations, unless otherwise approved by the Owner's Representative.

D. When roadway reconstruction and widening is being completed in phases, complete restoration of site in previous phase before continuing to next phase, unless otherwise approved by the Owner's Representative.

3.2 EXAMINATION

A. Construction Site Photographs. Document conditions on and adjacent to construction site with construction photographs as specified in Specification Section 01 32 36.01 – Project Photographs.

B. Make photographs of all areas where construction operations will be conducted including driveways and sidewalks within or adjacent to Work area.

3.3 PREPARATION

A. Remove or relocate existing fencing, if required, for construction operations. Maintain integrity of private property owner's fencing if needed for protection of children, pets, or property. Notify Property owner and/or resident at least 72 hours in advance before removing fencing and coordinate security needs in accordance with Specification Section 01 11 20 – Use of Premises.

3.4 INSTALLATION

A. Seeding and Sodding.

1. Clean up construction debris and level area with bank sand so that resulting surface of new grass matches level of existing grass and maintains pre-construction drainage patterns. Level minor ruts or depressions caused by construction operations where grass is still viable by filling with bank sand.

2. Restore previously existing turfed areas with sod and fertilize in accordance with Specification Section 32 90 00 – Seeding, Sodding, and Landscaping. Sod to match existing turf.

3. Restore unpaved areas not requiring sodding with hydromulch methods conforming to Specification Section 32 92 13 – Hydro-Mulching.

B. Trees, Shrubbery, and Plants.

1. Take extra care in removing and replanting trees, shrubbery, and plants. Remove trees, shrubbery, and plants, leaving soil around roots. Place

trees, shrubbery, and plants outside of excavation area.

2. Replace in kind any trees, shrubbery, and plants removed or damaged by construction operations.
3. Have nursery or landscape firm make tree replacements using balled-and-burlapped nursery stock.

C. Fence Removal and Replacement.

1. Replace fencing removed or damaged to equal or better than what existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material not damaged by Work may be reused.
2. Remove and dispose of damaged or substandard material.

3.5 CLEANING

A. Remove debris and trash to maintain clean and orderly site as described in General Conditions and Specification Section 01 74 19 – Construction Waste Management and Disposal.

3.6 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas through warranty period.

B. Replace shrubs, plantings, and seeded or sodded areas that fail to become established through warranty period.

C. Maintain newly planted trees, shrubs, and plantings as follows:

1. Water as often as necessary to keep ground and backfill moist until plantings have become established.
2. Repair or replace bracing as necessary.
3. Prune as necessary.
4. Treat plants in accordance with approved methods of horticultural practices where insects or disease affect plants after planting.

D. Refer to Specification Section 01 56 39 – Temporary Tree and Plant Protection, Specification Section 32 92 13 – Hydro-Mulching and Specification Section 32 90 00 – Seeding, Sodding, and Landscaping for additional maintenance requirements.

END OF SECTION

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SECTION 01 75 00

SYSTEM START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
2. Requirements for Substantial Completion Submittals.
3. Owner personnel training.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period:

1. The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   a. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
   b. Equipment start-up.
   c. Personnel training.

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the Project Classified System and starts up and operates the Project Classified System, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the Project Classified System as evidence of Substantial Completion.

D. Substantial Completion: See Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.

1.5 SUBMITTALS

A. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.

1. Master operation and maintenance training schedule:

a. Submit 30 days (minimum) prior to first training session for Owner's personnel.

b. Schedule to include:

1) Target date and time for Owner witnessing of each system initial start-up.

2) Target date and time for Operation and Maintenance training for each system, both field and classroom.

3) Target date for initiation of Demonstration Period.

c. Submit for review and approval by Owner.

d. Include holidays observed by Owner.

e. Attend a schedule planning and coordination meeting 90 calendar days prior to first anticipated training session.

1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.

2) Identify initial target dates for individual manufacturer's training sessions.

f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.

g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
    a. File Contractor's Notice of Substantial Completion and Request for Inspection.
    b. Approved Operation and Maintenance manuals received by Owner's Representative minimum 1 week prior to scheduled training.
    c. Written request for Owner to witness each system pre-demonstration start-up. Request to be received by Owner minimum 1 week before scheduled training of Owner's personnel on that system.
    d. Equipment installation and pre-demonstration start-up certifications.
    e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.6 SEQUENCING AND SCHEDULING

A. Phased Construction:

B. Schedule of Events:

1.7 COST OF START-UP

A. Contractor to pay all costs associated with System start-up.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Start-up Divided into Two Periods:
    1. Pre-Demonstration Period including:
        a. Completion of construction work to bring Project to a state of Substantial Completion.
        b. Start-up of Equipment.
        c. Training of Personnel.
        d. Completion of the filing of all required submittals.
        e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
    2. Demonstration Period including:
        a. Demonstration of functional integrity of facility or PCS.

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:

1. Complete the work to bring the Project to a state of substantial completion.

B. Equipment Start-up:

1. Requirements for individual items of equipment are included in Divisions 02 through 48 of these Specification Sections.
2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
3. Perform Equipment Start-up to extent possible without introducing product flow.
4. Introduce product flow to complete Equipment Start-up for the following equipment:
   a. Devices at Ground Storage Tank No. 2.
   b. Devices at Ground Storage Tank No. 1.
   c. Devices at flow and pressure control station.
5. Procedures include but are not necessarily limited to the following:
   a. Test or check and correct deficiencies of:
      1) Power, control, and monitoring circuits for continuity prior to connection to power source.
      2) Voltage of all circuits.
      3) Phase sequence.
      4) Cleanliness of connecting piping systems.
      5) Alignment of connected machinery.
      6) Vacuum and pressure of all closed systems.
      7) Lubrication.
      8) Valve orientation and position status for manual operating mode.
      9) Tankage for integrity using clean water.
      10) Pumping equipment using clean water.
      11) Instrumentation and control signal generation, transmission, reception, and response. See Specification Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.
      12) Tagging and identification systems.
      13) All equipment: Proper connections, alignment, calibration and adjustment.
   b. Calibrate all safety equipment.

c. Manually rotate or move moving parts to assure freedom of movement.

d. "Bump" start electric motors to verify proper rotation.

e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.

f. Documentation:

1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up. Provide a place for the Contractor to record date and person accomplishing required work. Submit completed document before requesting inspection for Substantial Completion certification.

6. Obtain certifications, without restrictions or qualifications, and deliver to Owner's Representative:

a. Manufacturer's equipment installation check letters.

b. Instrumentation Supplier's Instrumentation Installation Certificate.

C. Personnel Training:

1. See individual equipment specification sections.

2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.

a. Personnel training on individual equipment or systems will not be considered completed unless:

1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.

2) No system malfunctions occur during training.

3) All provisions of field and classroom training specifications are met.

b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.

3. Field and classroom training requirements:

a. Hold classroom training on-site.

b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.

1) Organize each training session in a format compatible with video recording.

c. Training instructor: Factory trained and familiar with giving both classroom and "hands-on" instructions.

d. Training instructors:

1) Be at classes on time. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule.

2) Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.

e. Organize training sessions into maintenance verses operation topics and identify on schedule.

f. Plan for minimum class attendance of ten (10) people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.

g. Instructors to have a typed agenda and well prepared instructional material.

1) The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs.

2) Deliver agendas to the Owner's Representative a minimum of seven (7) days prior to the classroom training.

3) Provide equipment required for presentation of films, slides, and other visual aids.

h. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals submitted according to Specification Section 01 33 00 – Submittals and the following areas as applicable to PCS's.

1) Operation of equipment.

2) Lubrication of equipment.

3) Maintenance and repair of equipment.

4) Troubleshooting of equipment.

5) Preventive maintenance procedures.

6) Adjustments to equipment.

7) Inventory of spare parts.

8) Optimizing equipment performance.

9) Capabilities.

10) Operational safety.

11) Emergency situation response.

12) Takedown procedures (disassembly and assembly).

i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions.

1) Address above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.

j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

D. Complete the filing of all required submittals:
   1. Shop Drawings.
   2. Operation and Maintenance Manuals.
   3. Training material.

E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:
   1. File the notice when the following have been completed:
      a. Construction work (brought to state of Substantial Completion).
      b. Equipment Start-up.
      c. Personnel Training.
      d. Submittal of required documents.
   2. Owner's Representative will review required submittals for completeness within five (5) calendar days of Contractor's notice. If complete, Owner's Representative will complete inspection of the Work, within 10 calendar days of Contractor's notice.
   3. Owner's Representative will inform Contractor in writing of the status of the Work reviewed, within 14 calendar days of Contractor's notice.
      a. Work determined not meeting state of Substantial Completion:
         1) Contractor: Correct deficiencies noted or submit plan of action for correction within five (5) days of Owner's Representative's determination.
         2) Owner's Representative: Reinspect work within five (5) days of Contractor's notice of correction of deficiencies.
         3) Reinspection costs incurred by Owner's Representative will be billed to Owner who will deduct them from final payment due Contractor.
      b. Work determined to be in state of tentative Substantial Completion: Owner's Representative to prepare tentative "Certificate of Substantial Completion."
      c. Certificate of Substantial Completion:
         1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
         2) Issued for Project as a whole or for one or more PCS.
         3) Issued subject to completion or correction of items cited in the certificate (punch list).
         4) Issued with responsibilities of Owner and Contractor cited.
         5) Executed by Owner's Representative.

6) Accepted by Owner.

7) Accepted by Contractor.

d. Upon successful completion of Demonstration Period, Owner's Representative will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:

1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative (service interruptions) exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.

   Service interruptions will be discussed between the Contractor, Owner, and Owner's Representative. Whether or not service interruptions are included within the allowable inoperative period will be determined solely at the Owner's discretion.

   Conduct the demonstration of functional integrity under full operational conditions.
4. Owner will provide operational personnel to provide process decisions affecting plant performance. Owner's assistance will be available only for process decisions. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
5. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
6. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Owner's Representative in advance of initiating Demonstration Period.

7. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
   a. Provide final field instruction on the following systems:
   b. For the above systems, provide a total of eight (8) HRS instruction.
   c. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
   d. Provide Training in shifts to accommodate Owner’s employees’ schedules.
   e. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION

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SECTION 01 77 19

CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for closeout of a construction project.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Introductory Information, Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS (NOT USED)

1.4 SUBSTANTIAL COMPLETION

A. Comply with Specification Section 00 72 00 – General Conditions of the Contract regarding Substantial Completion when Contractor considers the Work, or portion thereof designated by Owner's Representative, to be substantially complete.

B. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Owner's Representative for issuance of a Certificate of Substantial Completion:

1. Cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by specifications for each item;
2. Construction of, and repairs to, pavement, driveways, sidewalks, culverts, headwalls and curbs and gutters;
3. Sodding and hydromulch seeding, unless waived by the Owner in writing;
4. General clean up including signage, lighting, pavement markings, transfer of services, successful testing and landscape;
5. Installation of all bid items included in Specification Section 00 41 00.02 – Proposal Form and approved Contract Document changes.
6. Any additional requirements in Specification Section 01 14 19 – Use of Premises.

C. Assist Owner's Representative with inspection of Contractor's list of items and complete or correct the items, including items added by Owner's Representative, within a time period of 30 days or as mutually agreed.

D. Should Owner's Representative's inspection show failure of Contractor to comply with substantial completion requirements, including those items in Paragraph 1.2B of this specification, Contractor shall complete or correct the items, before requesting another inspection by Owner's Representative.

1.5 CLOSEOUT PROCEDURES

A. Comply with Specification Section 00 72 00 – General Conditions of the Contract regarding Final Inspection and Final Payment when Work is complete and ready for Owner's Representative's final inspection.

B. Provide Project Record Documents in accordance with Specification Section 01 78 39 – Project Record Documents.

C. Complete or correct items on punch list, with no new items added. Address new items during warranty period.

D. Owner will occupy portions of Work as specified in other Sections.

1.6 FINAL CLEANING

A. Execute final cleaning prior to Final Inspection.

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

C. Clean equipment and fixtures to sanitary condition.

D. Clean or replace filters of operating equipment.

E. Clean debris from roofs, gutters, down spouts, and drainage systems.

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

G. Remove waste and surplus materials, rubbish, and temporary construction facilities from site following final test of utilities and completion of Work.

1.7 ADJUSTING

A. Adjust operating equipment to ensure smooth and unhindered operation in accordance with manufacturer's written instructions. Value of this testing and adjusting is five (5) percent of Lump Sum Amount in Schedule of Values for item being tested.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit operations and maintenance data as noted in Specification Section 01 33 00 – Submittals.

B. Five (5) percent of Lump Sum Amount of each piece of equipment as indicated in Schedule of Unit Price Work or Schedule of Values shall be paid after

required O&M data submissions are received and approved by Owner's Representative.

1.9 WARRANTY

A. Provide one original and two copies of each warranty from subcontractors, suppliers, and manufacturers.

B. Provide Table of Contents and assemble warranties in three-ring/D binder with durable plastic cover.

C. Submit warranties prior to final progress payment.

D. Warranties shall commence in accordance with requirements in Specification Section 00 72 00 – General Conditions of the Contract.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance, and extra materials in quantities specified in individual Specification sections.

B. Deliver to location as directed by Owner's Representative; obtain receipt prior to final Payment Application.

1.11 TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR) INSPECTION

A. Contact TDLR's Houston Regional Office, 5425 Polk Street, Houston, Texas, 77023, telephone 713-924-6303, fax 713-921-3106, to schedule an inspection for ADA compliance prior to final completion.

B. Provide results of TDLR's inspection to Owner's Representative prior to final inspection.

1.12 FINAL PHOTOS

A. Provide per Specification Section 01 32 36.01 – Project Photographs.

1.13 PROJECT RECORD DOCUMENTS

A. Provide per Specification Section 01 78 39 – Project Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 78 23.13

OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Measurement and Payment
2. Submittals
3. Equipment Operation and Maintenance Data

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Value of approved equipment operations and maintenance manuals is 5 percent of individual equipment value as indicated in Specification Section 00 41 00.02 – Proposal Form. This amount can be included in next progress payment after approval of submitted manual.

1.3 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals. Submit list of operation and maintenance manuals and parts manuals to be provided.

B. Submit documents, bound in 8½- x 11-inch text pages, three-ring/D binders with durable plastic covers.

C. Prepare binder covers with printed title “OPERATION AND MAINTENANCE INSTRUCTIONS,” title of project and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Contents: Prepare Table of Contents for each volume, with each Product or system description identified.

1. Part 1: Directory, listing names, addresses, and telephone numbers of Owner, Owner’s Representative, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions, arranged by system. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify following:

a. Significant design criteria

b. List of equipment

c. Parts list for each component

d. Operating instructions

e. Maintenance instructions for equipment and systems

f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents

3. Part 3: Project documents and certificates, including following:

a. Shop drawings and product data

b. Air and water balance reports

c. Certificates

d. Photocopies of warranties

F. Within 1 month prior to placing equipment or facility in service, submit one original and two copies of operation and maintenance manual and parts manual for review.

G. Submit one original and two copies of completed volumes in final form 10 days prior to final inspection. This will be returned after final inspection, with Owner's comments. Revise content of documents as required prior to final submittal.

H. Revise and resubmit final volumes within 10 days after final inspection.

1.4 EQUIPMENT OPERATION AND MAINTENANCE DATA

A. Furnish operation and maintenance manuals for equipment. Operation and maintenance manual must contain all information required for the Owner to operate, maintain, and repair equipment. Manual must be prepared by equipment manufacturer, furnished to Owner's Representative and, as minimum, contain following:

1. Equipment functions, normal operating characteristics and limiting conditions

2. Assembly, installation, alignment, adjustment, and checking instructions

3. Operating instructions for start-up, normal operation, regulation and control, normal shutdown and emergency shutdown

4. Lubrication and detailed maintenance instructions. Maintenance instructions are to include detailed drawings giving location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of equipment

5. Troubleshooting guide

6. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability
7. Outline, cross-section, and assembly drawings; engineering data; wiring diagram
8. Test data and performance curves

B. Furnish parts manuals for equipment. Manual must be prepared by equipment manufacturers, furnished to Owner's Representative and, as minimum, contain following:

1. Detailed drawings giving location of each maintainable part
2. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability including local contact information.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Maintenance and Submittal.
2. Recording.
3. Submittals.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain one record copy of documents at site in accordance with Specification Section 00 72 00 – General Conditions of the Contract.

B. Store Record Documents and samples in field office when field office is required by Contract, or in secure location. Provide files, racks, and secure storage for Record Documents and samples.

C. Label each document “PROJECT RECORD” in neat, large, printed letters.

D. Maintain Record Documents in clean dry and legible condition. Do not use Record Documents for construction purposes.

E. Keep Record Documents and Samples available for inspection by Owner’s Representative.

F. Bring Record Drawings to progress review meetings for viewing by Owner’s Representative.

1.4 RECORDING

A. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

B. Contract Drawings: Legibly mark each item to record actual construction, or “as built” conditions, including:

1. Measured depths of elements of foundation in relation to finish first floor datum.

2. Measured horizontal locations and elevations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Elevations of underground utilities referenced to bench mark utilized for Project.
4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
5. Field changes of dimension and detail.
6. Modifications made by Change Order.
7. Details not on original Contract Drawings.
8. References to related shop drawings and modifications.

C. Maintain on site at all times an instrument for accurately measuring elevations. Survey every joint of water main at time of construction and record on drawings water main invert elevation, including elevation top of manway and centerline horizontal location relative to baseline.

D. Record information with red felt-tip marking pen on set of blue line opaque drawings.

E. Legibly mark Record Drawings to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

F. Legibly annotate shop drawings to record changes made after review.

1.5 SUBMITTALS

A. At Contract closeout, deliver Project Record Documents to Owner's Representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 03 05 05

TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contractor requirements for testing of concrete.
2. Definition of Owner provided testing.
3. Acceptance criteria for concrete.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 21 00 – Reinforcement.
4. Section 03 31 30 – Concrete, Materials and Proportioning.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 RESPONSIBILITY AND PAYMENT

A. Owner will hire an independent Testing Agency/Service Provider to perform the following testing and inspection and provide test results to the Owner's Representative and Contractor.

1. Testing and inspection of concrete and grout produced for incorporation into the work during the construction of the Project for compliance with the Contract Documents.
2. Additional testing or retesting of materials occasioned by their failure, be by test or inspection, to meet requirements of the Contract Documents.
3. Strength testing on concrete required by the Owner's Representative when the water-cement ratio exceeds the water-cement ratio of the typical test cylinders.
4. In-place testing of concrete as may be required by Owner's Representative when strength of structure is considered potentially deficient.

5. Other testing services needed or required by Contractor such as field curing of test specimens and testing of additional specimens for determining when forms, form shoring or reshoring may be removed.
6. Owner will pay for services defined in this paragraph.

1.4 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T260 – Standard Method of Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials.
2. American Concrete Institute (ACI):
   a. 318 – Building Code Requirements for Structural Concrete.
3. ASTM International (ASTM):
   a. C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   c. C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   d. C138 – Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
   e. C143 – Standard Test Method for Slump of Hydraulic Cement.
   f. C172 – Standard Practice for Sampling Freshly Mixed Concrete.
   g. C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   h. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   i. E329 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

B. Qualifications:

1. Testing Agency:
   a. Meeting requirements of ASTM E329.
   b. Provide evidence of recent inspection by Cement and Concrete Reference Laboratory (CCRL) of National Bureau of Standards (NBS), and correction of deficiencies noted.

C. Use of Testing Agency and approval by Owner's Representative of proposed concrete mix design shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

1.5 DEFINITIONS

A. Testing Agency/Service Provider: An independent professional testing/inspection firm or service hired by Owner to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

1.6 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
    a. Concrete materials and concrete mix designs proposed for use.
        1) Include results of all testing performed to qualify materials and to establish mix designs.
        2) Place no concrete until approval of mix designs has been received in writing.
        3) Submittal for each concrete mix design to include:
            a) Sieve analysis and source of fine and coarse aggregates.
            b) Test for aggregate organic impurities.
            c) Proportioning of all materials.
            d) Type of cement with mill certificate for the cement.
            e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Specification Section 03 31 30 – Concrete, Materials, and Proportioning.
            f) Slump.
            g) Brand, type and quantity of air entrainment and any other proposed admixtures.
            h) Shrinkage test results.
            i) Total chloride ion content per cubic yard of concrete determined in accordance with AASHTO T260.
            j) 28-day compression test results and any other data required by Specification Section 03 31 30 – Concrete, Materials, and Proportioning to establish concrete mix design.
3. Certifications:
    a. Testing Agency qualifications.

1.7 WARRANTY (NOT USED)

A. Refer to Article 13 of the General Conditions of the Contract (00 72 00)

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED BY OWNER

A. The following concrete testing will be performed by the Owner's Service Provider:

1. Concrete strength testing:

a. Secure concrete samples in accordance with ASTM C172.

1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.

b. For each strength test mold and cure four (4) 6-IN x 12-IN, or five (5) 4-IN x 8-IN cylinders from each sample in accordance with ASTM C31.

1) Record any deviations from requirements on test report.

2) Cylinder size: Per ASTM C31.

c. Field cure one cylinder for the seven (7) day test, laboratory cure the remaining.

d. Test cylinders in accordance with ASTM C39.

1) Test two (2) 6-IN x 12-IN, or three (3) 4-IN x 8-IN cylinders at 28 days for strength test result and one (1) at seven (7) days for information.

2) Hold remaining cylinder in reserve.

e. Strength test result:

1) Average of strengths of two (2) 6-IN x 12-IN, or three (3) 4-IN x 8-IN cylinders from the same sample tested at 28 days.

2) If one (1) cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder; average strength of remaining cylinders shall be considered strength test result.

3) Should all cylinders in a test show any of above defects, discard entire test.

f. Frequency of tests:

1) Concrete sand cement grout: One (1) strength test for each 4 HR period of grout placement or fraction thereof.

2) Precast concrete, concrete topping, concrete fill and lean concrete: One (1) strength test for each 10 CY of each type of concrete or fraction thereof placed.

3) All other concrete:

a) One (1) strength test to be taken not less than once a day, nor less than once for each 60 CY or fraction thereof placed in any one (1) day.

b) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five (5) strength tests for each concrete mix, tests shall then be made from at least five (5) randomly selected batches or from each batch if fewer than five (5) batches are provided.

2. Slump testing:

a. Determine slump of concrete sample for each strength test.

1) Determine slump in accordance with ASTM C143.

b. If consistency of concrete appears to vary, the Owner's Representative shall be authorized to require a slump test for each concrete truck.

1) This practice shall continue until the Owner's Representative deems it no longer necessary.

3. Air content testing: Determine air content of concrete sample for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138..

4. Temperature testing: Determine temperature of concrete sample for each strength test..

5. In-place concrete testing (if required).

3.2 SAMPLING ASSISTANCE AND NOTIFICATION FOR OWNER

A. To facilitate testing and inspection, perform the following:

1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at site.

2. Owner to provide and maintain for sole use of Testing Agency adequate facilities for safe storage and proper curing of test specimens on site for first 24 HRS as required by ASTM C31.

B. Notify Owner's Representative and Owner's Testing Agency sufficiently in advance of operations (minimum of 24 HRS) to allow completion of quality tests for assignment of personnel and for scheduled completion of quality tests.

3.3 ACCEPTANCE

A. Completed concrete work which meets applicable requirements will be accepted without qualification.

B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.

1. In this event, modifications may be required to assure that concrete work complies with requirements.

2. Modifications, as directed by Owner's Representative, to be made at no additional cost to Owner.

D. Dimensional Tolerances:

1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Owner's Representative.

2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.

a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.

3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.

4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.

a. Repair or remove and replace if required.

5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.

a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.

E. Appearance:

1. Concrete surfaces exposed to view with defects which, in opinion of Owner's Representative, adversely affect appearance as required by specified finish shall be repaired by approved methods.

2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Owner's Representative, the defects impair the strength or function of the member.

F. High Water-Cement Ratio:

1. Concrete with water in excess of the specified maximum water-cement ratio will be considered potentially deficient in durability.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Owner's Representative.

G. Strength of Structure:

1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:

a. Low concrete strength:

1) Test results for standard molded and cured test cylinders to be evaluated separately for each mix design.

a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.

b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three (3) strength tests.

c) A strength test shall be the average of two (2) cylinders from the same sample tested at 28 days.

2) Acceptance:

a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:

(1) Average of all sets of three (3) consecutive strength tests equal or exceed the required specified 28 day compressive strength.

(2) No individual strength test falls below the required specified 28 day compressive strength by more than 500 psi.

b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Specification Section 03 21 00 – Reinforcement or requirements of the Contract Drawings or approved Shop Drawings.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Curing time and procedure not meeting requirements of this Specification Section.

e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.

f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.

g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.

2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.

3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.

   a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Owner's Representative to determine relative strengths at various locations in the structure or for selecting areas to be cored.

      1) Such tests shall not be used as a basis for acceptance or rejection.

   b. Core tests:

      1) Where required, test cores will be obtained in accordance with ASTM C42.

         a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 DegF, relative humidity less than 60 percent) for seven (7) days before test then test dry.

         b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 HRS and test wet.

         c) Testing wet or dry to be determined by Owner's Representative.

      2) Three (3) representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.

         a) Location of cores shall be determined by Owner's Representative so as least to impair strength of structure.

         b) If, before testing, one (1) or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.

      3) Concrete in area represented by a core test will be considered adequate if average strength of three (3) cores is equal to at least 85 percent of specified strength and no single core is less than 75 percent of specified strength.

      4) Fill core holes with nonshrink grout and finish to match surrounding surface when exposed in a finished area.

4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 20.

5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Owner's Representative, at Contractor's expense.

6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

3.4 OWNER TRAINING (NOT USED)

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SECTION 03 09 00

CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete and grout.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R, Cement and Concrete Terminology.
   b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
   c. 212.3R, Chemical Admixtures for Concrete.
   d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   e. 304.2R, Placing Concrete by Pumping Methods.
   f. 305R, Hot Weather Concreting.
   g. 306R, Cold Weather Concreting.
   h. 318, Building Code Requirements for Structural Concrete.
   i. 347R, Recommended Practice for Concrete Formwork.
2. ASTM International (ASTM):
   a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

d. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

f. C33, Standard Specification for Concrete Aggregates.

g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

h. C94, Standard Specification for Ready-Mixed Concrete.

i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.

k. C150, Standard Specification for Portland Cement.

l. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.

m. C172, Standard Practice for Sampling Freshly Mixed Concrete.

n. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

p. C260, Standard Specification for Air-Entraining Admixtures for Concrete.

q. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

r. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

s. C494, Standard Specification for Chemical Admixtures for Concrete.

t. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

u. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

v. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

w. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

x. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

y. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

z. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

aa. E96, Standard Test Methods for Water Vapor Transmission of Materials.

bb. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

cc. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

3. Corps of Engineers (COE):

   a. CRD-C572, Specifications for Polyvinylchloride Waterstops.

   b. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).

B. Quality Control:

1. Concrete testing agency:

   a. Contractor to employ and pay for services of a testing laboratory to:

      1) Perform materials evaluation.

      2) Design concrete mixes.

   b. Concrete testing agency to meet requirements of ASTM E329.

2. Do not begin concrete production until proposed concrete mix design has been approved by Owner's Representative.

   a. Approval of concrete mix design by Owner's Representative does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.

3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.

   a. Do not use revised concrete mixes until submitted to and approved by Owner's Representative.

4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.

C. Qualifications:

1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).
2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the state where the Project is located.

1.4 DEFINITIONS

A. Per ACI 116R except as modified herein:

1. Concrete fill: Non-structural concrete.
2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
3. Exposed concrete: Exposed to view after construction is complete.
4. Indicated: Indicated by Contract Documents.
5. Lean concrete: Concrete with low cement content.
6. Nonexposed concrete: Not exposed to view after construction is complete.
7. Required: Required by Contract Documents.
8. Specified strength: Specified compressive strength at 28 days.
9. Submitted: Submitted to Owner's Representative.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Concrete mix designs proposed for use.
   a. Concrete mix design submittal to include the following information:
      1) Sieve analysis and source of fine and coarse aggregates.
      2) Test for aggregate organic impurities.
      3) Test for deleterious aggregate per ASTM C289.
      4) Proportioning of all materials.
      5) Type of cement with mill certificate for cement.
      6) Type of fly ash with certificate of conformance to specification requirements.
      7) Slump.
      8) Air content.

9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.

10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.

11) Shrinkage test results.

12) Standard deviation value for concrete production facility.

3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturers and types:
      1) Joint fillers.
      2) Curing agents.
      3) Chemical sealer.
      4) Bonding and patching mortar.
      5) Construction joint bonding adhesive.
      6) Non-shrink grout with cure/seal compound.
      7) Waterstops.
4. Reinforcing steel:
   a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
   b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
   c. Obtain approval of Shop Drawings by Owner’s Representative before fabrication.
   d. Mill certificates.
5. Strength test results of in place concrete including slump, air content and concrete temperature.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:
   1. Cement and fly ash:
      a. Store in moisture proof, weathertight enclosures.
      b. Do not use if caked or lumpy.

2. Aggregate:
    a. Store to prevent segregation and contamination with other sizes or foreign materials.
    b. Obtain samples for testing from aggregates at point of batching.
    c. Do not use frozen or partially frozen aggregates.
    d. Do not use bottom 6 IN of stockpiles in contact with ground.
    e. Allow sand to drain until moisture content is uniform prior to use.
3. Admixtures:
    a. Protect from contamination, evaporation, freezing, or damage.
    b. Maintain within temperature range recommended by manufacturer.
    c. Completely mix solutions and suspensions prior to use.
4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:
1. Concrete:
    a. Prepare a delivery ticket for each load for ready-mixed concrete.
    b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
    c. Ticket to show:
        1) Mix identification mark.
        2) Quantity delivered.
        3) Amount of each material in batch.
        4) Outdoor temp in the shade.
        5) Time at which cement was added.
        6) Numerical sequence of the delivery.
        7) Amount of water added.
2. Reinforcing steel:
    a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
    b. Mark numbers to match Shop Drawing mark number.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:

1. Nonshrink, nonmetallic grout:
   a. Sika "SikaGrout 212."
   b. Euclid Chemial "NS Grout."
   c. BASF Admixtures, Inc. "Masterflow 713."
2. Epoxy grout:
   a. BASF Admixtures, Inc. "Brutem MPG."
   b. Euclid Chemical Company, "E3-G."
   c. Fosroc, "Conbextra EPHF".
3. Expansion joint fillers:
   a. Permaglaze Co.
   b. Rubatex Corp.
   c. Williams Products, Inc.
4. Waterstops, PVC:
   a. Greenstreak Plastic Products, Inc.
   b. W.R.Meadows, Inc.
   c. Burke Company.
5. Form coating:
   a. Richmond "Rich Cote."
   b. Industrial Lubricants "Nox-Crete Form Coating."
   c. Euclid Chemical "Eucoslip VOX."
6. Prefabricated forms:
   a. Simplex "Industrial Steel Frame Forms."
   b. Symons "Steel Ply."
   c. Universal "Uniform."
7. Chemical sealer:
   a. L&M Construction Chemicals, Inc.
   b. Euclid Chemical Company.
   c. Dayton Superior.

8. Bonding agent:
    a. Euclid Chemical Co.
    b. BASF Admixtures, Inc.
    c. L&M Construction Chemicals Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Portland Cement: Conform to ASTM C150 Type I or Type II.

B. Fly Ash:
1. ASTM C618, Class F or Class C.
2. Nonstaining.
    a. Hardened concrete containing fly ash to be uniform light gray color.
3. Maximum loss on ignition: 4 percent.
4. Compatible with other concrete ingredients.
5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.

C. Admixtures:
1. Air entraining admixtures: ASTM C260.
2. Water reducing, retarding, and accelerating admixtures:
    a. ASTM C494 Type A through E.
    b. Conform to provisions of ACI 212.3R.
    c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Owner’s Representative and at no cost to Owner.
    d. Follow manufacturer's instructions.
    e. Use chloride free admixtures only.
3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
    a. 0.10 all concrete.
4. Do not use calcium chloride.
5. Pozzolanic admixtures: ASTM C618.
6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water: Potable, clean, free of oils, acids and organic matter.

E. Aggregates:
   1. Normal weight concrete: ASTM C33, except as modified below.
   2. Fine aggregate:
      a. Clean natural sand.
      b. No manufactured or artificial sand.
   3. Coarse aggregate:
      a. Crushed rock, natural gravel, or other inert granular material.
      b. Maximum amount of clay or shale particles: 1 percent.
   4. Gradation of coarse aggregate:
      a. Lean concrete and concrete topping: Size #7.
      b. All other concrete: Size #57 or #67.

F. Concrete Grout:
   1. Nonshrink nonmetallic grout:
      a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
      b. Grout to produce a positive but controlled expansion.
      c. Mass expansion not to be created by gas liberation.
      d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
      e. In accordance with COE CRD-C621.
   2. Epoxy grout:
      a. 3-component epoxy resin system.
         1) Two liquid epoxy components.
         2) One inert aggregate filler component.
      b. Each component packaged separately for mixing at jobsite.

G. Reinforcing Steel:
   1. Reinforcing bars: ASTM A615, Grade 60.
   2. Welded wire reinforcement: ASTM A185.
      a. Minimum yield strength: 60,000 psi.
   3. Column spirals: ASTM A82.

H. Forms:
   1. Prefabricated or job built.
   2. Wood forms:
      a. New 5/8 or ¾ IN 5-ply structural plywood of concrete form grade.

b. Built-in-place or prefabricated type panel.

c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.

d. When approved, plywood may be reused.

3. Metal forms:

a. Metal forms excluding aluminum may be used.

b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

4. Chamfer strips: Clear white pine, surface against concrete planed.

5. Form ties:

a. Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.

b. Cone diameter: 3/4 IN minimum to 1 IN maximum.

c. Embedded portion 1-1/2 IN minimum back from concrete face.

d. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.

e. Provide ties with built-in waterstops at all walls that will be in contact with process liquid during plant operation.

6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.

I. Waterstops:

1. Plastic: COE CRD-C572.

2. Serrated with center bulb.

3. Thickness: 3/8 IN.

4. Length (general use): 6 IN unless indicated otherwise.

5. Expansion joints:

a. Length: 9 IN.

b. Center bulb: 1 IN OD x 1/2 IN ID.

6. Provide hog rings or grommets spaced at maximum 12 IN OC along the length of the water stop.

7. Provide factory made waterstop fabrications at all changes of direction, intersections and transitions leaving only straight butt splices for the field.

J. Chairs, Runners, Bolsters, Spacers, and Hangers:

1. Stainless steel, epoxy coated, plastic, brick, or plastic coated metal.

a. Plastic coated: Rebar support tips in contact with the forms only.

K. Chemical Floor Sealer:
   1. Colorless low VOC water-based solution containing acrylic copolymers.
      a. ASTM C1315, Class B, minimum 30 percent solids.
   2. L&M Construction Chemicals Inc. Dress & Seal WB 30.

L. Vapor Retarder:
   1. ASTM E1745, Class A, minimum 15 mil thickness.
   2. Water vapor permeance: 0.03 maximum per ASTM E96.
   3. Puncture resistance: ASTM D1709, Method B, 2200 grams.
   4. Minimum tensile strength: 45 LBS/IN, ASTM D882.
   5. Vapor retarder tape: As recommended by vapor retarder manufacturer.

M. Membrane Curing Compound:
   1. ASTM C309, Type I-D.
   2. Resin based, dissipates upon exposure to UV light.
   3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
   4. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.

N. Bonding Agent:
   1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
   2. Euclid Chemical Co. "Flex-Con."
   3. BASF Admixtures, Inc. "Acryl-Set."
   4. L&M Construction Chemicals "Everbond."
   5. Thoro System Products "Acryl 60."

O. Expansion Joint Filler:
   1. In contact with water or sewage:
      a. Closed cell neoprene.
      b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
   2. Exterior driveways, curbs and sidewalks:
      a. Asphalt expansion joint filler.
      b. ASTM D994.

3. Other use:

   a. Fiber expansion joint filler.

   b. ASTM D1751.

2.3 CONCRETE MIXES

A. General:

1. All concrete to be ready mixed concrete conforming to ASTM C94.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete except where lightweight concrete is indicated on Drawings.

B. Strength:

1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
Concrete fill	Normal weight	3000 psi
Lean concrete	Normal weight	3000 psi
Concrete topping	Normal weight and lightweight	4000 psi
Precast concrete	Normal weight and lightweight	5000 psi
All other general use concrete	Normal weight	4000 psi

* Minimum 28-day compressive strength.

C. Air Entrainment:

1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 IN or 3/4 IN	5 to 7
1/2 IN	5 1/2 to 8

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 IN maximum, 1 IN minimum:

1. Measured at point of discharge of the concrete into the concrete construction member.

2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Pumped concrete:
   a. Provide additional water at batch plant to allow for slump loss due to pumping.
   b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
4. Determine slump per ASTM C143.

E. Selection of Proportions:

1. General:
   a. Proportion ingredients to:
      1) Produce proper workability, durability, strength, and other required properties.
      2) Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

	MINIMUM CEMENT, LB/CY			MAXIMUM
	MAXIMUM AGGREGATE SIZE			WATER
SPECIFIED STRENGTH	1/2 IN	3/4 IN	1 IN	CEMENT RATIO BY WEIGHT
3000	---	517	517	0.45
4000	611	611	611	0.45
5000	---	686	665	0.40

3. Substitution of fly ash: Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Sand cement grout:
   a. Three parts sand.
   b. One part Portland cement.
   c. Entrained air: Six percent plus or minus one percent.
   d. Sufficient water for required workability.
   e. Minimum 28-day compressive strength: 3,000 psi.
5. Pan stair fill:
   a. Coarse aggregate: 100 percent passing a 1/2 IN sieve.

b. Proportions:

1) 1 sack cement.

2) 150 LBS coarse aggregate.

3) 150 LBS fine aggregate (sand).

c. Adjust mix to obtain satisfactory finishing.

6. Normal weight concrete:

a. Proportion mixture to provide desired characteristics using one of methods described below:

1) Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.

a) Air content within range specified above.

b) Record and report temperature of trial mixes.

c) Proportion trial mixes per ACI 211.1.

2) Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:

a) Field test records must be acceptable to Owner's Representative to use this method.

b) Test records shall represent materials, proportions and conditions similar to those specified.

7. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.

F. Allowable Shrinkage: 0.048 percent per ASTM C157.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:

1. Contractor is responsible for design and erection of formwork.

2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

a. Allowable tolerances: As recommended in ACI 347R.

3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
   a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
   b. Do not place floor drains through beams.
4. Openings: Provide openings in formwork to accommodate work of other trades.
   a. Accurately place and securely support items built into forms.
5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
6. Clean and adjust forms prior to concrete placement.
7. Tighten forms to prevent mortar leakage.
8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

B. Reinforcement:
1. Position, support and secure reinforcement against displacement.
2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
5. Extend reinforcement to within 2 IN of concrete perimeter edges.
   a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
7. Do not weld reinforcing bars.
8. Welded wire reinforcement:
   a. Install welded wire reinforcement in maximum practical sizes.
   b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
      1) One spacing of cross wires plus 2 IN.
      2) 1.5 x development length.
      3) 6 IN.

c. Development length: ACI 318 basic development length for the specified fabric yield strength.

9. Provide at locations indicated.
10. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.
11. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
12. Locate construction joints in columns and walls:
    a. At the underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
    b. Haunches, drop panels, and column capitals are considered part of the supported floor or roof and shall be placed monolithically therewith.
    c. Column based need not be placed monolithically with the floor below.
13. Locate construction joints in beams and girders:
    a. At the middle of the span, unless a beam intersects a girder at that point.
    b. If the middle of the span is at an intersection of a beam and girder, offset the joint in the girder a distance equal to twice the beam width.
    c. Provide satisfactory means for transferring shear and other forces through the construction joint.
14. Locate construction joints in suspended slabs:
    a. At or near the center of span in flat slab or T-beam construction.
    b. Do not locate a joint between a slab and a concrete beam or girder unless so indicated on Drawings.
15. In pan-formed joists:
    a. At or near span center when perpendicular to the joists.
    b. Centered in the slab, midway between joists, when parallel to the joists.
16. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
17. At least 48 HRS shall elapse between placing of adjoining concrete construction.
18. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
19. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.

C. Embedments:

1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
2. Use setting diagrams, templates and instructions for locating and setting.
3. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.

D. Placing Concrete:

1. Place concrete in compliance with ACI 304R and ACI 304.2R.
2. Place in a continuous operation within planned joints or sections.
3. Begin placement when work of other trades affecting concrete is completed.
4. Place concrete by methods which prevent aggregate segregation.
5. Do not allow concrete to free fall more than 4 FT.
6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

E. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

F. Protection:

1. Protect concrete from physical damage or reduced strength due to weather extremes.
2. In cold weather comply with ACI 306R except as modified herein.
   a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
   b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

   c. Do not place heated concrete that is warmer than 80 DegF.
   d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
   e. Do not allow concrete to cool suddenly.

3. In hot weather comply with ACI 305R except as modified herein.
    a. At air temperature of 95 DegF and above, keep concrete as cool as possible during placement and curing.
    b. Do not allow concrete temperature to exceed 95 DegF at placement.
    c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
    d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

G. Curing:
1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Curing floor flood water will be supplied by the Owner.
3. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
4. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
5. Provide curing for minimum of 7 days.
6. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
7. In hot weather follow curing procedures outlined in ACI 305R.
8. In cold weather follow curing procedures outlined in ACI 306R.
9. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
10. Curing vertical surfaces with a curing compound:
    a. Cover vertical surfaces with a minimum of two coats of the curing compound.
    b. Allow the preceding coat to completely dry prior to applying the next coat.
    c. Apply the first coat of curing compound immediately after form removal.
    d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
    e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

H. Form Removal:
1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.

2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.
3. Where reshoring is planned, supporting formwork may be removed when concrete has sufficient strength to safely support its own weight and loads placed thereon.
    a. While reshoring is underway, no superimposed loads shall be permitted on the new construction.
    b. Place reshores as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.
    c. Tighten reshores to carry their required loads.
    d. Leave reshores in place until concrete being supported has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

A. Tolerances:
    1. Class A: 1/8 IN in 10 FT.
    2. Class B: 1/4 IN in 10 FT.
B. Surfaces Exposed to View:
    1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
        a. To be covered with a coating or covering material applied directly to concrete.
        b. Scheduled for grout cleaned finish.
    2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
    3. Fill tie holes with nonshrink nonmetallic grout.
C. Surfaces Not Exposed to View:
    1. Patch voids, air pockets and honeycomb areas with cement grout.
    2. Fill tie holes with nonshrink nonmetallic grout.
D. Grout Cleaned Finish:
    1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient bonding agent/water mixture to produce a grout with the consistency of thick paint.
        a. White Portland cement shall be substituted for gray Portland cement to produce a color that matches color of surrounding concrete as determined by trial patch for areas not to be painted.

2. Wet surface of concrete to prevent absorption of water by grout and uniformly apply grout with brushes or spray gun.
3. Immediately scrub the surface with a cork float or stone to coat and fill air bubbles and holes.
4. While grout is still plastic, remove all excess grout by working surface with rubber float, sack or other approved means.
5. After the surface whitens from drying, rub vigorously with clean burlap.
6. Keep final finish damp for a minimum of 36 HRS after final rubbing.

E. Slab Float Finish:

1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
5. Refloat slab immediately to a uniform sandy texture.

F. Troweled Finish:

1. Float finish surface.
2. Next power trowel, and finally hand trowel.
3. Produce a smooth surface which is relatively free of defects with first hand troweling.
4. Perform additional trowelings by hand after surface has hardened sufficiently.
5. Final trowel when a ringing sound is produced as trowel is moved over surface.
6. Thoroughly consolidate surface by hand troweling.
7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.

G. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

H. Apply chemical floor hardener to permanently exposed interior concrete floor slab surfaces where indicated.

1. Apply in accordance with manufacturer's instructions.

3.3 GROUT

A. Preparation:

1. Nonshrinking nonmetallic grout:

a. Clean concrete surface to receive grout.

b. Saturate concrete with water for 24 HRS prior to grouting.

2. Rock anchors:

a. Clean rock anchors of all loose material.

b. Orient hook or bends in anchor bars to clear anchor bolts, reinforcements, and other embedments to be installed later.

3. Epoxy grout: Apply only to clean, dry, sound surface.

B. Application:

1. Nonshrinking nonmetallic grout:

a. Mix in a mechanical mixer.

b. Use no more water than necessary to produce flowable grout.

c. Place in accordance with manufacturer's instructions.

d. Completely fill all spaces and cavities below the bottom of baseplates.

e. Provide forms where baseplates and bedplates do not confine grout.

f. Where exposed to view, finish grout edges smooth.

g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.

h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.

i. Wet cure grout for seven (7) days, minimum.

2. Rock anchors:

a. See Item 1 above.

b. If rodded:

1) Fill each hole so that it overflows when anchor bar is inserted.

2) Force anchor bars into place.

c. If pressure placed, set anchor bar before grouting.

d. Take special care to avoid any movement of anchors that have been placed.

3. Epoxy grout:
    a. Mix and place in accordance with manufacturer's instructions.
    b. Completely fill all cavities and spaces around dowels and anchors without voids.
    c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
    1. Contractor to cooperate with Owner in obtaining and testing samples.

B. Tests During Construction:
    1. Strength test - procedure:
        a. Three cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and ASTM C31.
        b. Cylinders will be tested per ASTM C39:
            1) One at 7 days.
            2) Two at 28 days.
    2. Strength test - frequency:
        a. Not less than one test each day concrete placed.
        b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
        c. Not less than one test for each type of concrete poured.
        d. Not less than one test for each concrete structure exceeding 2 CY volume.
    3. Slump test:
        a. Per ASTM C143.
        b. Determined for each strength test sample.
        c. Additional slump tests may be taken.
    4. Air content:
        a. Per ASTM C231, ASTM C173, and ASTM C138.
        b. Determined for each strength test sample.
    5. Temperature: Determined for each strength test sample.

C. Evaluation of Tests:

1. Strength test results:

a. Average of 28-day strength of two cylinders from each sample.

1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.

2) If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Concrete:

1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:

a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.

b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.

2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Owner's Representative.

a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

A. Form Types:

1. Surfaces exposed to view:

a. Prefabricated or job-built wood forms.

b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.

c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.

d. Construct forms sufficiently tight to prevent leakage of mortar.

2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.

3. Other types of forms may be used:

a. For surfaces not restricted to plywood or lined forms.

b. As backing for form lining.

B. Grout:

1. Nonshrinking nonmetallic grout: General use.

2. Epoxy grout:

a. Grouting of dowels and anchor bolts into existing concrete.

b. Other uses indicated on Drawings.

3. Sand cement grout: Keyways of precast members.

C. Concrete:

1. Precast concrete: Where indicated on Drawings.
2. Lean concrete: Where indicated on Drawings.
3. Concrete fill: Where indicated on Drawings.
4. Lightweight concrete: Where indicated on Drawings.
5. Normal weight concrete: All concrete.
6. Concrete pan fill: Stair and landings where indicated on Drawings.
7. General use concrete: All other locations.

D. Concrete Finishes:

1. Grout cleaned finish: Where indicated on Drawings.
2. Slab finishes:

a. Use following finishes as applicable, unless otherwise indicated:

1) Floated finish: Surfaces intended to receive roofing, concrete topping, lean concrete, concrete fill and waterproofing.

2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.

3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

3.6 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 03 11 13

FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R – Cement and Concrete Terminology.
   b. 347R – Guide to Formwork for Concrete.
2. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Formwork, shoring and reshoring to be designed by a professional structural engineer currently licensed in the state where the Project is located and having a minimum of three (3) years experience in this type of design work.
   a. Above qualifications apply to slabs and beams not cast on the ground, wall and column pours over 15 FT high.

C. Miscellaneous:

1. Design and engineering of formwork, shoring, and reshoring, as well as its construction, is the responsibility of the Contractor.
2. Design requirements:
   a. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local Building Code.
      1) Where conflicts occur between the above two (2) standards, the more stringent requirements shall govern.
   b. Design formwork to limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.
3. For slabs and beams not cast on the ground, develop a procedure and schedule for removal of shores and installation of reshores and for calculating the loads transferred to the structure during this process.
   a. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
   b. When developing procedure, schedule and structural calculations, consider the following at each stage of construction:
      1) Safety of people involved with the use of forms (forming, placing concrete, stripping forms).
      2) The structural system that exists.
      3) Effects of all loads during construction.
      4) Strength of concrete.
      5) The influence of deformations of the structure and shoring system on the distribution of dead loads and construction loads.
      6) The strength and spacing of shores or shoring systems used, as well as the method of shoring, bracing, shore removal, and reshoring including the minimum time intervals between the various operations.
      7) Any other loading or condition that affects the safety or serviceability of the structure during construction.

1.4 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for the requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Manufacturer and type of proposed form materials.
    d. Manufacturer and type of proposed form ties.
    e. Manufacturer and type of proposed form coating material.
    f. Manufacturer and type of void forms including compressive strength.

B. Samples:

1. A 12 IN SQ sample of each of the following form finishes:
    a. Ground storage tank foundation.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Void forms:
    a. SureVoid Products, Inc.
    b. Deslauriers, Inc.
2. Stay-in-place forms:
    a. Alabama Metal Industries Corporation.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Forms for Surfaces Exposed to View:

1. Wood forms:
    a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
    b. Built-in-place or prefabricated type panel.

c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.

d. When approved, plywood may be reused.

2. Metal forms:

a. Metal forms excluding aluminum may be used. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

B. Forms for Surfaces Not Exposed to View:

1. Wood or metal sufficiently tight to prevent leakage.

2. Do not use aluminum forms.

2.3 ACCESSORIES

A. Form Ties:

1. Commercially fabricated for use in form construction.

a. Do not use wire ties.

2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.

3. 3/4 IN minimum to 1 IN maximum diameter cones on both ends.

4. Embedded portion of ties to be not less than 1-1/2 IN from face of concrete after ends have been removed.

5. Provide ties with built-in waterstops in all walls that are intended to retain fluids.

6. Through-wall ties that are designed to be entirely removed are not allowed in all walls that are intended to retain fluids.

B. Void Forms:

1. Continuous void forms.

2. Specially designed and manufactured for the purpose of creating a void area directly under concrete members which will allow a space for soil vertical upward movement.

3. Able to support the weight of concrete and construction loads to be placed thereon with no decrease in required void form depth.

4. Constructed from double faced corrugated cardboard or fiberboard which is wax impregnated and laminated with moisture-resistant adhesive.

5. Capable of resisting moisture with no loss of load carrying strength or change in depth or configuration.

C. Stay-In-Place Forms:

1. Ribbed expanded metal leave-in-place concrete forms commercially fabricated to provide an intentionally rougher surface.
2. Hot-dipped galvanized.
3. Alabama Metal Industries Corporation "Stay-Form" or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Form Surface Treatment:

1. Before placing of either reinforcing steel or concrete, cover surfaces of forms with an approved coating material that will effectively prevent absorption of moisture and prevent bond with concrete, will not stain concrete or prevent bonding of future finishes.
   a. A field applied form release agent or sealer of approved type or a factory applied nonabsorptive liner may be used.
   b. Form oil shall not be toxic 30 days after application.
2. Do not allow excess form coating material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

B. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation.

1. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 FT apart.

C. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 ERECTION

A. Install products in accordance with manufacturer's instructions.

B. Tolerances:

1. Variation from plumb:
   a. In lines and surfaces of columns, piers, walls, and in risers.
      1) Maximum in any 10 FT of height: 1/4 IN.
      2) Maximum for entire height: 1/2 IN.

b. For exposed corner columns, control-joint grooves, and other exposed to view lines:

1) Maximum in any 20 FT length: 1/4 IN.

2) Maximum for entire length: 1/2 IN.

2. Variation from level or from grades specified:

a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores.

1) Maximum in any 10 FT of length: 1/4 IN.

2) Maximum in any bay or in any 20 FT length: 3/8 IN.

3) Maximum for entire length: 3/4 IN.

b. In exposed lintels, sills, parapets, horizontal grooves, and other exposed to view lines:

1) Maximum in any bay or in 20 FT length: 1/4 IN.

2) Maximum for entire length: 1/2 IN.

3. Variation of linear structure lines from established position in plan and related position of columns, walls, and partitions:

a. Maximum in any bay: 1/2 IN.

b. Maximum in any 20 FT of length: 1/2 IN.

c. Maximum for entire length: 1 IN.

4. Variation in sizes and location of sleeves, floor openings, and wall openings: Maximum of +1/2 IN.

5. Variation in horizontal plan location of beam, column and wall centerlines from required location: Maximum of +1/2 IN.

6. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls: Maximum of -1/4 IN, +1/2 IN.

7. Footings and foundations:

a. Variations in concrete dimensions in plan: -1/2 IN, +2 IN.

b. Misplacement or eccentricity:

1) 2 percent of footing width in direction of misplacement but not more than 2 IN.

c. Thickness:

1) Decrease in specified thickness: 5 percent.

2) Increase in specified thickness: No limit except that which may interfere with other construction.

8. Variation in steps:
    a. In a flight of stairs:
        1) Rise: +1/8 IN.
        2) Tread: +1/4 IN.
    b. In consecutive steps:
        1) Rise: +1/16 IN.
        2) Tread: +1/8 IN.
9. Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
10. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project.
11. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.

C. Make forms sufficiently tight to prevent loss of mortar from concrete.

D. Place 3/4 IN chamfer strips in exposed to view corners of forms to produce 3/4 IN wide beveled edges.

E. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at least 1 IN.
    1. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
    2. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.

F. Where circular walls are to be formed and forms made up of straight sections are proposed for use, provide straight lengths not exceeding 2 FT wide.
    1. Brace and tie formwork to maintain correct position and shape of members.

G. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.

H. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.

I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

J. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation.

1. Securely brace forms against lateral deflection.
2. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

K. After void forms are in place and before concrete is placed thereon, cover joints between abutting form sections and cover ends of forms to prevent intrusion of soil, concrete or any other materials.

1. Install void forms in accordance with manufacturer's instructions.

L. Stay-In-Place Forms:

1. Support stay-in-place forms as required to maintain the formwork in proper position.
2. Hold the edge of stay-in-place forms back a minimum of 2 IN from all smooth formed concrete surfaces.
3. Stay-in-place forms may be used at the Contractor's option at:
   a. Surfaces that will be backfilled with soil.
      1) Maintain a minimum of 3 IN of concrete cover over all reinforcing.
   b. Roughened construction joints.
   c. Other locations approved by Owner’s Representative.

3.3 REMOVAL OF FORMS

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads places thereon.

B. When required for concrete curing in hot weather, required for repair of surface defects or when finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.

C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging.

1. Perform any needed repairs or treatment required on such sloping surfaces at once, followed by curing specified in Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

D. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.

E. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

F. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in place until concrete has attained its specified 28 day compressive strength, and not less than required below.

1. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.

2. Leave forms in place until 28 day compressive strength is attained but not less than:

Span, L	Days
L<= 10’	7
10’<L<20’	14
20’<=L	21

3. Contractor may submit a proposed from removal plan and schedule for approval by Owner’s Representative.

G. When shores and other vertical supports are so arranged that non-load-carrying form facing material may be removed without loosening or disturbing shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

3.4 RESHORING

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.

B. While reshoring is underway, no superimposed dead or live loads shall be permitted on the new construction.

C. During reshoring do not subject concrete in structural members to combined dead and construction loads in excess of loads that structural members can adequately support.

D. Place reshores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs.

E. Tighten reshores to carry their required loads without overstressing.

F. Shoring, reshoring and supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.

G. For floors supporting shores under newly placed concrete leave original supporting shores in place or reshore.

1. Reshoring system shall have a capacity sufficient to resist anticipated loads.
2. Locate reshores directly under a shore position above.

H. In multi-story buildings, extend reshoring over a sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that design superimposed loads of floors supporting shores are not exceeded.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 03 21 00

REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bar requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. SP 66 – ACI Detailing Manual.
   b. 318 – Building Code Requirements for Structural Concrete.
2. ASTM International (ASTM):
   a. A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   b. A497 – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
   c. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   e. A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
3. American Welding Society (AWS):
   a. D1.4 – Structural Welding Code - Reinforcing Steel.
4. Concrete Reinforcing Steel Institute (CRSI):
   a. Manual of Standard Practice.

B. Qualifications:

1. Welding operators, processes and procedures to be qualified in accordance with AWS D1.4.
2. Welding operators to have been qualified during the previous 12 months prior to commencement of welding.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Mill certificates for all reinforcing.
   d. ESICC reports for manufactured mechanical splice and adhesive anchor.
   e. Manufacturer and type of proprietary rebar mechanical splices.
   f. Manufacturer and type of rebar adhesive anchor including installation instructions.
3. Qualifications of welding operators, welding processes and procedures.
4. Rebar number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and rebar supports.
5. Sufficient rebar details to permit installation of reinforcing.
6. Rebar details in accordance with ACI SP 66.
7. Locations where proprietary rebar mechanical splices are required or proposed for use.
8. Shop Drawings shall be in sufficient detail to permit installation of reinforcing without reference to Contract Drawings.
   a. Shop Drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Support and store all reinforcing above ground.

B. Ship to jobsite with attached plastic or metal tags with permanent mark numbers which match the Shop Drawing mark numbers.

C. Handling of Epoxy-Coated Rebar:

1. Use padded or nonmetallic slings and padded straps to protect coated reinforcement from damage.
2. Handle bundled bars to prevent sagging that could damage the coating.
3. Do not drop or drag rebars.
4. Store on wooden cribbing.
5. Coated rebars subject to rejection by Owner's Representative if rebar coating has been damaged.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Rebar adhesive anchors:
   a. HIT-RE 500-SD by Hilti, Inc.
   b. SET High Strength Epoxy-Tie by Simpson Strong-Tie Anchor Systems.
2. Rebar mechanical splices:
   a. Lenton Rebar Splicing by Erico, Inc.
   b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
   c. Bar-Grip Systems by Barsplice Products, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Reinforcing Bars: ASTM A615, grade 60, deformed.

B. Reinforcing Bars to be Welded: ASTM A706, grade 60 deformed.

C. Welded Wire Reinforcement: ASTM A185 or ASTM A497.

D. Smooth Dowel Bars: ASTM A615, grade 60 with metal end cap to allow longitudinal movement equal to joint width plus 1 IN.

E. Epoxy-Coated Rebars: ASTM A775 and ASTM A615, Grade 60, meeting Annex A1 for epoxy coating.

F. Epoxy-Coated Rebar Patching Material:

1. Compatible with the coating material.
2. Inert in concrete.
3. Meet requirements of Annex A1 of ASTM A775.

4. Obtained from the manufacturer of the epoxy resin that was used to originally coat the rebars.

G. Proprietary Rebar Mechanical Splices: To develop in tension and compression a minimum of 125 percent of the yield strength of the rebars being spliced.

H. Welding Electrodes:

1. E90 meeting requirements of AWS D1.4.

I. Rebar Adhesive Anchors:

1. Manufactured for the specific purpose of embedding and developing 125 percent of the yield strength of rebars in hardened concrete.

2.3 ACCESSORIES

A. Metal Chairs, Runners, Bolsters, Spacers, Hangers, and Other Rebar Supports:

1. Plastic-coated tips in contact with forms.
2. Plastic coating meeting requirements of CRSI Manual of Standard Practice.

B. Protective plastic caps at mechanical splices.

2.4 FABRICATION

A. Tolerances:

1. Sheared lengths: +1 IN.
2. Overall dimensions of stirrups, ties and spirals: +1/2 IN.
3. All other bends: +0 IN, -1/2 IN.

B. Minimum diameter of bends measured on the inside of the rebar to be as indicated in ACI 318 Paragraph 7.2.

C. Ship rebars to jobsite with attached plastic or metal tags.

1. Place on each tag the mark number of the rebar corresponding to the mark number indicated on the Shop Drawing.
2. Mark numbers on tags to be so placed that the numbers cannot be removed.
3. For epoxy-coated rebars, use only plastic tags secured to rebars by nylon or plastic ties.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tolerances:

1. Rebar placement:

a. Clear distance to formed surfaces: +1/4 IN.

b. Minimum spacing between bars: -1/4 IN.

c. Top bars in slabs and beams:

1) Members 8 IN deep or less: +1/4 IN.

2) Members between 8 IN and 2 FT deep: -1/4 IN, +1/2 IN.

3) Members more than 2 FT deep: -1/4 IN, +1 IN.

d. Crosswise of members: Spaced evenly within +1 IN.

e. Lengthwise of members: +2 IN.

2. Minimum clear distances between rebars:

a. Beams, walls and slabs: Distance equal to rebar diameter, 1 IN, or 1 IN.33 times maximum aggregate, whichever is greater.

b. Columns: Distance equal to 1-1/2 times the rebar diameter or 1-1/2 IN, whichever is greater.

c. Beam and slab rebars shall be threaded through the column vertical rebars without displacing the column vertical rebars and still maintaining the clear distances required for the beam and slab rebars.

B. Minimum concrete protective covering for reinforcement: As shown on Drawings.

C. Splice lengths for reinforcing: as follows:

1. For rebars: As indicated on Drawings.

2. For welded wire reinforcement:

a. Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than one (1) spacing of cross wires plus 2 IN, nor less than 1.5 x development length nor less than 6 IN.

b. Development length shall be as required for the yield strength of the welded wire reinforcement in accordance with Paragraph 12.8 of ACI 318.

3. Provide splices of reinforcing not specifically indicated or specified subject to approval of Owner's Representative.

a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

D. Welding:

1. Obtain approval by the Owner's Representative prior to welding reinforcing.

2. Perform welding of rebars in accordance with requirements of AWS D1.4.

3. Have each welder place an approved identifying mark near each completed weld.

4. Only weld reinforcing where specifically indicated on Drawings and that is certified per ASTM A 706.

E. Placing Rebars:

1. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.
2. Reinforcement with surface rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample is not less than required by applicable ASTM specification that governs for the rebar supplied.
3. Rebar support:
    a. Uncoated rebar:
        1) Support rebars and fasten together to prevent displacement by construction loads or placing of concrete.
            a) Locate and support reinforcement with bar supports to maintain minimum concrete cover.
            b) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
        2) On ground, provide supporting concrete blocks or metal bar supports with bottom plate.
            a) Do not use concrete blocks to support slab-on-grade reinforcing.
        3) Over formwork, provide plastic-coated metal chairs, runners, bolsters, spacers, hangers and other rebar support.
            a) Only tips in contact with the forms need to be plastic coated.
    b. Coated rebar:
        1) Support coated rebars and fasten together to prevent displacement.
        2) Use plastic or nylon ties to hold rebars rigidly in place.
        3) Support rebars by use of plastic or plastic-coated chairs, runners, bolsters, spacers, hangers and rebar supports as required.
4. Support rebars over cardboard void forms by means of concrete supports which will not puncture or damage the void forms during construction nor impair the strength of the concrete members in any way.
5. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, rebars in the upper layers shall be placed directly above rebars in the bottom layer with clear distance between layers to be 1IN.
    a. Place spacer rebars at 3 FT maximum centers to maintain the required 1IN clear distance between layers.
6. Extend reinforcement to within 2 IN of concrete perimeter edges.
    a. If perimeter edge is formed by earth or stay-in-place forms, extend reinforcement to within 3 IN of the edge.

b. For earth form conditions increase footing width by 2 IN.

7. To assure proper placement, furnish templates for all column vertical bars and dowels.
8. Do not bend reinforcement after embedding in hardened concrete unless approved by Engineer.
   a. Do not bend reinforcing by means of heat.
9. Do not tack weld reinforcing.
10. Embed rebars into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
    a. Drill hole in concrete with diameter and depth as required to develop 125 percent of the yield strength of the bar according to manufacturer's requirements.
    b. Clean holes per manufacturer's recommendations.
    c. Place adhesive in drilled hole.
    d. Insert rebar into hole and adhesive in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Reinforcement Congestion and Interferences:

1. Notify Owner’s Representative whenever the specified clearances between rebars cannot be met.
2. Do not place any concrete until the Owner’s Representative submits a solution to rebar congestion problem.
3. Rebars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. Verify with Owner’s Representative for control steel design.
4. If rebars are moved more than one bar diameter, obtain Owner’s Representative's approval of resulting arrangement of rebars.
5. No cutting of rebars shall be done without written approval of Owner’s Representative.

B. Inspection of Epoxy-Coated Rebars:

1. Coated rebars will be inspected on the jobsite for handling defects, coating abrasion, coating thickness and continuity of coating.
2. Owner’s Representative may defer final inspection of rebar coating integrity and repairs until the rebars have been erected and all handling is completed.
3. Repair coated areas as directed by Owner’s Representative.
   a. Do not place concrete until all repairs to coatings have been completed.

C. Patching of Epoxy-Coated Rebar:

1. Patching and repair to be performed in accordance with the instructions of patching material manufacturer.
2. Patching material to provide a minimum film thickness of 5 mils over the bare area.
    a. Thickness of area adjacent to patched area not to exceed 15 mils.
3. Areas to be patched to be clean and free of surface contaminants.
    a. Treat areas in accordance with patching material manufacturer's instructions before oxidation occurs.
4. Total surface area covered by patching material not to exceed 2 percent of total surface area of the rebar.
5. Rebar welds and adjacent bare rebar areas to also be patched after welding is completed.

D. Owner shall employ a testing laboratory to perform and report following:

1. Review and approve Contractor proposed welding procedures and processes for conformance with AWS D1.4.
2. Qualify welders in accord with AWS D1.4.
3. Test three (3) samples of each bar size and each type of weld in accord with AWS D1.4.
    a. The tensile strength of each test shall be not less than 125 percent of the required yield strength of the rebar tested.
4. Conduct nondestructive field tests (radiographic or magnetic particle) on not less than one (1) random sample for each 10 welds.
    a. In addition if any welds are found defective, test five (5) previous welds performed by same welder.
5. Visually inspect each weld for presence of cracks, undercuts, inadequate size and other visible defects.
6. Cost for additional testing or retesting to be borne by the contractor.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 03 31 30

CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete materials, strengths and proportioning for concrete work.
2. Grouting:
    a. Base plates for columns and equipment.
    b. Dowels and anchors into concrete.
    c. Patching cavities in concrete.
    d. As specified and indicated in the Contract Document.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 05 05 – Testing.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
    a. 116R – Cement and Concrete Terminology.
    b. 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
    c. 212.3R – Chemical Admixtures for Concrete.
    d. 318 – Building Code Requirements for Structural Concrete.
    e. 350 – Code Requirements for Environmental Engineering Concrete Structures.
2. ASTM International (ASTM):
    a. C33 – Standard Specification for Concrete Aggregates.

b. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

c. C94 – Standard Specification for Ready-Mixed Concrete.

d. C150 – Standard Specification for Portland Cement.

e. C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.

f. C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

g. C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

h. C494 – Standard Specification for Chemical Admixtures for Concrete.

i. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

3. Corps of Engineers (USACE):

a. CRD-C621 – Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (NonShrink).

1.4 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's instructions.

c. Concrete mix designs as required by Specification Section 03 05 05.

d. Manufacturer and type of proposed admixtures.

e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.

3. Certifications:

a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.

b. Certification that the fly ash meets the quality requirements stated in this Specification Section, and fly ash supplier's certified test reports for each shipment of fly ash delivered to concrete supplier.

c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.

d. Certification of aggregate gradation.

4. Test reports: Cement mill reports for all cement to be supplied.

1.6 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:

1. Store cement and pozzolan in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
4. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.

a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.

b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:

1. ASTM C150, Type I/II.
2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. Fly Ash:

1. ASTM C618, Class F or Class C.
2. Non-staining.
3. Suited to provide hardened concrete of uniform light gray color.
4. Maximum loss on ignition: 4 percent.
5. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
6. Produced by source approved by the governing jurisdiction where the Project is located for use in concrete for bridges.

7. Cement and fly ash type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:
   1. Air entraining: ASTM C260.
   2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
   3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
   4. Admixtures to be chloride free.
      a. Do not use calcium chloride.
   5. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water:
   1. Potable.
   2. Clean and free from deleterious substances.
   3. Free of oils, acids and organic matter.

E. Aggregates for Normal Weight Concrete:
   1. ASTM C33.
   2. Fine and coarse aggregates to be regarded as separate ingredients.
   3. Fine aggregates to be natural, not manufactured.
   4. Coarse aggregate sieve analysis:
      a. For lean concrete, concrete topping, and integral wearing course: ASTM C33, size number 7 (maximum 1/2 IN).
      b. For all other concrete: ASTM C33, size number 57 (maximum 1 IN) or size number 67 (maximum 3/4 IN).
   5. Provide aggregates approved for bridge construction by the governing jurisdiction where the Project is located.
   6. Pozzolan or other additives shall not be used to compensate for alkali reactivity of aggregates.

F. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement:
   1. Prestressed concrete: 0.06.
   2. All other concrete: 0.10.

G. Sand Cement Grout:

1. Approximately three (3) parts sand, one (1) part Portland cement, 6 ±1 percent entrained air and water to produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
    a. Provide sand in accordance with requirements for fine aggregate for concrete.
2. Minimum 28 day compressive strength: 3000 psi.

H. Non-shrink Grout:

1. Non-shrink, non-metallic, non-corrosive, and non-staining.
2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
3. Grout to produce a positive but controlled expansion.
    a. Mass expansion shall not be created by gas liberation or by other means.
4. Minimum 28 day compressive strength: 6500 psi.
5. Acceptable manufacturers:
    a. BASF Admixtures, Inc. "Masterflow, 713 Plus".
    b. Euclid Chemical "NS Grout".
    c. Sauereisen Cements "F-100 Level Fill Grout".
    d. U. S. Grout "Five Star Grout".
    e. Set Products, Inc. "Set Non-Shrink Grout".
    f. The Upco Corp "Upcon".
    g. L&M "Crystex".
    h. Sika Corporation "Sika Grout 212".
6. In accordance with COE CRD-C621.

I. Epoxy Grout:

1. Three-component epoxy resin system:
    a. Two (2) liquid epoxy components.
    b. One (1) inert aggregate filler component.
2. Adhesive acceptable manufacturers:
    a. BASF “Masterflow 648 CP”.
    b. Exxon Chemical Company "Escoweld 2505."
    c. Sika "Sikadur Hi-Mod."
    d. U. S. Grout "Five Start Epoxy Grout."
    e. Euclid Chemical "E3-G."

3. Aggregate acceptable manufacturers:
   a. BASF “Masterflow 648 CP”.
   b. Exxon Chemical Company "Escoweld 2510."
   c. Sika aggregate.
   d. U. S. Grout aggregate.
   e. Euclid Chemical "Euclid aggregate."
4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
5. The aggregate shall be compatible with the adhesive.
6. Each component furnished in separate package for mixing at jobsite.
7. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MIXES

A. General:
   1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
   2. Ready-mixed concrete shall conform to ASTM C94.
   3. All concrete to be normal weight concrete weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Minimum 28 Day Compressive Strengths:

Normal weight concrete fill	3000 psi
Normal weight lean concrete	1500 psi
Normal weight concrete topping	4000 psi
Normal weight concrete	4000 psi
Normal weight precast concrete	5000 psi
Normal weight concrete pavements	4000 psi
Normal weight concrete integral wearing course	6000 psi

C. Air Entrainment:
   1. Provide air entrainment in all concrete resulting in a total air content percent by volume as indicated by ACI 318-08, Chapter 4:
      a. Exposure Class: F1.
      b. Do not air entrain and maximum entrapped air shall not exceed 3 percent total air content for the following:

1) Interior slabs

2) Slabs with a steel trowel finish.

3) Slabs on composite metal decks.

D. Slump:

1. General: 4 IN maximum (+/- 1 IN) minimum measured at point of discharge into the concrete construction member.
   a. Walls, beams, and columns: Provide high range water reducer (HRWR) and slump shall be 8 IN maximum (+/- 1 IN).
   b. Provide HRWR as required for placement.
   c. Do not provide HRWR in slab and pavements.
2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
   a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ratio is not exceeded.
4. Slump may be adjusted in the field through the use of water reducers.
   a. Coordinate dosage and mixing requirements with concrete supplier.

E. Proportioning:

1. General:
   a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
   b. Proportion ingredients to produce proper placability, durability, strength and other required properties.
2. Normal weight concrete minimum cement contents and maximum water cement ratios:

SPECIFIED STRENGTH (PSI)	MINIMUM CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
3000	517*	0.45
4000	564*	0.45
4000 (Drilled Shaft)	658*	0.45
4500	611*	0.42

SPECIFIED STRENGTH (PSI)	MINIMUM CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
5000	611*	0.45
6000	658*	0.45

* If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall equal these values.

3. Fly ash:
   a. For cast-in-place concrete only, a maximum of 25 percent by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
   b. If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Specification Section.
   c. Concrete containing fly ash shall not be used in the construction of the precast and prestressed concrete units.
4. Water reducing, retarding, and accelerating admixtures:
   a. Use in accordance with manufacturer's instructions.
   b. Do not use unless required by these specifications or approved for use by Owner’s Representative.
5. High range water reducers (superplasticizers):
   a. Use in accordance with manufacturer's instructions.
   b. Do not use unless required by these Specifications or approved for use by Owner’s Representative.
6. Concrete mix proportioning methods for normal weight concrete:
   a. Method 1:
      1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
      2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
      3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
      4) For each water cement ratio or cement content, make at least three (3) compression test cylinders for specified test age, and cure in accordance with ASTM C192.
         a) Test for strength at 28 days in accordance with ASTM C39.

5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.

6) From this curve select water cement ratio or cement content to be used to produce required average strength.

7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.

8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.

9) See paragraph hereafter for definition of required average strength.

b. Method 2:

1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.

2) Use of proposed concrete mix proportions based on field test records subject to approval by Owner's Representative based on information contained in field test records and demonstrated ability to provide the required average strength.

3) Field test records to represent materials, proportions and conditions similar to those specified.

a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.

b) Field test records shall meet the requirements of ACI 318/ACI 350 Paragraph 5.3.1.

4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Specification Section.

7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with Paragraph 5.3 of ACI 318/ACI 350 using the standard deviation of the proposed concrete production facility as described in Paragraphs 5.3.1 and 2 of ACI 318/ACI 350.

a. Mixture shall contain no more than 30 percent fines.

b. Proportioning of mixture shall be sufficient to produce a minimum unconfined compressive strength of 50 psi at 7 days.

F. Allowable Shrinkage: 0.048 percent per ASTM C157.

2.3 SOURCE QUALITY CONTROL

A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

B. Do not use frozen or partially frozen aggregates.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform concrete tests per Specification Section 03 05 05 – Testing.

B. Perform strength test on any concrete to which water has been added at the jobsite.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 03 31 31

CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 05 05 – Testing.
4. Section 03 11 13 – Formwork.
5. Section 03 21 00 – Reinforcement.
6. Section 03 31 30 – Concrete, Materials and Proportioning.
7. Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.
8. Section 07 92 00 – Joint Sealants.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R – Cement and Concrete Terminology.
   b. 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   c. 304.2R – Placing Concrete by Pumping Methods.
   d. 305R – Hot Weather Concreting.
   e. 306R – Cold Weather Concreting.
   f. 308 – Standard Practice for Curing Concrete.
   g. 309R – Guide for Consolidation of Concrete.
2. ASTM International (ASTM):

a. C94 – Standard Specification for Ready-Mixed Concrete.

b. C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.

c. C171 – Standard Specification for Sheet Materials for Curing Concrete.

d. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

e. D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

f. D1056 – Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

g. D1751,Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

3. Corps of Engineers (USACE):

a. CRD-C572, Specifications for Polyvinylchloride Waterstops.

4. National Ready Mixed Concrete Association (NRMCA):

a. Checklist for Certification of Ready Mixed Concrete Production Facilities.

5. National Sanitation Foundation International (NSF).

B. Qualifications:

1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.

1.4 DEFINITIONS

A. Words and terms used in this Specification Section are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation instructions.

1) Procedure for adding high-range water reducer at the jobsite.

c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints and joint keyway dimensions.

d. Manufacturers and types:

1) Joint fillers.

2) Curing agents.

3) Construction joint bonding adhesive.

4) Pressure relief valves.

5) Waterstops.

3. Certifications:

a. Ready mix concrete plant certification.

b. Waterstops: Products shipped meet or exceed the physical properties specified.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 – Submittals for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Copies of concrete delivery tickets.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Concrete:

a. Prepare a delivery ticket for each load of ready mixed concrete.

b. Truck operator shall hand ticket to Contractor at the time of delivery.

c. Ticket to show:

1) Mix identification.

2) Quantity delivered.

3) Amount of material in each batch.

4) Outdoor temperature in the shade.

5) Time at which cement was added

6) Time of delivery.

7) Time of discharge.

8) Amount of water that may be added at the site without exceeding the specified water-cement ratio.

9) Amount of water added at the site.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Neoprene Expansion Joint Fillers:

1. Acceptable manufacturers:
   a. Permaglaze.
   b. Rubatex.
   c. Williams Products.
2. Materials:
   a. Closed cell neoprene.
   b. ASTM D1056, Class SC.
   c. Compression deflection: As required to limit deflection to 50 percent of joint thickness under pressure from concrete pour height.

B. Asphalt Expansion Joint Fillers:

1. Acceptable manufacturers:
   a. W R Meadows.
   b. J and P Petroleum Products.
2. Materials: ASTM D994.

C. Fiber Expansion Joint Fillers:

1. Materials: ASTM D1751.

D. Waterstops, PVC Type:

1. Acceptable manufacturers:
   a. Greenstreak Plastic Products.
   b. W R Meadows.
   c. Paul Murphy Plastics.
2. Materials:
   a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.
   b. Standard: COE CRD-C572.
3. In expansion joints:
   a. 6 IN or 9 IN wide by 3/8 IN thick tear web type waterstop as indicated in drawings.
   b. 2 IN minimum horizontal movement without rupturing.
   c. Greenstreak Plastic Products Style #700.

d. Greenstreak Plastic Products Style #701 and #705.

4. In control joints:
   a. 6 IN wide by 3/8 IN thick with ribs and center bulb.
   b. Greenstreak Plastic Products Style #705.
5. In all other joints:
   a. 6 IN wide by 3/8 IN thick with ribs and center bulb.
   b. Greenstreak Plastic Products Style #705, #679 or #783.
6. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop.
7. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field.

E. Waterstops, Preformed Strip Type:
1. Acceptable manufacturers:
   a. Hydrotite CJ by Greenstreak Plastics, Inc.
   b. Adeka Ultra Seal USA.
2. Materials:
   a. Hydrophilic type waterstop manufactured solely for the purpose of preventing water from traveling through construction joints.
   b. Hydrotite type CJ-0725-3K.

F. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
1. Complete formwork.
   a. See Specification Section 03 11 13 – Formwork.
2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
3. Secure reinforcement in place.
   a. See Specification Section 03 21 00 – Reinforcement.
4. Position expansion joint material, anchors and other embedded items.
5. Obtain approval of reinforcement erection and placement prior to placing concrete.

6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
    a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
    b. Do not allow rainwater to increase mixing water nor to damage surface finish.
7. Prepare all construction joints for proper bond per the Article JOINTS AND EMBEDDED ITEMS, paragraph Construction Joints - Bonding of this Specification Section.
8. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
9. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
    a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.

B. Preparation of Subgrade for Slabs On Ground:
1. Subgrade drained and of adequate and uniform load-bearing nature.
2. Obtain approval of subgrade compaction density prior to placing slabs on ground.
3. Maintain subgrade at a temperature above 32 DegF before concrete placing begins for a sufficient amount of time to remove frost.
4. Moisten subgrade to eliminate absorption.
    a. Keep subgrade moist at time of concreting.
    b. Allow no free-standing water on subgrade or soft or muddy spots when concrete is placed.

C. Edge Forms and Screeds:
1. Set accurately to produce designated elevations and contours of finished surface.
2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

A. General:
1. Provide all concrete from a central or dry mixed plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.

2. Batch, mix, and transport in accordance with ASTM C94.
3. Time limit for discharging concrete from mixer trucks:
    a. Agitated:
        1) 90 minutes below 75 DegF.
        2) 60 minutes at or above 75 DegF and up to 90 DegF.
        3) A set-retarder may be used to extend delivery time by 30 minutes.
    b. Non-Agitated:
        1) 30 minutes below 80 DegF
        2) 15 minutes at or above 80 DegF

B. Control of Admixtures:
1. Charge admixtures into mixer as solutions.
    a. Measure by means of an approved mechanical dispensing device.
    b. Liquid considered a part of mixing water.
    c. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
2. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
3. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

C. Tempering and Control of Mixing Water:
1. Mix concrete only in quantities for immediate use.
2. Discard concrete which has set.
3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94.
4. Addition of water at the jobsite:
    a. See Specification Section 03 31 30 – Concrete, Materials and Proportioning for specified water cement ratio and slump.
    b. Do not exceed maximum specified water cement ratio or slump.
    c. Incorporate water by additional mixing equal to at least half of total mixing required.
    d. Perform strength test on any concrete to which water has been added at the jobsite.
        1) See Specification Section 03 05 05 – Testing for testing requirements.

3.3 PLACING OF CONCRETE

A. General:

1. Comply with ACI 304R and ACI 304.2R.
2. Deposit concrete:
   a. Continuously to avoid cold joints.
   b. In layers of 12 to 18 IN.
3. Locate construction joints at locations approved by Owner's representative.
   a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
4. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still workable.
5. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
6. Spreaders:
   a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
   b. Embedded:
      1) Obtain approval of Owner's representative.
      2) Materials: Concrete or metal.
      3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
7. Do not begin placing of concrete in supported elements until concrete previously placed in supporting members is no longer plastic and has been in place at least a minimum of 2 HRS.
8. Deposit concrete as nearly as practicable in its final position to avoid segregation.
   a. Maximum free fall: 5 FT without high range water reducer. 10 FT with high range water reducer.
   b. Drilled shafts place in the dry do not have a free fall restriction.
   c. Free fall exceeding limits specified: Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 1 FT of surface placed upon.
9. Perform the following operations before bleeding water has an opportunity to collect on surface:
   a. Spread.
   b. Consolidate.

c. Straightedge.

d. Darby or bull float.

B. Admixtures:

1. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.

C. Cold Weather Concrete Placement:

1. Comply with ACI 306R.
2. Do not place concrete on substrates that are below 32 DegF or contain frozen material.
3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site:

AIR TEMPERATURE DEGF	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION LESS THAN 12 IN	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION 12 IN OR GREATER
30 to 45	60	55
0 to 30	65	55
below 0	70	60

5. Heat subgrade, forms, and reinforcement so the temperature of the subgrade, forms, and reinforcement will be between 45 and 70 DegF, when temperature of surrounding air is 40 DegF or below at time concrete is placed.

   a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.

6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DegF.
7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DegF.
8. Do not place slabs on ground if temperature is below 40 DegF or if temperature surrounding the slab will be below 40 DegF before structure is enclosed and heated.

D. Hot Weather Concrete Placement:

1. Comply with ACI 305R.

2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete when placed:
    a. Not to exceed 90 DegF.
    b. The maximum temperature of concrete shall not exceed 90 F at the time the concrete is placed. The temperatures of the mixing water shall be reduced by the use of chilled water or ice.
    c. The maximum temperature of concrete with high range water reducing admixture shall not exceed 95 F at the time concrete is placed.
    d. Under extreme heat, wind, or humidity conditions, concreting operations may be suspended if the quality of the concrete being placed is not acceptable.
    e. Not so high as to cause:
        1) Shrinkage cracks.
        2) Difficulty in placement due to loss of slump.
        3) Flash set.
4. Temperature of forms and reinforcing when placing concrete:
    a. Not to exceed 90 DegF.
    b. May be reduced by spraying with water to cool below 90 DegF.
        1) Leave no standing water to contact concrete being placed.

E. Consolidating:
1. Consolidate in accordance with ACI 309R except as modified herein.
2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
    a. Eliminate:
        1) Air or stone pockets.
        2) Honeycombing or pitting.
        3) Planes of weakness.
3. Internal vibrators:
    a. Minimum frequency of 8000 vibrations per minute.
    b. Insert and withdraw at points approximately 18 IN apart.
        1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
    c. Use in:

1) Beams and girders of framed slabs.

2) Columns and walls.

d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.

4. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.
5. Do not use vibrators to transport concrete within forms.
6. Provide spare vibrators on jobsite during all concrete placing operations.
7. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
8. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.

F. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.

1. The sum of time for transporting in agitating and non-agitating devices may not exceed the maximum agitated concrete time allowed.
2. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94.
3. Horizontal belt conveyors:

a. Mount at a slope which will not cause segregation or loss of ingredients.

b. Protect concrete against undue drying or rise in temperature.

c. Use an arrangement at discharge end to prevent segregation.

d. Do not allow mortar to adhere to return length of belt.

e. Discharge conveyor runs into equipment specially designed for spreading concrete.

4. Metal or metal lined chutes:

a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.

b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.

c. Provide end of each chute with a device to prevent segregation.

5. Pumping or pneumatic conveying equipment:

a. Designed for concrete application and having adequate pumping capacity.

b. Control pneumatic placement so segregation is avoided in discharged concrete.

c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.

d. Do not convey concrete through pipe made of aluminum or aluminum alloy.

e. Provide pumping equipment without Y sections.

G. Placing of Concrete on Metal Deck:

1. Prior to concrete placement, the metal deck shall be free of soil, debris, standing water, loose mill scale, and all other foreign matter.

2. Care shall be exercised when placing concrete so that the deck will not be subject to construction loads or impact that exceed the design capacity of the deck.

3. Concrete shall be placed in a uniform manner and spread toward the center of the deck span.

4. If buggies are used to place concrete, runways shall be planked, and the buggies shall only operate on planking.

   a. Planks shall be of adequate stiffness to transfer loads to the steel supports without damaging the deck.

5. Deck damage caused by careless placement of concrete shall be repaired or replaced.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:

1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.

   a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in the Construction Joints - Spacing paragraph below, submit proposed construction joint location in conformance with this Specification Section.

2. Unplanned construction joints will not be allowed.

   a. If concrete cannot be completely placed between planned construction joints, then it must be removed.

3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.

4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
    a. At Contractor's option, beam pockets may be formed into concrete walls.
    b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
5. Place beams, girders, column capitals and drop panels at same time as slabs.
6. Place corbels monolithically with walls.
    a. Locate wall vertical construction joints midway between corbels.
    b. Where only a single corbel is located place it also monolithically with wall and locate wall vertical construction joint a minimum of 3 FT from face of corbel.
7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
8. Provide roughened construction joints at all construction joints unless indicated otherwise on Drawings.
    a. Clean the previously hardened concrete interface and remove all laitance.
    b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
    c. Provide recessed flat surface as required to install strip type waterstops.
9. Provide continuous keyways only where indicated on drawings.
    a. Construction joint keyways shall have the following dimensions, unless shown otherwise on Drawings or directed otherwise by Owner’s representative.
    b. Construction joint keyways in walls:
        1) Keyway width, not less than 1/3 and not more than 1/2 the wall thickness measured perpendicular to wall faces.
        2) Keyway depth to be not less than 1-1/2 IN.
        3) Place keyway in wall center unless shown otherwise on Drawings.
    c. Construction joint keyways in footings, foundations, base slabs, and structural or elevated slabs:
        1) Keyway height not less than 1/3 and not more than 1/2 the footing or slab thickness.
        2) Keyway depth not less than 1-1/2 IN.
        3) Keyway in footing or slab center unless shown otherwise on Drawings.
    d. Construction joint keyways in beams:

1) Keyway height not less than 1/3 and not more than 1/2 the beam depth.
2) Keyway depth not less than 1-1/2 IN.
3) Keyway in beam center unless shown otherwise on Drawings.

10. Allow a minimum of 48 HRS before placement of adjoining concrete construction.

B. Construction Joints - Spacing:

1. General - Structures not intended to contain liquid:
   a. Wall vertical construction joints, unless noted otherwise:
      1) 40 FT maximum centers.
      2) At wall intersections, 20 FT maximum from corner.
   b. Wall horizontal construction joints: 15 FT centers.
   c. Base slab, floor, and roof slab construction joints:
      1) Placements to be approximately square and not to exceed 3500 SF.
      2) Maximum side dimension of a slab pour to be less than:
         a) Twice the length of the short side.
         b) 80 FT.
2. Structures intended to contain liquids:
   a. Wall vertical construction joint, unless noted otherwise:
      1) 30 FT maximum centers.
      2) At wall intersections, 15 FT maximum from corner.
   b. Wall horizontal construction joints: 15 FT centers.
   c. Base slab, floor, and roof slab construction joints:
      1) Placements to be approximately square and not to exceed 2000 SF.
      2) Maximum side dimension of a slab pour to be less than:
         a) Twice the length of the short side.
         b) 60 FT.

C. Construction Joints - Bonding:

1. General: Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.
   a. Before new concrete is placed, all construction joints shall be dampened and at a saturated, surface dry condition – surface moisture weakens the joint.

2. Roughened construction joints: All joints shall be roughened unless otherwise noted. Roughen the surface of the concrete to expose the aggregate uniformly, minimum 1/4" amplitude.
3. Keyed construction joints: Provide keyed joints where indicated on the Drawings.

D. Locate control joints in slabs on grade as indicated on Drawings.
   1. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
      a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw. Approximately 1 to 2 hours after finishing operations are completed.
      b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:
   1. Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.
   2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.
   3. Seal expansion joints as shown on Drawings.
      a. See Specification Section 07 92 00 – Joint Sealants for requirements.

F. Waterstops:
   1. Preformed strip type:
      a. Install on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete.
      b. Waterstop to be continuous with splices in accordance with manufacturer's instructions.
      c. Use in joints against existing concrete and where indicated on Drawings.
   2. PVC type:
      a. Position waterstop accurately in forms.
      b. Secure waterstops in correct position using hog rings or grommets spaced along the length of waterstop and tie wire to adjacent reinforcing.
      c. Hold horizontal waterstops in place with continuous supports.
      d. Install according to manufacturer's instructions.
         1) Do not displace reinforcement from required location.
      e. Waterstops to be continuous.

f. Splice ends with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.

g. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.

G. Other Embedded Items:

1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.

2. Do not place electrical conduit, drains, or pipes in or thru concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Owner's representative.

H. Placing Embedded Items:

1. Position expansion joint material, waterstops, and other embedded items accurately.

2. Support against displacement.

3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

4. Provide adequate means for anchoring waterstop in concrete.

a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.

b. Work concrete under the waterstops by hand, so as to avoid the formation of air and rock pockets, when placing roof and floor slab concrete around waterstops.

3.5 FINISHING

A. See Specification Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.

B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

A. Grout Schedule of Use:

1. Sand cement grout:

a. Fill keyways if precast HCU.

b. General use.

2. Non-shrinking non-metallic grout:

a. Filling form tie holes.

b. Under column and beam base plates.

c. Other uses indicated on the Drawings.

3. Epoxy grout:
    a. Patching cavities in concrete.
    b. Grouting of dowels and anchor bolts into existing concrete.
    c. Grouting of equipment base plates where driving motor is 500 HP and above.
    d. Other uses indicated on the Drawings.

B. Grout Installation:
1. Sand cement grout:
    a. Fill keyways between precast concrete hollow core slabs with sand cement grout.
    b. Consolidate grout by rodding or by other means to assure complete filling of keyways.
    c. Cure grout by one of methods specified.
2. Non-shrink non-metallic grout:
    a. Clean concrete surface to receive grout.
    b. Saturate concrete with water for 24 HRS prior to grouting.
    c. Mix in a mechanical mixer.
    d. Use no more water than necessary to produce flowable grout.
    e. Place in accordance with manufacturer's instructions.
    f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
    g. Completely fill all spaces and cavities below the top of base plates.
    h. Provide forms where base plates and bed plates do not confine grout.
    i. Where exposed to view, finish grout edges smooth.
    j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
    k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
3. Epoxy grout:
    a. Mix and place in accordance with manufacturer's instructions.
    b. Apply only to clean, dry, sound surface.
    c. Completely fill all cavities and spaces around dowels and anchors without voids.

d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.

e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.

1. Follow recommendations of ACI 308 except as modified herein.

B. Unless noted otherwise, apply one of the following curing procedures immediately after completion of placement and finishing, for concrete surfaces not in contact with forms.

1. Ponding or continuous sprinkling.
2. Application of absorptive mats or fabric kept continuously wet.
3. Application of sand kept continuously wet.
4. Continuous application of steam (not exceeding 150 DegF) or mist spray.
5. Application of waterproof sheet materials, conforming to ASTM C171.
6. Application of other moisture retaining covering as approved.
7. Application of a curing compound conforming to ASTM C309.

a. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen which may develop after finishing has disappeared from concrete surface.

b. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.

c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two (2) coats of the curing compound.

1) Apply the first coat of curing compound to a vertical surface immediately after form removal.

2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.

3) Allow the preceding coat to completely dry prior to applying the next coat.

4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.

d. Curing compounds used in water treatment plant construction shall be non-toxic and taste and odor free.

1) Curing compound to be NSF approved and have a moisture loss of not more than 0.62 kg/SQ meter per ASTM C156.

   a) Atlas Tech Products Atlas Quantum-Cure.

2) Alternately, all tank surfaces shall be sand-blasted as required to remove non-NSF approved curing compound.

C. Curing Concrete In Contact with Forms:

1. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
2. After form removal, cure concrete until end of time prescribed.

   a. Use one of methods listed above.

3. Forms left in place shall not be used as a method of curing in hot weather.
4. The term "hot weather," where used in these specifications, is defined in ACI 305R.
5. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.

D. Continue curing for at least seven (7) days for all concrete except high early strength concrete for which period shall be at least three (3) days.

1. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is one (1) day old, provided concrete is not permitted to become surface dry during transition.

E. Cold Weather:

1. Follow recommendations of ACI 306R.
2. Maintain temperature of concrete between 50 and 70 DegF for required curing period, when outdoor temperature is 40 DegF, or less.
3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

F. Hot Weather:

1. Follow recommendations of ACI 305R.

2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.

G. Rate of Temperature Change:

1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.
2. Do not exceed a temperature change of 5 DegF in any 1 HR or 50 DegF in any 24 HR period.

H. Protection from Mechanical Injury:

1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self-supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

A. Tests in accordance with Specification Section 03 05 05 – Testing.

1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
   a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

B. Field samples of fabricated waterstop fittings (crosses, tees, etc.) will be selected at random by the Owner’s representative for testing by a laboratory at the Owner's expense.

1. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

3.9 OWNER TRAINING (NOT USE)

END OF SECTION

SECTION 03 31 32

CONCRETE FINISHING AND REPAIRS OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete finishing and repair of surface defects.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 11 13 – Formwork.
4. Section 03 31 30 – Concrete, Materials and Proportioning.
5. Section 03 31 31 – Concrete Mixing, Placing, Jointing and Curing.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R – Cement and Concrete Terminology.
2. ASTM International (ASTM):
   a. C150 – Standard Specification for Portland Cement.
   b. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   c. C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
   d. D4258 – Standard Practice for Surface Cleaning Concrete for Coating.
   e. D4259 – Standard Practice for Abrading Concrete.
3. Society for Protective Coatings/NACE International (SSPC/NACE):
   a. SP 13/NACE No. 6 – Surface Preparation of Concrete.

B. Qualifications:

1. Applicator of epoxy surfacer surface/filler must be approved, in writing, by manufacturer.
2. Manufacturer of epoxy surfacer surface/filler shall have minimum of five (5) years experience in manufacturing of same with documented performance history for similar installations.
3. Installer/applicator of epoxy surfacer surface/filler shall have minimum of three (3) years experience installing similar coatings and shall be licensed or approved in writing by manufacturer to install/apply this product.
4. Applicator of concrete sealer, hardener, densifier shall be factory trained and approved, in writing, by the manufacturer to apply the product.
    a. Applicator shall have a minimum of five (5) years experience successfully applying materials specified.

1.4 DEFINITIONS

A. Vertical Surface Defects:

1. Any void in the face of the concrete deeper than 1/8 IN, such as:
    a. Tie holes.
    b. Air pockets (bug holes).
    c. Honeycombs.
    d. Rock holes.
2. Scabbing:
    a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
3. Foreign material embedded in face of concrete.
4. Fins 1/16 IN or more in height.

B. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

C. Other words and terms used in this Specification Section are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
3. Certifications:
    a. Certification of aggregate gradation.
    b. Certification that products being used will not interfere with bonding of future floor or wall finishes.

B. Miscellaneous Submittals:
1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations and requirements for materials used.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Chemical floor sealer (CS-1) (CS-3):
    a. L&M Construction Chemicals, Inc.
    b. Euclid Chemical Co.
    c. Dayton Superior.
2. Bonding agents:
    a. Euclid Chemical Co.
    b. BASF Admixtures, Inc.
    c. L&M Construction Chemicals, Inc.
    d. Sika Corporation.
3. Structural Repair Material:
    a. Sika Corporation
    b. Five Star Products, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Chemical Floor Sealer CS-1:

1. Colorless low VOC water-based solution containing acrylic copolymers.
    a. ASTM C1315, Class B, minimum 30 percent solids.
    b. ASTM C309, Type 1.
    c. Non-yellowing UV resistant.
    d. Capable of being painted after cured.
2. L&M Construction Chemicals, Inc. Dress and Seal WB 30.

B. Bonding Agent:

1. For use only on concrete surfaces not receiving liquid water repellent coating:
    a. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
    b. Euclid Chemical Co. "Flex-Con."
    c. BASF Admixtures, Inc. "Acryl-Set."
    d. L&M Construction Chemicals, Inc. "Everbond."
    e. Thoro System Products "Acryl 60."
    f. Sika Corporation “Armatec 110 EpoCem.”
2. For use only on concrete surface receiving liquid water repellent:
    a. Non-acrylic base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.

C. Cement:

1. ASTM C150, Type I/II Portland.

D. Aggregate:

1. Sand: Maximum size #30 mesh sieve.
2. For exposed aggregate finish surfaces: Same as surrounding wall.

E. Water: Potable.

F. Structural Repair Material: Prepackaged non-shrink, non-slump, non-metallic, quick setting patching mortar; as approved by the manufacturer for each application and applied and cured in accordance with the manufacturer’s recommendations.

G. Non-Shrink Grout: See Specification Section 03 31 30 – Concrete, Materials and Proportioning and Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing and Curing.

2.3 MIXES

A. Bonding Grout: One (1) part cement to one (1) part aggregate.

B. Patching Mortar:

1. Site mixed, repair mortar: One (1) part cement to two and one-half (2-1/2) parts aggregate by damp loose volume.
   a. Substitute white Portland cement for a part of gray Portland cement to produce color matching surrounding concrete.
   b. To be used in lieu of prepackaged repair material only at the discretion of Owner's Representative.
2. Prepackaged repair mortar: To be used in all cases unless otherwise directed by Owner's Representative.
   a. Sika Corporation "SikaTop 122 Plus" or "SikaTop 123 Plus."
   b. Five Star Products, Inc. "Five Star Structural Concrete."

PART 3 - EXECUTION

3.1 PREPARATION

A. For methods of curing, see Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing and Curing.

B. Preparation of Bonding Grout Mixture:

1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
3. Add bonding agent/water mixture to cement/aggregate mixture.
4. Mix to consistency of thick cream.
5. Bonding agent itself may be used as bonding grout if approved by manufacturer and Owner's Representative.

C. Preparation of Patching Mortar Mixture:

1. Mix cement and aggregate.
2. Mix Prepackaged Repair Mortar per manufacturer's requirements. Extend mix with aggregate in accordance with manufacturer's requirements.
3. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
4. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling and placing.
5. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to allow placement.

D. Clean surfaces in accordance with ASTM D4258 to remove dust, dirt, form oil, grease, or other contaminants prior to abrasive blasting, chipping, grinding or wire brushing.

1. Abrasive blast surfaces in accordance with ASTM D4259 and SSPC SP13/NACE No. 6 to completely open defects down to sound concrete and remove laitance.

a. If additional chipping or wire brushing is necessary, make edges perpendicular to surface or slightly undercut.

b. No featheredges will be permitted.

2. Rinse surface with clean water and allow surface water to evaporate prior to repairing surface defects.

3. Prepare surface as recommended by Repair Mortar manufacturer.

E. Repairing Surface Defects:

1. This method of repairing surface defects is to be used only on vertical concrete surfaces, in tanks containing water, surfaces to receive liquid water repellent and exterior surfaces.

2. Fill and repair using patching mortar mix specified in the MIXES Article.

a. Use non-shrink grout to fill tieholes as outlined in this Specification Section.

3. If required by bonding agent manufacturer, etch surfaces with a muriatic acid solution followed by a thorough rinse with clean water.

a. Test concrete to determine pH level and continue flushing with clean water until surface pH is within acceptable limits.

4. Dampen area to be patched and an area at least 6 IN wide surrounding it prior to application of bonding grout.

5. Brush bonding grout into the surface after the surface water has evaporated.

6. Allow bonding grout to set for period of time required by bonding agent manufacturer before applying premixed patching mortar.

7. Fill tie holes with non-shrink non-metallic grout.

a. Where exposed to view and scheduled to receive concrete Finish #2 or #5, hold grout below surface of concrete and fill with patching mortar to match surrounding concrete.

8. Fill all other defects with patching mortar.

a. Match color of surrounding wall.

b. Do not use acrylic bonding agent in patching mortar for filling defects in surfaces to be treated with liquid water repellent.

9. Consolidate grout or mortar into place and strike off so as to leave patch slightly higher than surrounding surface.

10. Leave undisturbed for at least 60 minutes before finishing level with surrounding surface.
    a. Do not use metal tools in finishing a patch in a formed wall which will be exposed or coated with other materials.
11. Keep areas damp in accordance with grout manufacturer or bonding agent manufacturer's directions.
12. Cure Repair Mortar as recommended by the manufacturer,

3.2 INSTALLATION AND APPLICATION

A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be below 50 DegF.
   1. If necessary, enclose and heat area to between 50 and 70 DegF during repair of surface defects and curing of patching material.
      a. Use only clean fuel, indirect fired heating apparatus.

B. Chemical Floor Sealer (CS-1 and CS-3) Application:
   1. Apply to floor areas indicated on the Drawings in accordance with manufacturer's recommendations.
   2. Apply at rate recommended by manufacturer.
   3. After final coat of material is applied, remove surplus in accordance with manufacturer's recommendations.
   4. Do not apply sealer to floors scheduled to receive epoxy floor finish.

C. Concrete Finishes for Vertical Wall Surfaces:
   1. General: Give concrete surfaces finish as specified below after removal of formwork and repair of surface defects.
   2. Finish #1 - As cast rough form finish:
      a. Selected forming materials are not required.
      b. Prepare surface in accordance with the PREPARATION Article and repair the following surface defects:
         1) Tie holes.
         2) Honeycombs deeper than 1/4 IN.
         3) Air pockets deeper than 1/4 IN.
         4) Rock holes deeper than 1/4 IN.
      c. Chip or rub off fins exceeding 1/4 IN in height.
      d. Use at unexposed surfaces such as foundations and backfilled surfaces of walls not to be waterproofed.

3. Finish #2 - As cast form finish:
    a. Form facing material shall produce a smooth, hard, uniform texture.
        1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03 11 13.
    b. Prepare surface in accordance with the PREPARATION Article and repair the following surface defects:
        1) Tie holes.
        2) Honeycombs deeper than 1/4 IN or larger than 1/4 IN DIA.
        3) Air pockets deeper than 1/4 IN or larger than 1/4 IN DIA.
        4) Rock holes deeper than 1/4 IN or larger than 1/4 IN DIA.
        5) Scabbing.
    c. Chip or rub off fins exceeding 1/8 IN in height.
        1) Finish shall provide uniform color and texture.
    d. Provide this finish for:
        1) Walls being waterproofed or coated with some other material.
        2) Exposed surfaces not specified to receive another finish.
4. Finish #5 - Smooth form finish:
    a. Form facing material shall produce a smooth, hard, uniform texture.
        1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03 11 13 – Formwork.
    b. Prepare surface in accordance with the PREPARATION Article and repair the following surface defects:
        1) Tie holes.
        2) Honeycombs, air pockets, rock holes and other holes deeper than 1/16 IN or larger than 1/16 IN DIA.
        3) Scabbing.
    c. Chip or rub off fins exceeding 1/16 IN in height.
    d. Provide this finish for:
        1) All surfaces which are to be painted, are to receive tank linings or are to remain exposed to view.
    e. Construct mock-up per PART 1.

D. Related Unformed Surfaces (Except Slabs):
1. Strike smooth and level tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.

2. Float surface to a texture consistent with that of formed surfaces.
    a. If more than one (1) finish occurs immediately adjacent to unformed surface, provide surface with most stringent formed surface requirement.
3. Continue treatment uniformly across unformed surfaces.

E. Concrete Finishes for Horizontal Slab Surfaces:
1. General:
    a. Tamp concrete to force coarse aggregate down from surface.
    b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
    c. Dusting of surface with dry cement or sand during finishing processes not permitted.
2. Unspecified slab finish:
    a. When type of finish is not indicated, use following finishes as applicable:
        1) Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
        2) Surfaces intended to receive roofing except future floors, or waterproofing membranes: Floated finish.
        3) Floors: Troweled finish.
        4) Garage floors and ramps: Broom or belt finish.
        5) Exterior slabs, sidewalks, platforms, steps and landings, and ramps, not covered by other finish materials: Broom or belt finish.
        6) All slabs to receive a floated finish before final finishing.
3. Scratched slab finish: After concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen surface with stiff brushes or rakes before final set.
4. Floated finish:
    a. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
    b. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operations.
        1) Use wood or cork float.
    c. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two (2) different angles.
    d. Cut down all high spots and fill all low spots to produce a surface with Class B tolerance throughout.
    e. Refloat slab immediately to a uniform texture.

5. Troweled finish:
    a. Float finish surface to true, even plane.
    b. Power trowel, and finally hand trowel.
    c. First troweling after power troweling shall produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.
    d. Perform additional trowelings by hand after surface has hardened sufficiently.
    e. Final trowel when a ringing sound is produced as trowel is moved over surface.
    f. Thoroughly consolidate surface by hand troweling.
    g. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
    h. On surfaces intended to support floor coverings, remove any defects that would show through floor covering by grinding.
6. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom or burlap belt across surface.
7. Underside of concrete slab finish:
    a. Match finish as specified for adjacent vertical surfaces.
    b. If more than one (1) finish occurs immediately adjacent to underside of slab surface, provide surface with most stringent formed surface requirement.

3.3 FIELD QUALITY CONTROL

A. Horizontal slab finishes will be accepted provided:
    1. Applicable specification requirements are satisfied.
    2. Water does not pond in areas sloped to drain.
    3. Gap between a 10 FT straightedge placed anywhere and the finished surface does not exceed:
        a. Class A tolerance: 1/8 IN.
        b. Class B tolerance: 1/4 IN.
        c. Class C tolerance: 1/2 IN.
    4. Accumulated deviation from intended true plane of finished surface does not exceed 1/2 IN.
    5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items, or items fitted to floor (doors, tracks, etc.).

B. Unacceptable finishes shall be replaced or, if approved in writing by Owner's Representative, may be corrected provided strength and appearance are not adversely affected.

   1. High spots to be removed by grinding and/or low spots filled with a patching compound or other remedial measures to match adjacent surfaces.

3.4 PROTECTION

A. All horizontal slab surfaces receiving chemical floor sealer shall be kept free of traffic and loads for minimum of 72 HRS following installation of sealer.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
2. Design of all temporary bracing not indicated on Drawings.
3. Design of systems and components, including but not limited to:
    a. Framing
    b. Ladders.
    c. Bollards
    d. Plating
    e. Grating

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Division 03 – Concrete.
4. Section 05 52 02 – Aluminum Railings.
5. Section 09 91 00 – Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
    a. ADM-1 – Aluminum Design Manual.
    b. 45 – Designation System for Aluminum Finishes.

2. American Association of State Highway and Transportation Officials (AASHTO):
   a. Standard Specification for Highway Bridges.
3. American Institute of Steel Construction (AISC):
   a. Manual of Steel Construction - Allowable Stress Design (ASD).
   b. 360 – Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
4. American National Standards Institute (ANSI):
   a. A14.3 – Ladders - Fixed - Safety Requirements.
5. ASTM International (ASTM):
   a. A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   b. A36 – Standard Specification for Carbon Structural Steel.
   c. A47 – Standard Specification for Ferritic Malleable Iron Castings.
   d. A48 – Standard Specification for Gray Iron Castings.
   e. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   f. A108 – Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
   g. A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   h. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   i. A197 – Standard Specification for Cupola Malleable Iron.
   j. A269 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   k. A276 – Standard Specification for Stainless Steel Bars and Shapes.
   l. A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   m. A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   n. A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   o. A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   p. A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

q. A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

r. A536 – Standard Specification for Ductile Iron Castings.

s. A554 – Standard Specification for Welded Stainless Steel Mechanical Tubing.

t. A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

u. A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

v. A668 – Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.

w. A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

x. A786 – Standard Specification for Hot-Rolled Carbon, Low-.Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

y. A967 – Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

z. A992 – Standard Specification for Steel for Structural Shapes.

aa. B26 – Standard Specification for Aluminum-Alloy Sand Castings.

bb. B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

cc. B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

dd. B308 – Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

ee. B429 – Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

ff. B632 – Standard Specification for Aluminum-Alloy Rolled Tread Plate.

gg. F467 – Standard Specification for Nonferrous Nuts for General Use.

hh. F468 – Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

ii. F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

jj. F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

6. American Welding Society (AWS):

a. A5.1 – Standard Specification for Carbon Steel Electrodes for Shielded

Metal Arc Welding.

b. D1.1 – Structural Welding Code Steel.

c. D1.2 – Structural Welding Code Aluminum.

7. National Association of Architectural Metal Manufacturers (NAAMM):

a. AMP 510 – Metal Stairs Manual.

b. MBG 531 – Metal Bar Grating Manual.

8. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910 – Occupational Safety and Health Standards, referred to herein as OSHA Standards.

9. Building code:
a. International Code Council (ICC):

1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Qualify welding procedures and welding operators in accordance with AWS.

2. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.

3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Texas.

1.4 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.

2. Installer and applicator are synonymous.

B. Hardware: As defined in ASTM A153.

C. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Fabrication and/or layout drawings and details:

a. Submit drawings for all fabrications and assemblies.

1) Include erection drawings, plans, sections, details and connection details.

b. Identify materials of construction, shop coatings and third party accessories.

3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Provide manufacturer's standard allowable load tables for the following:
      1) Grating and checkered plate.
      2) Expansion anchor bolts.
      3) Adhesive anchor bolts.
      4) Castings, trench covers and accessories.
4. Contractor designed systems and components, including but not limited to, stairs, landings and ladders:
   a. Certification that manufactured units meet all design loads specified.
   b. Shop Drawings and engineering design certifications:
      1) Indicate design live loads.
      2) Certificate signed and sealed by Professional Engineer that calculations have been performed in accordance with project criteria and standard engineering practices.
      3) Owner’s representative will review for general compliance with Contract Documents.

B. Miscellaneous Submittals:
   1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
   2. Certification of welders and welding processes.
      a. Indicate compliance with AWS.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Headed studs and deformed bar anchors:
   a. Nelson Stud Welding Div., TRW Inc.
   b. Stud Welding Products, Inc.
2. Expansion anchor bolts:
   a. Hilti Inc.
   b. ITW Ramset/Red Head.
   c. Simpson Strongtie.
3. Epoxy adhesive anchor bolts:
   a. Hilti Inc.
   b. ITW Ramset/Red Head.
   c. Simpson Strongtie.
4. Castings, trench covers and accessories:
   a. Neenah Foundry Co.
   b. Deeter Foundry Co.
   c. Barry Craft Construction Casting Co.
   d. McKinley Iron Works.
5. Stainless steel ladders:
   a. Any manufacturer capable of meeting the requirements of this Specification Section.
6. Galvanizing repair paint:
   a. Clearco Products Co., Inc.
   b. ZRC Products.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Steel, Structural Shapes and Plate unless otherwise note on Drawings:

1. Structural:
   a. W-shapes and WT-shapes: ASTM A992, 50 ksi yield.
   b. All other plates and rolled sections: ASTM A36.

2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
3. Structural tubing:
   a. ASTM A500, Grade B (46 ksi minimum yield).
4. Bolts, nuts and washers, high strength:
   a. ASTM A325.
   b. Provide two (2) washers with all bolts.
5. Bolts and nuts:
   a. ASTM A307, Grade A.
6. Welding electrodes: AWS D1.1, E70 Series.
7. Steel forgings: ASTM A668.

B. Iron:
1. Ductile iron: ASTM A536.
2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).
3. Malleable iron: ASTM A47, ASTM A197.

C. Stainless Steel:
1. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
   a. Bars, shapes: ASTM A276, Type 304.
   b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
   c. Strip, plate and flat bars: ASTM A666, Type 304 or 316, Grade A.
   d. Bolts and nuts: ASTM F593, Type 303, 304 or 316.
2. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
   a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
3. Welding electrodes: In accordance with AWS for metal alloy being welded.

D. Aluminum:
1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
   a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
   b. Weir plates, baffles and deflector plates, ASTM B209.
2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
   a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.

3. ASTM B26 for castings.
4. ASTM F468, alloy 2024 T4 for bolts.
5. ASTM F467, alloy 2024 T4 for nuts.
6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

E. Washers: Same material and alloy as found in accompanying bolts and nuts.

F. Embedded Anchor Bolts:

1. Building anchor bolts:
   a. ASTM F1554, Grade 55 with weldability supplement S1 or ASTM A36 for threaded rods galvanized.
   b. ASTM A307, Grade A for headed bolts galvanized.
2. All other anchor bolts: Type 304 or 316 stainless steel with matching nut and washer.

G. Expansion Anchor Bolts and Adhesive Anchor Bolts:

1. Stainless steel, Type 304, 314 or 316.
2. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as indicated on Drawings whichever is larger.
   a. Minimum embedment as recommended by manufacturer or eight (8) diameters of bolt, whichever is larger.
   b. Notify Owner’s Representative if required depth of embedment cannot be achieved at a particular anchor bolt location.
   c. Follow manufacturer's recommendations for installation and torque.

H. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

I. Deformed Bar Anchors: ASTM A496 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

J. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be galvanized.

K. Galvanizing Repair Paint:

1. Specification Section 09 91 00
2. High zinc dust content paint for regalvanizing welds and abrasions.
3. ASTM A780.
4. Zinc content: Minimum 92 percent in dry film.
5. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

L. Dissimilar Materials Protection: See Specification Section 09 91 00.

2.3 MANUFACTURED UNITS

A. Ladders:

1. Material:
   a. Stainless steel: Type 316
2. Rails: As shown on Drawings.
3. Rungs: As shown on Drawings.
4. Rung spacing:
   a. Uniform, 12 IN.
   b. Top rung shall be level with landing or platform.
   c. Spacing of bottom rung from grade or platform may vary but shall not exceed 14 IN.
5. As a minimum, design ladder in accordance with OSHA Standards, ANSI A14.3, and applicable Building Codes.
   a. Ladders shall be designed to support a minimum concentrated live load of 200 LBS.
   b. Maximum allowable stresses per AISC Specification and AA Specification.
   c. Maximum lateral deflection: Side rail span/240 when lateral load of 100 LBS is applied at any location.
6. Construction:
   a. Fully welded type.
   b. All welds to be full penetration welds, where applicable.
   c. All ladders of a particular material shall have consistent construction and material shapes and sizes unless detailed otherwise on the Drawings.
   d. Provide cap at top and bottom of side rails.
   e. Rungs shall not extend beyond the outside face of the siderail.
   f. The side rails of through ladder extension shall extend 42 IN above the top rung or landing and shall flare out on each side to provide a clearance of 24 IN centerline to centerline of rails.
7. Finish:
   1) Stainless steel: Satin.

B. Bollards:

1. 8 IN DIA extra strength steel pipe, ASTM A53.
   a. Prime painted.
2. Minimum 48 IN projection above ground.

3. Minimum 48 IN embedment in concrete, unless otherwise shown on plans.

C. Steel Checkered Plate:

1. Conform to ASTM A786.
   a. Diamond pattern: No.3 (large) or No.4 (medium).
   b. Use one (1) pattern throughout Project.
   c. Material: 36 ksi minimum yield strength.
2. Design live load:
   a. 100 psf, uniform load.
   b. 300 LBS concentrated load on 4 IN square area.
   c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
   d. Maximum deflection: 1/300 of span under a superimposed live load of 50 psf.
3. Reinforce as necessary with steel angles.
4. Plate sections:
   a. Maximum 3 FT wide.
   b. Minimum 1/4 IN thick.
   c. Maximum 100 LBS per section if required to be removable.
5. Provide joints at center of all openings unless shown otherwise.
   a. Reinforce joints and openings with additional angles to provide required load carrying capacity.
6. Unless shown otherwise, frame for opening with steel checkered plate cover:
   a. Steel support angles:
      1) 3 x 2 x 1/4 IN minimum size with long leg vertical.
      2) 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
   b. Steel concrete insert seats:
      1) 2 x 2 x 1/4 IN minimum size.
      2) Auto-welded studs or strap anchors, ASTM A108 at 18 IN OC with not less than two (2) studs or anchors per side.
   c. Drill and tap frame to receive 3/8 IN DIA steel cap screws at not more than 24 IN OC with not less than two (2) screws per side.
7. Provide galvanized checkered plate and edge supports.

D. Aluminum Checkered Plate:
   1. Conform to ASTM B632.
      a. Diamond pattern: Use one (1) pattern throughout Project.
      b. Material: Type 6061-T6.
   2. Design live load:
      a. 100 psf, uniform load.
      b. 300 LBS concentrated load on 4 IN square area.
      c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
      d. Maximum deflection: 1/300 of span under a superimposed live load of 50 psf.
   3. Reinforce as necessary with aluminum angles.
   4. Plate sections:
      a. Maximum 3 FT wide.
      b. Minimum 1/4 IN thick.
      c. Maximum 100 LBS per section if required to be removable.
   5. Provide joints at center of all openings unless shown otherwise.
      a. Reinforce joints and openings with additional angles to provide required load carrying capacity.
   6. Unless shown otherwise, frame for openings with aluminum checkered plate cover:
      a. Aluminum support angles:
         1) 3 x 2 x 1/4 IN minimum size with long leg vertical.
         2) 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
      b. Aluminum concrete insert seats:
         1) 2 x 2 x 1/4 IN minimum size.
         2) Auto-welded studs or strap anchors at 18 IN OC with not less than two (2) studs or anchored per side.
      c. Drill and tap frame to receive 3/8 IN DIA aluminum cap screws at not more than 24 IN OC with not less than two (2) screws per side.

E. Aluminum Grating:
   1. NAAMM MBG 531.

2. Bearing bars: Rectangular, 1-1/2 x 3/16 IN at 1-3/16 IN OC spacing OR I-bar, 1-1/2 IN deep with minimum 1/16 IN thick bar and minimum 1/4 IN flange width at 1-3/16 IN OC spacing., unless shown otherwise on Drawings Cross bars:
    a. Welded, swaged or pressure locked to bearing bars:
    b. Maximum 4 IN/OC spacing.
3. Top edges of bars: Grooved or serrated.
4. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
5. Standard mill finish.
6. Ends and perimeter edges: Banded.
7. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
8. Provide joints at openings between individual grating sections.
9. Clips and bolts: Stainless steel.
10. Seat angles: Aluminum.

F. Steel Grating:
1. NAAMM MBG 531.
2. Bearing bars:
    a. Rectangular 1-1/2 x 3/16 IN unless shown otherwise on Drawings.
    b. Maximum 1-3/16 IN OC spacing.
3. Cross bars:
    a. Welded, swagged or pressure locked to bearing bars.
    b. Maximum 4 IN OC spacing.
4. Top edges of bars: Serrated or grooved.
5. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
6. Finish:
    a. Galvanized.
    b. Clips and bolts: Stainless steel.
    c. Seat angles: Galvanized steel.
7. Ends and perimeter edges: Banded.
8. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
9. Provide joints at openings between individual grating sections.

G. Heavy-Duty Castings, Trench Covers, and Accessories:

1. Prefabricated, cast iron ASTM A48 or ductile iron ASTM A536 or cast aluminum ASTM B26.
2. Design load: AASHTO HS-20 wheel loading for indicated span.
3. Machine horizontal mating surfaces.

H. Access Cover:

1. Tank type manhole frame and solid lid: ASTM A48 or ASTM A536, cast iron.
2. Unless shown otherwise, design of cover shall be such that top of frame extends several inches above slab to prevent surface water from entering tank.
3. Equip lid with four (4) stainless steel screws to secure lid to frame.

I. Loose Lintels:

1. Steel, ASTM A36 or ASTM A572 Grade 50, sizes as indicated on Drawings.
2. Hot-dip galvanized per ASTM A123.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.

1. Grind smooth all rough welds and sharp edges.
   a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.

C. Provide drilled or punched holes with smooth edges.

1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Permanent Shop Connections:

1. Welds to be continuous fillet type unless indicated otherwise.
2. Full penetration butt weld at bends in stair stringers and ladder side rails.
3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1.
4. Weld aluminum in accordance with AWS D1.2.
5. All headed studs to be welded using automatically timed stud welding equipment.
6. Grind smooth welds that will be exposed.

E. Conceal fasteners where practicable.

F. Fabricate work in shop in as large assemblies as is practicable.

G. Tolerances:

1. Rolling:

   a. ASTM A6.

   b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specifications.

2. Fabrication tolerance:

   a. Member length:

      1) Both ends finished for contact bearing: 1/32 IN.

      2) Framed members:

         a) 30 FT or less: 1/16 IN.

         b) Over 30 FT: 1/8 IN.

   b. Member straightness:

      1) Compression members: 1/1000 of axial length between points laterally supported.

      2) Non-compression members: ASTM A6 tolerance for wide flange shapes.

   c. Specified member camber (except compression members):

      1) 50 FT or less: Minus 0/plus 1/2 IN.

      2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).

      3) Members received from mill with 75 percent of specified camber require no further cambering.

      4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.

      5) Camber shall be measured in fabrication shop in unstressed condition.

   d. At bolted splices, depth deviation shall be taken up by filler plates.

      1) At welded joints, adjust weld profile to conform to variation in depth.

      2) Slope weld surface per AWS requirements.

   e. Finished members shall be free from twists, bends and open joints.

      1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

H. Fabricate grating, checkered plate, stairs, ladders and accessories as shown on Drawings.

1. Finish:

a. Aluminum: Mill finished unless scheduled or otherwise specified or, if approved by Owner's representative, finished in manufacturer's standard.

b. Coat surfaces in contact with dissimilar materials.

1) See Specification Section 09 91 00.

2. See Specification Section 09 91 00 for preparation and painting of ferrous metals and other surfaces.

I. Maximum tolerance for difference in depth between checkered plate or grating depth and seat or support angle depth: 1/8 IN.

J. Distance between edge of grating or checkered plate and face of embedded seat angle or face of wall or other structural member shall be 1/4 IN.

1. Tolerance per NAAMM MBG 531.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:

1. Refer to Specification Section 09 91 00 – Painting and Protective Coatings for surface preparation requirements.

B. Shop Applied Paint Coating Application:

1. Refer to Specification Section 09 91 00 – Painting and Protective Coatings for painting requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.

1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

1. Field welding aluminum is not permitted unless approved in writing by Owner's Representative.

3.2 INSTALLATION

A. Set metal work level, true to line, plumb.

1. Shim and grout as necessary.

B. Bolt Field Connections: Where practicable, conceal fastenings.

C. Grind welds smooth where field welding is required.

D. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.

1. Replace entire section.

E. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

F. Unless noted or specified otherwise:

1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
2. Connect aluminum to aluminum with 3/4 IN DIA aluminum bolts.
3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts.
   a. Provide dissimilar metals protection.
4. Connect aluminum and steel members to concrete and masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
   a. Provide dissimilar materials protection.
5. Provide washers for all bolted connections.
6. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top nut.
   a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

G. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC Manual of Steel Construction - Allowable Stress Design (ASD).

1. Provide hardened washers for all ASTM A325 bolts.
   a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

H. After bolts are tightened, upset threads of ASTM A307 unfinished bolts or anchor bolts to prevent nuts from backing off.

I. Secure metal to wood with lag screws of adequate size with appropriate washers.

J. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.

1. Provide full penetration welded splices where continuity is required.

K. Provide each fabricated item complete with attachment devices as indicated or required to install.

L. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.

M. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.

1. See Division 03 – Concrete Specification Sections for non-shrink grout.
2. Set and anchor each base plate to proper line and elevation.
    a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
        1) Wedges, shims and setting nuts to be of same metal as base plate they support.
        2) Tighten nuts on anchor bolts.
    b. Fill space between bearing surface and bottom of base plate with nonshrink grout.
        1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
    c. Do not remove wedges or shims.
        1) Where they protrude, cut off flush with edge of base plate.
    d. Fill sleeves around anchor bolts solid with non-shrink grout.

N. Tie anchor bolts in position to embedded reinforcing steel using wire.

1. Tack welding prohibited.
    a. Coat bolt threads and nuts with heavy coat of clean grease.
2. Anchor bolt location tolerance:
    a. 1/16 IN.
    b. Provide steel templates for all column anchor bolts.

O. Install bollards in concrete as detailed.

1. Fill pipe with concrete and round off at top.

P. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing.

1. Center stair nosings in stair width.
2. Coordinate nosings with railing vertical posts.
    a. Maintain 2 IN clear between end of nosing and edge of railing base plate.

Q. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor.

1. Keep screw holes clean and ready to receive screws.

R. Attach grating to end and intermediate supports with grating saddle clips and bolts.

1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with a minimum of two (2) clips per side.

S. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 91 00 – Painting and Protective Coatings.

T. Repair damaged galvanized surfaces in accordance with ASTM A780.

1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

U. Anchor ladder to concrete or masonry structure with minimum 3/4 IN stainless steel expansion or adhesive anchor bolts with minimum 6 IN embedment.

1. When anchoring into cavity wall construction, provide minimum 6 IN embedment into concrete or masonry back-up wall.
   a. At each anchor location, provide sleeve between back face of veneer and cavity face of concrete or masonry back-up wall.
   b. Cut cavity insulation as required and seal around sleeve.
      1) Sleeve to be 1 IN DIA schedule 40 stainless steel tubing, TP-304L, ASTM A269.
         a) Minimum wall thickness to be .065 IN.
      2) Continuously weld 4 x 4 x 1/4 IN Type 304 stainless steel, ASTM A666 flange onto each end of pipe.
         a) Drill 1 IN hole in flange to match pipe.
         b) Attach sleeve to concrete or masonry back-up with 1/4 IN self-tapping concrete anchors.
      3) Grout solid, area around bolt where bolt penetrates veneer.
      4) Accurately locate sleeves to align with bolt locations on ladder.
2. When anchoring into masonry, fill masonry cores with grout at anchor locations and each masonry core within 8 IN of anchor3.

V. Anchor ladder to metal stud walls using minimum 1/2 IN stainless steel bolts, nuts and washers.

1. Verify that stud wall has been provided with adequate backing to accept ladder anchors.

3.3 CLEANING

A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 91 00 – Painting and Protective Coatings.

3.4 OWNER TRAINING

A. Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel in the use and maintenance of the equipment and materials provided in this specification. Refer to section 01 75 00 – System Start-Up.

END OF SECTION

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SECTION 05 52 02

ALUMINUM RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum handrail, stair rail and guardrail.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 05 50 00 – Metal Fabrications.
4. Section 09 91 00 – Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. Section IX – Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
2. ASTM International (ASTM):
   a. B108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings.
   b. B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   c. B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
   d. B247 – Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
   e. B308 – Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
   f. B429 – Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

3. American Welding Society (AWS):
    a. C5.5 – Recommended Practices for Gas Tungsten Arc Welding.
    b. D1.2 – Structural Welding Code Aluminum.
4. National Association of Architectural Metal Manufacturers (NAAMM):
    a. AMP 521 – Pipe Railing Systems Manual.
5. U. S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
    a. Americans with Disabilities Act (ADA):
        1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
6. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910 – Occupational Safety and Health Standards, referred to herein as OSHA Standards.
7. Building code:
    a. International Code Council (ICC):
        1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
1. Qualify welding procedures and welding operators in accordance with AWS and ASME Section IX.

1.4 DEFINITIONS

A. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

B. Handrail: A railing provided for grasping with the hand for support.

C. Railing: A generic term referring to guardrail, handrail and/or stair rails.

D. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.5 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings:
    a. Drawings showing profile, location, sections and fabrication details including all welding information of each railing.

b. Type and details of anchorage.

c. Location and type of expansion joints.

d. Materials of construction, shop coatings and all third-party accessories.

3. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation details.

4. Certification that railings have been designed and fabricated to meet the loading requirements specified.

5. Certification for all proposed deviations from the Specification.

a. Certificate signed and sealed by Professional Engineer that calculations have been performed in accordance with project criteria and standard engineering practices for all proposed deviations. Calculations Certification shall be specific to this Project and shall include all assumptions, references and design interpretations used to achieve the results obtained by the Certifying Engineer.

b. Reduction in load criteria is not acceptable as reason for deviation from sizes indicated in the Specification.

B. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Certification of welders and welding procedures indicating compliance with AWS requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver and handle railings to preclude damage.

B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect against corrosion.

1.7 WARRANTY

A. Provide PVDF coating manufacturer's standard 10 year warranty against finish, fading, chipping, cracking and peeling.

1. Repair of finish shall be done using same material, application method and color to match surrounding railings.

2. Commencement date of warranty is date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Welded railing systems:

a. Any manufacturer meeting this Specification Section.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.

1. ASTM B209 for sheets and plates.
2. ASTM B221 and ASTM B308 for shapes - beams, channels, angles, tees, and zees.
3. ASTM B247 for forgings.

B. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.

1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.

C. Cast Fittings: Aluminum, ASTM B108.

D. Shims: Aluminum of same alloy as component being shimmed.

E. Fasteners: See Specification Section 05 50 00 – Metal Fabrications.

F. Expansion and Adhesive Anchors: See Specification Section 05 50 00 – Metal Fabrications.

G. Electrodes for Welding:

1. Aluminum: AWS D1.2.
2. Filler alloy 5356 or 4043.

2.3 FABRICATION

A. General:

1. Verify field conditions and dimensions prior to fabrication.
2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.

3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.

a. Ease exposed edges to a radius of approximately 1/32 IN.

b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

c. Drill or punch holes with smooth edges.

4. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding.

   a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.

5. Provide for anchorage of type indicated on Drawings or as required by field conditions.

   a. Drill or punch holes with smooth edges.

6. Design railings and anchorage system in accordance with NAAMM AMP 521 to resist loading as required by Building Code.

7. Custom fabricate railings to dimensions and profiles indicated.

   a. Fabricate handrail mounted to wall or to guardrail vertical posts using minimum 1-1/4 IN nominal diameter Schedule 40 pipe.

   b. Fabricate all guardrail top rails using minimum 2 IN nominal diameter Schedule 40 pipe.

   c. Fabricate all guardrail vertical posts using minimum 2 IN nominal diameter Schedule 40 pipe.

      1) Guardrail vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.

   d. All intermediate rails shall be fabricated using minimum 1-1/2 IN nominal diameter Schedule 40 pipe.

      1) Where details are not indicated, set horizontal rails and vertical pickets to requirements of the Building Code ADAAG or OSHA Standards, whichever requires the more restrictive design.

   e. Space vertical posts as required by loading requirements but not more than 4 FT on center.

   f. Space handrail brackets as required by loading requirements but not more than 4 FT on center.

   g. Base plate for vertical guardrail posts mounted to top of concrete surface:

      1) 3/8 x 6 x 6 IN square plate.

      2) Predrilled to accept four (4) anchors.

      3) Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.

      4) Fit the vertical post over the solid rod and weld the post to the base plate.

h. Base plate for vertical guardrail post mounted to flange of metal structure:
   1) 3/8 x 3 x 8 IN plate.
   2) Predrilled to accept two (2) fasteners.
   3) Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
   4) Fit the vertical post over the solid rod and weld the post to the base plate.

i. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
   1) Pair of 3/8 IN angles or bent plates.
   2) Predrilled to accept two (2) fasteners each.
   3) Weld angles or bent plates to vertical posts.

j. Provide 3/8 IN x 4 IN flat bar toeboards or 1/4 IN minimum thickness x 4 IN high extruded toeboard with stiffener ribs on back side at all elevated walkways, platforms and stair landings, and where indicated on the Drawings or required by OSHA Standards.

8. Fit exposed ends of guardrails and handrails with solid terminations.
   a. Return ends of handrail to wall, but do not attach to wall.
   b. Where guardrail terminates at a wall, provide a vertical post located 4 IN off the wall to center of post.
9. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.

B. Finish: Mill.

C. Railing Fabrication:
   1. All railings are to be welded systems.
   2. Use wire welding for all joints.
   3. All welding to be continuous in accordance with AWS C5.5 and AWS D1.2.
      a. All welded railing joints shall have full penetration welds unless noted otherwise.
   4. All exposed welds to be ground smooth and flush to match and blend with adjoining surfaces.
      a. NAAMM AMP 521, Type 2.
   5. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
   6. Finishing joints with filler is not acceptable.

7. Provide flush weld fittings using locking weld connectors or coped drive-on connectors.
8. All railings are to be mechanically fastened component system.
9. Railing system shall be an engineered system designed specifically for use as guardrail system.
    a. Fittings shall be internally connected, flush-fitting aluminum or stainless steel.

D. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
1. Drill 1/4 IN weep hole in railings closed at bottom:
    a. 1 IN above walkway surface at bottom of posts set in concrete.
    b. 1 IN above solid aluminum rod at posts having base plate.
    c. At low point of intermediate rails.
    d. Do not drill weep holes:
        1) In bottom of base plate.

E. Expansion Joints:
1. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
    a. Top rail splices and expansion joints shall be located within 8 IN of post or other support.
    b. Where railings span tank expansion joints; provide a railing expansion joint in the span crossing the tank expansion joint.
2. Provide expansion joints in any continuous run exceeding 20 FT in length.
    a. Space expansion joints at not more than 40 FT on center.
3. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DegF differential between installation temperature and maximum design temperature.
    a. Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
        1) Provide additional expansion joints as required to limit expansion joint width.
4. Provide slip-joint with internal sleeve.
    a. Extend slip joint min 2 IN beyond joint at maximum design width.
    b. Fasten internal sleeve securely to one side
        1) Provide allen-head set screw located in bottom of rail.
        2) Rivets or exposed screw heads are not acceptable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify condition of substrate.

B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

A. Install handrails and guardrails to meet loading requirements of the Building Code.

B. Install products in accordance with manufacturer's instructions.

C. Set work accurately in location, alignment and elevation; plumb, level and true.

1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.

D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.

1. Provide shims as required.

E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.

1. Lubricate expansion joint splice bar for smooth movement of railing sections.

F. Provide removable railing sections where indicated on Drawings.

G. Attach handrails to walls or guardrail with brackets designed for condition:

1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.

a. Handrails shall not project more than 4-1/2 IN into required stairway width.

2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors with stainless steel hex head bolts.

H. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents.

1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.

a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.

b. Bevel the top of the bolt after cutting to provide a smooth surface.

I. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.

J. Install toeboards to fit tight to the walking surface.

1. Notch toeboards at base plates or other obstructions.

2. Bottom of toeboard shall not exceed 1/4 IN above walking surface.

K. Coat aluminum in contact with dissimilar metal or concrete in accordance with Specification Section 09 91 00 – Painting and Protective Coatings.

L. Provide railings as required for stair construction identified in Specification Section 05 50 00 – Metal Fabrications.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealant work.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 09 91 00 – Painting and Protective Coatings.

C. Work included consists of but is not necessarily limited to:

1. Sealing all joints which will permit penetration of dust, air or moisture, unless sealing work is specifically required under other Specification Sections.

a. Work may include the following:

1) Flashing reglets and retainers.

2) Exterior wall joints.

3) Masonry control joints, exterior and interior and between masonry and other materials.

4) Flooring joints.

5) Isolation joints.

6) Joints between paving or sidewalks and building.

7) Concrete construction, control and expansion joints, exterior and interior.

8) Sawed joints in interior concrete slabs.

9) Joints between precast roof units, between precast roof units and walls, and all exterior and interior joints between precast wall panels.

10) Joints at penetrations of walls, floors and decks by piping and other services and equipment.

11) Exterior and interior perimeters of exterior and interior door and window frames, louvers, grilles, etc.

12) Thresholds at exterior doors.

13) Sealing of plumbing fixtures to floor or wall.

14) Sealing around piping, duct or conduit penetrations through roof, floors, interior and exterior walls.

15) Sealing perimeter and penetrations of sound insulated walls.

16) Other joints where calking, sealant, expanding foam sealant or compressible sealant is indicated.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 302.1R – Guide for Concrete Floor and Slab Construction.
2. ASTM International (ASTM):
   a. C834 – Standard Specification for Latex Sealants.
   b. C920 – Standard Specification for Elastomeric Joint Sealants.
   c. C1521 – Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
3. National Sanitation Foundation International (NSF).
4. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products specified on projects with similar scope.

C. Mock-Ups:

1. Before caulking work is started, a mock-up of each type of joint shall be caulked where directed by the Owner's Representative.
   a. The approved mock-ups shall show the workmanship, bond, and color of calking materials as specified or selected for the work and shall be the minimum standard of quality on the entire project.
   b. Each sample shall cure for a minimum of seven (7) days at which time the sealant manufacturer's authorized factory representative shall perform adhesion tests on each sample joint.
      1) Perform adhesion tests per ASTM C1521.
      2) If mock-up is not acceptable or if adhesion test fails, provide additional mock-up and adhesion testing as required until acceptable to Owner's Representative.

1.4 DEFINITIONS

A. "Caulk(ing)," "calk(ing)," and "sealant": Joint sealant work.

B. "Interior wet areas": Toilets, showers, laboratories, wet wells and similar areas.

C. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

D. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

E. Defect(ive): Failure of watertightness or airtightness.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
3. Warranty.
4. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
5. Certification of applicator qualification.

B. Samples:

1. Cured sample of each color for Owner’s representative's color selection.
2. Color chart not acceptable.

C. Miscellaneous Submittals: See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

D. Test Results:

1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

1.7 WARRANTY

A. Material and Labor Warranty:

1. Sealant work free of defects for a period of five (5) years from date of Substantial Completion.
2. Remove any defective work or materials and replace with new work and materials.
3. Warranty signed jointly by Applicator and sealant manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Polyurethane sealants:
   a. Pecora.
   b. Sika Chemical Corp.
   c. Sonneborn - Rexnord.
   d. Tremco.
2. Silicone sealants:
   a. General Electric.
   b. Dow Corning Corp.
   c. Tremco.
3. Compressible sealant:
   a. Polytite Manufacturing Corporation.
   b. Emseal.
   c. Norton.
   d. Sandell.
4. Acoustical sealant:
   a. Pecora.
   b. Sonneborn.
   c. Tremco.

5. Polysulfide rubber sealant:
    a. Pecora.
    b. Sonneborn.
    c. Morton Polymer Systems.
6. Expanding foam sealant:
    a. Macklanburg Duncan.
    b. Convenience Products.
    c. FAI International, Inc.
    d. Power Fasteners.
7. Polyurea joint filler:
    a. Dayton Superior Specialty Chemical Corporation.
    b. Euclid Chemical Co.
    c. L&M Construction Chemicals, Inc.
    d. Sonneborn.
8. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Sealants - General:
1. Provide colors matching materials being sealed.
2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
3. Nonsagging sealant for vertical and overhead horizontal joints.
4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.

B. Polyurethane Sealant:
1. One (1) or two (2) components.
    a. Use one part component for above grade structure.
    b. Use two part component only for on or below grade and water containment structures.
2. Paintable.
3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
    a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.

b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.

c. Sonneborn Sonolastic NP-1, NP-II, SL-1 SL-2.

d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

C. Silicone Sealant:

1. One (1) component.
2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
   a. General Electric: Silpruf, Silglaze II.
   b. General Electric: Sanitary 1700 sealant for sealing around plumbing fixtures.
   c. Dow Corning: 786 for sealing around plumbing fixtures.
   d. Dow Corning: 790, 795.
   e. Tremco: Spectrem 1, Spectrem 3, Tremsil 600.
3. Mildew resistant for sealing around plumbing fixtures.

D. Compressible Sealant:

1. Size so that width of material is twice joint width.
2. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
   a. Polytite Manufacturing Corp. "Polytite-B."
3. Fire rated where required.

E. Joint Cleaner, Primer, Bond Breaker: As recommended by sealant manufacturer.

F. Sealant Backer Rod and/or Compressible Filler:

1. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, nonbituminous material recommended by sealant manufacturer to:
   a. Control joint depth.
   b. Break bond of sealant at bottom of joint.
   c. Provide proper shape of sealant bead.
   d. Serve as expansion joint filler.

G. Adhesive, Compressible Sealant: As recommended by sealant manufacturer.

H. Expanding Foam Sealant:

1. One (1) or two (2) component fire rated moisture cured expanding urethane.
2. Shall not contain formaldehyde.

3. Density: Minimum 1.5 pcf.
4. Minimum 70 percent closed cell content.
5. R-value minimum 5.0/IN.
6. Flame spread: Less than 25.
7. Smoke developed: Less than 25.

I. Acoustical Sealant:

1. One (1) component siliconized acrylic latex sealant.
2. Non-staining, non-bleeding.
3. Compatible with paints specified for adjoining materials.
   a. See Specification Section 09 91 00 – Painting and Protective Coatings.
4. Meet ASTM C834.
   a. Pecora - AC20+.
   b. Sonneborn - Sonolac.
   c. Tremco - Tremflex 834.

J. Polysulfide Rubber Sealant:

1. One (1) or two (2) component.
2. Meet ASTM C920.
   a. Pecora Synthacalk GC2+.
   b. Sonneborn - Sonolastic - two-part polysulfide sealant.
   c. Morton Polymer Systems - Thiokol Sealants.

K. Polyurea Joint Filler:

1. Two (2) component, semi-rigid material for filling control, sawcut and construction joints in interior concrete floors.
   a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
   b. Euclid Chemical Co. "EUCO QWIK" joint.
   c. L&M Construction Chemicals, Inc. "Joint Tite 750".
   d. Sonneborn "TF-100" control joint filler.
2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
3. Color: Gray.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.

1. Limit application to surfaces to receive calking.
2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

E. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:

1. Take care to not puncture backer rod and compressible filler.
2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

F. Apply bond breaker where required.

G. Tool sealants using sufficient pressure to fill all voids.

H. Upon completion, leave calking with smooth, even, neat finish.

I. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

J. Install compressible sealant to position at indicated depth.

1. Take care to avoid contamination of sides of joint.
2. Protect side walls of joint (to depth of finish sealant).
3. Install with adhesive faces in contact with joint sides.
4. Install finish sealant where indicated.

K. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.

1. Provide adequate fire rated backing material as required.
2. Hold material back from exposed face of wall as required to provide backer rod and finish sealant.
   a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
3. Material shall be minimum of 70 DegF prior to and during installation.
4. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 FIELD QUALITY CONTROL

A. Adhesion Testing:

1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
   a. Water bearing structures: One (1) test per every 1000 LF of joint sealed.
   b. Exterior precast concrete wall panels: One (1) test per every 2000 LF of joint sealed.
   c. Chemical containment areas: One (1) test per every 1000 LF of joint sealed.
   d. Building expansion joints: One (1) test per every 500 LF of joint sealed.
   e. All other type of joints except butt glazing joints: One (1) test per every 3000 LF of joint sealed.
   f. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.4 SCHEDULE

A. Furnish sealant as indicated for the following areas:

1. Exterior areas: Polyurethane.
2. Interior wet areas: Polyurethane.
3. Interior wet, corrosive areas: Polyurethane.
4. Interior nonwet, corrosive areas: Polyurethane.
5. Interior nonwet, noncorrosive areas: Polyurethane.
6. Compressible sealant: Where indicated.
7. Sealant which will be subject to prolonged contact with or submersion in water (except wastewater and sewage):
   a. Polysulfide or polyurethane: NSF approved for use in potable water tanks.

8. Penetrations exterior wall above grade:
   a. For non-corrosive areas, provide expanding urethane foam, with polyurethane finish sealant.
   b. For corrosive areas, provide expanding urethane foam, bond breaker and polysulfide finish sealant on corrosive side with polyurethane finish sealant on non-corrosive side.
9. Sealant exposed to or having the potential of being exposed to concentrated chlorine gas or chlorine liquid: Polysulfide.
10. Sealant which will be immersed in wastewater or sewage: Polysulfide.
11. Interior concrete floor control joints or sawed joints: Polyurea joint filler.
12. Sealing around plumbing fixtures: Silicone.
13. Plastic laminate casework, plastic laminate countertops and solid surface materials: Silicone Latex.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 07 95 13

EXPANSION JOINT COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Expansion joint cover assemblies.
2. Fire barriers.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 05 50 00 - Metal Fabrications.
4. Section 07 92 00 - Sealants.
5. Section 09 91 00 - Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. The Aluminum Association (AA):
   a. 45, Designation System for Aluminum Finishes.
2. ASTM International (ASTM):
   a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   b. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   c. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
   d. D2000, Standard Classification System for Rubber Products in Automotive Applications.

e. E1399, Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

3. Underwriters Laboratories (UL):

a. 2079, Tests for Fire Resistance of Building Joint Systems.

b. Building Materials Directory.

1.4 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.

2. Installer and applicator are synonymous.

B. Heavy Duty: Capable of withstanding a point load of 2000 LB without damage or permanent deformation.

C. Standard Duty: Capable of withstanding a point load of 500 LB without damage or permanent deformation.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation instructions.

3. Scaled plan and detail Drawings.

a. Drawings shall show expansion joint cover locations, types, extents, joints, controlling dimensions, details, etc.

b. Minimum plan scale: 1/8 IN = 1 FT 0 IN.

c. Minimum detail scale: 3/4 IN = 1 FT 0 IN.

B. Samples:

1. Minimum 12 IN long sample of each type of expansion joint assembly and cover specified.

a. Actual color samples of resilient inserts for Owner’s representative’s selection.

C. Miscellaneous Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Certifications:
    a. UL Certification of fire rated assemblies

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Expansion joint covers:
        a. C/S Group.
        b. MM Systems.
    2. Expansion joint fire barrier:
        a. C/S Group.
        b. MM Systems.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Aluminum:
    1. Sheet and plate: ASTM B209, alloy 6061-T6.
    2. Extrusions, bars, rods, wire, and tubes: ASTM B221, alloy 6063-T5.

B. PVC: ASTM D1784.

C. Thermoplastic Elastomer:
    1. Extrusions and sheet goods: ASTM D2000.

2.3 MANUFACTURED UNITS

A. General:
    1. Product numbers listed are based on MM Systems.
    2. Provide expansion joint cover assemblies of design, profile, materials and operation indicated.
        a. Factory fabricated joints, transitions, connections and intersections.
    3. Provide manufacturer's standard anchors, fasteners, spacers, vapor seals, filler materials, adhesive and other accessories as required for complete installation.
    4. Where expansion joint covers are located in fire-rated assemblies, include fire-barrier system to provide a UL-listed joint assembly.

5. Provide units in longest practicable lengths to minimize number of end joints.
    a. Locate end joints in non-conspicuous areas; avoid locating in traffic areas.
6. Finishes:
    a. Aluminum: Clear anodized AA-M12C22A41.
    b. Elastomeric inserts: To be selected by Owner's representative.

B. Floor Expansion Joint Covers:
1. Continuous extruded aluminum frame assemblies with floating cover plate and seal.
    a. Provide continuous neoprene waterstop at floor-ceiling assemblies.
2. Standard duty, block-out mount:
    a. Concrete and ceramic tile floors:
        1) Floor-to-floor joints: Series HFX.
        2) Floor-to-wall joints: Series HFXE.
3. Heavy duty, block-out mount:
    a. Floor-to-floor joints: Series EHFX.
4. Provide standard duty covers in administrative areas.
    a. Provide heavy duty covers in all process related areas and areas not considered as administrative or office areas.
5. Refer to Drawings for joint width.

C. Wall Expansion Joint Covers:
1. Gypsum board wall assemblies:
    a. Frame: Aluminum with square corners designed for overlay construction on finished face of gypsum board.
    b. Wall to wall: Series X-M.
    c. Corner wall: Series X-N.
2. Precast concrete, cast-in-place concrete or masonry wall assemblies:
    a. Frame: Extruded aluminum designed for recessed construction in joint.
    b. Continuous elastomeric inserts:
        1) Primary seal:
            a) Extruded thermoplastic elastomer.
            b) Color to be selected by Owner's representative.
        2) Secondary seal: PVC.

c. Wall to wall joints: Series VSS.

d. Wall to wall at corner joints: Series VSS.

D. Floor Expansion Joint Covers:

1. Concrete floors with no additional topical finishes applied:

a. Floor to floor: Series LMS.

b. Floor to wall: Series LMS-C.

E. Fire Barriers:

1. Flexible mat material with corrugated metal facing on each face and continuous galvanized steel mounting angles.

2. Designed for required dynamic structural movement without material degradation or fatigue in accordance with ASTM E1399.

3. Prefabricated for hourly rating of adjacent floor, wall or ceiling assemblies.

a. UL labeled: Tested in maximum joint width condition as a component of a joint assembly in accordance with UL 2079.

2.4 ACCESSORIES

A. Fire-rated Sealant: See Specification Section 07 92 00.

B. Fasteners:

1. Stainless steel.

2. See Specification Section 05 50 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction to Contractor in time to allow their installation.

1. If such items are not provided in time for installation, coordinate block-out requirements for later installation.

2. Where block-outs are subject to traffic or potential for damage, provide temporary fillers to protect joint until specified items can be installed.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

1. Locate end joints in non-conspicuous areas; avoid locating in traffic areas.

2. Seal joints in accordance with manufacturer’s written installation instructions.

3. Ensure bolting joints are fastened such that the two (2) components create a smooth flat surface with hairline jointery unless a wider joint is required by the joint cover manufacturer.

B. Set work level, true and plumb.

C. Install fire barriers in fire-rated sealant as required for UL assembly required.

D. Provide dissimilar materials protection in accordance with Specification Section 09 91 00.

E. After installation, clean all aluminum surfaces to remove excess calking, sealer, adhesives, etc.

1. Repair or replace damaged inserts, patch paint coatings on components having scratched or otherwise damaged finish coatings.
2. Replace all components that cannot be adequately repaired to satisfaction of the Owner's representative.

END OF SECTION

SECTION 09 91 00

PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High performance industrial coatings (HPIC).
2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
3. Minimum surface preparation requirements.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.
4. Section 05 50 00 – Metal Fabrications.
5. Section 10 14 00 – Identification Devices.
6. Section 33 16 14 – Reservoirs: Prestressed Concrete
7. Section 33 16 15 – Reservoirs: Renovations

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. D4258 – Standard Practice for Surface Cleaning Concrete for Coating.
   b. D4259 – Standard Practice for Abrading Concrete.
   c. D4261 – Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
   d. D4262 – Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
   e. D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

f. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

2. NACE International (NACE).
   a. RP0188 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
   b. RP0287 Field Measurements of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape
3. National Association of Pipe Fabricators (NAPF):
   a. 500-03-04 – Abrasive Blast Cleaning for Ductile Iron Pipe.
   b. 500-03-05 – Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
4. National Bureau of Standards (NBS):
   a. Certified Coating Thickness Calibration Standards.
5. National Fire Protection Association (NFPA):
   a. 101 – Life Safety Code.
6. National Sanitation Foundation International (NSF).
   a. Standard 61 Drinking Water Components
7. Steel Door Institute/American National Standards Institute (SDI/ANSI):
   a. A250.10 – Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors.
8. The Society for Protective Coatings (SSPC):
   a. PA 2 – Measurement of Dry Paint Thickness with Magnetic Gages.
   b. SP 1 – Solvent Cleaning.
   c. SP 2 – Hand Tool Cleaning.
   d. SP 3 – Power Tool Cleaning.
   e. SP 16 – Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals.
9. The Society for Protective Coatings/NACE International (SSPC/NACE):
   a. SP 5/NACE No. 1 – White Metal Blast Cleaning.
   b. SP 6/NACE No. 3 – Commercial Blast Cleaning.
   c. SP 7/NACE No. 4 – Brush-off Blast Cleaning.
   d. SP 10/NACE No. 2 – Near-White Blast Cleaning.
   e. SP 12/NACE No. 5 – Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating.
   f. SP 13/NACE No. 6 – Surface Preparation of Concrete.

B. Shop Applicator Qualifications:

1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
2. Applicators shall have minimum of 10 years experience in application of similar products on similar project.
    a. Provide references for minimum of three (3) different projects completed in last five (5) years with similar scope of work.
    b. Include name and address of project, size of project in value (painting) and contact person.

C. Field Applicator Qualifications

1. Provide 5 references which show that the Contractor has previous successful experience with the specified or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the Contractor applied the protective coating.
2. The manufacturer shall provide written certification that the coating Contractor's supervisor and each applicator performing Work on the project have been trained and approved by the manufacturer to apply the selected coating system.
3. A written certification from the Contractor stating that they are qualified and experienced in the application of the specified coating systems.
4. Field coating applicator shall provide SSPC QP 1 Certification.

D. Miscellaneous:

1. Each paint system shall be provided through one (1) manufacturer unless noted otherwise.
2. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.

E. Deviation from specified mil thickness or product type is not allowed without written authorization of Owner’s representative.

F. Material shall not be thinned unless approved, in writing, by paint manufacturer's authorized representative.

1.4 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified.

C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a corrosive material such as water, wastewater, or chemical solution; or exposure to corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range of 5 to 9.

1. For purposes of this Specification Section, corrosive environments include:

a. The interior of Ground Storage Tanks (GST)

b. Exterior areas of the GST

D. Highly Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a highly corrosive material such as water, wastewater, or chemical solution; or exposure to highly corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range below five (5) or above nine (9).

E. Exposed Exterior Surface:

1. Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.

2. Exterior surfaces are considered corrosive environment.

a. The following areas are considered highly corrosive:

1) All chemical unloading stations and areas within 10 FT-0 IN of containment areas.

2) All chemical unloading station containment areas.

3) All areas within a 6 FT radius of chemical tank vents.

F. Finished Area: An area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be painted.

G. Immersion Surface:

1. Any surface immersed in water or some other liquid.

2. Surface of any pipe, valve, or any other component of the piping system subject to condensation including the pipe support system.

H. Paint includes the following:

1. High performance industrial coatings (HPIC) include: Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.

I. Surface Hidden from View: Surfaces such as those within pipe chases, surfaces between top side of ceilings (including drop-in tile ceilings) and underside of floor or roof structures above, surfaces under overhanging walkways if over five feet above adjacent walking surfaces

J. AP: Architectural paints.

K. HPIC: High performance industrial coatings.

L. SC: Special coatings.

M. Water level for purposes of painting: See Drawings.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Field Applicator experience qualifications.
    a. No submittal information will be reviewed until Owner's representative has received and approved applicator qualifications.
    b. Field coating applicator shall provide SSPC QP 1 Certification for HPIC products in Corrosive and Highly Corrosive Environments.
3. Shop Applicator Qualifications
    a. NACE Coating Inspector Program certification documents for the person responsible for Quality Assurance/Quality Control at the facility. This person will be responsible for submitting inspection reports to the Owner.
    b. A copy of a typical Quality Assurance/Quality Control inspection report containing coating inspection items listed in Paragraph 3.7 of this Specification.
    c. The Shop Coating Applicator shall provide SSPC QP 3 Certification or the coating manufacturer's certification for selected coating system.
4. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's application instructions.
    c. Manufacturer's surface preparation instructions.
    d. If products being used are manufactured by Company other than listed in the MATERIALS Article of this Specification Section, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates and verification that product is designed for intended use.
    e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
    f. Coating manufacturer's recommendation on abrasive blasting.
    g. Manufacturer's recommendation for universal barrier coat.
    h. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.

5. Manufacturer's statement regarding applicator instruction on product use.
6. Certification that High Performance Coating Systems proposed for use have been reviewed and approved by Senior Corrosion Specification Specialist employed by the coating manufacturer.

B. Samples:

1. Manufacturer's full line of colors for Owner's Representative's preliminary color selection.
2. After preliminary color selection by Owner's Representative provide two (2) 3 x 5 IN samples of each final color selected.

C. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Approval of application equipment.
3. Applicator's daily records:
   a. Submit daily records at end of each week in which painting work is performed unless requested otherwise by Owner's Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:

1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

1.7 WARRANTY

A. The Contractor and coating manufacturers shall warrant the coating system applications against defects and workmanship after final acceptance of the Work for a period of 5 years. The Contractor shall perform all Work and supply all equipment and materials associated with the repair of failures identified in the warranty inspection at no cost to the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:

1. High performance industrial coatings:
   a. Tnemec.

b. ICI Devoe.

c. Carboline Protective Coatings.

d. Sherwin Williams.

e. Dampney Company, Inc.

f. PPG Industries/Amercoat.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

1. Product VOC content as measured per EPA Method 24 in compliance with TCEQ Chapter 115.453 VOC limits will be an important factor when determining acceptability of substitution.

2.2 MATERIALS

A. For unspecified materials such as thinner, provide manufacturer's recommended products.

B. Paint Systems - General:

1. P = prime coat.

2. F1, F2 . . . Fn = first finish coat, second finish coat . . . . nth finish coat, color as selected by Owner’s representative.

3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.

C. HPIC products listed in the MATERIALS Article, Paint Systems paragraph are manufactured by Tnemec.

1. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, does not exceed TCEQ Chapter 115.453 VOC limits, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.

D. Paint Systems (Systems not shown are not used):

1. HPIC SYSTEM #1 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).

a. Prime coat:

1) P1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine

Epoxy).

b) F2 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

2) Exterior:

a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b) F2 = 1 coat, 2.5 mils, Series 1080 Endura-Shield. W.B.(Waterborne Acrylic Polyurethane).

2. HPIC SYSTEM #2 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).

a. Prime coat:

1) P1 = 1 coat, 3.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 63 to 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

2) Exterior:

a) F1 = 1 coat, 63 to 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b) F2 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B.(Waterborne Acrylic Polyurethane).

3. HPIC SYSTEM #3 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine135 Chembuild (surface tolerant epoxy).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

2) Exterior:

4. HPIC SYSTEM #4 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).

1) P1 = 1 coat, 2.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine135 Chembuild (surface tolerant epoxy).

2) Exterior:

a) F1 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

5. HPIC SYSTEM #4 - Surface Tolerant Epoxy with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 2.5 mils, Series 135 Chembuild (surface tolerant epoxy)

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 3 mils, Series 135 Chembuild (surface tolerant epoxy).

2) Exterior:

a) F1 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

6. HPIC SYSTEM #5 - Modified Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 2.0 mils, Series 135 Chembuild (Modified Polyamidoamine Epoxy).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 2.5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

2) Exterior:

a) F1 = 1 coat, 2.0 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

7. HPIC SYSTEM #5.1 - Cycloaliphatic Amine Epoxy Primer with Aliphatic Polyester Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 10 mils, Series 104 H.S. Epoxy (Amine Epoxy).

b. Finish coat:

1) F1 = 1 coat, 3.0 mils, Series 290 CRU (Aliphatic Polyester Polyurethane).1080 Endura Shield W.B.

8. HPIC SYSTEM #6 - Modified Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 3 mils, Series 135 Chembuild (Modified L69 Epoxoline (Polyamidoamine Epoxy).
    b. Finish coat(s):
        1) Interior:
            a) F1 = 1 coat, 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
        2) Exterior:
            a) F1 = 1 coat, 3 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).
9. HPIC SYSTEM #7 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 2.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).
    b. Finish coat(s):
        1) Interior:
            a) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
        2) Exterior:
            a) F1 = 1 coat, 3.0 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).
10. HPIC SYSTEM #8 - Air Dry Silicone Copolymer Primer with Silicone Copolymer Top Coat.
    a. Prime coat:
        1) P1 = 1 coat, 2.0 mils, Dampney Thurmalox 260C Series (Air Dry Silicone Copolymer).
    b. Finish coat:
        1) Interior or exterior:
            a) F1 = 1 coat, 2.0 mils, Dampney Thurmalox 260C Series (Air Dry Silicone Copolymer).
11. HPIC SYSTEM #9 - Modified Polyamidoamine Epoxy.
    a. Prime coat:
        1) P1 = 1 coat, 3 mils, Series 135 Chembuild (Modified Polyamidoamine Epoxy).

12. HPIC SYSTEM #10 - Modified Silicone Co-Polymer Primer with Modified Silicone Co-Polymer Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 4.0 to 5.0 mils, Dampney Thurmalox 225 HD (Modified Silicone Co-Polymer).
    b. Finish coat(s):
        1) F1 = 1 coat, 2.5 to 3.0 mils, Dampney Thurmalox 230C.
13. HPIC SYSTEM #11 - Single Pack Liquid Organic Zinc-Rich Aromatic Urethane Primer. Compound
    a. Prime coat:
        1) P1 = 1 coat, 3.01.5 mils, 90-97 Tneme-ZRC Galvilite Galvanized Repair Compound (Liquid Organic Zinc (Zinc-Rich UrethaneCompound).
14. HPIC SYSTEM #12 - HDP Acrylic Polymer Primer and Top Coat.
    a. Prime coat:
        1) P1 = 1 coat, 2.5 mils, Series1029 Enduratone (HDP Acrylic Polymer).
    b. Finish coat:
        1) Interior:
            a) F1 = 1 coat, 2.5 mils, Series1029 Enduratone (HDP Acrylic Polymer).
15. HPIC SYSTEM #13 - Modified-Acrylate Elastomer Primer and Top Coat.
    a. Prime coat:
        1) P1 = 1 coat, 8 mils, Series 156 Enviro-Crete (Modified-Acrylate Elastomer).
    b. Finish coat:
        1) Exterior:
            a) F1 = 1 coat, 8 mils, Series 156 Enviro-Crete (Modified-Acrylate Elastomer).
16. HPIC SYSTEM #14 - Waterborne Modified Polyamine Epoxy Primer with Specialized Acrylate Waterborne Top Coats.
    a. Prime coat:
        1) P1 = 1 coat, 1.5 mils, Series 151 Elasto-Grip FC (Waterborne Modified Polyamine Epoxy).
    b. Finish coat(s):
        1) Interior:
            a) F1 = 1 coat, 6.5 to 7.5 mils, Series 158 Bio-Lastic (Specialized

Waterborne Acrylate).

b) F2 = 1 coat, 6.5 to 7.5 mils, Series 158 Bio-Lastic (Specialized Waterborne Acrylate).

17. HPIC SYSTEM #15 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy Top Coat.
    a. Prime coat:
        1) P1 = 1 coat, 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
    b. Finish coat:
        1) Interior:
            a) F1 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
            b) F2 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
18. HPIC SYSTEM #16 - Polyamidoamine Epoxy Prime and Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 80 to 110 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).
    b. Finish coat(s):
        1) Interior:
            a) F1 = 1 coat, 175-200 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).
19. HPIC SYSTEM #17 - Acrylic Emulsion Primer with Acrylic Emulsion Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 60 to 90 SF/GAL/coat, Series 180 W.B. Tneme-Crete (Acrylic Emulsion).
    b. Finish coat(s):
        1) Exterior:
            a) F1 = 1 coat, 125 to 150 SF/GAL/coat, Series 180 W.B. Tneme-Crete (Acrylic Emulsion).
20. HPIC SYSTEM #18 - Modified Alkyd Primer with HDP Acrylic Polymer Top Coat(s).
    a. Prime coat:
        1) P1 = 1 coat, 2.5 mils, Series V10 Tnemec Primers (Modified Alkyd).

b. Finish coat(s):

1) Interior or exterior:

a) F1 = 1 coat, 2.5 mils, Series 1029 Enduratone (HDP Acrylic Polymer).

b) F2 = 1 coat, 2.5 mils, Series 1029 Enduratone (HDP Acrylic Polymer).

21. HPIC SYSTEM #19 - Polyamidoamine Epoxy Coating.

a. Prime coat:

1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

22. HPIC SYSTEM #21 - Modified Polyamidoamine Epoxy.

a. Prime coat:

1) P1 = 1 coat, 5 mils, 135-1243 Chembuild (Modified Polyamidoamine Epoxy).

23. HPIC SYSTEM #22 - Modified Polyamine Epoxy Primer with Modified Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 16 mils, Series 2220 Pota-Pox 100 (Modified Polyamine Epoxy).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 25 mils, Series 264 Elasto-Shield (Modified Polyurethane).

b) F2 = 1 coat, 25 mils, Series 264 Elasto-Shield (Modified Polyurethane).

24. HPIC SYSTEM #23 - Zinc-Rich Urethane Potable Water Approved Primer with Polyamine Epoxy Potable Water Approved Top Coats.

a. Prime coat:

1) P1 = 1 coat, 3 mils, Series 91 H_20 Hydro-Zinc (Zinc-Rich Urethane).

b. Finish coat(s):

1) Interior:

a) F1 = 1 coat, 25 mils, Series 2220 Pota-Pox 100 (Modified Polyamine Epoxy).

25. HPIC SYSTEM #24 - Vinyl Ester Primer with Vinyl Ester Top Coat.

a. Prime coat:

1) P1 = 1 coat, 17 mils, Series 120-5002 Vinester (Vinyl Ester).

b. Finish coat:

1) F1 = 1 coat, 17 mils, Series 120-5001 Vinester (Vinyl Ester).

26. HPIC SYSTEM #27 - Waterborne Acrylic Emulsion Prime and Top Coats.

a. Prime coat:

1) P1 = 1 coat, 80 to 110 SF/GAL/coat, Series 180, W.B. Tneme-Crete (Acrylic Emulsion).

b. Finish coat:

1) Exterior:

a) F1 = 1 coat, 175 to 200 SF/GAL/coat, Series 180, W.B. Tneme-Crete (Acrylic Emulsion).

27. HPIC SYSTEM #29 - Waterborne Epoxy-Amine Adduct Primer and Top Coat.

a. Prime coat:

1) P1 = 1 coat, 4 mils, Series 287 Enviro-Tread (Waterborne Epoxy-Amine Adduct).

b. Finish coat:

1) Interior:

a) F1 = 1 coat, 4 mils, Series 287 Enviro-Tread (Waterborne Epoxy-Amine Adduct).

28. HPIC SYSTEM #31 - Polyamidoamine Epoxy Primer and Intermediate Coat with Waterborne Polyester Polyurethane Top Coat with Glass Beads mixed in for slip resistance.

a. Prime coat:

1) P1 = 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b. Finish coats:

1) Exterior and interior:

a) F1 = 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b) F2 = 3 mils minimum (thickness as required to cover glass beads), Series 291 CRU (Waterborne Polyester Polyurethane).

c. Slip resistance:

1) Blend coarse glass beads into first finish coat (F1) at rate required to provide a medium slip resistant texture.

a) Refer to accepted mock-up panel.

2) Apply second finish coat (F2) at minimum 3 mil DFT.

a) Apply additional coats of F2 product as required to achieve the non-slip texture per the accepted mock-up panel.

d. Glass beads: TNEMEC Product #211-212 Coarse Glass Beads.

29. HPIC SYSTEM #32 - Waterborne Cementitious Acrylic Patching Compound/Filler with Polyamidoamine Epoxy Top Coat.
    a. Patching/filling coat:
        1) P/F1 = 1 coat, 60 to 80 SF/GAL/coat, Series 130 Envirofill (Waterborne Cementitious Acrylic).
    b. Finish coat:
        1) Interior:
            a) F1 = 1 coat, 175 to 200 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).
            b) F2 = 1 coat, 175 to 200 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).
30. HPIC SYSTEM #33 - Waterborne Vinyl Acrylic Primer with Water-base Acrylic-Emulsion Top Coat.
    a. Prime coat(s):
        1) P1 = 1 coat, 2.0 mils, Series 51-792 PVA Sealer.
    b. Finish coat(s):
        1) Interior and exterior:
            a) F1 = 1 coat, 2.5 mils, Series 6 Tneme-Cryl.
31. HPIC SYSTEM #34 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy Top Coat (with silica sand broadcast for slip resistance).
    a. Prime coat:
        1) P1 = 1 coat, 5 mils, Series L69 Epoxoline II.
    b. Slip resistance:
        1) Blend dry, washed 30 to 50 mesh silica sand into first finish coat (F1) at rate required to provide a medium slip resistant finish.
    c. Finish coat:
        1) F1 = 1 coat, 4 mils, Series L69 Epoxoline II.
        2) F2 = 1 coat, Series L69 Epoxoline II.
            a) F2 coat mil thickness is to be as required to achieve non-slip texture specified.
32. HPIC SYSTEM #35 - Polyamine Novolac Epoxy Primer with Polyamine Novolac Epoxy Top Coat.
    a. Prime coat:
        1) P1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.

2) P1 (vertical surface) = 1 coat, 8 to 10 mils, Series 282 Tneme-Glaze.

b. Finish coat:

1) F1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.

2) F1 (vertical surface) = 1 coat, 8 to 10 mils, Series 282 Tneme-Glaze.

33. HPIC SYSTEM #36 - Epoxy Modified Surfacer/Filler with Polyamine Novolac Epoxy Top Coats.

a. Filler/surfacer coat:

1) Filler = 1 coat, 0.0625 IN thick, Series 218 Mortar Clad.

b. Prime coat:

1) P1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.

2) P1 (vertical surface) = 1 coat, 6 to 8 mils, Series 282 Tneme-Glaze.

c. Finish coat:

1) F1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.

2) F1 (vertical surface) = 1 coat, 6 to 8 mils, Series 282 Tneme-Glaze.

34. HPIC SYSTEM #37 - Modified Polyamine Epoxy Primer with Modified Aliphatic Amine Epoxy Mortar Intermediate Coat and Modified Polyamine Epoxy Top Coat(s) - (Over New Concrete).

a. Prime coat:

1) P1 = 1 coat, 6 mils, Series 201 Epoxoprime (Modified Polyamine Epoxy).

b. Intermediate coat:

1) I1 = 1 coat, 1/8 IN or 125 mils, Series 434 Perma-Shield H_2S (Modified Aliphatic Amine Epoxy Mortar).

c. Finish coat:

1) F1 = 1 coat, 20 mils, Series 435 Perma-Glaze (Modified Polyamine Epoxy).

35. HPIC SYSTEM #38 - Modified Polyamine Epoxy Primer with Epoxy Modified Mortar Filler/Surfacer Repair Coat with Modified Aliphatic Amine Epoxy Mortar Intermediate Coat and Modified Polyamine Epoxy Top Coat(s) - (Over Existing Concrete).

a. Prime coat - for exposed reinforcing steel (when applicable):

1) P1 = Prime all exposed reinforcing, 1 coat, 4 mils, Series L69

Epoxoline (Polyamidamine Epoxy).

b. Filler/surfacer (for voids over 1/4 IN in depth):

1) Filler/surfacer: 1 coat, thickness as required to patch damaged area but not to exceed manufacturer's recommended thickness, Series 219 Mortar Cast (Water Based Epoxy Modified Cement).

c. Filler/surfacer (for voids up to 1/4 IN in depth):

1) Filler/surfacer: 1 coat, thickness as required to patch damaged area but not to exceed 1/4 IN, Series 218 Mortar Clad (Epoxy Modified Mortar).

d. Prime coat:

1) P1 = 1 coat, 6 mils, Series 201 Epoxoprime (Modified Polyamine Epoxy).

e. Intermediate coat:

1) I1 = 1 coat, 1/8 IN or 125 mils, Series 434 Perma-Shield H_2S (Modified Aliphatic Amine Epoxy Mortar).

f. Finish coat:

1) F1 = 1 coat, 20 mils, Series 435 Perma-Glaze (Modified Polyamine Epoxy).

36. AP SYSTEM #39 - Architectural Paints (AP).

a. Cross Linked Acrylic, PPG Manor Hall "Timeless" Series.

b. Prime coat:

1) P1 = 1 coat, 3 mils, Interior PVA Drywall Primer.

c. Finish coat:

1) Interior:

a) F1 = 1 coat, 1.5 to 2.5 mils, PPG Manor Hall "Timeless" Series, Pearl finish.

b) F2 = 1 coat, 1.5 to 2.5 mils, PPG Manor Hall "Timeless" Series, Pearl finish as needed for complete coverage.

37. SC SYSTEM #40 - Special Coatings (SC).

a. Water-based coating having pigmented resin particles suspended in an aqueous solution.

b. Prime coat:

1) For new gypsum board surfaces:

a) P1 = Zo-Cryl Sealer 92.

2) For new concrete and concrete masonry surfaces:

a) For unfilled concrete and concrete masonry surfaces:

(1) Zo-Cryl Sealer 92.

(a) P1 = 1 coat, 60-80 SF/GAL, Series 54-562 Fine Masonry Filler (Modified Epoxy).

b) For filled concrete and concrete masonry surfaces.

(1) Zo-Prime Block Filler 96.

(a) P2 = Z95 Primer.

c. Finish coat:

1) For new gypsum board surfaces:

a) F1 = Zolatone water-based coating.

(1) Color to be selected by Owner's representative.

2) For new unfilled concrete and concrete masonry surfaces:

a) F1 = Zolatone water-based coating.

(1) Color to be selected by Owner's Representative.

3) For new filled concrete and concrete masonry surfaces:

a) F1 = Zolatone water-based coating.

(1) Color to be selected by Owner's Representative.

38. SYSTEM #41 - Touch-up of galvanized surfaces not requiring a top coat.

a. Refer to Specification Section 05 50 00 – Metal Fabrications.

39. SYSTEM #42 - Alkyd wood stain with water-based polyurethane varnish top coats.

a. Apply washcoat uniformly to wood at manufacturer's recommended application rate.

b. Wood stain: Color to be selected.

c. First coat of water-based polyurethane varnish: Gloss.

d. Second coat of water-based polyurethane varnish: Satin.

e. Third coat of water-based polyurethane varnish: Satin.

40. HPIC SYSTEM #43 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy Top Coat.

a. Prime coat:

1) P1 = 1 coat, 2.5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

b. Finish coat:

1) Interior:

a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

41. HPIC SYSTEM #44 - Hydrophobic Aromatic Moisture-Cured Polyurethane Primer with Hydrophobic Aromatic Moisture-Cured Polyurethane Top Coat(s).

a. Prime coat:

1) P1 = 1 coat, 5 mils, Series 446 Perma-Shield-MCU (Hydrophobic Aromatic Moisture-Cured Polyurethane).

b. Finish coat(s):

1) F1 = 1 coat, 8 mils, Series 446 Perma-Shield-MCU.

2) F2 = 1 coat, 8 mils, Series 446 Perma-Shield-MCU.

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. General:

1. Paint the following surfaces in a corrosive or highly corrosive area, whether exposed to view or not unless otherwise specified:

a. Concrete and/or concrete masonry units identified in the finish schedule as shown on drawings.

b. Conduit.

c. Ducts.

d. Galvanized metal surfaces.

B. Exposed Exterior Surfaces including:

1. Concrete walls, columns, beams, equipment supports, equipment pads, pipe supports.
2. Piping, valves, fittings, and hydrants.
3. Ductwork and supports.
4. Conduit, device boxes, junction boxes and covers, pull boxes and covers and supports when attached to a surface required to be painted.
5. Exterior and interior surfaces of ferrous metal tankage.
6. Miscellaneous ferrous metal surfaces.
7. Hollow metal doors and frames and window frames.
8. Steel pipe bollards (if not galvanized).

9. Steel lintels.
10. Steel components of concrete lintels (plain or galvanized only).
    a. Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.
11. Exposed wood.
12. Structural steel. (if not galvanized).
13. Steel joists that are not galvanized (including bridging).
14. Copper and brass surfaces.
15. External and internal surfaces of digester covers whether sealed from direct exposure of outside atmosphere or digester atmosphere or not, and associated equipment.
    a. Internal surfaces include trusses and other inside surfaces.
16. Gas appliance flue vents and cast iron pipe plumbing vents.

C. Interior Finished Areas:
   1. Paint all appurtenant surfaces within the space unless specifically noted not to be painted in the Contract Documents.
      a. If walls are not required to be painted, appurtenant concrete surfaces are not required to be painted unless specifically noted otherwise.
      b. Appurtenant surfaces include:
         1) Concrete columns, equipment pads, pipe supports, and equipment supports, underside of overhead concrete slabs which are exposed, semi-exposed or concealed from view but still exposed to the adjacent atmosphere and as noted in the finish schedule shown on drawings.
         2) Piping, valves, fittings and hydrants.
            a) All bituminous coated ductile iron pipe to have coating completely removed prior to painting.
         3) Miscellaneous ferrous metal surfaces that are not galvanized.
         4) Hollow metal doors and frames and borrowed light window frames.
         5) Ferrous metal angle supports at top of masonry walls that are not galvanized.
         6) Steel lintels.
         7) Steel components of concrete lintels (plain or galvanized only).
            a) Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.

D. Surfaces in Areas Not Considered Finished:
   1. Paint following surfaces in areas not considered as finished area:

a. Piping, valves, fittings, and hydrants.

b. Miscellaneous ferrous metal surfaces that are not galvanized .

c. Steel lintels.

d. Steel components of concrete lintels (plain or galvanized only).

1) Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.

e. Inside and outside of ferrous metal tankage (if not galvanized).

f. Hollow metal doors and frames and borrowed light window frames.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article unless specifically noted in the Contract Documents to be painted.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical Equipment:

1. Do not field paint electrical equipment except where painting is specifically stated elsewhere in these Contract Documents, or where the equipment is subject to a corrosive environment and is specifically noted to be painted.

2. Pump motors to be factory painted by pump manufacturer. Color to match piping and equipment with which it is associated.

D. Other Items:

1. Stainless steel surfaces except:

a. Piping where specifically noted to be painted.

b. Banding as required to identify piping.

2. Aluminum surfaces except:

a. Where specifically shown in the Contract Documents.

b. Where in contact with concrete.

c. Where in contact with dissimilar metals.

3. Fiberglass surfaces except:

a. Fiberglass piping where specifically noted to be painted.

b. Piping supports where specifically noted to be painted.

4. Interior of pipe, ductwork, and conduits.

5. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

6. Code labels and equipment identification and rating plates.

7. Concealed surfaces of precolored masonry.

8. Structural steel or steel deck required to be fireproofed.
9. Clad aluminum, clad steel, anodized aluminum, PVDF coated aluminum and PVDF coated steel.
10. Prefinished wood doors and Prefinished wood trim.
    a. Provide touch-up painting to damaged areas of prefinished surfaces.
11. Steel deck, unless specifically noted to be painted in these Contract Documents.
12. Standing seam metal roof, fascia, trim, and roof accessories.
13. Contact surfaces of friction-type connections.
14. Metal soffit.
15. Galvanized steel items, unless specifically noted to be painted.
16. Bituminous coated ductile iron pipe.
    a. See the ITEMS TO BE PAINTED Article, Interior Finished Areas paragraph of this Specification Section.

3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

A. Concrete:
   1. Interior cast-in-place and interior precast surfaces (other than prefinished panels):
      SYSTEM #15.
      a. Includes equipment bases, pads, walls, beams, slabs, columns, ceilings, pedestals, pilasters, etc.
   2. Exterior cast-in-place and exterior precast surfaces (other than SYSTEM #13).

B. Concrete Masonry Units:
   1. Interior smooth faced standard (heavy) weight: SYSTEM #16.
   2. Exterior smooth faced standard (heavy) weight: SYSTEM #27.
   3. Exterior rough faced standard (heavy) weight: SYSTEM #17.
   4. Interior face of exterior precolored standard (heavy) weight: SYSTEM #16.
   5. Interior smooth face of exterior prefaced masonry units: SYSTEM #32.

C. Wood:
   1. Interior Paint: SYSTEM #18.
   2. Interior stain and varnish: SYSTEM #42.

D. Steel:
   1. Structural:

a. Immersion or non-immersion surfaces subject to highly corrosive environment: SYSTEM #24.

b. Immersion surfaces subject to corrosive environment and not requiring NSF approval: SYSTEM #2.

c. Immersion surfaces subject to corrosive or highly corrosive environment requiring NSF approval: SYSTEM #23.

d. Non-immersion surfaces subject to corrosive environment: SYSTEM #7.

e. All other surfaces (non-corrosive dry environment): SYSTEM #1.

2. Joists:

a. Exposed: SYSTEM #6.

b. Above lay-in acoustical or suspended GWB ceiling: SYSTEM #9.

3. Potable water storage tanks and all ferrous metal items subject to contact with potable water requiring NSF approval: SYSTEM #23.

a. Includes all ferrous metal surfaces subject to splash, spillage, vapor, condensation or other chronic potable water exposure.

b. Also includes ferrous metal surfaces within concrete potable water storage tankage requiring NSF approval.

c. Exterior surfaces of potable water storage tanks: SYSTEM #7.

E. Miscellaneous ferrous metals (non-corrosive dry environment): SYSTEM #1.

1. Not for coating galvanized steel, steel (hollow metal) doors, steel (hollow metal) door and window frames, and products with approved factory finishes.

F. Ferrous metals subject to corrosive environment: SYSTEM #2.

1. Includes ferrous metal components of equipment located in corrosive environments such as bar screens, grit washers, wetted parts of aerobic digester covers, final clarifier covers and mechanisms, sluice gates, slide gates, trickling filter mechanisms, bare steel handrails and guardrails, piping, stairs, tank or equipment bridges, pumps, and similar items.

2. Does not include items subject to contact with potable water.

G. Ferrous metals subject to highly corrosive environment: SYSTEM #35.

1. Includes ferrous metal components of equipment located in highly corrosive environments such as bar screens, grit washers, wetted parts of anaerobic digester covers, primary clarifier covers and mechanisms, sluice gates, slide gates, trickling filter mechanisms, piping, tank or equipment bridges, pumps and similar items.

2. Does not include items subject to contact with potable water.

H. Galvanized Metals:

1. Field touch-up where top coat is required: SYSTEM #3, prime and first finish coat only.

   a. Prime paint only the damaged area.

2. Assembled galvanized steel items: SYSTEM #3.

3. Field touch-up of galvanized surfaces not requiring a finish top coat: SYSTEM #11.

   a. Paint only damaged areas.

4. Galvanized pipe bollards: SYSTEM #3.

I. Steel (hollow metal) doors and frames and window frames primed in the factory in accordance with SDI/ANSI A250.10.

1. For doors and frames in non-corrosive environments: SYSTEM #5.

2. For doors and frames in corrosive or highly corrosive environments: SYSTEM #5.1.

   a. Specifically including all chemical room door openings having fiberglass reinforced plastic doors with hollow metal frames.

J. Steel equipment with existing paint coating or factory-applied prime or finish coating not complying with this Specification Section: SYSTEM #5.

1. Includes equipment specifically indicated in the Contract Documents to be painted.

2. Factory-applied coats to remain.

K. Non-ferrous metals (except galvanized): SYSTEM #3.

1. Includes copper, brass, aluminum and aluminum flashing specifically indicated on the Drawings to be painted.

L. Plastic Surfaces:

1. PVC, FRP, and CPVC surfaces: SYSTEM #3.

   a. Includes tankage and piping.

M. Electrical Conduit:

1. Galvanized: SYSTEM #3.

2. PVC coated: SYSTEM #3.

N. Pipe, Valves, and Fittings:

1. Bare steel pipe bollards: SYSTEM #2.

2. Steel, cast-iron, and uncoated ductile iron: SYSTEM #2.

3. Stainless steel: SYSTEM #1.

4. Brass and bronze: SYSTEM #3.

5. Steel aeration piping: SYSTEM #8.
6. PVC and CPVC piping (exterior only): System #3.

O. Pipe and duct insulation: SYSTEM #12.

P. Aluminum buried in concrete, between dissimilar metals and dissimilar materials: SYSTEM #19.

Q. Aluminum colored pipe thread touch-up, and aluminum colored finish where top coat is not required: SYSTEM #21.

1. Not for coating aluminum material.

R. Steel pipe, ducts, and equipment subject to maximum high temperatures of 400 DegF: SYSTEM #8.

S. Emergency generator engine exhaust piping: SYSTEM #10.

T. Interior gypsum board abuse resistant panels: SYSTEM #14.

U. Field painting of fusion bonded epoxy coated piping, valves, couplings, etc.: SYSTEM #43.

3.4 PREPARATION

A. General:

1. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.
   a. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
      1) Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
      2) Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
         a) Vent exhaust gases to exterior environment.
         b) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.
2. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
   a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Owner’s Representative.
3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

4. Adhere to manufacturer's recoat time surface preparation requirements.
    a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.
        1) Minimum SSPC SP 7/NACE No. 4 unless otherwise approved by Owner's Representative.

B. Protection:
    1. Protect surrounding surfaces not to be coated.
    2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Wood:
    1. Sandpaper smooth, then dust.
    2. Seal all knots, pitch and resinous sapwood after priming coat has dried.
    3. Putty nail holes and minor defects to match wood color.

E. Ferrous Metal:
    1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.
        a. All piping, pumps, valves, fittings and any other component used in the water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.
            1) Pipe: NAPF 500-03-04.
            2) Fittings: NAPF 500-03-05
        b. Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
        c. Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.
            1) The most stringent recommendations shall apply.
    2. Complete fabrication, welding or burning before beginning surface preparation.
        a. Chip or grind off flux, spatter, slag or other laminations left from welding.
        b. Remove mill scale.
        c. Grind smooth rough welds and other sharp projections.

3. Solvent clean in accordance with SSPC SP 1 or detergent and low-pressure water clean in accordance with SSPC SP 12/NACE No. 5 all surfaces scheduled to receive additional SSPC surface preparation.
4. Surfaces subject to corrosive or highly corrosive environment and all surfaces subject to immersion service:
   a. Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
5. All interior and exterior structural steel not included in corrosive, highly corrosive or immersion service surfaces:
   a. Minimum commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
6. Surfaces subject to high temperatures.
   a. Heat in excess of 600 DegF: SSPC SP 10/NACE No. 2.
   b. Heat in excess of 200 DegF but less than 600 DegF: SSPC SP 6/NACE No. 3.
7. Surfaces of steel joists and steel trusses:
   a. Commercial blast clean the major portion of the truss in accordance with SSPC SP 6/NACE No. 3.
   b. Power tool or hand tool clean tight connection areas and other difficult to access areas in accordance with SSPC SP 2 or SSPC SP 3.
8. Steel surfaces scheduled to receive SYSTEM #24 or #35:9
   a. White metal blast clean in accordance with SSPC SP 5/NACE No. 1.
   b. Provide 2-1/2 to 3 mil anchor profile for SYSTEMS #24 and #359.
9. All fusion bonded epoxy coated surfaces identified to be field painted:
   a. Remove all traces of gloss finish by sanding or by abrasive brush blasting.
   b. Clean surface after removing gloss finish to remove sanding or blasting residue.
10. Restore surface of field welds and adjacent areas to original surface preparation.
11. Black iron piping: Remove surface varnish by solvent or waterjet and detergent cleaning or brush-off blast cleaning in accordance with SSPC SP 7/NACE No. 4.

F. Hollow Metal:
   1. Clean in accordance with SSPC SP 1 or SSPC SP 12/NACE No. 5 and in accordance with hollow metal manufacturer.

G. Galvanized Steel and Non-ferrous Metals:

1. Solvent clean in accordance with SSPC SP 1 followed by brush-off blast clean in accordance with SSPC SP 16 to remove zinc oxide and other foreign contaminants.

    a. Provide uniform 1 mil profile surface.

H. Abrasive blast clean the following equipment or surfaces regardless of previous finish, if any.

I. Gypsum Wallboard and Abuse Resistant Panels:

1. Repair minor irregularities left by finishers.
2. Avoid raising nap of paper face on gypsum wallboard.
3. Verify moisture content is less than 8 percent before painting.

J. Concrete:

1. Cure for minimum of 28 days.
2. Verify that concrete surfaces have been cleaned and that voids have been patched in accordance with Specification Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.

    a. Concrete surfaces shall be cleaned in accordance with ASTM D4258.

3. Mechanically abrade concrete surfaces in accordance with ASTM D4259 as recommended by coating manufacturer.
4. Abrasive blast concrete surfaces in accordance with SSPC SP 13/NACE No. 6 to provide profile recommended by coatings manufacturer in accordance with ICRI Technical Guideline 310.2 Concrete Surface Profile 4.
5. Test pH of surface to be painted in accordance with ASTM D4262.

    a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable range.

    b. Retest pH until acceptable results are obtained.

6. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.

    a. Test moisture content of surface to be coated in accordance with ASTM D4263.

    b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable results are obtained.

K. Concrete Unit Masonry:

1. Cure for minimum of 28 days.
2. Remove all mortar spatters and protrusions.

3. Verify that concrete unit masonry surfaces have been cleaned in accordance with ASTM D4261.
4. Test pH of surface to be painted in accordance with ASTM D4262.
    a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable limits.
    b. Retest pH until acceptable results are obtained.
5. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
    a. Test moisture content of surface to be coated in accordance with ASTM D4263.
    b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable range is obtained.

L. Metal Surface Preparation by Abrasive Blasting:

1. All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of paint coatings.
    a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.
2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
3. Perform additional blasting and cleaning as required to achieve surface preparation required.
    a. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.
    b. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected prior to paint application.
4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
5. The Field Coating Applicator shall abrasive blast the shop coated surfaces per SSPC SP7 prior to the application of the final coats.
6. The Field Coating Applicator shall not apply a coating on a bare steel surface that has not been prepared to the required SSPC SP6, SP10 or SP5 standard. Special attention shall be given to uncoated steel weld joints, coating holdbacks, and bare metal.
7. Provide compressed air for blasting that is free of water and oil.
    a. Provide accessible separators and traps.
8. Confine blast abrasives to area being blasted.

a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.

b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.

9. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.

10. Reblast surfaces not meeting requirements of these Specifications.

11. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Owner's representative's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.

12. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

M. All Plastic Surfaces and Non-Ferrous Surfaces Except Galvanized Steel:

1. Sand using 80-100 grit sandpaper to scarify surfaces.

3.5 APPLICATION

A. General:

1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.

a. Application equipment must be inspected and approved in writing by coating manufacturer.

b. Hollow metal shall be spray applied only.

2. Temperature and weather conditions:

a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Owner's representative and paint manufacturer's authorized representative.

b. Avoid painting surfaces exposed to hot sun.

c. Do not paint on damp surfaces.

3. Immediately after surface has been inspected and accepted by NACE certified coatings inspector, apply structural steel and miscellaneous steel steel joist and steel truss prime coat in the factory.

a. Finish coats shall be applied in the field.

b. Prime coat referred to here is prime coat as indicated in this Specification.

1) Structural steel and miscellaneous steel, steel joist and steel truss prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.

4. Provide complete coverage to mil thickness specified.
    a. Thickness specified is dry mil thickness.
    b. All paint systems are "to cover." In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
    c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
5. If so directed by Owner's Representative, do not apply consecutive coats until Owner's Representative has had an opportunity to observe and approve previous coats.
6. Apply materials under adequate illumination.
7. Evenly spread to provide full, smooth coverage.
8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
    a. Clean contaminated surfaces before applying next coat.
10. Smooth out runs or sags immediately, or remove and recoat entire surface.
11. Allow preceding coats to dry before recoating.
    a. Recoat within time limits specified by coating manufacturer.
    b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
12. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
13. Coat all aluminum in contact with dissimilar materials.
14. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.
15. Backroll concrete and masonry, gypsum board and wood surfaces with a roller if paint coatings are spray applied.

B. Prime Coat Application:
1. Prime all surfaces indicated to be painted.
    a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
2. Ensure field-applied coatings are compatible with factory-applied coatings.
    a. Employ services of coating manufacturer's qualified technical representative.

1) Certify through material data sheets.

2) Perform test patch.

b. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.

c. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.

1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.

4. Back prime all wood scheduled to be painted, prior to installation.

5. After application of primer to gypsum board surfaces, inspect surface and repair in accordance with the PREPARATION Article of this Specification Section.

a. Re-prime repaired surfaces to uniform finish before application of finish coat(s).

6. Apply zinc-rich primers while under continuous agitation.

7. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.

8. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.

9. Touch up damaged primer coats prior to applying finish coats.

a. Restore primed surface equal to surface before damage.

10. All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely painted with both prime and finish coats prior to placing in wall.

C. Finish Coat Application:

1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.

2. Touch up damaged finish coats using same application method and same material specified for finish coat.
a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.6 COLOR CODING

A. Color and band piping in accordance with the SCHEDULES Article of this Specification Section.

1. Band piping using maximum of three (3) different colors at 20 FT maximum centers.
2. Factory painted piping shall be color banded in the factory per the Schedule in the SCHEDULE Article of this Specification Section.
3. Place bands:
    a. Along continuous lines.
    b. At changes in direction.
    c. At changes of elevation.
    d. On both sides of an obstruction (e.g., wall, ceiling) that painted item passes through.
4. Band width for individual colors (pipe diameter measured to outside of insulation, if applicable):
    a. Piping up to 8 IN DIA: 2 IN minimum.
    b. Piping greater than 8 IN up to 24 IN DIA: 4 IN minimum.
    c. Piping greater than 24 IN up to 48 IN DIA: 6 IN minimum.
    d. Piping greater than 48 IN DIA: 8 IN minimum.

3.7 FIELD QUALITY CONTROL

A. Contractor to provide protection for surfaces painted with epoxy coatings to prevent chalking.

1. Surfaces showing chalking will not be accepted regardless of condition of paint film.

B. Maintain Daily Records:

1. Record the following information during application of each coat of paint applied:
    a. Date, starting time, end time, and all breaks taken by painters.
    b. For exterior painting:
        1) Sky condition.
        2) Wind speed and direction.
    c. Air temperature.
    d. Relative humidity.
    e. Moisture content and surface temperature of substrate prior to each coat.

f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate windblown dust and debris from contaminating the wet paint film.

g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) hours during application.

1) Record hourly when temperatures are below 50 DegF or above 100 DegF.

2. Record the following information daily for the paint manufacturer's recommended curing period:

a. Date and start time of cure period for each item or area.

b. For exterior painting:

1) Sky conditions.

2) Wind speed and direction.

c. Record environmental conditions not less than once every 12 hours.

1) Record once every four (4) hours when ambient temperature is below 35 DegF.

d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.

3. Format for daily record to be computer generated.

C. Measure wet coating with wet film thickness gages.

D. Measure coating dry film thickness in accordance with SSPC PA 2 using a digital magnetic-type dry film thickness gauge, Elcometer 456, or equal.

1. Owner’s Representative may measure coating thickness at any time during project to assure conformance with these Specifications.

E. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

F. Measure substrate humidity with humidity gage specifically designed for such.

G. Provide wet paint signs.

3.8 CLEANING

A. For every 100 square feet, or less, of surface blasted, the surface profile shall be tested with the use of Press-o-Film as manufactured by Testex, or other RP0287 approved equal, at locations to be determined by the INSPECTOR. The replica tape thickness shall be measured using a dial micrometer manufactured by Testex, or other ASTM D4417 Type C approved equal. For each test area, three replica tape tests shall be performed within a single test area 12 inches in diameter. For each test area, the three replica tape thickness

values shall be recorded and must be within 10% of the coating manufacturer's recommended profile.

B. Clean paint spattered surfaces.

1. Use care not to damage finished surfaces.

C. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

D. Remove surplus materials, scaffolding, and debris.

3.9 SCHEDULE

A. Piping and Pipe Banding Color Schedule (Colors based on Tnemec):
1. Match existing piping and banding colors.
2. Piping systems shown in italics with no paint color shown for the pipe but having paint colors shown for the banding color are systems that will be banded using material other than paint.
   a. Refer to Specification Section 10 14 00 – Identification Devices for the piping system and banding material and refer to this Specification Section and this Schedule for the banding colors.
3. Wastewater Treatment Plant Piping Color Schedule:

SERVICE	PIPE COLOR	BANDING COLOR
Wastewater Piping:		
Plant influent	32GR-Gray	35GR-Black
Settled primary	32GR-Gray	YB24-Brown
Settled final	32GR-Gray	07SF-Red
Filtered	32GR-Gray	05SF/35GR-International Orange/Black
Final effluent	32GR-Gray	05SF/YB24-International Orange/Brown
Plumbing drains	32GR-Gray	11SF-Safety Blue
Supernatant	32GR-Gray	08SF-Safety Green filtrate or centrate
Filter backwash	32GR-Gray	02SF-Safety Yellow
Sump	32GR-Gray	11WH-White
Steam Piping - High Pressure:		
Saturated	05SF-InternationalOrange	11WH-White
Super heated	05SF-InternationalOrange	11WH/32GR-White/Gray

SERVICE	PIPE COLOR	BANDING COLOR
Steam Piping - Low Pressure:		
Saturated	05SF-InternationalOrange	11WH/32GR-White/Gray
Super heated	05SF-InternationalOrange	--
Sludge Piping:		
Raw (primary)	YB24-Brown	35GR-Black
Waste activated	YB24-Brown	32GR/35GR-Gray/Black
Recirculated	YB24-Brown	32GR/07SF-Gray/Red waste activated
Thickened waste activated	YB24-Brown	07SF/35GR-Red/Black
Thickened raw	YB24-Brown	07SF/05SF-Red/International Orange
Thickened raw plus waste activated	YB24-Brown	07SF/11SF-Red/Safety Blue
Digested or processed	YB24-Brown	05SF/35GR-International Orange/Black
Dewatered	YB24-Brown	11SF/35GR-Safety Blue/Black
Wasted	YB24-Brown	11SF/32GR-Safety Blue/Gray
Ash	YB24-Brown	08SF-Safety Green
Miscellaneous Sludge Piping:		
Grease	YB23-Dk. Brown	35GR-Black
Scum	YB23-Dk. Brown	32GR-Gray
Grit	YB23-Dk. Brown	07SF-Red
Water Piping:		
Fire	06SF-Safety Red	--
Service	08SF-Safety Green	35GR-Black
Nonpotable	08SF-Safety Green	32GR-Gray
Make-up	08SF-Safety Green	YB24-Brown
Potable water hot	--	05SF-InternationalOrange
Cooling	08SF-Safety Green	11SF-Safety Blue
Condensate	08SF-Safety Green	35GR/32GR-Black/Gray
Potable water cold	--	35GR/07SF-Black/Red
Gas and Fuel Piping:		
Oxygen, gas	02SF-Safety Yellow	35GR-Black
Oxygen, liquid	02SF-Safety Yellow	35GR/32GR-Black/Gray
Chlorine, gas	02SF-Safety Yellow	32GR/YB24-Gray/Brown

SERVICE	PIPE COLOR	BANDING COLOR
Chlorine, liquid	02SF-Safety Yellow	32GR/07SF-Gray/Red
Chlorine, solution	02SF-Safety Yellow	32GR/05SF-Gray/International Orange
Ammonia, gas	02SF-Safety Yellow	YB24/35GR-Brown/Black
Ammonia, liquid	02SF-Safety Yellow	YB24/07SF-Brown/Red
L-P or natural	02SF-Safety Yellow	06SF/35GR-Safety Red/Black
Digester	02SF-Safety Yellow	06SF/11SF-Safety Red/Blue
Gasoline	02SF-Safety Yellow	06SF/11WH-Safety Red/White
Fuel oil	02SF-Safety Yellow	06SF/08SF-Safety Red/Safety Green
Ozone	02SF-Safety Yellow	05SF-InternationalOrange
Vacuum	02SF-Safety Yellow	11SF-Safety Blue
Nitrogen	02SF-Safety Yellow	08SF-Safety Green
Exhaust	02SF-Safety Yellow	11WH/35GR-White/Black
Air	02SF-Safety Yellow	11WH/32GR-White/Gray
Chemical Piping:		
Alum	11WH-White	35GR/32GR-Black/Gray
Ferric chloride	11WH-White	35GR/YB24/07SF-Black/Brown/Red
Ferric sulfate	11WH-White	35GR/YB24/05SF-Black/Brown/International Orange
Ferrous chloride	11WH-White	35GR/YB24/11SF-Black/Brown/Safety Blue
Ferrous sulfate	11WH-White	35GR/YB24/08SF-Black/Brown/Safety Green
Lime or associated chemicals	11WH-White	35GR/07SF-Black/Red
Neutralization Piping:		
Acidic	11WH-White	32GR/YB24-Gray/Brown
Caustic	11WH-White	32GR/07SF-Gray/Red
Calcium carbonate	11WH-White	32GR/05SF-Gray/International Orange
Magnesium hydroxide	11WH-White	32GR/11SF-Gray/Safety Blue
Calcium hydroxide	11WH-White	32GR/08SF-Gray/Safety Green
Soda ash	11WH-White	32GR/02SF-Gray/Yellow
Carbon slurry	11WH-White	YB24-Brown
Odor Control and Sulfide Destruction Piping:		

SERVICE	PIPE COLOR	BANDING COLOR
Potassium permanganate	11WH-White	07SF/YB24-Red/Brown
Hydrogen peroxide	11WH-White	07SF/05SF-Red/International Orange
Chlorine	11WH-White	07SF/11SF-Red/Safety Blue
Algae Suppressant Piping:		
Copper sulfate	11WH-White	05SF/11SF-International Orange/Safety Blue
n-hexadecanol	11WH-White	05SF/YB24-International Orange/Brown
Defoaming	11WH-White	11SF-SafetyBlue
Polymer Piping:		
Anionic coagulant	11WH-White	08SF/35GR/32GR-Safety Green/Black/Gray
Cationic coagulant	11WH-White	08SF/35GR/YB24-Safety Green/Black/Brown
Nonionic coagulant	11WH-White	08SF/35GR/07SF-Safety Green/Black/Red
Coagulant aid	11WH-White	08SF/YB24-Safety Green/Brown
Anionic flocculent	11WH-White	08SF/07SF/32GR-Safety Green/Red/Gray
Cationic flocculent	11WH-White	08SF/07SF/05SF-Safety Green/Red/International Orange
Nonionic flocculent	11WH-White	08SF/07SF/11SF-Safety Green/Red/Safety Blue
Dechlorination	11WH-White	02SF-Safety Yellow
Dual Purpose Piping:	Aluminum-GR04 Lt. Gray	Colors of Pipe color above

4. Water Treatment Plant Piping Color Schedule:

SERVICE	PIPE COLOR	BANDING COLOR
Wastewater Piping:		
Sump	--	14SF-Safety Purple
Rain leader	32GR-Gray	06SF-Safety Red
Secondary rain leader	32GR-Gray	06SF/08SF-Safety Red/Safety Green

SERVICE	PIPE COLOR	BANDING COLOR
Settled primary	32GR-Gray	YB24-Brown
Settled final	32GR-Gray	07SF-Red
Condensate drain	--	02SF-Safety Yellow
Filtered	32GR-Gray	05SF/35GR-International Orange/Black
Vent	46GR-Sinker Gray	11WH/08SF-White/Safety Green
Final effluent	32GR-Gray	05SF/YB24-International Orange/Brown
Process drain	32GR-Gray	02SF/06SF-Safety Yellow/Safety Red
Sanitary drain line	32GR-Gray	11SF-Safety Blue
Supernatant	32GR-Gray	08SF-Safety Green filtrate or centrate
Filter to waste	32GR-Gray	08SF/02SF-Safety Green/Safety Yellow
Filter backwash waste	32GR-Gray	08SF-Safety Green
Steam Piping - High Pressure:		
Saturated	05SF-InternationalOrange	11WH-White
Super heated	05SF-InternationalOrange	11WH/32GR/08SF-White/Gray/Safety Green
Steam Piping - Low Pressure:		
Saturated	05SF-InternationalOrange	11WH/32GR-White/Gray
Super heated	05SF-InternationalOrange	11WH/32GR/02SF-White/Gray/Safety Yellow
Sludge Piping:		
Clarified	YB24-Brown	32GR/35GR/07SF-Gray/Black/Red
Gravity thickener effluent	YB24-Brown	32GR/07SF/08SF-Gray/Red/Safety Green
Processed	YB24-Brown	05SF/35GR/02SF-International Orange/Black/Safety Yellow
Recycled	YB24-Brown	32GR/07SF-Gray/Red
Dewatered	YB24-Brown	11SF/35GR-Safety Blue/Black
Thickened residuals forcemain	YB24-Brown	32GR/35GR-Gray/Black

SERVICE	PIPE COLOR	BANDING COLOR
Thickened residuals	YB24-Brown	07SF/05SF-Red/International Orange
Solids	YB24-Brown	05SF/35GR-International Orange/Black
Equalized return	YB23-Dk. Brown	11SF-Safety Blue
Equalization basin overflow	YB23-Dk. Brown	11WH-White
Decant overflow	YB23-Dk. Brown	08SF-Safety Green
Decant forcemain	YB23-Dk. Brown	02SF-Safety Yellow
Decant	YB23-Dk. Brown	11SF/02SF/08SF-Safety Blue/Safety Yellow/Safety Green
Foul Water Piping:		
Supernatant, filtrate or centrate	YB23-Dk. Brown	11SF-Safety Blue
Filter backwash	YB23-Dk. Brown	08SF-Safety Green
Condensate	YB23-Dk. Brown	02SF-Safety Yellow
Water Piping:		
Fire	06SF-Safety Red	--
Service	08SF-Safety Green	35GR-Black
Solids contact basin influent	08SF-Safety Green	11SF/07SF-Safety Blue/Red
Nonpotable	08SF-Safety Green	32GR-Gray
Make-up	08SF-Safety Green	YB24-Brown
Solids contact basin effluent	08SF-Safety Green	11SF/YB24/07SF-Safety Blue/Brown/Red
Gravity thickener	08SF-Safety Green	07SF-Red
Potable water hot	--	05SF-InternationalOrange
Potable water hot circulating	--	05SF/02SF-International Orange/Safety Yellow
Cooling	08SF-Safety Green	11SF-Safety Blue
Sample water	--	02SF-Safety Yellow
Treated water	08SF-Safety Green	--
Filter wash	08SF-Safety Green	11WH-White
Filter influent	08SF-Safety Green	35GR/32GR-Black/Gray
Condensate	08SF-Safety Green	35GR/32GR-Black/Gray
Filter backwash supply	08SF-Safety Green	11WH-White
Filter surface wash	08SF-Safety Green	35GR/YB24-Black/Brown
Filter effluent	08SF-Safety Green	35GR/YB24-Black/Brown
Potable water cold	--	35GR/07SF-Black/Red
Deionized water	--	11SF/02SF/35GR-Safety Blue/Safety Yellow/Black
High service discharge	08SF-Safety Green	11SF/35GR-Safety Blue/Black

SERVICE	PIPE COLOR	BANDING COLOR
Low service discharge	08SF-Safety Green	09SF-Spearmint Safety Green
Low service suction	08SF-Safety Green	02SF/11SF/07SF-Safety Yellow/Safety Blue/Red
Well	08SF-Safety Green	11SF/35GR-Safety Blue/Black
Surface	08SF-Safety Green	11SF/YB24-Safety Blue/Brown
Pretreatment, presedimentation, aeration, prechlorination, grit removal	08SF-Safety Green	11SF/07SF-Safety Blue/Red
Plant influent	08SF-Safety Green	11SF/05SF-Safety Blue/International Orange
Softened	08SF-Safety Green	11SF/02SF-Safety Blue/Safety Yellow
Filtered	08SF-Safety Green	11SF/02SF/35GR-Safety Blue/Safety Yellow/Black
Finished water	08SF-Safety Green	11SF/02SF/05SF-Safety Blue/Safety Yellow/International Orange
Plant effluent	11SF-Safety Blue	--
GAC wash	08SF-Safety Green	11WH-White
Gas, Fuel and Air Piping:		
Oxygen, gas	02SF-Safety Yellow	35GR-Black
Oxygen, liquid	02SF-Safety Yellow	35GR/32GR-Black/Gray
Chlorine, gas	02SF-Safety Yellow	32GR/YB24-Gray/Brown
Chlorine, liquid	02SF-Safety Yellow	32GR/07SF-Gray/Red
Chlorine, solution	02SF-Safety Yellow	32GR/05SF-Gray/International Orange
Ammonia, gas	02SF-Safety Yellow	YB24/35GR-Brown/Black
Aqueous ammonia	02SF-Safety Yellow	YB24/07SF/08SF-Brown/Red/Safety Green
Ammonia, liquid	02SF-Safety Yellow	YB24/07SF-Brown/Red
Reverse osmosis	--	32GR/05SF/08SF-Gray/International Orange/Safety Green
Reverse osmosis return	--	32GR/02SF/08SF-Gray/Safety Yellow/Safety Green
L-P or natural	02SF-Safety Yellow	06SF/35GR-Safety-Red/Black
Gasoline	02SF-Safety Yellow	06SF/11WH-Safety Red/White
Fuel oil return supply	02SF-Safety Yellow	06SF/08SF/YB24-Safety Red/Safety Green/Brown

SERVICE	PIPE COLOR	BANDING COLOR
Fuel oil	02SF-Safety Yellow	06SF/08SF-Safety Red/Safety Green
Acetylene	02SF-Safety Yellow	06SF/05SF-Safety Red/International Orange
Ozone	02SF-Safety Yellow	05SF-InternationalOrange
Vacuum	02SF-Safety Yellow	11SF-Safety Blue
Filter air backwash	02SF-Safety Yellow	11WH/08SF-White/Safety Green
Air	02SF-Safety Yellow	11WH/32GR-White/Gray
Compressed air	02SF-Safety Yellow	11WH/YB24-White/Brown
Ultra pure air	02SF-Safety Yellow	11WH/07SF-White/Red
Carbon dioxide vapor	--	07SF/05SF-Red/International Orange
Carbon dioxide liquid	--	07SF/11 SF-Red/Safety Blue
Carbon dioxide solution	--	07SF/11SF/05SF-Red/Safety Blue/International Orange
Lime dust	11WH-White	32GR/14SF-Gray/Safety Purple
Lime (dry)	11WH-White	32GR/YB24-Gray/Brown
Lime slurry	--	32GR/07SF-Gray/Red
Refrigerant	11SF-Safety Blue	32GR-Gray
Fluoride	--	YB24-Brown
Acidic	11WH-White	32GR/YB24-Gray/Brown
Caustic	11WH-White	32GR/07SF-Gray/Red
Powder activated carbon	11WH-White	35GR-Black
Powder activated carbon dust	11WH-White	35GR/32GR-Black/Gray
Powder activated carbon slurry	--	35GR/09SF-Black/Spearmint Safety Green
Powder activated carbon slurry exhaust	--	35GR/02SF-Black/Safety Yellow
Powder activated carbon vent	--	35GR/07SF-Black/Red
Sodium permanganate	--	14SF-Safety Purple
Potassium permanganate	--	14SF/06SF-Safety Purple/Safety Red
Chlorine	11WH-White	07SF/11SF-Red/Safety Blue
Sodium hypochlorite	11WH-White	07SF/11SF/05SF-Red/Safety Blue/International Orange
Sodium hexametaphosphate		
Brine		
Ferric sulfate		
Finished brine		

SERVICE	PIPE COLOR	BANDING COLOR
Preheated brine		
Cold brine		
Depleted brine		
Brine recirculation		
Copper sulfate	11WH-White	07SF/05SF-Red/International Orange
Algae Suppressant Piping:		
Copper sulfate	11WH-White	05SF/11SF-International Orange/Safety Blue
n-hexadecanol	11WH-White	05SF/YB24-International Orange/Brown
Anionic coagulant	11WH-White	08SF/35GR/32GR-Safety Green/Black/Gray
Cationic coagulant	11WH-White	08SF/35GR/YB24-Safety Green/Black/Brown
Nonionic coagulant	11WH-White	08SF/35GR/07SF-Safety Green/Black/Red
Coagulant air	11WH-White	08SF/YB24-Safety Green/Brown
Anionic flocculent	11WH-White	08SF/07SF/32GR-Safety Green/Red/Gray
Cationic flocculent	11WH-White	08SF/07SF/05SF-Safety Green/Red/ International Orange
Nonionic flocculent	11WH-White	08SF/07SF/11SF-Safety Green/Red/Safety Blue

a. Finished water piping to include suction header and pump suction to high service pumps, high service pump discharge and discharge header from the pumps.

3.10 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 10 14 00

IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items, and hazard and safety signs.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. A13.1 – Scheme for the Identification of Piping Systems.
2. Instrumentation, Systems, and Automation Society (ISA).
3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
   a. Z535.1 – Safety Color Code.
   b. Z535.2 – Environmental and Facility Safety Signs.
   c. Z535.3 – Criteria for Safety Symbols.
   d. Z535.4 – Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
5. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910.145 – Specification for Accident Prevention Signs and Tags.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Catalog information for all identification systems.
   b. Acknowledgement that products submitted meet requirements of standards referenced.
3. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. W.H. Brady Co.
2. Panduit.
3. Seton.
4. National Band and Tag Co.
5. Carlton Industries, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MANUFACTURED UNITS

A. Type A1 - Round Metal Tags:

1. Materials:
   a. Aluminum or stainless steel.
   b. Stainless steel shall be used in corrosive environments.
2. Size:
   a. Diameter: 1-1/2 IN minimum.
   b. Thickness: 0.035 IN (20 GA) minimum.
3. Fabrication:
   a. 3/16 IN minimum mounting hole.

b. Legend: Stamped and filled with black coloring.

4. Color: Natural.

B. Type A2 - Rectangle Metal Tags:

1. Materials: Stainless steel.
2. Size:
   a. 3-1/2 IN x 1-1/2 IN minimum.
   b. Thickness: 0.036 IN (20 GA) minimum.
3. Fabrication:
   a. 3/16 IN minimum mounting hole.
   b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

C. Type A3 - Metal Tape Tags:

1. Materials: Aluminum or stainless steel.
2. Size:
   a. Width 1/2 IN minimum.
   b. Length as required by text.
3. Fabrication:
   a. 3/16 IN minimum mounting hole.
   b. Legend: Embossed.
4. Color: Natural.

D. Type B1- Square Non-Metallic Tags:

1. Materials: Fiberglass reinforced plastic.
2. Size:
   a. Surface: 2 x 2 IN minimum.
   b. Thickness: 100 mils.
3. Fabrication:
   a. 3/16 IN mounting hole with metal eyelet.
   b. Legend: Preprinted and permanently embedded and fade resistant.
4. Color:
   a. Background: Manufacturer standard or as specified.
   b. Lettering: Black.

E. Type B2 - Non-Metallic Signs:

1. Materials: Fiberglass reinforced or durable plastic.

2. Size:
    a. Surface: As required by text.
    b. Thickness: 60 mils minimum.
3. Fabrication:
    a. Rounded corners.
    b. Drilled holes in corners with grommets.
    c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
4. Color:
    a. Background: Manufacturer standard or as specified.
    b. Lettering: Black.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

F. Type C - Phenolic Name Plates:
1. Materials: Phenolic.
2. Size:
    a. Surface: As required by text.
    b. Thickness: 1/16 IN.
3. Fabrication:
    a. Two (2) layers laminated.
    b. Legend: Engraved through top lamination into bottom lamination.
    c. Two (2) drilled side holes, for screw mounting.
4. Color: Black top surface, white core, unless otherwise indicated.

G. Type D - Self-Adhesive Tape Tags and Signs:
1. Materials: Vinyl tape or vinyl cloth.
2. Size:
    a. Surface: As required by text.
    b. Thickness: 5 mils minimum.
3. Fabrication:
    a. Indoor/Outdoor grade.
    b. Weather and UV resistant inks.
    c. Permanent adhesive.
    d. Legend: Preprinted.

e. Wire markers to be self-laminating.

4. Color: White with black lettering or as specified.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

H. Type E - Heat Shrinkable Tape Tags:

1. Materials: Polyolefin.
2. Size: As required by text.
3. Fabrication:
   a. Legend: Preprinted.
4. Color: White background, black printing.

I. Type F - Underground Warning Tape:

1. Materials: Polyethylene.
2. Size:
   a. 6 IN wide (minimum).
   b. Thickness: 3.5 mils.
3. Fabrication:
   a. Legend: Preprinted and permanently imbedded.
   b. Message continuous printed.
   c. Tensile strength: 1750 psi.
4. Color: As specified.

J. Type G - Stenciling System:

1. Materials:
   a. Exterior type stenciling enamel.
   b. Either brushing grade or pressurized spray can form and grade.
2. Size: As required.
3. Fabrication:
   a. Legend: As required.
4. Color: Black or white for best contrast.

K. Underground Tracer Wire:

1. Materials:
   a. Wire:
      1) 12 GA AWG.
      2) Solid.

b. Wire nuts: Waterproof type.

c. Split bolts: Brass.

2.3 ACCESSORIES

A. Fasteners:

1. Bead chain: #6 brass, aluminum or stainless steel.
2. Plastic strap: Nylon, urethane or polypropylene.
3. Screws: Self-tapping, stainless steel.
4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install identification devices at specified locations.

B. All identification devices to be printed by mechanical process, hand printing is not acceptable.

C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.

D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.

1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.

E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.

1. Several items of equipment mounted in housing to be individually tagged inside the compartment.

F. Tracer Wire:

1. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
2. Continuous pass from each valve box and above grade at each structure.
3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
4. 1,000 FT maximum spacing between valve boxes.
5. If split bolts are used for splicing, wrap with electrical tape.

6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.
7. Use continuous strand of wire between valve box where possible.
    a. Continuous length shall be no shorter than 100 FT.

3.2 SCHEDULES

A. Process Systems:

1. General:
    a. Provide arrows and markers on piping.
        1) At 20 FT maximum centers along continuous lines.
        2) At changes in direction (route) or obstructions.
        3) At valves, risers, "T" joints, machinery or equipment.
        4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
    b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
        1) If flow is in both directions use double headed arrow markers.
    c. Apply tapes and stenciling in uniform manner parallel to piping.
2. Trenches with piping:
    a. Tag type: Type F - Underground Warning Tape
    b. Location: Halfway between top of piping and finished grade.
    c. Letter height: 1-1/4 IN minimum.
    d. Natural gas or digester gas:
        1) Color: Yellow with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED GAS LINE BELOW”
    e. Potable water:
        1) Color: Blue with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED WATER LINE BELOW”
    f. Storm and sanitary sewer lines:
        1) Color: Green with black letters.

2) Legend:

a) First line: "CAUTION CAUTION CAUTION"

b) Second line: "BURIED SEWER LINE BELOW"

g. (Nonpotable) water piping, except 3 IN and smaller irrigation pipe:

1) Color: Green with black letters.

2) Legend:

a) First line: "CAUTION CAUTION CAUTION"

b) Second line: "BURIED NONPOTABLE WATER LINE BELOW"

h. Chemical feed piping (e.g., chlorine solution, polymer solution, caustic solution, etc.):

1) Color: Yellow with black letters.

2) Legend:

a) First line: "CAUTION CAUTION CAUTION"

b) Second line: "BURIED CHEMICAL LINE BELOW"

i. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):

1) Color: Yellow with black letters.

2) Legend:

a) First line: "CAUTION CAUTION CAUTION"

b) Second line: "BURIED PIPE LINE BELOW"

3. Yard valves, buried, with valve box and concrete pad:

a. Tag type: Type A2 - Rectangle Metal Tags.

b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.

c. Legend:

1) Letter height: 1/4 IN minimum.

2) Valve designation as indicated on the Drawings and valve schedule (e.g., "WD-GWP04-GST-GST2-BFV-02-001").

4. Valves and slide gates:

a. Tag type:

1) Outdoor locations: Type B1 - Square Non-Metallic Tags.

2) Indoor non-corrosive:

a) Type A1 - Round Metal Tags.

b) Type B1 - Square Non-Metallic Tags.

3) Indoor corrosive:

4) Stainless steel Type A1 - Round Metal Tags.

5) Type B1 - Square Non-Metallic Tags.

b. Fastener:

1) Type A1: Chain of the same material.

2) Type B1: Stainless steel chain.

a) Color: Per ASME A13.1 corresponding to the piping system.

b) Legend:

3) Letter height: 1/4 IN minimum.

4) Valve designation as indicated on the Drawings and valve schedule (e.g., "WD-GWP04-GST-GST2-BFV-02-001").

5. Piping systems:

a. Tag type:

1) Outdoor locations: Type G - Stenciling System.

2) Indoor locations:

a) Type D - Self-Adhesive Tape Tags and Signs.

b) Type G - Stenciling System.

b. Fastener: Self.

c. Color: Per ASME A13.1.

d. Legend:

1) Letter height: Manufacturers standard for the pipe diameter.

2) Mark piping in accordance with ASME A13.1.

3) Use piping designation as indicated on the Drawings.

4) Arrow: Single arrow.

6. Equipment that starts automatically:

a. Tag type:

1) Type B2 - Non-Metallic Signs.

2) Type D - Self-Adhesive Tape Tags and Signs.

b. Fastener:

1) Type B2 - Screw or adhesive.

2) Type D - Self.

c. Size: 5 IN x 7 IN

d. Legend:

1) OSHA Warning Sign.

2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".

B. Instrumentation Systems:

1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):

a. Tag type:

1) Outdoor locations: Type B1 - Square Non-Metallic Tags.

2) Indoor non-corrosive:

a) Type A1 - Round Metal Tags.

b) Type B1 - Square Non-Metallic Tags.

3) Indoor corrosive:

a) Stainless steel Type A1 - Round Metal Tags.

b) Type B1 - Square Non-Metallic Tags.

b. Fastener:

1) Type A1: Chain of the same material.

2) Type B1: Stainless steel chain.

c. Legend:

1) Letter height: 1/4 IN minimum.

2) Equipment ISA designation as indicated on the Drawings (e.g., "WD-GWP04-GST-GST2-LIT-02-001").

2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):

a. Tag type: Type C - Phenolic Name Plates.

b. Fastener: Screws.

c. Legend:

1) Letter height: 1/2 IN minimum.

2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").

3. Components inside equipment enclosure, (e.g., PLC's, control relays, contactors, and timers):

a. Tag type: Type D - Self-Adhesive Tape Tags.

b. Fastener: Self.

c. Legend:

1) Letter height: 3/16 IN minimum.

2) Description or function of component (e.g., "PLC-xxx" or "CR-xxx").

4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) Component ISA tag number as indicated on the Drawings (e.g., "HS-xxx").

C. Electrical Systems:
1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
   a. Tag type: Type F - Underground Warning Tape.
   b. Letter height: 1-1/4 IN minimum.
   c. Location:
      1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
      2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
   d. Electrical power (e.g., low and medium voltage):
      1) Color: Red with black letters.
      2) Legend:
         a) First line: "CAUTION CAUTION CAUTION".
         b) Second line: "BURIED ELECTRIC LINE BELOW".
   e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
      1) Color: Orange with black letters.
      2) Legend:
         a) First line: "CAUTION CAUTION CAUTION".
         b) Second line: "BURIED COMMUNICATION LINE BELOW".
2. Switchgear, switchboards and motor control centers:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Main equipment legend:
      1) Letter height:

a) First line: 1 IN minimum.

b) Subsequent lines: 3/8 IN minimum.

2) First line: Equipment name (e.g., "MAIN SWITCHBOARD MSBxxx").

3) Second line:

a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").

b) The source of power room number is only required when there are multiple electrical rooms, if the source is in another building, the building name or number shall be used.

4) Third line: System voltage and phase (e.g., “480/277 V, 3PH”).

5) Main and feeder device legend:

a) Letter height: 3/8 IN minimum.

b) Description of load (e.g., “MAIN DISCONNECT”, "PUMP Pxxx" or "PANELBOARD HPxxx").

3. Panelboards and transformers:

a. Tag type: Type C - Phenolic Name Plates.

b. Fastener: Screws.

c. Legend:

1) Letter height:

a) First line: 3/8 IN minimum.

b) Subsequent lines: 3/16 IN minimum.

2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").

3) Second line (panelboards only): System voltage and phase (e.g., “208/120V, 3PH”).

4. Transfer switches:

a. Tag type: Type C - Phenolic Name Plates.

b. Fastener: Screws.

c. Legend:

1) Letter height:

a) First line: 3/8 IN minimum.

b) Subsequent lines: 3/16 IN minimum.

2) First line: Equipment name (e.g., "AUTOMATIC TRANSFER SWITCH ATSxxx").

5. Safety switches, separately mounted circuit breakers and motor starters, VFD's, etc.:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
6. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/2 IN minimum.
      2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
   d. Provide the following diagrams and tables on the inside door of each MCC/Panel/Cabinet Compartment:
      1) Elementary wiring disgram (laminated, clean, and legible).
      2) If, after a reasonable effort, the factory panel and design will not accommodate the laminated diagram, attached to the door, it may be placed in a document pouch designed into the panel for this purpose.
      3) Table of Overload Heater elements/settings with the correct settings highlighted.
      4) Table of motor circuit protector/breaker settings with the correct settings highlighted.
   e. All components inside MCC/panels/cabinet compartments to be clearly labeled and identified with permanent, laminated or plastic phenolic identification tag/label. Tags/Labels to be neatly (square.plumb, level) and securely installed on the back plate. All components (i.e. All relays, terminal blocks, transformers, fuse blocks, modules, rectifiers, auxillary/accessory devices, etc.) to be tagged/labeled/identified to correspond to the applicable letters/numbers used on the terminal blocks or wiring diagrams.
   f. All devices mounted to MCC/panel/cabinet compartment doors to be labeled outside doors as follows:
      1) Engrave stock, melamine plastic laminate, 1/16-inch thick for signs up to 20-sq inches. (129 sq. cm) 1/8-inch (3.2 mm) thick for larger sizes.
         a) Engraved Legend: Black Letters on white face.

b) Punch for mechanical fasteners,

2) Fasteners for Plastic laminated and Metal Signs: Self tapping 316-SS screws or No. 4/40 316-SS machine screws. Tap and thread as needed for U.S.E. 316-SS flat nuts.

7. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description or function of component (e.g., "M-xxx", “CR-xxx” or “TR-xxx").
8. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., “HS-xxx”).
   d. All devices mounted to MCC/panel/cabinet compartment doors to be labeled inside doors as follows
      1) Use self-stick labels as manufactured by Brady or pre-approved equal.
      2) Secure label above each device so as wiring of device will not interfere with reading of label.
      3) Nomenclature on label shall match tag on outside of door (i.e. HAND OFF AUTO, RUN, RESET, ALARM, etc. along with corresponding Pump/Equipment No.).
9. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
   a. Tag type: Type D - Self-Adhesive Tape Tags.
   b. Fastener: Self.
   c. Tag conductor at both ends.
   d. Legend:
      1) Letter height: 1/8 IN minimum.

2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.

10. Conductors in cable trays.
    a. Tag type: Type D - Self-Adhesive Tape Tags.
    b. Fastener: Self.
    c. Tag all conductors at the same location in the tray at 50FT maximum intervals.
    d. Legend:
        1) Letter height: 1/8 IN minimum.
        2) Circuit number or wire number as scheduled on the Drawings.
11. Grounding conductors associated with grounding electrode system in accordance with the following:
    a. Tag type: Type D - Self-Adhesive Tape Tags.
    b. Fastener: Self.
    c. Legend:
        1) Letter height: 1/8 IN minimum.
        2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
12. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
    a. Tag type: Type D - Self-Adhesive Tape Signs.
    b. Fastener: Self.
    c. Legend: Per NFPA 70.
13. Entrances to electrical rooms:
    a. Tag type: Type B2 - Non-Metallic Signs.
    b. Fastener: Screw or adhesive.
    c. Size: 5 IN x 7 IN.
    d. Location: Each door to room.
    e. Legend:
        1) OSHA Danger Sign.
            2) Description of Danger: “HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY”.
14. Equipment where more than one (1) voltage source is present:
    a. Tag type:
        1) Type B2 - Non-Metallic Signs.

2) Type D - Self-Adhesive Tape Signs.

b. Fastener:

1) Screw or adhesive.

2) Self.

c. Size: 1-3/4 IN x 2-1/2 IN.

d. Location: Exterior face of enclosure or cubical.

e. Legend:

1) OSHA Danger Sign.

2) Description of Danger: “MULTIPLE VOLTAGE SOURCES”.

3.3 HAZARD AND SAFETY SIGNS (NOT USED)

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 26 05 00

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 10 14 00 – Identification Devices.
4. Division 26 – Electrical.
5. Section 26 05 19 – Wire and Cable - 600 Volt and Below.
6. Section 26 05 33 – Raceways and Boxes.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA).
2. American Iron and Steel Institute (AISI).
3. ASTM International (ASTM):
   a. A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ETL Testing Laboratories (ETL).
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C2 – National Electrical Safety Code (NESC).
6. National Electrical Manufacturers Association (NEMA):
   a. 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

7. National Fire Protection Association (NFPA):
    a. 70 – National Electrical Code (NEC).
8. Underwriters Laboratories, Inc. (UL).

B. Where Underwriters Laboratories, Inc. (UL) test procedures have been established for the product type, use UL or ETL Testing Laboratories (ETL) approved electrical equipment and provide with the UL or ETL label.

1.4 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.

1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
4. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
5. Hazardous areas: Class I, II or III areas as defined in NFPA 70 (NEC).
6. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of submittal process.
2. General requirements:
    a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
    b. Include data sheets that include manufacturer's name and product model number.
        1) Clearly identify all optional accessories.
    c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
    d. Manufacturer's delivery, storage, handling and installation instructions.

e. Product installation details.

f. See individual specification sections for any additional requirements.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 – Submittals and Specification Section 01 78 23.13 – Operation and Maintenance Data for requirements for:

a. The mechanics and administration of the submittal process.

b. The content process of Operation and Maintenance Manuals.

C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 – Submittals and all Specification Sections shall be submitted simultaneously.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 01 65 50 – Product Delivery, Storage, and Handling.

B. Protect nameplates on electrical equipment to prevent defacing.

1.7 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.

1. Outdoor areas:

a. Wet.

b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

2. Indoor areas:

a. Dry.

b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Division 26 – Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

C. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:

1. Approved manufacturers:
   a. Modular strut:
      1) Unistrut Building Systems.
      2) B-Line.
      3) Globe Strut.
2. Material requirements:
   a. Modular strut:
      1) Galvanized steel: ASTM A123 or ASTM A153.
      2) Stainless steel: AISI Type 316.
      3) PVC coated galvanized steel: ASTM A123 or ASTM A153 and 20 mil PVC coating.
      4) Aluminum: AA Type 6063-T6.
   b. Strut and mounting hardware:
      1) Hot-Dip Galvanized Steel to be used for indoor dry locations only.
      2) Type 316 Stainless Steel to be used for all locations except indoor dry locations.
   c. Anchorage per Specification Section 05 50 00.

B. Field touch-up of galvanized surfaces.
   1. Zinc-rich primer.
      a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
   1. NFPA 70 (NEC).
   2. IEEE C2.
   3. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.

1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:

1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
4. See Specification Section 26 05 19 – Wire and Cable - 600 Volt and Below for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70 (NEC).

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.

I. Device Mounting Schedule:

1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
   a. Light switch (to center): 48 IN.
   b. Receptacle in architecturally finished areas (to center): 18 IN.
   c. Receptacle on exterior wall of building (to center): 18 IN.
   d. Receptacle in non-architecturally finished areas (to center): 48 IN.
   e. Telephone outlet in architecturally finished areas (to center): 18 IN.
   f. Telephone outlet for wall-mounted phone (to center): 54 IN.
   g. Safety switch (to center of operating handle): 54 IN.
   h. Separately mounted motor starter (to center of operating handle): 54 IN.
   i. Pushbutton or selector switch control station (to center): 48 IN.

j. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.

1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments in equipment locations in accordance with the following without obtaining the Owner's Representative's approval:

a. 1 FT at grade, floor and roof level in any direction in the horizontal plane.

b. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.

c. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.

d. 1 FT on walls in a horizontal direction within the vertical plane.

e. Changes in equipment location exceeding those defined above require the Owner's Representative's approval.

K. Provide electrical equipment support systems per the following area designations:

1. Indoor Dry Areas:

a. Galvanized system consisting of hot-dip galvanized steel channels and fittings, nuts and hardware.

b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.

2. All Locations except Indoor Dry Areas:

a. Type 316 stainless steel channels and fittings, nuts and hardware.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.

1. Do not cut, or weld to, building structural members.

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

M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.

N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

P. Do not use materials that may cause the walls or roof of a building to discolor or rust.

Q. Identify electrical equipment and components in accordance with Specification Section 10 14 00 – Identification Devices.

3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.

1. See Specification Section 01 73 20 – Openings and Penetrations for openings and penetrations in structures.

B. Replace equipment and systems found inoperative or defective and re-test.

C. Cleaning:

1. See Specification Section 01 74 13 – Cleaning.

D. The protective coating integrity of support structures and equipment enclosures shall be maintained.

1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair surfaces which will be inaccessible after installation prior to installation.
4. See Specification Section 26 05 33 – Raceways and Boxes for requirements for conduits and associated accessories.

E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01 75 00 – Facility Start Up.

END OF SECTION

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SECTION 26 05 19

WIRE AND CABLE 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Building wire.
    b. Power cable.
    c. Control cable.
    d. Instrumentation cable.
    e. Wire connectors.
    f. Insulating tape.
    g. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 26 05 00 – Electrical Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Canadian Standards Association (CSA):
    a. Test Methods for Electrical Wires and Cables (FT-4 Vertical Cable Tray Test).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    a. 1202 – Standard for Flame-Propagation Testing of Wire and Cable.
3. National Electrical Manufacturers Association (NEMA):
    a. ICS 4 – Industrial Control and Systems: Terminal Blocks.

4. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
   a. WC 57/S-73-532 – Standard for Control Cables.
   b. WC 70/S-95-658 – Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
5. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
6. Underwriters Laboratories, Inc. (UL):
   a. 13 – Standard for Safety Power-Limited Circuit Cables.
   b. 44 – Standard for Safety Thermoset-Insulated Wires and Cables.
   c. 83 – Standard for Safety Thermoplastic-Insulated Wires and Cables.
   d. 467 – Standard for Safety Grounding and Bonding Equipment.
   e. 486A – Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
   f. 486C – Standard for Safety Splicing Wire Connections.
   g. 510 – Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
   h. 1277 – Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   i. 1569 – Standard for Safety Metal-Clad Cables.
   j. 1581 – Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
   k. 1666 – Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts.
   l. 2225 – Cables and Cable Fittings for Use in Hazardous (Classified) Locations.
   m. 2250 – Standard for Safety Instrumentation Tray Cable.

1.4 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. The following are specific types of instrumentation cables:
      a. Analog signal cable:
         1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller

conductors.

2) Commonly used types are defined in the following:

a) TSP: Twisted shielded pair.

b) TST: Twisted shielded triad.

b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.

C. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 8 AWG and larger.

D. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

E. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. See Specification Section 26 05 00 – Electrical: Basic Requirements for additional requirements.
3. Provide a sample of largest size of each type of wire or cable for review prior to installation.
   a. Sample shall have a legible and complete surface printing of identification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00 – Electrical Basic Requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Building wire, power and control cable:
   a. American Insulated Wire Corporation.
   b. General Cable.
   c. Houston Wire & Cable Company.

d. Manhattan/CDT.

e. Southwire Company.

2. Instrumentation cable:

a. Analog cable:

1) Alpha Wire Corporation.

2) American Insulated Wire Corporation.

3) Belden CDT Inc.

4) General Cable.

5) Houston Wire & Cable Company.

6) Manhattan/CDT.

3. Wire connectors:

a. Burndy Corporation.

b. Buchanan.

c. Ideal.

d. Ilsco.

e. 3M Co.

f. Teledyne Penn Union.

g. Thomas and Betts.

h. Phoenix Contact.

4. Insulating and color coding tape:

a. 3M Co.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MANUFACTURED UNITS

A. Building Wire:

1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for THHN/THWN-2 insulation.
5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Power Cable:

1. Conductor shall be copper with 600 V rated XHHW-2 insulation.
2. Conductor shall be stranded copper with 600 V rated insulation. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.
4. Number of conductors as required, including a bare ground conductor.
5. Individual conductor color coding:
   a. ICEA Method 4.
   b. See PART 3 of this Specification Section for additional requirements.
6. Conform to NFPA 70 Type TC.

C. Control Cable:

1. Conductor shall be copper with 600 V rated XHHW-2 insulation.
2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.
4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
   a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
5. Individual conductor color coding:
   a. NEMA/ICEA Method 1, Table E-2.
   b. See PART 3 of this Specification Section for additional requirements.
6. Conform to NFPA 70 Type TC.

D. Electrical Equipment Control Wire:

1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to UL 44 for Type SIS insulation.
5. Conform to UL 83 for Type MTW insulation.

E. Instrumentation Cable:

1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
2. Analog cable:
   a. Tinned copper conductors.
   b. 600 V PVC insulation with PVC jacket.
   c. Twisted with 100 percent foil shield coverage with drain wire.
   d. Six (6) twists per foot minimum.
   e. Individual conductor color coding: ICEA Method 1, Table K-2.
   f. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
3. Digital cable:
   a. As recommended by equipment (e.g., PLC, RTU) manufacturer.
   b. Horizontal voice and data cable:
      1) Category 6a per TIA/EIA/ANSI 568 unless otherwise specified.
      2) Category 5e per TIA/EIA/ANSI 568 with 600V insulation and shielding only where cable is routed with power conductors in cable tray or raceways.
      3) Cable shall be label-verified.
      4) Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
      5) Conductors: No. 24 AWG solid untinned copper.
      6) Rated CMP per NFPA 70.
   c. DeviceNet cable:
      1) Flat cable:
         a) No. 16 AWG, 4 conductor, unshielded with PVC jacket.
         b) ODVA Class 2 Flat cable.
      2) Thick cable:
         a) One (1) No. 15 AWG twisted shielded pair, one (1) No. 18 AWG twisted shielded pair with overall tinned copper braid (65 percent) and drain wire and PVC jacket.
         b) ODVA Class 2 Thick cable.
      3) Thin cable:
         a) One (1) No. 22 AWG twisted shielded pair, one (1) No. 24 AWG twisted shielded pair with overall tinned copper braid (65 percent) and drain wire and PVC jacket.

b) ODVA Class 2 Thin cable.

d. Conform to NFPA 262 and NFPA 70 Type ITC.

e. Foundation Fieldbus and DeviceNet cables shall each have a color coded jacket (e.g., yellow and orange) that is different from all other cables.

f. Structured wiring system for Foundation Fieldbus, Profibus or DeviceNet:

1) Cables meeting the above requirements with factory installed connectors.

F. Wire Connectors:

1. Twist/screw on type:

a. Insulated pressure or spring type solderless connector.

b. 600 V rated.

c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.

d. Phase and neutral conductors: Conform to UL 486C.

2. Compression and mechanical screw type:

a. 600 V rated.

b. Ground conductors: Conform to UL 467.

c. Phase and neutral conductors: Conform to UL 486A.

3. Terminal block type:

a. High density, screw-post barrier-type with white center marker strip.

b. 600 V and ampere rating as required, for power circuits.

c. 600 V, 20 ampere rated for control circuits.

d. 300 V, 15 ampere rated for instrumentation circuits.

e. Conform to NEMA ICS 4 and UL 486A.

G. Insulating and Color Coding Tape:

1. Pressure sensitive vinyl.

2. Premium grade.

3. Heat, cold, moisture, and sunlight resistant.

4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.

5. For cold weather or outdoor location, tape must also be all-weather.

6. Color:

a. Insulating tape: Black.

b. Color coding tape: Fade-resistant color as specified herein.

7. Comply with UL 510.

H. Pulling Lubricant: Polywater J, no exception.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:

1. Type XHHW-2:

a. Building wire and power and control cable in conduit below grade.

2. Type THHN/THWN-2:

a. Building wire and power and control cable in conduit above grade.

3. Type SIS and MTW:

a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards and motor control centers.

B. Conductor Size Limitations:

1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:

1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Purple
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.

b. Conductors larger than No. 6 AWG:

1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:

a) Continuous colored outer finish along its entire length.

b) 3 IN of colored tape applied at the termination.

2) Insulated grounding conductor shall be identified by one (1) of the following methods:

a) Continuous green outer finish along its entire length.

b) Stripping the insulation from the entire exposed length.

c) Using green tape to cover the entire exposed length.

3) The color coding shall be applied at all accessible locations including, but not limited to: Junction and pull boxes, wireways, manholes and handholes.

2. Power cables ICEA Method 4 with:

a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

b. Ground conductor: Bare.

3. Control cables NEMA/ICEA Method 1, Table E-2:

a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.

b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:

1. Where specifically indicated on the Drawings.

2. Where field conditions dictate and written permission is obtained from the Owner's representative.

3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits, but combining of control circuits is permitted.

a. The combinations shall comply with the following:

1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.

2) 125 Vdc shall be isolated from all other AC and DC circuits.

3) AC control circuits shall be isolated from all DC circuits.

4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
    a. The combinations shall comply with the following:
        1) Analog signal circuits may be combined.
        2) Digital signal circuits may be combined but isolated from analog signal circuits.
5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
    a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:
        1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
        2) The neutral conductor may be shared on sequential circuits (e.g., circuit numbers 1,3,5 of a three phase system) if multiple circuit breakers are provided.
        3) Up sizing raceway size for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
    1. The preferred grounding location is at the control panel, not at the field mounted instrument.
    2. Grounded end at drain cable to be of sufficient length to reach ground screw or terminal strip. Insulate with heat shrink. No daisy chain of grounds

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
    1. Feeder and branch power circuits:
        a. Device outlet boxes:
            1) Twist/screw on type connectors.
        b. Junction and pull boxes and wireways:
            1) Twist/screw on type connectors for use on No. 10 and smaller wire.
            2) Compression, terminal block or terminal strip type connectors for use on No. 8 AWG and larger wire.
        c. Motor terminal boxes:
            1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
            2) Insulated compression type connectors for use on No. 8 AWG and larger wire.

d. Manholes or handholes:

1) Twist/screw on type connectors pre-filled with epoxy for use on No. 10 AWG and smaller wire.

2) Watertight compression type connectors for use on No. 8 AWG and larger wire.

2. Control circuits:

a. Junction and pull boxes: Terminal block type connector.

b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.

c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.

3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Owner's representative.

a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.

b. Junction and pull boxes: Terminal block type connector.

c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.

4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

H. Insulating Tape Usage:

1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.

2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.

3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

I. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

A. Megger Testing

1. Megger test conductors No. 8 AWG and larger which are energized at 480 volts. Record megger tests on a test sheet and provide test sheets to SJRA in the form of a submittal. Include circuit designation, date, time, temperature, weather conditions and megohm readings on the test sheet.

END OF SECTION

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SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for grounding systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 10 14 00 – Identification Devices.
4. Section 26 05 00 – Electrical: Basic Requirements.
5. Section 26 05 19 – Wire and Cable - 600 Volt and Below.
6. Section 26 05 33 – Raceways and Boxes.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 837 – Standard for Qualifying Permanent Connections Used in Substation Grounding.
3. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
      1) Article 250 – Grounding and Bonding.
4. Underwriters Laboratories, Inc. (UL):
   a. 467 – Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data.
    a. Provide submittal data for all products specified in PART 2 of this Specification Section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Ground rods and bars and grounding clamps, connectors and terminals:
    a. Burndy.
    b. Harger Lightning Protection.
    c. Heary Brothers.
    d. Joslyn.
    e. Robbins Lightning Protection.
    f. Thomas & Betts (Blackburn).
    g. Thompson.
2. Exothermic weld connections:
    a. Erico Products Inc., Cadweld.
    b. Harger Lightning Protection.
    c. Thermoweld.
3. Ground Test Well Stations:
    a. Brooks.
    b. Oldcastle.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 COMPONENTS

A. Wire and Cable:

1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
2. Insulated conductors: Color coded green, per Specification Section 26 05 19 – Wire and Cable - 600 Volt and Below.

B. Conduit: As specified in Specification Section 26 05 33 – Raceways and Boxes.

C. Ground Bars:

1. Solid copper:
    a. 1/4 IN thick.
    b. 2 or 4 IN wide.
    c. 24 IN long minimum in main service entrance electrical rooms, 12 IN long elsewhere.
2. Predrilled grounding lug mounting holes.
3. Stainless steel or galvanized steel mounting brackets.
4. Insulated standoffs.

D. Ground Rods:

1. 3/4 IN x 20 FT minimum.
2. Copperclad:
    a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
    b. Corrosion resistant bond between the copper and steel.
    c. Hard drawn for a scar-resistant surface.

E. Grounding Clamps, Connectors and Terminals:

1. Mechanical type:
    a. Standards: UL 467.
    b. High copper alloy content.
2. Compression type for interior locations:
    a. Standards: UL 467.
    b. High copper alloy content.
    c. Non-reversible.
    d. Terminals for connection to bus bars shall have two bolt holes.
3. Compression type suitable for direct burial in earth or concrete:
    a. Standards: UL 467, IEEE 837.
    b. High copper alloy content.
    c. Non-reversible.

F. Exothermic Weld Connections:

1. Copper oxide reduction by aluminum process.

2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.
2. Size grounding conductors and bonding jumpers in accordance with NFPA 70 Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections.
4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves and install per Specification Section 01 73 20 – Openings and Penetrations.
5. Do not splice grounding conductors except at ground rods.
6. Install ground rods and grounding conductors in undisturbed, firm soil.
   a. Provide excavation required for installation of ground rods and ground conductors.
   b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
   c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors. Test before energize.
   d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
   e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:

1. Provide a grounding electrode system in accordance with NFPA 70 Article 250 and as indicated on the Drawings.
2. Grounding conductor terminations:
   a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
   b. Ground bars in electrical equipment, use compression type terminal and bolt it to the ground bar.
   c. Piping systems use mechanical type connections.

d. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.

e. At all above grade terminations, the conductors shall be labeled per Specification Section 10 14 00 – Identification Devices.

3. Ground ring grounding system:

a. Ground ring consists of ground rods and a grounding conductor looped around the structure.

b. Placed at a minimum of 4 FT from the structure foundation and 2 FT-6 IN below grade.

c. Provide a minimum of four (4) ground rods placed at the corners of the structure and additional rods so that the maximum distance between ground rods does not exceed 50 FT.

d. Building/Structure grounding:

1) Bond building/structure metal support columns to the ground ring at all corners of the structure.

e. Grounding conductor: Bare conductor, size as indicated on the Drawings.

f. Ground rod test stations:

1) Provide for all ground rod locations, unless otherwise noted.

2) Grounding conductors connected to ground rod with removable ground clamps.

C. Supplemental Grounding Electrode:

1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.

2. Metal light poles:

a. Connect metal pole to a ground rod.

b. Grounding conductor: Bare #6 AWG minimum.

3. Equipment support rack and pedestals mounted outdoors:

a. Connect metallic structure to a ground rod.

b. Grounding conductor: #6 AWG minimum.

D. Other Bonding Requirements:

1. Other metal piping:

a. As indicated on the Drawings.

2. Lightning protection system:

a. Connect to ground ring.

E. Low Voltage Transformer Separately Derived Grounding System:

1. Ground separately mounted step-down transformers XO terminal to one of the following:

   a. The first choice is to connect to the ground ring around the structure where the transformer is located.

   b. The second choice is to connect to a driven ground rod.

2. Ground step-down transformer integrally mounted in motor control centers to motor control center ground bus.

F. Telecommunications Grounding System:

1. Coil 5 FT of insulated #6 AWG conductor at each telephone terminal board and connect to the ground ring around the structure.

G. Raceway Bonding/Grounding:

1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

H. Equipment Grounding:

1. All utilization equipment shall be grounded with an equipment ground conductor.

I. Manhole and Handhole Grounding:

1. Provide a ground rod in each manhole and handhole.

   a. Expose a minimum of 4 IN of the rod above the floor for field connections to the rod.

2. Connect all exposed metal parts (e.g., conduits and cable racks) to the ground rod.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by Owner's Representative.

B. Testing:

1. Test the resistance of installed ground system at the ground test wells after backfilling and before connection to any other grounded system including underground piping, utility services or other building ground systems and before energizing of equipment. Record test resistances and submit information to SJRA in the form of a submittal.

END OF SECTION

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SECTION 26 05 33

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Material and installation requirements for:
    a. Conduits.
    b. Conduit fittings.
    c. Conduit supports.
    d. Wireways.
    e. Outlet boxes.
    f. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 26 05 00 – Electrical: Basic Requirements.
4. Section 26 05 43 – Electrical: Exterior Underground.
5. Section 26 27 26 – Wiring Devices.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Iron and Steel Institute (AISI).
2. ASTM International (ASTM):
    a. A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    b. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    c. D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

d. F512 – Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.

3. National Electrical Manufacturers Association (NEMA):
   a. 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. RN 1 – Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC).
   c. TC 2 – Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   d. TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
   a. C80.1 – Electric Rigid Steel Conduit (ERSC).
   b. C80.3 – Steel Electrical Metallic Tubing (EMT).
   c. OS 1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box
   d. Supports.
5. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
6. Underwriters Laboratories, Inc. (UL):
   a. 1 – Standard for Flexible Metal Conduit.
   b. 6 – Standard for Electrical Rigid Metal Conduit - Steel.
   c. 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations.
   d. 360 – Standard for Liquid-Tight Flexible Steel Conduit.
   e. 467, Grounding and Bonding Equipment.
   f. 514A – Metallic Outlet Boxes.
   g. 514B – Conduit, Tubing, and Cable Fittings.
   h. 651 – Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
   i. 797 – Electrical Metallic Tubing - Steel.
   j. 870 – Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
   k. 886 – Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
    a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    b. See Specification Section 26 05 00 – Electrical Basic Requirements for additional requirements.
3. Fabrication and/or layout drawings:
    a. Identify dimensional size of pull and junction boxes to be used.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00 – Electrical Basic Requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Rigid metallic conduits:
    a. Allied Tube and Conduit Corporation.
    b. Hydro Extrusions (RAC)
    c. Triangle PWC Inc.
    d. Western Tube and Conduit Corporation.
    e. Wheatland Tube Company.
    f. LTV Steel Company.
2. PVC coated rigid metallic conduits:
    a. Perma-Cote.
    b. Plastibond.
    c. KorKap.
3. Rigid non-metallic conduit:
    a. Carlon.
    b. Cantex.
    c. Osburn Associates.
4. Flexible metallic conduit (FLEX):
    a. AFC Cable Systems.

b. Anamet, Inc.
c. Electri-Flex.
d. Flexible Metal Hose Company.
e. International Metal Hose Company.
f. Triangle PWC Inc.
g. LTV Steel Company.

5. Flexible non-metallic conduit (FLEX-NM)
   a. Carlon Carflex
6. Wireway:
   a. Hoffman Engineering Company.
   b. Wiegmann.
   c. Square D.
7. Underfloor raceways.
   a. Walker.
   b. Square D.
8. Conduit fittings and accessories:
   a. Appleton.
   b. Carlon.
   c. Cantex.
   d. Crouse-Hinds.
   e. Killark.
   f. Osburn Associates.
   g. OZ Gedney Company.
   h. RACO.
   i. Steel City.
   j. Thomas and Betts.
9. Support systems:
   a. Unistrut Building Systems.
   b. B-Line Systems Inc.
   c. Kindorf.
   d. Minerallac Fastening Systems.
   e. Caddy.

10. Outlet, pull and junction boxes:
    a. Appleton Electric Co.
    b. Crouse-Hinds.
    c. Killark.
    d. O-Z/Gedney.
    e. Steel City.
    f. Raco.
    g. Bell.
    h. Hoffman Engineering Co.
    i. Wiegmann.
    j. B-Line Circle AW.
    k. Adalet.
    l. Rittal.
11. Anti-seize compound
    a. Crouse Hinds

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 RIGID METALLIC CONDUITS

A. PVC-Coated Rigid Steel Conduit (PVC-RGS):

1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
    a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
    b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
2. Conduit must have ETL rating.
3. Nominal 2 mil, minimum, urethane interior coating.
4. Urethane coating on threads.
5. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
6. Female Ends:
    a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN,
    b. whichever is less beyond the opening.
    c. The inside diameter of the sleeve shall be the same as the outside
    d. diameter of the conduit to be used with it.

7. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.

B. Rigid Galvanized Steel Conduit (RGS):

1. Mild steel with continuous welded seam.
2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
3. Threads galvanized after cutting.
4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
5. Standards: NEMA/ANSI C80.1, UL 6.

C. Electrical Metallic Tubing (EMT):

1. Mild steel with continuous welded seam.
2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
3. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
4. Standards: NEMA/ANSI C80.3, UL 797.

D. Rigid Aluminum Conduit (RAC):

1. AA Type 6063 aluminum alloy, T-1 temper.
2. Maximum copper content of 0.10 percent.
3. Extruded, seamless.
4. Standards: NEMA/ANSI C80.5, UL 6.

2.3 RIGID NON-METALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):

1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
2. Rated for direct sunlight exposure.
3. Fire retardant and low smoke emission.
4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

A. Flexible Galvanized Steel Conduit (FLEX):

1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Standard: UL 1.

B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):

1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.

2. Extruded PVC outer jacket positively locked to the steel core.
3. Liquid and vaportight.
4. Standard: UL 360.

C. Nonmetallic Liquidtight Flexible Conduit (FLEX-NM):

1. Carlon Carflex with type LT connectors.

2.5 WIREWAY

A. General:

1. Suitable for lay-in conductors.
2. Designed for continuous grounding.
3. Covers:
   a. Hinged or removable in accessible areas.
   b. Non-removable when passing through partitions.
4. Finish: Rust inhibiting primer and manufacturers standard paint inside and out except for stainless steel type.
5. Standards: UL 870, NEMA 250.

B. General Purpose (NEMA 1 rated) Wireway:

1. 14 or 16 gage steel without knockouts.
2. Cover: Solid, non-gasketed and held in place by captive screws.

C. Raintight (NEMA 3R) Wiring Trough:

1. 14 or 16 GA galvanized steel without knockouts.
2. Cover: Non-gasketed and held in place by captive screws.

D. Watertight (NEMA 4X rated) Wireway:

1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.
2. Cover: Fully gasketed and held in place with captive clamp type latches.
3. Flanges: Fully gasketed and bolted.

E. Dusttight (NEMA 12 rated) Wireway:

1. 14 GA steel bodies and covers without knockouts and 10 GA steel flanges.
2. Cover: Fully gasketed and held in place with captive clamp type latches.
3. Flanges: Fully gasketed and bolted.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:

1. General:
    a. In hazardous locations listed for use in Class I, Groups C and D
    b. locations.
2. Locknuts:
    a. Threaded steel or malleable iron.
    b. Gasketed or non-gasketed.
    c. Grounding or non-grounding type.
3. Bushings:
    a. Threaded, insulated metallic.
    b. Grounding or non-grounding type.
4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
5. Couplings:
    a. Threaded straight type: Same material and finish as the conduit with which they are used on.
    b. Threadless type: Gland compression or self-threading type, concrete tight.
6. Unions: Threaded galvanized steel or zinc plated malleable iron.
7. Conduit bodies (ells and tees):
    a. Body: Zinc plated cast iron with threaded hubs.
    b. Standard and mogul size.
    c. Cover:
        1) Clip-on type with stainless steel screws.
        2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron.
8. Conduit bodies (round):
    a. Body: Zinc plated cast iron.
    b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron.

B. Fittings for Use with RAC:

1. General:
    a. In hazardous locations listed for use in Class I, Groups C and D locations.

2. Locknuts:
    a. Threaded stainless steel.
    b. Gasketed or non-gasketed.
    c. Grounding or non-grounding type.
3. Bushings:
    a. Threaded, insulated metallic.
    b. Grounding or non-grounding type.
4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
5. Couplings:
    a. Threaded straight type: Same material and finish as the conduit with which they are used on.
6. Unions: Threaded copper free cast aluminum.
7. Conduit bodies (ells and tees):
    a. Body: Cast copper free aluminum with threaded hubs.
    b. Standard and mogul size.
    c. Cover:
        1) Clip-on type with stainless steel screws.
        2) Gasketed or non-gasketed cast copper free aluminum.
8. Conduit bodies (round):
    a. Body: Cast copper free aluminum with threaded hubs.
    b. Cover: Threaded screw on type, gasketed, cast copper free aluminum.
9. Sealing fittings:
    a. Body: Cast copper free aluminum with threaded hubs.
    b. Standard and mogul size.
    c. With or without drain and breather.
    d. Fiber and sealing compound: UL listed for use with the sealing fitting.

C. Fittings for Use with PVC-RGS:
1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS" and coated as defined under paragraph "PVC Coated Rigid Steel Conduit (PVC-RGS)."

D. Fittings for Use with EMT:
1. Connectors:
    a. Straight, angle and offset types furnished with locknuts.

b. .Zinc plated steel.

c. Insulated gland compression type.

d. Concrete and raintight.

2. Couplings

a. Zinc plated steel.

b. Gland compression type.

c. Concrete and raintight.

3. Conduit bodies (ells and tees):

a. Body: Copper free aluminum with threaded hubs.

b. Standard and mogul size.

c. Cover:

1) Screw down type with steel screws.

2) Gasketed or non-gasketed galvanized steel or copper free aluminum.

4. Standard: UL 514B.

E. Fittings for Use with FLEX:

1. Connector:

a. Zinc plated malleable iron.

b. Squeeze or clamp-type.

2. Standard: UL 514B.

F. Fittings for Use with FLEX-LT and FLEX-NM:

1. Connector:

a. Straight or angle type.

b. Insulated and gasketed.

c. Composed of locknut, grounding ferrule and gland compression nut.

d. Liquidtight.

2. Standards: UL 467, UL 514B.

G. Fittings for Use with Rigid Non-Metallic PVC Conduit:

1. Coupling, adapters and conduit bodies:

a. Same material, thickness, and construction as the conduits with which they are used.

b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.

c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.

2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

H. Weather and Corrosion Protection Tape:

1. PVC based tape, 10 mils thick.
2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
3. Used with appropriate pipe primer.

2.7 ALL RACEWAY AND FITTINGS

A. Mark Products:

1. Identify the nominal trade size on the product.
2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

A. Metallic Outlet Boxes:

1. Hot-dip galvanized steel.
2. Conduit knockouts and grounding pigtail.
3. Styles:
   a. 2 IN x 3 IN rectangle.
   b. 4 IN square.
   c. 4 IN octagon.
   d. Masonry/tile.
4. Accessories:
   a. Flat blank cover plates.
   b. Barriers.
   c. Extension, plaster or tile rings.
   d. Box supporting brackets in stud walls.
   e. Adjustable bar hangers.
5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:

1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
2. Threaded hubs and grounding screw.

3. Styles:
    a. "FS" or "FD".
    b. Single or multiple gang and tandem.
    c. "EDS" or "EFS" for hazardous locations.
4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
5. Standards: UL 514A, UL 886.

C. See Specification Section 26 27 26 – Wiring Devices for wiring devices, wall plates and cover plates.

2.9 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:

1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. With or without concentric knockouts on four (4) sides.
3. Flat cover fastened with screws.

B. NEMA 4X Rated (metallic):

1. Body and cover: 14 GA Type 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

C. NEMA 7 and NEMA 9 Rated:

1. Copper-free aluminum with manufacturer’s standard finish.
2. Drilled and tapped openings or tapered threaded hub.
3. Cover bolted-down with stainless steel bolts or threaded cover with neoprene gasket.
4. External mounting flanges.
5. Grounding lug.
6. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.

D. NEMA 12 Rated:

1. Body and cover:
    a. 14 GA steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
    b. Optional Construction: Type 5052 H-32 aluminum, unpainted.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
6. Flat door with oil resistant gasket.

E. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
2. Split covers when heavier than 25 LBS.
3. Weldnuts for mounting optional panels and terminal kits.
4. Tamper proof screws.
5. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

F. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:

1. Material requirements.
    a. Stainless steel: Type 316.

B. Single Conduit and Outlet Box Support Fasteners:

1. Material requirements:
    a. Stainless steel: Type 316.

2.11 OPENINGS AND PENETRATONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:

1. See Specification Section 01 73 20.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:

1. NFPA 70.
2. Manufacturer instructions.

B. Size of Raceways:

1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
2. Unless specifically indicated otherwise, the minimum raceway size shall be:
   a. Conduit: 3/4 IN.
   b. Wireway: 2-1/2 IN x 2-1/2 IN.

C. Field Bending and Cutting of Conduits:

1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
2. Do not reduce the internal diameter of the conduit when making conduit bends.
3. Prepare tools and equipment to prevent damage to the PVC coating.
4. Degrease threads after threading and apply a zinc rich paint.
5. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.

1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
   a. Total nominal thickness: 40 mil.
4. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.

1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the

conduit, to remove obstructions.

2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.

1. See Specification Section 01 73 20 – Openings and Penetrations.
2. Where conduit terminates at a cable tray system, fit conduit with an insulated bushing.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.

1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
2. Run in straight lines parallel to or at right angles to building lines.
3. Do not route conduits:
   a. Through areas of high ambient temperature or radiant heat.
   b. In suspended concrete slabs.
   c. Do not penetrate the top of PLC panels.
4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 270 degrees of bends or 3-90 degree bends in the conduit run or in long straight runs to limit pulling tensions.

B. All rigid conduits within a structure shall be installed exposed except as follows:

1. As indicated on the Drawings.
2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
3. Concealed within stud frame, poured concrete, concrete block and brick walls of an architecturally finished area.
4. Embedded in floor slabs or buried under floor serving equipment in non-architecturally finished areas that are not located on or near a wall or column and the ceiling height is greater than 12 FT.

5. Embedded in floor slabs or buried under floor slabs where shown on the Contract Drawings or with the Owner's representative's permission.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:

1. Between instrumentation and telecommunication: 1 IN.
2. Between instrumentation and 125 V, 48 V and 24 Vdc, 2 IN.
3. Between instrumentation and 600 V and less AC power or control: 12 IN.
4. Between instrumentation and greater than 600 Vac power: 12 IN.
5. Between telecommunication and 125 V, 48 V and 24 Vdc, 2 IN.
6. Between telecommunication and 600 V and less AC power or control: 6 IN
7. Between telecommunication and greater than 600 Vac power: 12 IN.
8. Between 125 V, 48 V and 24 Vdc and 600 V and less AC power or control: IN.
9. Between 125 V, 48 V and 24 Vdc and greater than 600 Vac power: 2 IN.
10. Between 600 V and less AC and greater than 600 Vac: 2 IN.
11. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.

1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.

1. See Specification Section 01 73 20 – Openings and Penetrations.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:

1. Power wire or cables: All raceway types.
2. Control wire or cables: All raceway types.
3. Instrumentation cables: Metallic raceway except non-metallic may be used underground.
4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
5. Telecommunication cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
   1. Dry areas:
      a. RAC.
   2. Wet areas:
      a. RAC.
   3. Corrosive areas:
      a. PVC-RGS.
      b. PVC-80.
   4. Highly corrosive areas:
      a. PVC-RGS.
      b. PVC-80.
   5. NFPA 70 hazardous areas:
      a. RAC.

C. Permitted Raceway Types Per Routing Locations:
   1. In stud framed walls:
      a. EMT.
   2. In concrete block or brick walls:
      a. PVC-40.
   3. Above acoustical tile ceilings:
      a. EMT.
      b. NEMA 1 rated wireway.
   4. Embedded in poured concrete walls and floors:
      a. PVC-40.
      b. PVC-RGS when emerging from concrete into areas designated as wet, corrosive or highly corrosive.
   5. Beneath floor slab-on-grade:
      a. PVC-40.
   6. Through floor penetrations, see Specification Section 01 73 20 – Openings and Penetrations:
      a. PVC-RGS in areas designated as wet, corrosive or highly corrosive.
   7. Direct buried conduits and duct banks:
      a. PVC-80.
      b. 90 degree elbows for transitions to above grade:

1) PVC-RGS.

c. Long sweeping bends greater than 15 degrees:

1) PVC-RGS.

8. Concrete encased duct banks:

a. PVC-40.

b. 90 degree elbows for transitions to above grade:

1) PVC-RGS.

c. Long sweeping bends greater than 15 degrees:

1) PVC-RGS.

d. Long sweeping bends greater than 15 degrees:

1) RGS.

D. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above ceilings.

1. The maximum length shall not exceed:

a. 6 FT to light fixtures.

b. 3 FT to all other equipment.

E. FLEX-NM conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and electrical equipment that is liable to vibrate.

1. The maximum length shall not exceed:

a. 6 FT to light fixtures.

b. 3 FT to motors.

c. 2 FT to all other equipment

F. NEMA 1 Rated Wireway:

1. Surface mounted in electrical rooms
2. Surface mounted above removable ceilings tiles of an architecturally finished area.

G. NEMA 4X Rated Wireway:

1. Surface mounted in areas designated as wet and or corrosive.

H. NEMA 12 Rated Wireway:

1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.

I. Underground Conduit: See Specification Section 26 05 43 – Electrical Exterior Underground.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Conduit Seals:

1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.

B. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.

1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

C. Install Expansion Fittings:

1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
2. Elsewhere as identified on the Drawings.

D. Install Expansion/Deflection Fittings:

1. Where conduits enter a structure.
    a. Except electrical manholes and handholes.
    b. Except where the duct bank is tied to the structure with rebar.
2. Where conduits span structural expansions joints.
3. Elsewhere as identified on the Drawings.

E. Threaded connections shall be made wrench-tight.

F. Conduit joints shall be watertight:

1. Where subjected to possible submersion.
2. In areas classified as wet.
3. Underground.

G. Terminate Conduits:

1. In metallic outlet boxes:
    a. RGS and RAC:
        1) Conduit hub and locknut.
        2) Insulated bushing and two (2) locknuts.
        3) Use grounding type locknut or bushing when required by NFPA 70.
    b. EMT: Compression type connector and locknut.
2. In NEMA 1 rated enclosures:
    a. RGS and RAC:
        1) Conduit hub and locknut.
        2) Insulated bushing and two (2) locknuts.

3) Use grounding type locknut or bushing when required by NFPA 70.

b. EMT: Compression type connector and locknut.

3. In NEMA 12 rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
   b. Use grounding type locknut or bushing when required by NFPA 70.
4. In NEMA 4X rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
5. In NEMA 7 and NEMA 9 rated enclosures:
   a. Into an integral threaded hub.
6. When stubbed up through the floor into floor mount equipment:
   a. With an insulated grounding bushing on metallic conduits.
   b. With end bells on non-metallic conduits.

H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted single and multi-conduit surface or trapeze type support system per area designations:
   1. Dry Indoor Area:
      a. Hot dip galvanized steel support system consisting of: Hot dip galvanized steel channels and fittings, nuts, hardware and conduit clamps.
   2. Wet, Hazardous, Corrosive Areas and Areas under Canopies:
      a. Type 316 stainless steel support system consisting of: Stainless steel channels and fittings, nuts, hardware and conduit clamps.

B. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.
   4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
      a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
      b. Conduit hangers:

1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.

c. Do not use suspended ceiling support systems to support raceways.

d. Hangers in metal roof decks:

1) Utilize fender washers.

2) Not extend above top of ribs.

3) Not interfere with vapor barrier, insulation, or roofing.

5. Conduit support system fasteners:

a. Use Type 316 stainless steel sleeve-type expansion anchors as fasteners in masonry walls or concrete surfaces.

b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions
2. Install approved thread grease on all plugs prior to installation.
3. See Specification Section 26 05 00 – Electrical Basic Requirements and the Drawings for area classifications
4. Fill unused punched-out, tapped, or threaded hub openings with insert plugs. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box

B. Outlet Boxes:

1. Permitted uses of metallic outlet boxes:

a. Housing of wiring devices:

1) Recessed in all stud framed walls and ceilings.

2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.

b. Pull or junction box:

1) Above gypsum wall board or acoustical tile ceilings.

2) Above 10 FT in an architecturally finished area where there is no ceiling.

2. Permitted uses of cast outlet boxes:

a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, highly corrosive and hazardous areas.

b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.

3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00 – Electrical Basic Requirements.
4. Set device outlet boxes plumb and vertical to the floor.
5. Outlet boxes recessed in walls:
    a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
    b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
6. Place barriers between switches in boxes with 277 V switches on opposite phases.
7. Back-to-back are not permitted.
8. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.

C. Pull and Junction Boxes:
1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
    a. Make covers of boxes accessible.
2. Permitted uses of NEMA 1 enclosure:
    a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.
3. Permitted uses of NEMA 4X metallic enclosure:
    a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.
4. Permitted uses of NEMA 7 enclosure:
    a. Pull or junction box surface mounted in areas designated as Class I hazardous.
        1) Provide PVC coating in corrosive and highly corrosive areas when PVC coated conduit is used.
5. Permitted uses of NEMA 12 enclosure:
    a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION

SECTION 26 05 43

ELECTRICAL EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
   a. Manholes.
   b. Pull Boxes and Handholes.
   c. Underground conduits and duct banks.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Division 03 – Concrete.
4. Section 10 14 00 – Identification Devices
5. Section 26 05 26 – Grounding
6. Section 26 05 33 – Raceways and Boxes
7. Section 31 21 33 – Trenching, Backfilling and Compacting for Utilities

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. Standard Specifications for Highway Bridges.
   b. A48/A48M-03 – standard specification for gray iron castings.
2. ASTM International (ASTM):
   a. A536 – Standard Specification for Ductile Iron Castings.
3. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).

4. Society of Cable Telecommunications Engineers (SCTE):
    a. 77 – Specification for Underground Enclosure Integrity.

1.4 DEFINITIONS

A. Direct Buried conduits are not used on this project.

B. Concrete encased duct bank: An individual (single) or multiple conduits, arranged in one or more planes, encased in a common concrete envelope. All underground conduits on this project are to be installed in concrete encased duct bank.

1.5 SUBMITTALS

A. Shop Drawings:
    1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
    2. Product technical data:
        a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    3. Fabrication and/or layout drawings:
        a. Provide dimensional drawings of each manhole indicating all specified accessories and conduit entry locations.
        b. Layout drawings for all conduit runs, coordinated with all conduit.
        c. Provide detailed layout drawings showing the following as a minimum:
            1) Physical dimensions of the system.
            2) Dimension cable trench to other utilities in the path of the trench.
            3) Dimension cable trench to site structures.
            4) Cross-sectional sketch of the trench showing:
                a) Power cable runs.
                b) Control cable runs and support.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Precast concrete pull boxes and handholes:
        a. Locke Solutions.
        b. Oldcastle Precast, Inc.
    2. Precast concrete manholes:
        a. Locke Solutions.

b. Oldcastle Precast, Inc.

3. Manhole, pull box, handhole and duct bank accessories:
   a. Neenah.
   b. Unistrut.
   c. Condux International, Inc.
   d. Underground Devices, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MANHOLES, PULL BOXES AND HANDHOLES

A. Precast Concrete Manholes, Pull Boxes and Handholes:
   1. Steel reinforced cement concrete structures:
   2. Shall have an AASHTO live load rating of H-20 for full deliberate vehicle traffic.
   3. Mating edges: Tongue and groove type.
   4. Solid bottom with a 12 IN x 12 IN or 12 IN DIA french drain in the bottom.
   5. Cover extension rings as required.
   6. Cable pulling eyes opposite all conduit entrances.
      a. Coordinate exact location with installation contractor.

2.3 CONCRETE MANHOLE, PULL BOX AND HANDHOLE ACCESSORIES

A. Cover and Frame:
   1. Cast ductile iron: ASTM A536.
   2. AASHTO live load rating: H-20.
   3. Diameter: 36 IN.
   4. Cast the legend "ELECTRICAL" or "COMMUNICATIONS" into covers.

B. Cable Racks and Hooks:
   1. Material: Heavy-duty non-metallic (glass reinforced nylon).
   2. Hook loading capacity: 400 LBS minimum.
   3. Rack loading capacity: Four (4) hooks maximum.
   4. Hook deflection: 0.25 IN maximum.
   5. Hooks: Length, as required, with positive locking device to prevent upward movement.
   6. Mounding hardware: Type 316 stainless steel.

C. Cable Pulling Irons:

1. 7/8 IN DIA hot-dipped galvanized steel.
2. 6000 LB minimum pulling load.

D. Ground Rods and Grounding Equipment: See Specification Section 26 05 26 – Grounding.

2.4 UNDERGROUND CONDUIT AND ACCESSORIES

A. Concrete: 3,000 psi red concrete with steel rebar reinforcement as detailed on the Contract Drawings.

B. Conduit: See Specification Section 26 05 33 – Raceways and Boxes.

C. Duct Spacers/Supports:

1. High density polyethylene or high impact polystyrene.
2. Interlocking.
3. Provide minimum spacing between conduits, per NEC.
4. Accessories, as required:
   a. Hold down bars.
   b. Duct bank strapping.

PART 3 - EXECUTION

3.1 GENERAL

A. Drawings indicate the intended location of manholes, pull boxes and handholes and routing of duct banks and direct buried conduit.

1. Field conditions may affect actual routing.

B. Manhole, Pull Box and Handhole Locations:

1. Approximately where shown on the Drawings.
2. As required for pulling distances.
3. As required to keep pulling tensions under allowable cable tensions.
4. As required for number of bends in duct bank routing.
5. Shall not be installed in a swale or ditch.
6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
7. Locations are to be approved by the Principal Architect/Engineer prior to excavation and placement or construction.

C. Install products in accordance with manufacturer's instructions.

D. Install manholes, pull boxes and handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.

E. Comply with Specification Section 31 21 33 – Trenching, Backfilling and Compacting for Utilities for trenching, backfilling and compacting.

3.2 MANHOLES, PULL BOXES AND HANDHOLES

A. Precast Manholes, Pull Boxes and Handholes:

1. For use in vehicular and non-vehicular traffic areas.
2. Construction:
   a. Grout or seal all joints, per manufacturer's instructions.
   b. Support cables on walls by cable racks:
      1) Provide a minimum of two (2) racks, install symmetrically on each wall of manholes, pull boxes and handholes.
         a) Provide additional cable racks, as required, so that both ends of cable splices will be supported horizontally.
      2) Equip cable racks with adjustable hooks: Quantity of cable hooks as required by the number of conductors to be supported.
   c. In each manhole, pull box and handhole, drive 3/4 IN x 20 FT long copper clad ground rod into the earth with approximately 6 IN exposed above finished floor.
      1) Drill opening in floor for ground rod.
      2) Connect all metallic components to ground rod by means of #8 AWG minimum copper wire and approved grounding clamps.
3. Place manhole, pull box or handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than manhole, pull box or handhole footprint on all sides.
4. Install so that the top of cover is flush with finished grade.
5. After installation is complete, backfill and compact soil around manholes and handholes.
6. Pull Box and Handhole size:
   a. As indicated on the Contract Drawings or as required for the number and size of conduits entering.
7. Manhole size:
   a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.
      1) Minimum floor dimension of 6 FT x 6 FT and a minimum inside headroom of 6 FT-6 IN.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:

1. Do not concrete encase duct banks until conduits have been observed by the Owner's representative.
2. Duct banks shall be sloped a minimum of 4 IN per 100 FT or as detailed on the Drawings.
   a. Low points shall be at manholes, pull boxes or handholes.
3. During construction and after conduit installation is complete, plug the ends of all conduits.
4. Provide conduit supports and spacers.
   a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
      1) 1 IN and less: 3 FT.
      2) 1-1/4 to 3 IN: 5 FT.
      3) 3-1/2 to 6 IN: 7 FT.
   b. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete.
5. Stagger conduit joints at intervals of 6 IN vertically.
6. Make conduit joints watertight and in accordance with manufacturer's recommendations.
7. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
   a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
8. Furnish manufactured bends at end of runs.
   a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.
9. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
10. After the conduit run has been completed:
    a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
       1) Test mandrel:
          a) Length: Not less than 12 IN
          b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.

b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.

11. Pneumatic rodding may be used to draw in lead wire.
    a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
    b. Extend cord 3 FT beyond ends of conduit.
12. Transition from rigid non-metallic conduit to rigid metallic conduit, per Specification Section 26 05 33 – Raceways and Boxes, prior to entering a structure or going above ground.
    a. Terminate rigid PVC conduits with end bells.
13. Place warning tape in trench directly over duct banks, direct-buried conduit, and direct-buried wire and cable in accordance with Specification Section 10 14 00, 12-inch minimum cover.
14. Placement of conduits stubbing into Pull boxes, handholes and manholes shall be located to allow for proper bending radiuses of the cables.

B. Concrete Encased Duct bank:
1. Duct bank system consists of conduits completely encased in minimum 3 IN of red colored concrete (8-lbs. red dye/CY) and with separations between different cabling types as required in Specification Section 26 05 33 – Raceways and Boxes or as detailed on the Drawings.
2. Install so that top of concrete encased duct, at any point:
    a. Is not less than 24 IN below grade.
    b. Is below pavement sub-grading.
3. All duct bank shall be concrete encased and reinforced.
    a. The reinforcement shall consist of #4 bars and #4 ties placed 12 IN on center.
4. Conduit supports shall provide a uniform minimum clearance of 3 IN between the bottom of the trench and the bottom row of conduit.
5. Conduit separators shall provide a uniform minimum clearance of 2 IN between conduits or as required in Specification Section 26 05 33 – Raceways and Boxes for different cabling types.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Light switches.
    b. Receptacles.
    c. Device wall plates and cover plates.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 26 05 00 – Electrical: Basic Requirements.
4. Section 26 05 33 – Raceways and Boxes.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
    a. 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. WD 1 – General Color Requirements for Wiring Devices.
    c. WD 6 – Wiring Devices - Dimensional Requirements.
2. Underwriters Laboratories, Inc. (UL):
    a. 20 – General-Use Snap Switches.
    b. 498 – Standard for Attachment Plugs and Receptacles.
    c. 514A – Metallic Outlet Boxes.
    d. 894 – Standard for Switches for Use in Hazardous (Classified) Locations.
    e. 943 – Ground-Fault Circuit-Interrupters.

f. 1010 – Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirement for the mechanics and administration of the submittal process.
2. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. See Specification Section 26 05 00 – Electrical Basic Requirements for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Light switches and receptacles:
   a. Bryant
   b. Cooper Wiring Devices
   c. Hubbell
   d. Leviton
   e. Pass & Seymour
   f. Crouse-Hinds
   g. Appleton Electric Co.
   h. Killark

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 LIGHT SWITCHES

A. General requirements unless modified in specific requirements paragraph of switches per designated areas or types:

1. Toggle type, quiet action, Industrial Specification Grade.
2. Self-grounding type with grounding terminal.
3. Side wired.
4. Solid silver cadmium oxide contacts.
5. Rugged urea housing and one-piece switch arm.

6. Rated 20 A, 120/277 Vac.
7. Switch handle color: black.
8. Types as indicated on the Drawings:
   a. Single-pole.
   b. Double-pole.
   c. 3-way.
   d. 4-way.
9. Standards: UL 20, UL 514A, NEMA WD 6.

B. Architecturally Finished Areas:
   1. Wall plate:
      a. Type 302 stainless steel.
      b. Single or multiple gang as required.

C. Dry Non-architecturally Finished Areas:
   1. Cover plate:
      a. Type 302 stainless steel.
      b. Single or multiple gang as required.

D. Wet Non-architecturally Finished Areas:
   1. Cover plate:
      a. Gasketed aluminum cover plate, Appleton FSKWT2 with stainless steel screws.
      b. Single or multiple gang as required.

E. Corrosive Areas:
   1. Cover plate:
      a. Gasketed copper free aluminum with stainless steel screws.
      b. Single or multiple gang as required.

2.3 RECEPTACLES

A. General requirements unless modified in specific requirements paragraph of receptacles per designated areas:
   1. Straight blade, Industrial Specification Grade.
   2. Brass triple wipe line contacts.
   3. One-piece grounding system with double wipe brass grounding contacts and self-grounding strap.
   4. Side wired.

5. Rated 20 A, 125 Vac.
6. High impact nylon body.
7. Receptacle body color:
   a. Normal power: black.
   b. Generator or UPS power: Red.
8. Types as indicated on the Drawings:
   a. Normal: Self grounding with grounding terminal.
   b. Ground fault circuit interrupter with test and reset buttons.
9. Duplex or simplex as indicated on the Drawings.
10. Configuration: NEMA 5-20R.
11. Standards: UL 498, UL 514A, UL 943, NEMA WD 1, NEMA WD 6.

B. Architecturally Finished Areas:
   1. Wall plate: Type 302 stainless steel.
   2. Single or multiple gang as required.

C. Dry Non-architecturally Finished Areas:
   1. Cover plate:
      a. Type 302 stainless steel.
      b. Single or multiple gang as required.

D. Wet Non-architecturally Finished Areas:
   1. Cover plate: Weatherproof (NEMA 3R) while in use, gasketed, copper-free aluminum, 2.5 IN minimum cover depth.
   2. Appleton FSK-WGF1.
   3. Approved Equal.

E. Corrosive Areas:
   1. Corrosion resistant thermoplastic.
   2. Receptacle body color: Yellow.
   3. Carlon E98GRDN-CAR.

F. Special Purpose Receptacles:
   1. NEMA configuration as indicated on the Drawings.
   2. Cover plate: See requirements per area designations herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05 00 – Electrical Basic Requirements.

C. See Specification Section 26 05 33 – Raceways and Boxes for device outlet box requirements.

D. Where more than one (1) receptacle is installed in a room, they shall be symmetrically arranged.

1. GFCI receptacles wired on side only (no feed through).

Provide blank plates for empty outlets.

END OF SECTION

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SECTION 31 11 00
CLEARING AND GRUBBING

Part 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clearing and Grubbing

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Measurement

1. Measurement is not required.

B. Payment

1. Payment for the work specified will be made at the lump sum price bid for “Clearing and Grubbing”, which payment shall constitute full compensation for labor, equipment, tools, and incidentals necessary to complete the specified work, including refilling of depressions . No payment will be made for clearing and grubbing in the borrow or waste disposal areas, and all costs thereof shall be included in the appropriate bid price of the type of work involved.
2. The amount bid for “Clearing and Grubbing” shall not exceed 1 percent of the total amount bid, exclusive of “Mobilization” and “Clearing and Grubbing.”

1.3 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to perform operations in connection with clearing, grubbing, and disposal of cleared and grubbed materials.

1.4 QUALITY ASSURANCE; DEFINITIONS

A. Clearing: Clearing is defined as the removal of trees, shrubs, bushes, and other organic matter at or above original ground level.

B. Grubbing: Grubbing is defined as the removal of stumps, roots, boards, logs, and other organic matter found at or below ground level.

1.5 WARRANTY (NOT USED)

Part 2 - PRODUCTS (NOT USED)

Part 3 - EXECUTION

3.1 PREPARATION

A. Mark areas to be cleared and grubbed prior to commencing clearing operations. The Owner's Representative shall approve clearing and grubbing limits prior to commencement of clearing operations.

B. Trees and shrubs outside of the clearing limits, which are within 10 feet of the clearing limits, shall be clearly marked to avoid damage during clearing and grubbing operations.

C. Remove trees and brush outside the clearing limits, but within the immediate vicinity of the work, upon receipt of approval by the Owner's Representative, when the trees or brush interfere with the progress of construction operations.

D. Clearly mark trees and shrubs within the clearing limits, which are to remain, and protect the trees and shrubs from damage during the clearing and grubbing operations.

E. The clearing limits shall not extend beyond the project limits.

F. Establish the clearing limits as follows:

1. Embankments plus 10 feet beyond the toe of the embankment.
2. Excavations plus 5 feet beyond the top of the excavation.
3. Concrete structures plus 10 feet beyond the edge of the footing.
4. Roadways, runways, taxiways, and parking areas plus 5 feet beyond the edge of pavement or R.O.W. limits.
5. Retaining walls plus 10 feet beyond the edge of the footing.
6. Railroads plus 10 feet beyond the edge of the subgrade.
7. Underground utility trench top width plus 8 feet.
8. Coordinate with electric power provider for appropriate clearance width in feet along the centerline of the overhead utility lines.

G. Establish the grubbing limits as follows:

1. Embankments plus 2 feet beyond the toe of the embankment.
2. Concrete structures plus 2 feet beyond the edge of the footing.
3. Roadways, runways, taxiways, and parking areas plus 1 foot beyond the edge of pavement.
4. Retaining walls plus 2 feet beyond the edge of the footing.
5. Railroads plus 2 feet beyond the edge of the subgrade.

3.2 INSTALLATION

A. Clearing: Clearing shall consist of the felling, cutting up, and the satisfactory disposal of trees and other vegetation, together with the down timber, snags, brush, rubbish, fences, and debris occurring within the area to be cleared.

B. Grubbing:

1. Grubbing shall consist of the removal and disposal of stumps and roots larger than 1 inch in diameter.
2. Extend grubbing to the depth indicated below: In the case of multiple construction items, the greater depth shall apply.
   a. Footings: 18 inches below the bottom of the footing.
   b. Walks: 12 inches below the bottom of the walk.
   c. Roads and Taxiways: 18 inches below the bottom of the subgrade.
   d. Parking Areas: 12 inches below the bottom of the subgrade.
   e. Runways: 24 inches below the bottom of the subgrade.
   f. Embankments: 24 inches below existing ground.
   g. Railroads: 24 inches below the bottom of the subgrade.
   h. Concrete Structures: 18 inches below the bottom of the concrete.
   i. Retaining Walls: 18 inches below the bottom of the footing.

3.3 FIELD QUALITY CONTROL

A. Timber, logs, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, may be burned or removed at the Contractor's option from the Owner's property. However, when permitted in writing by the Engineer, disposal of material may be done without the burning logs and large stumps, as elected by the Contractor. Such permit shall state the conditions covering the disposal of logs and stumps without burning, including the areas of disposal. Burn timber and other refuse to be disposed of at locations approved by the Owner and in a method that does not damage to existing structures, construction in progress, trees, and vegetation.

B. The Contractor shall be responsible for compliance with the Federal, State, County, and Municipal laws and regulations relative to the building of fires. Constantly monitor the disposal by burning until the fires have burned out or have been extinguished. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner.

C. Burn materials weekly during the clearing and grubbing operations, unless permission is granted by the Owner's Representative to store the materials for longer periods.

D. Completely remove timber, logs, roots, brush, rotten wood, and other refuse from the Owner's property. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner. Materials shall be removed from the site daily, unless permission is granted by the Principal Architect/Engineer to store the materials for longer periods.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 31 21 33

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, trenching, backfilling and compacting for all underground utilities.
2. Specification Section is applicable to the utilities scheduled in Specification Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements, and fill materials used for tank in Specification Section 33 16 14 – Reservoirs: Prestressed Concrete.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.
4. Division 26 – Electrical.
5. Section 31 23 00 – Earthwork.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost for installed underground piping, sewer, conduit or ductwork.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C33 – Standard Specification for Concrete Aggregates.
   b. C40 – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
   c. C94 – Standard Specification for Ready-Mixed Concrete.
   d. C123 – Standard Test Method for Lightweight Particles in Aggregate.
   e. C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

f. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

g. C142 – Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

h. D558 – Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.

i. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

j. D1140 – Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve.

k. D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

l. D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

m. D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

n. D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

o. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

p. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

q. D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

2. Texas Department of Transportation (TxDOT):

   a. Tex-101-E – Preparing Soil and Flexible Base Materials for Testing.

   b. Tex-110-E – Particle Size Analysis of Soils.

   c. Tex-460-A – Determining Crushed Face Particle Count.

3. Occupational Safety and Health Administration (OSHA):

   a. Federal Regulations – 29 CFR Part 1926,

4. AWWA Standards – Excavation:

   a. AWWA M9 – Concrete Pressure Pipe

   b. AWWA M11 – Steel Water Pipe

5. Geotechnical Reports

   a. Geotechnical Engineering Report, Woodlands Water Plant No. 4, Ground Storage Tank No. 2, The Woodlands, Texas, Terracon Consultants, Inc.

B. Qualifications:

1. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by the Owner.
2. Contractor shall provide licensed professional engineer licensed in Texas for design of trench shoring systems or other trench safety plans.

1.4 DEFINITIONS

A. Classification of Excavation: Excavation shall be "unclassified" and involves the removing of the necessary materials to provide the trench to the required width and depth. The Contractor, prior to submitting a proposal, must satisfy himself as to the actual subsurface conditions. No extra or separate payments shall be made for rock, dewatering, or any other condition.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Submit planned typical method of excavation, backfill placement and compaction including:
   a. Trench widths.
   b. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction
   c. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
4. Submit backfill material sources and product quality information in accordance with requirements of this section.
5. Submit sieve analysis reports on all granular materials.
6. Certified Test Reports for embedment material, coarse gravel, and flexbase. Certified Test Reports shall be from an independent laboratory. Test reports shall include sieve analysis, Atterburg limits, and results of an Abrasion test.

B. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts and gradients.
3. Submit 11-inch by 17-inch copy of Drawing with plotted utility or obstruction location titled Critical Location Report to Owner's Representative as described in 1.6.D.1. Drawing shall be signed and sealed by R.P.L.S.
4. Submit trench excavation safety program.
5. Submit trench shield (trench box) certification if employed:
   a. Specific to Project conditions.
   b. Re-certified if members become distressed.
   c. Certification by licensed professional structural engineer, licensed in the State of Texas
   d. Owner's Representative and Owner are not responsible to, and will not, review and approve.

1.6 PROJECT CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner's Representative to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner's Representative and controlling agency.

D. Protection of Existing Structures and Utilities
   1. The Contractor shall advise the Owner's Representative of any existing utilities that are not shown on the Drawings, or are shown incorrectly, that affect the pipe layout. Contractor shall also propose a resolution to the utility conflict for the Owner's Representative's review. The Owner's Representative will determine whether the utility will be relocated or the proposed pipeline location revised. If the pipeline location is revised, an adjustment to the Contract price will be agreed to as described in the General Conditions. If the proposed pipe grade is adjusted by 2 vertical feet or less, no Contract Price adjustment will be made. If the proposed pipe grade is adjusted by more than 2 vertical feet, a Contract Price adjustment will be agreed to as described in the General Conditions.

2. Utilities that affect the pipe layout will be interpreted by the Owner's Representative as follows:
   a. Utilities that conflict with the grade of the proposed pipe will be interpreted as affecting the pipe layout.
   b. Utilities that conflict with the operations and maintenance of the proposed pipe will be interpreted as affecting the pipe layout.

E. Where excavation endangers adjacent structures and utilities, the Contractor shall, at his own expense, carefully support and protect such structures and/or utilities so that there shall be no damage. In the case where the structure cannot be protected and must be temporarily or permanently relocated, Contractor will be compensated for actual cost only once approved by the Owner's Representative.

F. If in the opinion of the Owner's Representative, concrete backfill is necessary for the support of utility lines crossing trenches, the Owner's Representative may direct 2000 psi concrete backfill to be used. Payment shall be made to the Contractor at the unit price bid for the installation of such quantity of the concrete backfill as directed by the Owner's Representative.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:
   1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
      a. Plasticity index: non-plastic.
      b. Gradation: D_{60}/D_{10} - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
   2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
      a. Plasticity index: non-plastic to 4.
      b. Gradations:
         1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.

2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.

3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.

3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
   a. Plasticity index: greater than 7.
   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
4. Class IVA: Lean clays (CL).
   a. Plasticity Indexes:
      1) Plasticity index: greater than 7, and above A line.
      2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
   b. Liquid limit: less than 50.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
5. Class IVB: Fat clays (CH).
   a. Plasticity index: above A line.
   b. Liquid limit: 50 or greater.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.2 MATERIALS

A. Soils classified as silt (ML), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials.
   1. These soils may be used for site grading and restoration in unimproved areas as approved by the Owner's representative.
   2. Soils in Class IVB, fat clay (CH) may only be used as backfill materials outside of roadways and where otherwise allowed by this Specification Section.

B. Provide backfill material that is free of stones greater than 2 IN, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C142.
2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C123.
3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C40.
4. Clay Clods: Less than 4 inches in least dimension.
5. In no case will the above materials be permitted in the pipe zone.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in the product specification, and approved by the Owner's representative, provided that the physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, or SW by the Unified Soil Classification System (ASTM D2487) meeting the following requirements:

1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140.
   a. The amount of clay lumps or balls not exceeding 2 percent.
2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D4318:
   a. Liquid limit: not exceeding 25 percent.
   b. Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C33 and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
3/8 IN	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to the requirements of ASTM C33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
3/8 IN	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of angular gravels and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
1/2 IN	100
3/8 IN	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for the same construction activity from a single source.
2. Non-plastic fines.
3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C131.
4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by Test Method TxDOT Tex-460-A, Part I.

5. Crushed stone:
   a. Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source.
   b. Uncrushed gravel are not acceptable materials for embedment where crushed stone is shown on the applicable utility embedment drawing details.
   c. Where coarse gravel is required for water drainage, restoration of trench foundation, or other uses, it shall be crushed stone in compliance with ASTM C33 for Coarse Concrete Aggregate. Gradation shall be ASTM C33 No. 57, No. 67, or as follows:

Sieve Size Sq. Openings	Amount Passing Percent by Weight
1”	95-100
3/4”	55-85
1/2”	25-50
No. 4	0-5

6. Crushed Concrete:
   a. The Owner’s Representative will make a determination as to whether crushed concrete can be allowed and what the acceptable gradation is.
   b. Gradation and quality control test requirements are the same as crushed stone.
   c. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with TxDOT Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15 IN	15 IN - 8 IN	<8 IN
1 IN	95 - 100	100	-
3/4 IN	60 - 90	90 - 100	100
1/2 IN	25 - 60	-	90 - 100
3/8 IN	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20 or clayey soils treated with lime to meet plasticity criteria. Refer to Geotechnical Report.

J. Native Backfill (On-site Soils): Any suitable soil or mixture of soils initially excavated during trench excavation, meeting the requirements of section 2.2 B and 2.2.I. of this Specification, and within Classes I, II, III and IV; or fat clay (CH) where allowed by this Specification Section.

K. Chemically Treated Select Backfill: Any suitable soil or mixture of soils meeting the requirements 2.2.B and 2.2.I or 2.2.J treated with a lime/fly-ash mixture. Chemicals should be applied as 2 to 3 percent lime and 7 to 8 percent fly-ash per dry weight of soil. Pre-mixed lime/flyash mixtures may be used at a rate of 67 pounds per square yard per 80inch depth, given a mixture of 20-30 percent lime to 70-80 percent fly-ash.

L. Cement Stabilized Sand:

1. Sand-cement mixture shall produce a minimum unconfined compressive strength of at least 100 pounds per square inch in 48 hours and contain not less than 1.5 sacks of cement per ton of dry sand.

   a. Design will be based on strength specimens molded in accordance with ASTM D558 at a moisture content within 2 percent of optimum and within 4 hours of batching.

   b. Determine minimum cement content from production data and statistical history.

   c. Granular material to be used as cement stabilized sand should be well graded and have the grain size characteristics as listed below:

Sieve	Percent Passing
No. 4	55 to 100
No. 10	37 to 100
No. 40	24 to 100
No. 200	10 to 20

2. Cement: Type I Portland cement conforming to ASTM C150.

3. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C33, or requirements for Bank Run Sand of this Specification Section and the following requirements:

   a. Classified as SW, SP, SW-SM, SP-SM, or SM by the United Soil Classification System of ASTM D2487.

   b. Deleterious materials:

      1) Clay lumps, ASTM C142; less than 0.5 percent.

      2) Lightweight pieces, ASTM C123; less than 5.0 percent.

3) Organic impurities, ASTM C40, color no darker than the standard color.

c. Plasticity index of 4 or less when tested in accordance with ASTM D4318.

1) Water: Potable water, free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94.

M. Concrete Backfill: Conform to Class B concrete as specified in Division 03 – Concrete.

N. Granular Embedment Material: Granular embedment material may be pea gravel or bank run sand as defined in sections 2.2 G and 2.2 D, respectively. Additionally, granular embedment material shall be free from large stones, clay, and organic material. Granular embedment material shall be a soil classification of GW, GP, SW, or SP as determined by ASTM D2487. The granular embedment material shall be such that when wet, the fine material shall not form mud or muck. The granular embedment material shall be composed of angular, tough durable particles, free from thin, flat and elongated pieces, of suitable quality to insure permanence in the trench and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or ASTM C535. The P.I. of the fines shall not exceed 3. Light weight aggregate is not acceptable for granular embedment. Material used for granular embedment shall have a resistivity of not less than 5000 ohms/cm as measured by ASTM G57.

O. Well-graded Crushed Stone Bedding Material:

1. ASTM C33, gradation 67 (3/4 IN to No. 4 sieve) defined below:

Sieve	Percent
1”	100
3/4”	90 to 100
3/8”	20 to 55
No. 4	0 to 10

P. Lime Stabilized Clay Backfill.

1. Clayey material hydrated lime or quicklime to achieve a pH of 12.4 and a plasticity index (PI) of less than 20 in accordance with ASTM D 4318.

2. The optimum lime content to be determined by lime optimization curve using specific soil sample and proposed lime additive.

Q. Flowable fill: Provide Flowable Fill in accordance with Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing as required.

R. Impervious Clay Material: Material shall be used for Trench Plug as described in geotechnical report and shown on drawings. USCS Classification of CL or CH with a plasticity index between 15 and 25.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed by Owner's Representative to site provided by Contractor.

B. Establish traffic control when working within the public right of way per applicable specifications. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

C. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as designed by the Contractor's engineer licensed in the State of Texas.

D. Immediately notify agency or company owning any existing utility line which is damaged, broken or disturbed. Obtain approval from Owner's Representative and agency for any repairs or relocations, either temporary or permanent.

E. Maintain permanent benchmarks, monumentation and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed.

F. Limit pavement removal to less than five pipe laying days in advance of pipe laying.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, sand, gravel, hard pan, loose shale, and loose stone to required lines and grades, or as directed by Owner's Representative.

B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Owner's Representative and obtain instructions before proceeding.

C. Excavation for Appurtenances:

1. 12 IN (minimum) clear distance between outer surface and embankment.
2. See Specification Section 31 23 00 – Earthwork for applicable requirements.

D. Groundwater Dewatering:

1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade, to allow subgrade stabilization, pipe, bedding, embedment, and backfill material to be placed in a dry, stable trench.
2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.

3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
   a. Employ dewatering specialist for selecting and operating dewatering system.
4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. No additional payment for groundwater dewatering.

E. Critical Location Investigation

1. Prior to manufacturing pipe, the contractor shall properly locate and identify all existing utilities in proximity to the water line corridor. The contractor shall confirm utilities using vacuum excavation or other suitable excavation method and provide a submittal to the Owner with their findings and proof of completion.
2. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. Unless otherwise approved by Owner's Representative, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within zone of 2 feet vertically and 4 feet horizontally of proposed work.
   a. Verify location of existing utilities prior to manufacturing pipe and prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.
   b. Notify Owner's Representative in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Owner's Representative is notified of obstruction.
3. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Owner's Representative with 48 hours notice prior to field excavation or related work.

4. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter water lines, submit to Owner's Representative for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed, and sealed by R.P.L.S. as described in 1.5.B.3.

F. Protection

1. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01 56 39 – Temporary Tree and Plant Protection.
2. Protect and support above-grade and below-grade utilities which are to remain.
3. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.
4. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to Owner.

G. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
   a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
      1) Stabilize excavation to prevent undermining of existing utility and yard piping.
2. Open trench outside buildings, units, and structures:
   a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
   b. No more than 100 LF of open trench where located on or parallel and adjacent to the Conroe Dam embankment.
   c. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
   a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner's Representative, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
   a. Said trench may not be reopened until Owner's Representative is

satisfied that work associated with trench will be prosecuted with dispatch.

H. Pipe Trench:

1. The "pipe zone" shall be defined as the zone from 12 inches below the bottom of the pipe to 12 inches above the top of the pipe, unless otherwise noted on Drawings.
2. The trench walls in the pipe zone shall be vertical. Trench widths shall be as shown on the Drawings.
3. Trench walls above the pipe zone may be laid back or benched where room permits as necessary to meet the requirements of OSHA.
4. For semi-rigid pipe or flexible pipe (including AWWA C200 steel pipe, AWWA C303 bar-wrapped concrete cylinder pipe, PVC, Ductile Iron, and other pipe materials as listed in appropriate specifications), where the character of the trench walls is loose, unstable, saturated soft clays, quicksand or otherwise unable to provide adequate side support to maintain the required pipe deflection, the Contractor shall modify the backfill to keep the pipe within the limits of the specified pipe deflection.
   a. Contractor shall widen the trench excavation to accommodate modified backfill procedure.
   b. Contractor shall protect exterior pipe coating, and shall repair any damage caused by backfilling.
   c. Concrete encasement, soil cement, flowable fill or some other method approved by the Owner's Representative may be used in lieu of this procedure.

I. Pipe Foundation:

1. Excavate the trench to an even grade so that the full length of the pipe barrel is supported and joints make up properly. Excavate the trench to the line and grade indicated and as directed by the Owner's Representative. Grades shall be uniform between high points and low points to eliminate intermediate "highs and lows."
2. The trench shall be "rough cut" a minimum of 12 inches below the bottom of the pipe, unless otherwise noted on drawings. The "rough cut" dimension shall be increased as necessary to provide a minimum clearance of 2 inches from the bottom of the trench to the bottom of the bells, flanges, valves, fittings, etc.
3. The entire foundation area in the bottom of all excavations shall be firm, stable material. Loose material shall be removed, leaving a clean, flat trench bottom, and material shall not be disturbed below required sub grade except as hereinafter described. If the subgrade is soft, spongy, disintegrated, or where the character of the foundation materials is such that a proper foundation cannot be obtained at the elevation specified, then

when directed by the Owner's Representative the Contractor shall deepen the excavation to a depth where a satisfactory foundation can be obtained. The subgrade shall then be brought back to the required grade with the well-graded crushed stone bedding materials and construction methods specified in section 3.3 and 3.4 of this specification. Payment for additional excavation and backfill shall be made at the unit price bid in the Proposal.

4. Remove soft, loose or spongy foundation soil caused by Contractor failure to dewater, rainfall, or Contractor operations. Replace with well-graded crushed stone bedding material, as noted above, with no additional compensation.

5. If over excavation does not yield satisfactory foundation conditions, then construct the foundation in accordance with section 3.3 J. of this specification.

J. Correcting Faulty Grade:

1. If the trench is excavated to a faulty grade (at a lower elevation than indicated), correct the faulty grade as specified below:

a. In uniform, stable dry soils, correct the faulty grade with embedment material thoroughly compacted, as defined in sections 3.3 and 3.4 of this specification.

b. In soft spongy disintegrated soils or where necessary to allow proper drainage, correct the faulty grade using well-graded crushed stone bedding in accordance with section 3.3 J. of this specification.

c. Maximum allowable loose lift thickness for embedment or well-graded crushed stone bedding material shall be 8 inches.

K. Pipe Clearance in Rock: Remove ledge rock, rock fragments, or unyielding shale or marl to provide a clearance of at least 12 inches below the parts of the pipe, valves or fittings. Provide adequate clearance for properly jointing pipe laid in rock trenches at bell holes. Refill the excavation to grade with embedment material.

L. Blasting Procedure: Blasting shall not be allowed.

M. Bell Holes Required:

1. Bell holes of ample dimension shall be dug in trenches at each joint of pipe to permit the jointing to be made properly, visually inspected, and so that the pipe will rest on the full length of the barrel.

2. Pipe with field-applied exterior coatings shall have the joints excavated to sufficient depth to allow proper cleaning, application, testing and inspection of the field-applied coating system.

N. Care of Surface Material for Reuse: Surface materials such as topsoil in its natural state, suitable for reuse in restoring the excavated surface, shall be kept separate from the general excavation material. The top 12 inches of the trench backfill shall be considered topsoil. Save the topsoil to be used as backfill of

the top 12 inches of the trench after pipe laying.

O. Manner of Piling Excavated Material: Place excavated material so that Work is not endangered or interferes with public traffic, or the stability of excavations and open trenches. Do not place excavated material over buried pipelines or existing utilities unless adequate provisions are made to protect those pipelines and/or utilities. Roads and driveways must be kept open in every case. Keep drainage channels clear of obstructions or make other satisfactory provisions for drainage.

P. Trenching by Machine or by Hand: The use of trench digging machinery is approved except in places where operations of same will cause damage to existing structures above or below ground, in which case employ hand methods.

Q. Trenching for Electrical Installations:

1. Observe the Trench Excavation paragraph above.
2. Modify for electrical installations as follows:
   a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN, but not more than 30 IN wide.
   b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
   c. Do not over excavate trench.
   d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
   e. See Division 26 – Electrical for additional requirements.

3.3 BACKFILLING OF TRENCHES OUTSIDE ROADWAYS

A. General: This Section is intended to cover the requirements for trench backfill where trench is in open fields, unimproved alleys, fields, and other similar open areas, except public and private roadways.

B. Time of Backfilling: Backfill operations shall immediately follow pipe jointing, joint coating application, and curing.

C. Braced and Sheeted Trenches: Remove sheeting and shoring as backfilling operations progress. Incorporate methods so that a good bond is obtained between the backfill material and the undisturbed trench walls.

D. Protection of Pipe during Backfilling Operations: Take the necessary precautions to protect the pipe during backfilling operations. Take care to prevent damage to the pipe or to the pipe coating, and repair any damaged pipe before being “covered up”. Backfill the trench to prevent the deformation or otherwise deflection of the cylindrical shape of the pipe by more than the allowable pipe deflection as specified elsewhere. Use methods such as stulling or ellipsing as necessary.

E. Site and Preparation: In addition to clearing and grubbing of brush and trees along the right of way for this Project, alteration to the topography shall be done if indicated on the Drawings, at the locations and to the extent shown.

F. Compaction: All compaction shall be in accordance with specification 3.6 of this specification. See specification section 3.6 for density and testing requirements.

G. Backfill Procedure for Water Lines:

1. Embedment material for water lines shall granular embedment material as specified in section 2.2 N. Place the first lift of granular embedment material (bedding layer) to a depth slightly above the bottom of pipe grade and compact. Lay pipe on this material to the indicated grade. Provide bell holes to permit the pipe to rest on the full length of the barrel and to permit joint make-up.

2. Place subsequent lifts of granular embedment uniformly on both sides of the pipe to a depth of 12 inches above the pipe. Compact using low ground pressure vibration or mechanical tamping in 6 to 8 inch loose lifts. Contractor shall take precautions to ensure no voids occur under the haunches of the pipe and to prevent disturbance of the pipe alignment. The Contractor shall be responsible for any damage that may occur to the pipe.

3. Backfill above pipe zone:

   a. Under unimproved areas: After placement and compaction of the granular embedment, place native backfill in the trench for the full width of the trench to the top of the trench. Consolidate this material by mechanical compaction in 6 to 8 inch loose lifts. The Contractor shall be responsible for any damage that may occur to the pipe.

   b. Under proposed paving: After placement and compaction of the granular embedment, deposit native backfill in the trench for the full width of the trench to within 3 feet of pavement subgrade then place lime stabilized clay or cement stabilized sand or Owner approved select backfill to immediately below pavement subgrade. Consolidate this material by mechanical compaction in 6 to 8 inch loose lifts. The Contractor shall be responsible for any damage that may occur to the pipe.

H. Backfill Procedure for Storm and Sanitary Lines:

1. Embedment material for storm and sanitary sewer lines shall cement stabilized sand as defined in section 2.2 K. Place the first lift of cement stabilized sand to the bottom of pipe grade and compact. Lay pipe on this material to the indicated grade. Provide bell holes to permit the pipe to rest on the full length of the barrel and to permit joint make-up.

2. Place subsequent lifts of cement stabilized sand uniformly on both sides of the pipe to 12 inches above the top of the pipe. Compact using low ground pressure vibration or mechanical tamping in 6 to 8 inch loose lifts.

Contractor shall take precautions to ensure no voids occur under the haunches of the pipe and to prevent disturbance of the pipe alignment.

3. Backfill above pipe zone:

   a. Under unimproved areas: Place the native material above the pipe zone in lifts not exceeding 8 inches loose depth. Mechanical compaction shall be utilized. The Contractor shall be responsible for any damage that may occur to the pipe.

   b. Under proposed paving: Continue placement and compaction of the cement stabilized sand in the trench for the full width above. Consolidate this material by mechanical compaction in 6 to 8 inch loose lifts. The Contractor shall be responsible for any damage that may occur to the pipe.

I. Surface Material Replacement:

1. The top 12 inches of the trench backfill shall be composed of the original surface material or topsoil excavated from the trench. Place the topsoil over the consolidated trench backfill material and neatly round over the trench to a sufficient height to allow settlement to grade after consolidation. Grade the surface to allow drainage in the same manner as existed prior to construction.

2. Top soil shall not contain rocks or clods larger than those adjacent to the trench in the undisturbed condition.

J. Backfill in Wet Conditions:

1. If wet conditions are encountered, backfill utilities lines in accordance with details provided in the Drawings for wet trench construction.

K. Flowable Fill:

1. Backfill the pipe trench with flowable fill to 12 inches above the top of the pipe. Pipe shall be blocked up on soil pads to allow a minimum of 6 inches of flowable fill below the pipe.

2. Discharge from a mixer by any means acceptable to the Owner's representative into the area to be filled.

3. Place in 4 FT maximum lifts to the elevations indicated.

   a. Allow 12 HR set-up time before placing next lift or as approved by the Owner's representative.

   b. Place flowable fill lifts in such a manner as to prevent flotation of the pipe.

4. Do not place flowable fill on frozen ground.

5. Place flowable fill on subgrade free of disturbed or softened material and water.

6. Conform to appropriate requirements of Specification Section 31 23 00.

7. Start flowable fill batching, mixing, and placing if weather conditions are favorable, and the air temperature is 34 DegF and rising.
8. Temperature of flowable fill at the time of placement: At least 40 DegF.
9. Stop mixing and placing when the air temperature is 38 DegF or less and falling.
10. Each filling stage shall be as continuous an operation as is practicable.
11. Prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
12. Do not place flowable fill until water has been controlled or groundwater level has been lowered in conformance with the requirements of the Groundwater Dewatering paragraph in this Specification Section.

L. Backfilling for Electrical Installations:

1. Observe backfilling methods described above or when approved by the Owner's representative.
2. Modify for electrical installation and observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.4 BACKFILL PROCEDURE FOR UTILITIES UNDER EXISTING PUBLIC AND PRIVATE ROADS OR UNDER OTHER UTILITIES

A. Compact backfill material within the pipe zone as described in 3.3.

B. For trench excavation above the pipe zone, fill the excavation to the pavement subgrade with cement stabilized sand compacted to 95 percent standard density at plus 2 to minus 1 percent optimum moisture in maximum 6 to 8 inch lifts.

3.5 TRENCH SHORING AND BACKFILL

A. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Owner's Representative. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.

B. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Recompact after shield is moved is soil is disturbed.
3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
5. Conform to applicable Government regulations.

C. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

D. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

E. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber–tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of pipeline company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by pipeline company's representative.

3.6 COMPACTION

A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:

1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.

LOCATION	MATERIAL	COMPACTION DENSITY
All applicable areas	Bank sand	95 percent of standard proctor density, +2 to -1% optimum density, by ASTM D698 and ASTM D2922
	Pea gravel	95 percent of maximum relative density by ASTM D4253 and ASTM D4254
	Well-graded crushed stone	95 percent of maximum relative density by ASTM D4253 and ASTM D4254
	Impervious Clay Material	95 percent of standard proctor density by ASTM D2922
	Select Backfill	95 percent of the Modified Effort maximum dry density, by ASTM D1557
	Native backfill	95 percent of the Modified Effort maximum dry density, by ASTM D1557
	Cement stabilized sand	95 percent of standard proctor density, +2 to -1% optimum density, by ASTM D558 and ASTM D2992

3.7 FIELD QUALITY CONTROL

A. Testing:

1. In-place density tests of compacted materials will be performed by Owner's Representative according to the standards provided in section 3.6, and at the following frequencies and conditions.
2. Owner will provide a recognized testing laboratory capable of performing a full range of testing procedures complying with the standards or testing procedures specified. The testing lab shall provide certified technicians that are trained and knowledgeable in, in-trench nuclear density testing, sand cone, concrete sampling and testing, ASTM D698 and D1557 proctors at a minimum.
3. Testing Frequency: Accommodate the Owner's Representative in performing the following:
   a. Testing: Pothole every 1000 feet and grab Samples at pipe level for materials testing and proctors.

b. Owner's Representative shall take a minimum of three in-trench/ pipe zone nuclear density tests every 150 feet of installed pipe.

c. Owner's Representative shall take a minimum of three nuclear density tests above the pipe zone for every 150 feet.

d. Owner's Representative shall take a minimum of three in-trench/pipe zone nuclear density test and a minimum of three above pipe zone nuclear density test at all open cut road crossings.

e. Contractor to update his field "as-built" drawings with density test locations in the profile.

4. When requested by Owner's Representative, Contractor shall excavate test pits after the backfill has been placed and compacted in the pipe zone for the purpose of taking field density tests and inspecting the haunch areas under the pipe for voids.

5. When requested by Owner's Representative, Contractor shall excavate the test pits to a depth and area of sufficient size to allow the inspector to visually inspect the haunch area of the pipe for voids or loose material next to the pipe and to make a field density test. Provide a safety trench shield to protect the inspector while in the pit.

6. After inspection, backfill and compact the test pit area in accordance with the applicable specification herein.

7. Dig one test pit for inspection of each day's work, if deemed necessary, as determined by the Owner's Representative. Repair and replace areas that are found not to be in compliance with the Specification requirements, until satisfactory results are consistently and uniformly attained.

8. Special care should be taken by the Contractor to ensure the backfill material flows under the pipe haunches. The Contract's method and procedures used to accomplish this will be observed to confirm that adequate results are being achieved. This may require the removal of pipe joints to observe the results and make density tests. Pipe laying shall not begin until satisfactory results are achieved by the Contractor's proposed method. Perform additional tests as directed until compaction meets or exceeds requirements.

   a. Cost associated with "Failing" tests shall be paid by Contractor.

9. Assure Owner's representative has immediate access for testing of all soils related work.

10. Ensure excavations are safe for testing personnel.

3.8 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 31 21 33.01

EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Measurement and payment applicable to extra unit price work items for excavation and backfill made necessary by unusual or unforeseen circumstances encountered during utility installations.
2. Extra unit price work for excavation and backfill is paid only when authorized in advance by Owner or Owner's Representative.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Excavation Around Obstructions: Payment for excavation around obstructions is on cubic yard basis, measured in place, without deduction for volume occupied by portions of pipes, ducts, or other structures left in place across trenches excavated under this item.

B. Extra Hand Excavation: Payment for extra hand excavation is on cubic yard basis, measured in place.

C. Extra Machine Excavation: Payment for extra machine excavation is on cubic yard basis, measured in place.

D. Extra Placement of Backfill Material: Payment for extra placement of backfill material is on cubic yard basis, measured in place, for material installed as part of Work. At discretion of Owner or Owner's Representative, measurement of cubic yards may be calculated from volume of Extra Hand Excavation or Extra Machine Excavation for which replacement is made, minus volume of any Extra Placement of Granular Backfill authorized in conjunction with Work.

E. Extra Placement of Granular Backfill: Payment for extra placement of granular backfill material is on cubic yard basis, measured in place.

F. Extra Select Backfill: Payment for extra select backfill is on cubic yard basis, measured in place for a theoretical minimum trench width. The Owner or Owner's Representative may authorize extra select backfill when soil from the excavation work does not include adequate quantities for placement of suitable on-site material (random backfill).

G. Refer to Section 00 21 00 – Unit Prices for unit price procedures.

1.3 DEFINITIONS

A. Excavation Around Obstructions: Excavation necessitated by obstruction of pipes (other than service connections 3 inches in diameter or less), ducts, or other structures, not shown on Drawings, and of an unusual or unforeseen nature which interfere with installation of utility piping by normal methods of excavation or auguring.

B. Extra Hand Excavation: Excavation by manual labor made necessary by unusual or unforeseen circumstances at locations approved in advance by Owner's representative.

C. Extra Machine Excavation: Excavation by machine at or near project site to perform related work not included in original project scope but added for convenience of Owner, as approved in advance by Owner's representative.

D. Extra Placement of Backfill Material: Handling, backfill, and compaction of excavated material authorized under extra work bid items for Extra Hand Excavation or Extra Machine Excavation. Placement and compaction shall conform to requirements specified for excavation and backfill in Division 31 – Earthwork.

E. Extra Placement of Granular Backfill: Hauling, placing, and compacting granular backfill materials as approved by Owner's Representative in conjunction with Extra Placement of Backfill Material. Materials placed under this item shall conform to requirements for Bank Run Sand, Cement Stabilized Sand, Concrete Sand, Gem Sand, Crushed Stone, or Crushed Concrete specified for backfill material in Division 31 - Earthwork.

F. Extra Select Backfill: Unsuitable material removed from the project and select backfill material hauled to the project, or conditioning unsuitable material on the site to make it select backfill. Provide select backfill material specified in Section 31 21 33 Trenching, Backfilling, and Compacting for Utilities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 31 23 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.
4. Section 33 16 14 – Reservoirs: Prestressed Concrete

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):

a. C33 – Standard Specification for Concrete Aggregates.

b. D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).

c. D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m)).

d. D3786 – Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm.

e. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

f. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

g. D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

2. Geotechnical Reports
    a. Geotechnical Engineering Report, Woodlands Water Plant No. 4, Ground Storage Tank No. 2, The Woodlands, Texas, Terracon Consultants, Inc.

1.4 SUBMITTALS

A. Shop Drawings:
    1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
    2. Product technical data including:
        a. Acknowledgement that products submitted meet requirements of standards referenced.
        b. Manufacturer's installation instructions.
    3. Certifications.
    4. Test reports:
        a. Soils inspection and testing results.
B. Samples:
    1. Submit samples and source of fill and backfill materials proposed for use.
    2. Submit samples and source of borrow materials proposed for use.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill: Selected materials must be approved by Owner’s representative (Soils Engineer) from site excavation or from offsite borrow.
B. Fill and backfill materials shall be in accordance with the provisions stated in the Geotechnical Report prepared by Terracon Consultants, Inc. and section 31 21 33.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
    1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
    2. Protect and maintain bench marks, monuments or other established reference points and property corners.
        a. If disturbed or destroyed, replace at own expense to full satisfaction of

Owner and controlling agency.

3. Verify location of utilities.
   a. Omission or inclusion of utility items does not constitute non-existence or definite location.
   b. Secure and examine local utility records for location data.
   c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
   d. Repair damages to utility items at own expense.
   e. In case of damage, notify Owner's Representative at once so required protective measures may be taken.
4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
   a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
   b. All repairs to be made and paid for by Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

C. Dispose of waste materials, legally, off site.
   1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.

B. Excavation and Grading: Perform as required by the Contract Drawings.
   1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
      a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
      b. Perform other layout work required.

c. Replace property corner markers to original location if disturbed or destroyed.

2. Preparation of ground surface for embankments or fills:

a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.

b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.

3. Protection of finish grade:

a. During construction, shape and drain embankment and excavations.

b. Maintain ditches and drains to provide drainage at all times.

c. Protect graded areas against action of elements prior to acceptance of work.

d. Reestablish grade where settlement or erosion occurs.

C. Borrow:

1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification Section and in Specification Section 31 21 33.

2. Include cost of all borrow material in original proposal.

3. Fill material to be approved by Owner's Representative (Soils Engineer) prior to placement.

D. Construct embankments and fills as required by the Contract Drawings:

1. Construct embankments and fills at locations and to lines of grade indicated.

a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.

2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.

a. Ensure that stones larger than 3/4 IN are not placed in upper 6 IN of fill or embankment.

b. Do not place material in layers greater than 8 IN loose thickness.

c. Place layers horizontally and compact each layer prior to placing additional fill.

3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.

a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 ROCK EXCAVATION

A. All rock excavation shall be under one classification.

1. This classification shall include solid ledge rock in its natural location that requires systematic quarrying, drilling and/or blasting for its removal and also boulders that exceed 1/2 CY in volume.

B. When rock is encountered, strip free of earth.

1. Employ an independent surveyor to determine rock quantities before removal operation begins.
2. In computing the volumetric content of rock excavation for payment, the pay lines shall be taken as follows:
   a. For structures: 3 FT outside the exterior limits of foundations and from rock surface to 6 IN below bottom of foundations.
   b. For piping and utilities: A width 18 IN wider than the outside diameter of the pipe or conduit and from rock surface to 6 IN below bottom exterior surface of the pipe or conduit.
   c. For paving: 2 FT outside the exterior limits of paving and from rock surface to 6 IN below bottom of pavement subbase.

3.4 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.5 FIELD QUALITY CONTROL

A. Do not include in bid price the cost of inspection services indicated herein as being performed by the Owner's Representative (Soils Engineer).

B. Moisture density relations to be established by the Owner's Representative (Soils Engineer) required for all materials to be compacted.

C. Extent of compaction testing will be as necessary to assure compliance with Specifications.

D. Give minimum of 24 HR advance notice to Owner's Representative (Soils Engineer) when ready for compaction or subgrade testing and inspection.

E. Should any compaction density test or subgrade inspection fail to meet Specification requirements, perform corrective work as necessary.

F. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.6 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Owner's Representative (Soils Engineer) with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Owner's Representative (Soils Engineer).

D. Stabilize subgrade with well graded granular materials as directed by Owner's Representative (Soils Engineer).

E. Assure by results of testing that compaction densities comply with the following requirements:

1. Sitework:

LOCATION	COMPACTION DENSITY
Under Paved Areas, Sidewalks and Piping:	
Cohesive soils	100 percent per ASTM D698
Cohesionless soils	75 percent relative density per ASTM D4253 and ASTM D4254
Unpaved Areas:	
Cohesive soils	85 percent of ASTM D698
Cohesionless soils	60 percent relative density per ASTM D4253 and ASTM D4254
Levees, Dams and Canals:	
Cohesive soils	Average (10 test running average) of 98% per ASTM D698
Cohesionless soils	75 percent relative density per ASTM D4253 and ASTM D4254

2. Structures:

LOCATION	COMPACTION DENSITY
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	95 percent per ASTM D1557
Outside structures next to walls, piers, columns and any other structure exterior member	90 percent per ASTM D1557

3. Specific areas:

LOCATION	COMPACTION DENSITY
Outside structures under equipment support foundations	95 percent per ASTM D1557
Under void	85 percent per ASTM D1557

F. Compaction density requirements for utilities are not included with this specification but are found in Specification Section 31 21 33 – Trenching, Backfilling and Compaction for Utilities.

3.7 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
    a. Materials and sources to be approved by Owner's Representative (Soils Engineer).
    b. Excavated material approved by Owner's Representative (Soils Engineer) may also be used for fill and backfill.
3. In this Specification Section, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
4. In this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:
    a. Do not commence excavation for foundations for structures until Owner's Representative (Soils Engineer) approves:
        1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
        2) Density and moisture content of site area compacted fill material meets requirements of specifications.
        3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
        4) Surcharge or mass fill material has been removed from construction area or portions thereof.
    b. Owner's Representative grants approval to begin excavations.
2. Dimensions:
    a. Excavate to elevations and dimensions indicated or specified.
    b. Allow additional space as required for construction operations and inspection of foundations.

3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
   a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Owner's Representative (Soils Engineer).
4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
   a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
   b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.
   c. Do not carry excavations lower than shown for foundations except as directed by Owner's Representative (Soils Engineer).
   d. If any part of excavations is carried below required depth without authorization, maintain excavation and start foundation from excavated level with concrete of same strength as required for superimposed foundation, and no extra compensation will be made to Contractor therefore.
5. Make excavations large enough for working space, forms, damp proofing, waterproofing, and inspection.
6. Notify Owner's Representative (Soils Engineer) as soon as excavation is completed in order that subgrades may be inspected.
   a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Owner's Representative (Soils Engineer) as being free of undesirable material, being of compaction density required by this Specification Section, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
   b. Owner's Representative (Soils Engineer) shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.

c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.

d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

7. Dewatering:

a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.

b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.

c. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

d. Employ dewatering specialist for selecting and operating dewatering system.

e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.

f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.

1) Install groundwater monitoring wells as necessary.

g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

8. Subgrade stabilization:

a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Owner's Representative (Soils Engineer).

b. Provide compaction density of replacement material as stated in this Specification Section.

c. Loose, wet, or soft materials, when approved by Owner's Representative (Soils Engineer), may be stabilized by a compacted working mat of well graded crushed stone.

d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.

e. Remove and replace frozen materials as directed by Owner's Representative (Soils Engineer).

f. Method of stabilization shall be performed as directed by Owner's Representative (Soils Engineer).

g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Owner's Representative (Soils Engineer).

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.

   a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF during the day of placement unless heated to a temperature of at least 50 DegF.

10. Protection of structures:

    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.

    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

11. Shoring:

    a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.

    b. Remove shoring as backfilling progresses, but only when banks are stable and safe from caving or collapse.

12. Drainage:

    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.

    b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.

    c. Provide pumping required to keep excavated spaces clear of water during construction.

    d. Should any water be encountered in the excavation, notify Owner's Representative (Soils Engineer).

    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

13. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.
    d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
    1. General:
        a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Owner's Representative (Soils Engineer) and scarified to a depth of 6 IN and compacted to density specified herein.
        b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
        c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Owner's Representative (Soils Engineer) as being free of undesirable material and compacted to specified density.
    2. Obtain approval of fill and backfill material and source from Owner's Representative (Soils Engineer) prior to placing the material.
    3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
    4. Fill and backfill placement:
        a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Owner's Representative (Soils Engineer).
        b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
        c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
        d. Use hand operated equipment for filling and backfilling next to walls.

e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.

f. Use vibratory equipment to compact granular material; do not use water.

5. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure the following horizontal distance whichever is greater:

a. As required to provide fill material to indicated finished grade.

b. 5 FT.

c. Distance equal to depth of compacted fill below bottom of foundations.

d. As directed by Owner's Representative (Soils Engineer).

D. Filling and Backfilling Outside of Structures.

1. This paragraph of this Specification Section applies to fill and backfill placed outside of structures above bottom level of both foundations and piping, but not under paving.

2. Provide material as approved by Owner's Representative (Soils Engineer) for filling and backfilling outside of structures.

3. Fill and backfill placement:

a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Owner's Representative (Soils Engineer).

b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.

c. Compact material with equipment of proper type and size to obtain density specified.

d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.

e. Do not place fill or backfill material when temperature is less than 40 DegF and/or when subgrade to receive material is frozen, wet, loose, or soft.

f. Use vibratory equipment for compacting granular material; do not use water.

4. Backfilling against walls:

a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.

b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, damp proofing and waterproofing have been completed.

c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.

d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling Outside of Structures Under Piping or Paving:

1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.

2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.

3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections in the Project.

3.8 SPECIAL REQUIREMENTS

A. Erosion Control:

1. Conduct work to minimize erosion of site.

2. Construct stilling areas to settle and detain eroded material.

3. Remove eroded material washed off site.

4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

3.9 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 31 25 00

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil erosion and sediment control.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Erosion control standards: "Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas" by the United Sates Department of Agriculture (USDA), Soil Conservation Service, College Park, Maryland.

1.4 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales, twine tied.

B. Pipe Riser and Barrel: 16 GA corrugated metal pipe (CMP) of size indicated.

C. Stone for Stone Filter: 2 IN graded gravel or crushed stone.

D. Grass Seed: Annual ryegrass.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to General Stripping Topsoil and Excavating:

1. Install perimeter dikes and swales.

2. Excavate and shape sediment basins and traps.
3. Construct pipe spillways and install stone filter where required.
4. Machine compact all berms, dikes and embankments for basins and traps.
5. Install straw bales where indicated.
    a. Provide two stakes per bale.
    b. First stake angled toward previously installed bale to keep ends tight against each other.

B. Construct sediment traps where indicated on Drawings during rough grading as grading progresses.

C. Temporarily seed basin slopes and topsoil stockpiles:
1. Rate: 1/2 LB/1000 SF.
2. Reseed as required until good stand of grass is achieved and acceptable to Owner's Representative.

3.2 DURING CONSTRUCTION PERIOD

A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, Etc.:
1. Inspect regularly and after rainstorms.
2. Repair or replace damaged or missing items.

B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.

C. Construct inlets as soon as possible.
1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.

D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.

E. Do not disturb existing vegetation (grass and trees).

F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
1. Remove sediment from behind bales to prevent overtopping.

G. Topsoil and Fine Grade Slopes and Swales, etc.:
1. Seed and mulch as soon as areas become ready.

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Eliminate basins, dikes, traps, etc.

B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 31 41 00

TRENCH SAFETY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Trench safety system for construction of trench excavations. For structural excavations which fall under provisions of State and Federal trench safety laws.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price

1. Measurement for trench safety systems used on trench excavations is on a per linear foot basis measured along centerline of trench, including manholes and other line structures.
2. No payment will be made for Trench Safety Systems for structural excavations, tunnel shafts, auger pits, or excavation for trenchless installations under this section. Include payment for Trench Safety Systems in applicable structural or utility installation sections.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price. Texas law requires Trench Safety to be a separate pay item.

1.3 DEFINITIONS

A. Trench. Narrow excavation (in relation to its depth) made below surface of ground. In general, depth is greater than width, but width of trench (measured at bottom) is not greater than 15 feet.

B. Trench safety system requirements shall apply to larger open excavations if erection of structures or other installations limits space between excavation slope and installation to dimensions equivalent of a trench as defined.

C. Trench safety systems include, but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage. Trench safety system is Contractor's methods and means of construction.

D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

1.4 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit trench safety program specifically for construction of trench excavation. Design trench safety program in accordance with OSHA 29 CFR standards.

C. Trench safety system and special designs containing deviations from OSHA standards to be sealed by a Professional Engineer registered by State of Texas.

D. Review of trench safety system by Owner's Representative shall only be in regards to compliance with this specification and shall not constitute approval by Owner's Representative nor relieve Contractor of obligations under State and Federal trench safety laws

E. Submit certification that trench safety system will not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information. When trench box is used in a manner other than what is indicated and certified in manufacturer's technical data, submit trench box manufacturer certifications of proposed usage.

1.5 REGULATORY REQUIREMENTS

A. Install and maintain trench safety systems in accordance with detail specifications set out in provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, Subpart P, as amended, including Final Rule, published in Federal Register Vol. 54, No. 209 on October 31, 1989. Sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. Reproduction of OSHA standards included in "Subpart P - Excavations" from Federal Register Vol. 54, No. 209 is available upon request to Contractors bidding on projects. The Owner assumes no responsibility for accuracy of reproduction. Obtain copy of this section of the Federal Register.

C. Legislation enacted by Texas Legislature with regard to Trench Safety Systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).

1.6 INDEMNIFICATION

A. Contractor to indemnify and hold harmless the Owner and the Owner's Representative, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and cost of investigation), judgments or claims by anyone for injury or death of persons resulting from collapse or failure of trenches constructed under this Contract.

B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner and the Owner's Representative, its employees and agents, in case the Owner and the Owner's Representative is negligent either

by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and hiring of Contractor.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and maintain trench safety systems in accordance with provisions of OSHA 29 CFR.

B. Install specially designed trench safety systems in accordance with Contractor's trench excavation safety program for locations and conditions identified in program.

C. A competent person, as identified in Contractor's Trench Safety Program, to verify that trench boxes and other pre-manufactured systems are certified for actual installation conditions.

3.2 INSPECTION

A. Contractor, or Contractor's independently retained consultant, to make daily inspections of trench safety systems to ensure that installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, immediately stop work in trench and move personnel to safe locations until necessary precautions have been taken to safeguard personnel entering trench.

C. Maintain permanent record of daily inspections.

3.3 FIELD QUALITY CONTROL

A. Verify specific applicability of selected or specially designed trench safety systems to each field condition encountered on project.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 31 13

CHAIN LINK FENCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of the existing north perimeter fence.
2. Installation of new chain link fence on the north boundary with the location as shown on the drawings to accommodate the extension of surface water piping to the new tank. The furnishing and installing of new six (6) foot high vinyl-coated galvanized chain link fence, and related labor, materials and accessories complete in place. Fence to include three (3) strands of barbed wire mounted above the six (6) foot high chain link fabric.
3. Restoration of impacted site, including site adjacent to Water Plant No. 4 north perimeter fence.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Division 03 – Concrete.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project. Measurement for payment for fence shall be in accordance with the bid proposal.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   c. A824 – Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for use with Chain-Link Fence.
   d. F552 – Standard Terminology Relating to Chain-Link Fencing.
   e. F567 – Standard Practice for Installation of Chain Link Fence.
   f. F626 – Standard Specification for Fence Fittings.

g. F900 – Standard Specification for Industrial and Commercial Swing Gates.

h. F1043 – Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

i. F1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

2. American Welding Society (AWS).
3. Chain Link Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric and Accessories."
4. National Fire Protection Association (NFPA):
   a. 70 – National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL).

B. Qualifications:
1. Installer bonded and licensed in the Project state.
2. Installer shall have a minimum two (2) years experience installing similar fencing.
3. Utilize only AWS certified welders.
4. Electric gate operators to be UL listed.
5. Grounding by an electrician licensed in Project state.

1.4 DEFINITIONS

A. See ASTM F552.

B. NPS: Nominal pipe size, in inches.

C. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.5 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Product data and samples for material used.

d. Shop drawings showing sizes, fabrication, anchorage, finish, and other pertinent data.

3. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
4. Mill certificates.
5. Source quality control test results.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MANUFACTURER(S)

A. Fence

1. Anchor Post Products, Inc., Colorguard Corporation, or equal.

2.2 COMPONENTS

A. Chain Link Fabric:

1. Height: fence shall be constructed of six (6) foot high by two (2) inch woven mesh and have three (3) barbed wires set horizontally on the top of the fence, with arms facing out.
2. Vinyl Coating: Coat fence components, except barbs, with thermally bonded plasticized polyvinyl chloride (PVC). Color vinyl coating black. Coat wire fabric with 7 mil. Vinyl. Coat other fence components with 10 mil. Vinyl.
3. Fabric to conform to ASTM A392, 6 feet high, No. 9 W&M gage wire woven in 2” mesh. Unless otherwise shown on Plans, use Class 2 zinc coating. Top and bottom salvages to be twisted and barbed.
4. Barbed wire to be 3 lines of wire mounted on extension arms and conforming to ASTM A121, No. 12-1/2 W&M gage wire, with 4 point barbs, and Class 3 zinc coating. Space barbs 3 inches apart.
5. Line Posts shall be 2” O.D. Schedule 40 galvanized steel pipe conforming to STM A120. Pipe to be installed at 10’ spacing maximum.
6. End, corner, and pull posts shall be Hot-Dip Galvanized piping 4” O.D.
7. Barbed wire extension arms to be standard, one-piece, three wire capacity, with steel conforming to ASTM A36/A36M.
8. Hot-Dip galvanized component metal parts not covered by ASTM specifications above with minimum standard zinc coating in accordance with ASTM A153 before application of vinyl coating.
9. Top, mid and bottom rail to be minimum 1 5/8 inch O.D. galvanized steel pipe.

B. Vinyl slats:

1. ASTM F3000/F3000M-13.
2. Slats type and color to match the existing fencing.
3. Size: 2” mesh size.
4. Height: 6 linear feet coverage.

C. Concrete: See specifications in Division 03 - Concrete.

2.3 SOURCE QUALITY CONTROL

A. Test related fence construction materials to meet the following standards:

1. Posts and rails:

a. ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with:

1. Manufacturer's instructions.
2. Lines and grades shown on Drawings.
3. In accordance with ASTM F567.

B. Contractor to be responsible for fence design. Size in accordance with dimensions shown on Plans. Furnish hinges, latches, stops, keepers, and other accessories. Furnish latches with provisions for padlocking.

C. Do not start fence installation before final grading is complete and finish elevations are established.

D. Drill holes in firm, undisturbed or compacted soil.

E. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.

1. Correct minor irregularities in earth to maintain maximum clearance.

F. Space line posts at equal intervals not exceeding 10 FT OC.

G. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.

H. Install tension bars full height of fabric.

I. Rails:

1. Fit rails with expansion couplings of outside sleeve type.
2. Rails continuous for outside sleeve type for full length of fence.

J. Provide expansion couplings in top rails at not more than 20 FT intervals.

K. Anchor top rails to main posts with appropriate wrought or malleable fittings.

L. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts.

1. Locate compression members at mid-height of fabric.
2. Extend diagonal tension members from compression members to bases of posts.
3. Install so that posts are plumb when under correct tension.

M. Pull fabric taut and secure to posts and rails.

1. Secure so that fabric remains in tension after pulling force is released.
2. Secure to posts at not over 15 IN OC, and to rails at not over 24 IN OC, and to tension wire at not over 24 IN OC.
3. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two (2) full turns.
4. Bend ends of wire to minimize hazards to persons or clothing.

N. Install post top at each post.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 90 00

SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding, sodding and landscape planting:

   a. Soil preparation.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):

   a. Z60.1 – American Standard for Nursery Stock.

2. AOAC International (AOAC – Association of Official Agricultural Chemists.).
3. ASTM International (ASTM):

   a. D2028 – Standard Specification for Cutback Asphalt (Rapid-Curing Type).

   b. D5276 – Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:

1. Fertilizer:

   a. If Owner’s Representative determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.

   b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.

c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Layout drawings:
   a. Scaled site plan (scale 1 IN = 20 FT or equal to scale of Project site plan drawing) on reproducible drawing.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.
3. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
4. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
5. Source and location of sod, plants, and plant material, as per Section 3.2 - Installation and Section 3.3 - Planting Trees, Shrubs, and Ground Covers of this Specification Section.
6. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

C. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.5 SEQUENCING AND SCHEDULING

A. Installation Schedule:

1. Provide schedule showing when trees, shrubs, groundcovers and other plant materials are anticipated to be planted.
2. Show schedule of when lawn type and other grass areas are anticipated to be planted.
3. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.

4. Indicate anticipated dates Owner's Representative will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:

1. Meet with Owner's Representative and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Owner's Representative.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

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2.2 MATERIALS

BOTANICAL AND COMMON NAME	PERCENT BY WEIGHT (PLS)	MINIMUM PERCENT GERMINATION	MINIMUM PERCENT PURITY
Kentucky Bluegrass (Poa pratensis)	60	85	95
Fescue, Tall, KY 31 (Festura arundiancea 'KY 31')	30	85	98
Ryegrass, Perennial (Lolium perenne)	10	90	95

Pasture Seeding:

BOTANICAL AND COMMON NAME	MINIMUM PERCENT GERMINATION	MINIMUM PERCENT PURITY	LBS PLS PER ACRE
Smooth Brome Grass (Bromus inermis 'Leyss')	80	90	14
Fescue, Tall, KY 31(Festura arundiancea 'KY 31')	90	98	2.5
Switchgrass (Panicum virgatum)	90	95	3.5

BOTANICAL AND COMMON NAME	MINIMUM PERCENT GERMINATION	MINIMUM PERCENT PURITY
Pennegift Crownvetch (Coronilla veria) (Blue-tagged certified hulled)	75	98
Ryegrass, Perennial (Lolium perenne)	90	95

A. Native Grass Seeding: Certified seed of locally adapted strains.

GRASSES	LBS PLS PER ACRE	APPROXIMATE NUMBER OF SEEDS PER LB (PLS)
Big bluestem(Andropogon gerardi)	2.4	165,000
Blue grama(Bouteloua gracilis)	0.1	825,000
Green needlegrass(Stipa viridula)	0.6	181,000
Indian grass(Sorghastrum nutans)	1.2	175,000
Little bluestem 'Blaze' (Andropogon scoparius 'Blaze')	1.4	260,000
Sideoats grama(Bouteloua curtipendula)	0.8	191,000
Switchgrass(Panicum virgatum)	1.0	389,000
Western wheatgrass(Agropyron smithhii)	1.5	110,000
Sand reedgrass(Calamovilfia gigantea)	1.0	273,000
Sand bluestem(Andropogon hallii)	2.5	113000
Sand Lovegrass(Eragrostis trichodes)	0.3	1300000
Reed canarygrass(Phalaris arundinacea)	2.0	533000

FORBS	LBS PLS PER ACRE	APPROXIMATE NUMBER OF SEEDS PER LB (PLS)
Purple prairieclover (Petalostemen purpureum)	0.2	278.000
Pitcher Sage		
Salvia pitcheri	0.2	149,000
Upright prairieconeflower	0.1	461,000

Buffalograss lawn: Spring seeding or dormant fall seeding.

BOTANICAL AND COMMON NAME	LBS (PLS) PER ACRE	APPROXIMATE NUMBER OF SEEDS PER POUND
Buffalograss (Buchloe dactyloides)	20.0	52,000
Blue Grama (Bouteloua gracilis)	0.1	825,000

B. Soil Amendments:

C. Asphalt Binder: Emulsified asphalt per State specifications.

D. Water:

1. Water free from substances harmful to grass or sod growth.
2. Provide water from source approved prior to use.

E. Plants:

1. Sound, healthy, vigorous, with normal top and root systems, free from disease, insect pests or their eggs, grown in same or colder climatic zone as project.
2. Nursery grown stock, freshly dug. No heeled-in, cold storage or collected stock.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:

1. Limit preparation to areas which will be planted soon after.
2. Provide facilities to protect and safeguard all persons on or about premises.
3. Protect existing trees designated to remain.
4. Verify location and existence of all underground utilities.
   a. Take necessary precaution to protect existing utilities from damage due to construction activity.
   b. Repair all damages to utility items at no cost to Owner.
5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
   a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:

1. Loosen surface to minimum depth of 4 IN.
2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
5. Distribute fertilizer uniformly over areas to be seeded:
   a. For lawn-type seeding: 30 LBS per 1000 SF.
   b. For pasture seeding: 200 LBS per acre.
6. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.

7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
    a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
    b. Limit fine grading to areas which can be planted soon after preparation.
9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.
10. Spread limestone uniformly over designated areas at a rate of 100 LBS per 1000 SF.
11. Distribute fertilizer as specified uniformly over areas to be seeded at a rate of 12 LBS per 1000 SF.

C. Native Grass Seeding

3.2 INSTALLATION

A. Lawn-Type and Pasture Seeding:

1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Owner's Representative.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area at rate of application not less than 4 LBS (PLS) of seed per 1000 SF, 50 percent sown in one direction, remainder at right angles to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
    a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
    a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Owner's Representative.
    a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.

9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 SF.
    a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
    b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
    c. Use appropriate shields to protect adjacent site improvements.

3.3 PLANTING TREES, SHRUBS, AND GROUND COVERS

A. Notification:
    1. Notify Owner's Representative of source of plants and plant materials at least 30 days prior to planting to permit Owner's Representative inspection of source qualifications.

B. Preparation:
    1. Handle plants so that roots or balls are adequately protected from breakage of balls, from sun or drying winds.
        a. Ensure tops or roots of plants are not permitted to dry out.
    2. During transportation, protect materials from wind and sun to prevent tops and roots from drying out.
    3. Protect tops of plants from damage. Plants with damaged tops will be rejected.
    4. For purpose of inspection and planting identification, attach durable, legible labels to bundle or container of plant material delivered at the planting site. State correct plant name and size of each plant in weather-resistant ink on labels.
    5. Do not prune trees and shrubs at nursery.

C. Planting Season:
    1. Plant deciduous shade trees and shrubs any time the ground is suitable between October 15 and June 1.
    2. Plant evergreen material between September 1 and June 1.
    3. Plant ground covers between March 15 to June 1.

D. Planting Procedure:
    1. Indicate locations of plants for approval by Owner's Representative before excavating plant locations.
    2. In event underground construction, utilities, obstructions, or rock are encountered in excavation of plantings, secure alternate locations from Owner's Representative

a. Make said changes without additional compensation.

b. Where tree locations fall under existing overhead wires, or crowd existing trees, adjust locations as directed by Owner's Representative.

3. Excavate pits and beds as necessary and in accordance with ANLA/ANSI Z60.1.

   a. Loosen bottom of pits prior to planting.

   b. Excavation is unclassified; excavate all materials without additional cost.

4. Tree and shrub pits to be circular in shape with vertical sides at least 1 FT greater in diameter than ball diameter.

   a. Pit to be of sufficient depth to provide 6 IN of planting soil under ball when set to natural grade.

5. Shrub and ground cover beds:

   a. Plant shrubs used in mass plantings in individual holes of required size.

   b. Strip all sod from among mass planting.

   c. For ground cover beds, remove sod from within limits of bed.

   d. Add soil amendments as specified and mix or rototill with existing topsoil to a depth of 6 IN.

6. Set plants straight or plumb, in locations when indicated and at such level that after settlement they bear same relationship to finished grade as they did in their former setting.

   a. Carefully tamp planting soil under and around base of balls to prevent voids.

   b. Remove burlap, rope and wires from top of balls.

   c. Do not remove burlap from sides and bottom of balls.

7. Backfill plants with planting soil.

   a. Tamp to 1/2 depth of pit and thoroughly water and puddle before bringing backfill to proper grade.

   b. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.

8. After planting is complete, form a level saucer 3 IN high around each tree extending to limit of plant pit for watering purposes.

9. Mulch plant pit after saucer has been shaped.

   a. Mulch to limits of pit and uniformly over ground cover beds to a depth of 3 IN.

   b. In mass plantings of shrubs, mulch entire area uniformly among shrubs to a depth of 3 IN.

c. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.

10. Staking: Stake trees immediately after planting as detailed on Drawings or in accordance with Nursery Standards.
11. Wrap deciduous trees 2 IN or more in caliper by neatly overlapping wrapping material between ground line and second branch. Place ties at top and bottom of wrapping material and not more than 12 IN apart between top and bottom ties.
12. Remove dead or damaged branches.
    a. Thin deciduous material to about two-thirds of initial branching.
    b. Remove only dead or damaged branches from evergreens.
13. Water plants during planting operations.
    a. Water each plant a minimum of once each week until final acceptance.
    b. Apply sufficient water to moisten backfill about each plant so that moisture will extend into the surrounding soil.

3.4 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
    a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
    b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Owner's Representative.

B. Seeded or Sodded Lawns:

1. Maintain seeded lawns: 90 days, minimum, after installation and review of entire project area to be planted.
2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
3. Owner's Representative will review seeded or sodded lawn area after installation for initial acceptance.

4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
    a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
    a. Repeat mowing as required to maintain height.
    b. Do not delay mowing until grass blades bend over and become matted.
    c. Do not mow when grass is wet.
    d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
    e. Do not mow lower than 1-1/2 IN.
7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
    a. Anchor as required to prevent displacement.
8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
9. Replant bare areas using same materials specified.
10. Owner's Representative will review final acceptability of installed areas at end of maintenance period.
11. Maintain repaired areas until remainder of maintenance period or approved by Owner's Representative, whichever is the longer period.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 91 05

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Topsoiling and finished grading.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 31 11 00 – Clearing and Grubbing.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittal for requirements for the mechanics and administration of the submittal process.
2. Project Data: Test reports for furnished topsoil.

1.4 PROJECT CONDITIONS

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary, to complete work.

B. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:

1. Imported, Original surface soil typical of the area.
2. Existing topsoil stockpiled under Specification Section 31 11 00 – Clearing and Grubbing.

3. Capable of supporting native plant growth.
4. pH: 5.5 to 8.5.
5. Liquid Limit: 50 or less.
6. Plasticity Index: 20 or less.
7. Gradation: maximum of 10 percent passing No. 200 sieve.

2.2 TOLERANCES

A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct, adjust and/or repair rough graded areas.
   1. Cut off mounds and ridges.
   2. Fill gullies and depressions.
   3. Perform other necessary repairs.
   4. Bring all sub-grades to specified contours, even and properly compacted.

B. Loosen surface to depth of 2 IN, minimum.

C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

A. Reviewed by Owner's Representative in Specification Section 31 11 00 – Clearing and Grubbing.

3.3 PLACING TOPSOIL

A. Do not place when subgrade is wet or frozen enough to cause clodding.

B. Spread to compacted depth of 4 IN for all disturbed earth areas.

C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.

D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.

E. Provide finished surface smooth and true to required grades.

F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

A. Upon completion of topsoiling, obtain Owner's Representative acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 92 13

HYDRO-MULCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding, fertilizing, mulching, and maintenance of areas indicated on Drawings.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 32 91 05 – Topsoiling and Finished Grading.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

C. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

1.4 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Conform to material requirements of Section 32 91 05 – Topsoiling and Finished Grading.

B. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.
2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.
3. Wet, moldy, or otherwise damaged seed will not be accepted.
4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE POUNDS/A	PLANTING DATE
Hulled Common Bermuda Grass 98/88	40	Jan 1 to Mar 31
Unhulled Common Bermuda Grass 98/88	40	
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88	40	Oct 1 to Dec 31
Unhulled Common Bermuda Grass 98/88	40	
Annual Rye Grass (Gulf)	30	

C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of following elements:
   1. Nitrogen: 10 Percent
   2. Phosphoric Acid: 20 Percent
   3. Potash: 10 Percent

D. Mulch:
   1. Virgin wood cellulose fibers from whole wood chips having minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.
   2. Cellulose fibers manufactured from recycled newspaper and meeting same fiber content and size as for cellulose fibers from wood chips.
   3. Dye mulch green for coverage verification purposes.

E. Soil Stabilizer: “Terra Tack 1” or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as “Benefin,” or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Place and compact topsoil in accordance with requirements of Section 32 91 05 – Topsoiling and Finished Grading.

B. Dispose of objectionable and waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

3.2 APPLICATION

A. Seed: Apply uniformly at rates given in Paragraph 2.1 B for type of seed and planting date.

B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.

C. Mulch: Apply uniformly at rate of 50 pounds per 1,000 square feet.

D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.

E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.

F. Sod: Lay single row of sod along perimeter where top soil and pavement intersect.

G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Owner’s representative approval before resuming operations.

3.3 MAINTENANCE

A. Maintain grassed areas minimum of 90 days, or as required to establish acceptable growth. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling, and replanting.

D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.

E. Mow grass when height reaches 3½ inches or greater on average before final acceptance. Mow to height of 2½ inches.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 33 13 00
DISINFECTION OF WATER LINES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Disinfection of potable water lines.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Water Works Association (AWWA):
   a. C 651 - Standard for Disinfecting Water Mains.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to water distribution system.

B. Water for disinfection and flushing will be furnished by the Contractor.

C. Contractor will conduct disinfection operations.

D. Coordinate chlorination operations through Owner's representative.

E. Water supply by contractor shall use metered connection with "backflow" prevention.

3.2 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines.

B. Install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Owner's representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to Drawings.

3.3 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.
2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 part per million parts of water.
4. Open and close valves in lines being sterilized several times during contact period.
5. If chemical compound is used for sterilizing agent, place in pipes as directed by Owner's representative.

3.4 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, perform bacteriological tests by testing laboratory in accordance with Section 01 45 29 - Testing Laboratory Services. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, perform additional disinfection operations.

3.5 COMPLETION

A. Wherever possible, provide temporary blow-off on existing access manway blind flange. Upon satisfactory completion of disinfection and hydrostatic testing, remove risers and cap directly at the water line, except those approved for use in subsequent hydrostatic testing. Do not leave any portion of riser extending from water line.

B. Where temporary blow-off is located outside access manhole or vault, backfill excavation promptly. Show blow-off locations on as-built record drawings, and note the type of cap used. If blow-off location is underneath pavement, comply with the following:

1. If pavement is restored prior to completion of disinfection and hydrostatic testing, install temporary pavement over blow-off. Comply with local requirements for dimensions of temporary pavement, if applicable.
2. Backfill excavation with select fill or cement stabilized sand in accordance with Section 31 21 33 – Trenching, Backfilling and Compacting for Utilities.

END OF SECTION

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SECTION 33 16 14

RESERVOIRS: PRESTRESSED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: design and installation of one (1) 2.0 MG Type III circular prestressed concrete ground storage tanks (GST No. 2). In the cast of conflict between this and other sections, the requirements of this section shall govern. Tank shall be in compliance with AWWA D110.

B. Related Specification Sections include, but are not necessarily limited to the following specifications. In the case of dispute between this specification and those referenced below, this specification, Section 33 16 14 – Reservoirs: Prestressed Concrete will govern.

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 - Testing
4. Section 03 21 00 - Reinforcement
5. Section 03 31 30 - Concrete Materials and Proportioning
6. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing
7. Section 03 31 32 - Concrete Finishing and Repair of Surface Defects
8. Section 31 23 00 - Earthwork
9. Section 05 50 00 - Metal Fabrications
10. Section 40 20 13 - Pipe: Miscellaneous Steel
11. Section 40 20 16 - Pipe: Ductile
12. Specification Section is applicable to WD-GWP04-GST-GST1-01-001 and WD-GWP04-GST-GST2-02-001.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

C. Provide Bid Prices for base bid and all alternatives.

1. Base bid: The base bid shall consist of the design and installation of a 2.0 MG ground storage tank, all appurtenances included in this specification,

and shown on drawings 02D101, 02D301, 02D302 and 02D303. The base bid does not include the improvements of GST No.1.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only. The latest revision of each publication shall be used.

1. American Association of State Highway and Transportation Officials (AASHTO)
   a. AASHTO T-99, Standard for the Moisture - Density Relations of Soils Using a 5.5 lb (2.5 Kg) Rammer and a 12-inch (305 mm) Drop (Eighteenth Edition).
2. American Concrete Institute (ACI):
   a. 301, Specification for Structural Concrete
   b. 305R, Hot Weather Concreting.
   c. 306R, Cold Weather Concreting
   d. 350, Environmental Engineering Concrete Structures
   e. 350.3, Seismic Design of Liquid Containing Concrete Structures and Commentary
   f. 372R, Design and Construction of Circular Wire and Strand-Wrapped Prestressed Concrete Structures
   g. 506R, Guide to Shotcrete.
   h. 506.2 Specification for Structural Concrete
3. American Society of Civil Engineers (ASCE):
   a. 7-10, Minimum Design Load for Buildings and Other Structures.
4. ASTM International (ASTM):
   a. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   b. A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
   c. A416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
   d. A475, Standard Specification for Zinc-Coated Steel Wire Strand
   e. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

f. A821, Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.

g. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

h. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

i. B241, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

j. C31/ C31M, Standard Practice for Making and Curing Concrete Test / Specimens in the Field

k. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

l. C138, Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

m. C173, (Rev. A) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

n. C192 / C192M, Standard Practice for Making and Curing Concrete / Specimens in the Laboratory.

o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

p. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

q. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

r. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

s. D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

t. D2000, Standard Classification System for Rubber Products in Automotive Applications.

u. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

v. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

5. American Water Works Association (AWWA):

a. C652, Standard for Disinfection of Water-Storage Facilities.

b. D110, Standard for Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

6. American Welding Society (AWS).
7. Corps of Engineers (COE):
   a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
8. Federal Specification (FS)
   a. FS-TT-S-00227E, Sealing Compound Elastomeric Type, Multi-Component (For Caulking, and Glazing in Buildings and other Structures)
9. Geotechnical Reports
   a. Geotechnical Engineering Report, The Woodlands Water Plant No. 4, Ground Storage Tank No. 2, The Woodlands, Texas, Terracon Consultants, Inc.
10. National Sanitation Foundation International (NSF)
    a. 61, Standard for Drinking Water System Components or Latest Edition or Revision Thereto
11. Occupational Safety and Health Administration (OSHA)
12. Texas Commission on Environmental Quality (TCEQ)
    a. Rules and Regulations for Public Water Systems Latest Edition or Revision Thereto
13. Building code:
    a. International Code Council (ICC):
       1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Singular Responsibility:

It is the intent of the specification to create singular responsibility for the design and construction of the prestressed concrete tank and appurtenances. The design and construction of all aspects of the foundation, floor slab, wall, prestressing, shotcrete, and dome roof of the prestressed concrete tank must be performed by the tank contractor.

C. Qualifications:

1. The company designing and constructing the tank (Tank Contractor):
   a. At least ten (10) years experience in design and construction of wire-wound circular prestressed composite tanks, AWWA D110, Type III precast concrete with a steel diaphragm.
   b. Have skill, reliability, and financial stability to build and guarantee the tank in accordance with the Contract Documents.

c. Has constructed, in the past ten (10) years, in its own name or under one of its divisions, and is presently responsible for a minimum of twenty (20) AWWA D110 Type III dome covered prestressed composite tanks of 2 MG capacity or greater, which meet these Specifications and have been in successful service for a minimum of five (5) years.

d. Experience in the design and construction of AWWA D110 Type I, Type II, or Type IV tanks will not be considered as a qualification for designing a Type III tank.

2. Professional engineer in responsible charge of engineering work:

a. Minimum ten (10) years experience in design and field construction of circular prestressed composite tanks, AWWA D110, Type III precast concrete with a steel diaphragm.

b. In responsible charge of engineering work to be done for tank design, construction, and testing.

c. Registered in Texas.

D. Certifications:

1. Drawings for the tank to be signed and sealed by a professional engineer licensed in the State of Texas.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Manufacturer's installation instructions.

3. Mill tests indicating ultimate and yield strength of all reinforcing bars, prestressing and post tensioning wires and cables, and any other steel components.

B. Furnish applicable "Affidavits of Compliance" to Building Codes and OSHA Standards.

C. Dimensioned, easily read full size (22" x 34") drawings of concrete ground storage tank, including foundation and all associated earthwork, location of wall and roof penetrations, piping, piping appurtenances, details of connections, pipe supports, roof vent details, ladder details, architectural finish details, and coating system, signed and sealed by a professional engineer registered in the State of Texas.

D. Design certificate signed and sealed by professional engineer licensed in the State of Texas that calculations have been performed in accordance with project criteria and standard engineering practices.

E. All concrete design mixes.

F. Acknowledgement that piping products submitted meet requirements of specifications and standards referenced.

G. Guarantee Document as specified in the following WARRANTY Article.

H. Stormwater Pollution Prevention Plan.

I. Detailed construction drawings.

J. Test reports for settlement, leakage, pipe pressure tests, and disinfection.

K. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

1.5 WARRANTY

A. The tank constructor will warrant workmanship and materials on the complete structural portion of the tank for a one (1) year period from date of Substantial Completion of the Work.

1. In case leakage or other defects appear within the one (1) year period, the tank constructor to promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found.

2. Leakage is defined as a flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank.

B. The Owner's or Engineer's review of the bidder's design, or the Owner's acceptance and final payment for the work is not to relieve the Tank Contractor of design responsibility. The Owner is to be the direct beneficiary of the warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - TANK CONSTRUCTORS

A. Subject to compliance with the Contract Documents, the following tank constructors are acceptable:

1. DN Tanks, Inc.; Grand Prairie, TX.

2. Preload Company; Garland, TX.

2.2 MATERIALS

A. Concrete:

1. Concrete to conform to ACI 301.

2. Cement to be Portland Cement Type I or Type II.

3. Admixtures, other than air-entraining and water reducing admixtures, will not be permitted unless approved by the Owner's representative.

4. Concrete for tank wall and dome construction to have a minimum compressive strength of 4,000 psi at 28 days. All precast wall concrete to be air-entrained.
5. Concrete for the tank floor, footings, pipe encasement, and all other work shall have a minimum compressive strength of 4,000 psi at 28 and days shall not be air-entrained. The coarse and fine aggregate shall meet the requirements of ASTM C33. Coarse aggregate shall be No. 467 with 100 percent passing the 1 1/2 inch sieve.
6. Superplasticizer and water-reducing admixtures shall be incorporated into the floor concrete. Fibers shall be Microfiber by Grace, Stealth Fibers by Synthetic Industries, or equal. Fiber lengths shall be a maximum of 3/4 inches. The amount of polypropylene fibers added to the concrete mix shall conform to the manufacturer's recommendations.
7. Proportioning for concrete to be in accordance with ACI 301.
8. Concrete used in precast, prestressed, concrete tank construction not to contain free chloride ions in excess of 0.06 percent of the weight of the cement in the mix.
9. Concrete for tank wall construction to be placed at a slump of 3-inches "+/- 1-inch, but not to exceed 4 inches. Concrete for floor (and dome if applicable) to be placed at a slump of 4 inches "+/-1-inch. Higher slumps are allowable with the use of a high range water reducer. Admixtures to be accomplished in accordance with the requirements of Specification Section 03 31 30 - Concrete Materials and Proportioning and Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

B. Shotcrete:

1. 28 day compressive strength not less than 4500 psi.
2. Cement: Conform to Specification Section 03 31 30.
3. Conform to ACI 506.2
4. Shotcrete for tank construction not to contain chloride ions in excess of 0.06 percent of the weight of the cement in the mix.
5. Shotcrete used for encasing prestressing wire to consist of not more than three parts sand to one part Portland cement by weight; shotcrete used for diaphragm cover, and additional coat for shotcrete, to consist of not more than four parts sand to one part Portland cement by weight.
6. Polypropylene fibers shall be included in the shotcrete used for the finish covercoat. Fibers shall be Fibercast 500 by Propex, or equal. Fiber length shall be ¼". The amount of the fibers added to the shotcrete used for the finish covercoat shall conform to the manufacturer's recommendation.

C. Prestress Wire:

1. Cold drawn, high-carbon wire.

2. Conform to ASTM A821.
3. A minimum ultimate tensile strength of 210,000 psi.
4. Splices of horizontal prestressed reinforcement to be ferrous material compatible with the reinforcement and to develop the full strength of the wire. Wire splice and anchorage accessories not to nick or otherwise damage the prestressing.

D. Reinforcing Bars, Wire Mesh:

1. ASTM A615, Grade 40.
2. ASTM A185.
3. Nonprestressed reinforcement shall conform to the requirements of ACI 350, Grade 60. Strand for seismic cables shall be galvanized and shall conform to the requirements of ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing.
4. Conform to Specification Section 03 21 00.

E. Steel Diaphragm:

1. Provide vertically ribbed steel sheets with adjacent and opposing channels that provide a mechanical bond to the concrete.
2. Diaphragm to have vertical channels with reentrant angles spaced not more than 3 inches apart and with depth of 3/8 inch. Individual sheets within wall panel to be roll seamed.
3. Conform to ASTM A1008.
4. Minimum thickness: 0.017 IN.
5. Provide a minimum of 4 inches of concrete on inside face of diaphragm.

F. Elastomeric Materials:

1. Waterstops that are polyvinyl chloride conforming to COE CRD-C572.
2. Bearing pads conforming to ASTM D2000.
3. Sponge filler conforming to ASTM D1056.
4. Epoxy: ASTM C881, Type III, Grade I.

2.3 DESIGN REQUIREMENTS

A. Ground Storage Tank No. 2:

1. Design in conformance with
   a. AWWA D110, Type III, Precast concrete with steel diaphragm.
   b. Most recent OSHA Standards.
   c. Texas Commission on Environmental Quality Rules and Regulations for Public Water Systems, latest revision.

d. ACI Standard Specifications for Structural Concrete for Buildings, designation ACI 301.

e. ACI Standard Building Code Requirements for Reinforced Concrete, Designation ACI 318/318R.

f. ACI 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary

g. ACI 350.3 Seismic Design of Liquid Containing Concrete Structures and Commentary

h. ACI 372R Design and Construction of Circular Wire- and Strand Wrapped Prestressed Concrete Structures

2. Characteristics: All dimensions and elevations to be field verified to match existing tank.

   a. Liquid volume: 2.0 MG.

   b. Inside diameter: 124.0 FT.

   c. Finished floor elevation: 194.0 FT MSL.

   d. High water level: 218.0 FT MSL.

   e. Top of tank dome: 222.4 FT MSL.

   f. Minimum thickness of composite wall at base: 4 IN.

   g. Minimum thickness of floor: 4 IN.

   h. Minimum thickness of dome: 4 IN.

3. Design Loads:

   a. Design for earthquake resistance based on requirements for Seismic Site Class D of the International Building Code or based on requirements of Zone 0 of AWWA D110 whichever requirements are more stringent.

   b. Design Load:

      1) Shall be as required by ASCE 7

      2) Base design on dead load of reservoir plus water load inside and 25 psf, uniform load on entire roof area.

   c. Wind loads:

   d. Design loads for full roof dead load plus the following live load conditions:

      1) Design for wind loading for exposure C with a 134 MPH 3 second gust in accordance with the provisions of ASCE 7.

   e. Snow Load: as required by ASCE 7.

4. Design reservoir walls, foundations, sumps, and bottoms in accordance with the allowable soil bearing pressures, equivalent fluid pressures and other recommendations of the geotechnical report, unless otherwise indicated.

recommendations of the geotechnical report, unless otherwise indicated.

5. Design foundations with the centroids of superimposed loads in their actual locations.
6. Design for lowest mean ambient temperature of 32 DegF and for temperature differential of 80 DegF.
7. Design to be in accordance with Texas Administrative Code Title 30 Chapter 290 “Public Drinking Water”.
8. Discontinuous prestressing tendons not permitted.
9. Design prestressed tank wall as composite concrete wall using embedded mechanically bonded steel diaphragm in combination with vertical reinforcement.
    a. Continuous mechanically bonded steel diaphragm can be taken as effective vertical reinforcing.
    b. Prestressed concrete wall to be precast construction.
    c. Shotcrete core walls not permitted.
10. Settlement: Tank is to be designed to accommodate the anticipated settlement as defined in the project geotechnical report by Terracon Consultants, Inc.

2.4 ACCESSORIES

Ground Storage Tank No. 2:

A. Wall Manway and Covers:
    1. Number required: Three (3) per tank.
    2. Location: As shown on PLANS.
    3. Material: Stainless Steel, ASTM Type 316.
    4. Minimum size: 42 IN diameter.
    5. Hatch Centerline Elevation: As shown on PLANS.

B. Ladders:
    1. Requirements: ladder, interior, and exterior, and safety device to be OSHA approved rigid rail system. Provide Two (2) belt assemblies, complete with all accessories.
    2. Location
        a. Exterior Ladders: As shown on PLANS.
        b. Interior Ladders: As shown on PLANS.
    3. Material:
        a. Interior Ladder: Stainless Steel, ASTM316
        b. Exterior Ladder: Stainless Steel, ASTM316

4. Refer to section 05 50 00 for additional details.

C. Roof Hatches:
   1. Number required: Three (3) per tank.
   2. Location: as shown on PLANS
   3. Material: Coated anodized aluminum
   4. Minimum Opening Size: 42 IN x 42 IN.
   5. Hatch to overlap curb and terminate in a downward direction for at least 2 inches to comply with TCEQ requirements.
   6. Sufficient space shall be provided between hatch lid and hatch base to allow for a 1 IN. conduit to penetrate through the curb while not interfering with hatch operation. Hatch to be tapped and conduit to be provided by others.
   7. Hatch to have arrangements for keeping it locked in place.
   8. Opening to have raised curbing of at least 4 inches in height.

D. Roof Vent(s):
   1. Number required: One (1)
   2. Size and Configuration: In accordance with TCEQ Regulations and as shown on PLANS.
   3. Material: Stainless Steel, ASTM 316
   4. Maximum air flow out of tank: 1,000 cfm
   5. Maximum air flow into tank: 1,500 cfm
   6. Vent Manufacturer: US Underwater Services.
   7. Vent to be vandal resistant model
   8. Vent to have easily replaceable #16 mesh stainless steel insect screen.
   9. Minimum vent throat diameter: 24 IN.
   10. Maximum pressure drop: 0.5” wg across each vent.
   11. Vent system to be designed by Tank Manufacturer.

E. Pipe Penetrations (Surface Water) in Roof:
   1. Number Required: One (1)
   2. Location: As shown on Plans.
   3. Required Air Gap: 32 IN per TCEQ regulations

F. Nozzles on Tank Roof:
   1. Number Required: Four (4).
   2. Ultrasonic Level Indicator Location: As shown on PLANS.
   3. Spare Nozzle Location: As shown on PLANS.

G. Pipe Penetrations (Overflow) through Tank Wall:
   1. Number Required: One (1)
   2. Location and Elevation: As shown on Plans.

H. Pipe Penetrations (Aeration Suction Piping Nozzle) through Tank Wall:
   1. Number Required: One (1)
   2. Location and Elevation: As shown on PLANS.

I. Instrumentation Connections through Tank Wall:
   1. Number Required: One (1).
   2. Location and Elevation: As shown on PLANS.

J. Sample Tap Connections on Tank Wall:
   1. Number Required: One (1).
   2. Location and Elevation: As shown on PLANS.

K. Spare Wall Nozzle on Tank Wall:
   1. Number Required: One (1).
   2. Location and Elevation: As shown on PLANS.

L. Waterstops:
   1. Materials:
      a. Extruded virgin polyvinyl chloride compound.
      b. Conform to COE CRD-C572.
   2. Fuse together butted joints of waterstops to ensure water tightness.

M. Silt Stops: Provide removable silt stop(s) at discharge pipes as shown on drawings.

N. Aluminum Railings and Toe Boards:
   1. Refer to Specification 05 52 02 for additional details.
   2. Provide railings and toe boards for entire circumference of tank as shown on PLANS.
   3. Comply with AWS for welding.
   4. Use gas-tungsten-arc (TIG) procedure.
   5. Comply with the Building Code.
   6. Comply with OSHA requirements.
   7. Provide all anchorage systems for mounting on tank roof.
   8. Color to match existing tank.

O. Piping:

1. The GST piping system consists of water piping within and under the tanks not extending beyond seven feet from the tank foundation.
2. Piping shall be in conformance with Specification 40 20 13 and 40 20 16.
3. All materials used in the GST piping system shall meet or exceed pressure test requirements specified herein.
4. Support system for the 16" SWL inlet and overflow pipes shall be the responsibility of the Contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. Site Preparation

1. Site preparation shall be done in accordance with the project specific geotechnical report, which shall be provided to the CONTRACTOR prior to the public bidding of the project.
2. Construction areas for staging operations shall be stripped of all vegetation, loose/soft topsoil, and any other debris/unsuitable material. Care shall be taken to replace or re-compact all soil removed or loosened by removal of tree roots that might exist at this site.
3. The existing fill soil below the existing water tank shall be removed to a full-depth of six feet minimum, or greater as directed by the geotechnical engineer. The Owner's representative (Soils Engineer) shall be on-site during removal of the fill soils to evaluate the exposed subgrade.
4. Once removal of the existing fill is completed and final subgrade cut or over-excavation elevations are achieved, the exposed subgrade shall be carefully proof rolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully-loaded dump truck, to detect weak zones in the subgrade. Weak areas detected during proof rolling, as well as zones of fill containing organic matter and/or debris shall be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proof rolling shall be performed under the direct observation of the geotechnical engineer or his/her representative.
5. Provide positive surface drainage away from the location of all excavations to prevent surface water runoff from flooding the prepared site and excavations. Contractor shall develop a plan to prevent water from pooling on exposed subgrade and submit plan to Owner's Representative prior to beginning excavation.
6. Subsequent to proof rolling, and just prior to placement of fill, the exposed subgrade within the construction area shall be evaluated for moisture and density. The moisture and density of the upper 6 inches of native soils shall

meet the requirement of at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 3 percent of the material's optimum moisture content. Exposed subgrade may require treatment in accordance with TxDOT Standard Specification Item 265 for lime-fly ash treated subgrade, upon geotechnical engineer's approval.

7. All traffic, including proof rolling, shall be avoided during extended periods of wet weather.

B. Fill

1. Excavation and fill shall be done in accordance with the project specific geotechnical report and the subsurface utility investigation, which shall be provided to the CONTRACTOR prior to the public bidding of the project.

2. In order to achieve 2,900 psf bearing pressure for the perimeter thickened slab, select fill and listed on-site soils for grading and to construct the pad below the thickened edge must be chemically treated. The chemically treated select fill and listed on-site soils should extend a minimum of 3 feet beyond the edges of the thickened-edge footing. The select fill and listed on-site soils should be treated with 10 percent lime-fly ash applied as 3 percent lime and 7 percent fly ash. The percentages are given as application by dry weight of soil and are equivalent to about 12 pounds per cubic foot of lime-fly ash. The soils should be treated in accordance with TxDOT Standard Specification Item 265 for lime-fly ash treated subgrade. If preferred, cement treated sand may be used in place of the chemically treated select fill or on-site soils below the perimeter thickened edge. If cement treated sand is used, cement should be applied at a rate of 1.5 sacks per ton of sand. For additional details, see Geotechnical Engineering Report, Revision 1, dated February 20, 2019.

3. Fill required to achieve the design grades for the proposed tank shall be select fill that meets the following criteria:

a. Select Fill

1) See specification 31 21 33 for material and compaction requirements.

2) Location of placement as shown on Drawings and described in geotechnical report.

b. On-site Soils

1) See specification 31 21 33 for material and compaction requirements. Additionally, on-site soils will only be approved for use if they meet a USCS classification of CL and/or SC and have a $10 \leq PI \leq 20$.

2) Location of placement as shown on Drawings and described in geotechnical report.

c. Crushed Stone Leveling Base (Aggregate Base Material)

1) Per the tank manufacturer's standard practice, but shall meet, as a minimum, the requirements of ACI 372.

4. If blended or mixed soils are intended for use, the geotechnical engineer of record shall be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing with a pulvimixer at the site. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the slab performance. If blended soils are used, additional samples of the blended soils, as well as the clay clods, must be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

5. Compaction

a. Fill Lift Thickness

1) The fill soils shall be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with a compacted thickness not to exceed 6 inches.

b. Compaction Requirements

1) The select fill and on-site soils (and chemically treated soils) shall be compacted to at least 95 percent of the Standard Effort (ASTM D698) maximum dry density.

2) Select fill and on-site soils (and chemically treated soils) shall be moisture adjusted to within 2 percent of the optimum moisture content.

6. Wet Weather and Soft Subgrade Considerations

a. Construction operations may encounter difficulties due to wet/soft surface soils becoming a general hindrance to equipment, especially following periods of wet weather. If the subgrade cannot be adequately compacted to the minimum densities as described previously, one of the following measures will be required:

1) Removal and replacement with select fill

2) Chemical treatment of the soil to dry and improve the stability of the subgrade, or

3) Drying by natural means.

7. Grading and Drainage

a. All grades must provide effective drainage away from the proposed ground storage tank during and after construction. The tank

foundation performance described in the geotechnical report is based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained.

b. Exposed ground shall be sloped away from the structure for at least 6 inches of fall over 10 feet (5 percent slope) beyond the perimeter of the structure. After construction, tank manufacturer to verify final grades to document that effective drainage has been achieved.

c. All utility trenches that penetrate beneath the structure must be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure. An effective clay "trench plug" that extends at least 5 feet out from the face of the structures' exteriors must be constructed. The plug material to consist of clay compacted at a water content at or above the soils optimum water content. The clay fill shall be placed to completely surround the utility line as shown in Drawings. Material and compaction requirements are defined in section 31 21 33.

3.2 CONSTRUCTION

A. General

1. Do not use curing compounds on surfaces to which mortar or shotcrete is to be applied.

B. Floor:

1. Concrete floors minimum of 4 IN thick (or greater) as required per design by tank manufacturer.
   a. A minimum thickness of 12 IN of concrete required over all pipe encasements in concrete floor.
   b. Minimum reinforcement in each direction: 0.5 percent of the concrete area.
   c. Use a clean, well-compacted granular base with a minimum thickness of 6 IN.
   d. Compact to a relative density of 75 percent per ASTM D4253 and ASTM D4254.
      1) See Specification Section 31 23 00.
2. Floor slab shall be placed monolithically.
3. Cure floor slab by flooding with water.
   a. Keep saturated throughout construction to the maximum extent possible and for a period of seven (7) days minimum after being poured.
   b. Curing floor flood water will be supplied by the owner.
4. Vibrate and consolidate the floor slab so no air pockets or voids are present.
5. Provide a troweled finish as noted in Specification Section 03 31 32.

6. No construction joints will be permitted in floor unless otherwise approved by Owner's representative.

C. Precast Core Wall:

1. Construct core wall of precast panels and vertical joints filled with shotcrete or cast-in-place concrete.
2. Provide a full length continuous waterproof steel diaphragm with no horizontal joints throughout and within the tank wall, located between the stored tank contents and the prestressing wires
   a. Mechanically seam vertical diaphragm joints except where located between wall panels, where either mechanical seaming or sealing with epoxy may be employed.
   b. Seal all vertical diaphragm joints to be full watertight.
   c. Piercing of the diaphragm is not permitted except by design. Completely seal punctures with polysulfide sealant.
   d. Do not allow form ties to pierce the diaphragm.
3. Fabricate precast panels to the curvature of the tank radius.
   a. Tolerance in panel wall thickness: Minus 0 to plus 1/4 IN.
   b. Place concrete for each panel in one (1) continuous operation.
4. Locate bearing pads and hold them in proper position prior to erection of wall panels.
   a. Do not nail pads.
5. Properly secure sponge filler pads.
   a. Calk all voids around bearing pads and sponge with a non-toxic sealant to prevent mortar seepage.

D. Horizontal Prestressing:

1. Place prestressing wire on the wall with a wire winding machine capable of consistently producing a stress in the wire within a range of 0 percent to plus or minus 2 percent of the stress required by the design.
   a. No circumferential movement of the wire along the tank wall will be permitted during or after stressing the wire.
   b. Stressing may be accomplished by drawing the wire through a die or by other means that result in uninterrupted elongation, thus assuring uniform stress throughout its length and over the periphery of the tank.
2. Temporarily anchor each coil of prestressing wire at sufficient intervals to minimize the loss of prestress in case a wire breaks during wrapping.
3. Minimum spacing (center to center) of prestressing wires is 3/8 IN and a minimum clear space between wires of 5/16 IN or 1.5 wire diameters, whichever is greater.

a. Replace any wires not meeting the spacing requirements.

b. Do not place prestressing closer than 3 IN from the base of walls or floors where radial movement may occur.

4. Displace the band of prestressing normally required over the height of an opening into circumferential bands immediately above and below the opening to maintain the required prestressing force.

   a. Bundling of wires is prohibited.

5. Joint ends of individual coils by suitable steel splicing devices capable of developing the full strength of the wire.

6. A properly designed stress plate to be used at all permanent wall penetrations equal to or greater than 12 inches in height. The stress plate is to accommodate a portion of the prestressing wires normally required for the height of the opening. The remaining prestress wires normally required to be displaced into circumferential bands immediately above and below the penetration. The effect of banded prestressing to be taken into account in the design.

7. Use a calibrated stress recording device, which can be recalibrated, in determining wire stress levels on the wall during and after the prestressing process.

   a. Take at least one (1) stress reading per foot or one (1) stress reading for every roll of wire, whichever is greater, immediately after the wire has been applied on the wall.

   b. Record readings referring to the applicable height and layer of wire for which the stress is being taken.

   c. Contractor to keep a written record of stress readings and then deliver said record to the Owner.

   d. Make all stress reading on straight lengths of wire.

   e. If applied stresses fall below the design stress in the steel, provide additional wire to bring the stress up to the required design stress.

   f. If the stress in the steel is more than 7 percent over the required design stress, the wrapping operation shall be discontinued and adjusted.

E. Shotcrete:

1. Weather limitations:

   a. Comply with AWWA D110.Shotcrete is not to be placed in freezing weather without provisions for protection of the shotcrete against freezing. Shotcrete placement can start without special protection when the temperature is 35 degrees Fahrenheit and rising, and must be suspended when the temperature is 40 degrees Fahrenheit and falling. The surface to which the shotcrete is applied must be free from frost. Cold weather shotcreting to be in accordance with ACI 301 and ACI 306R.

b. Hot weather shotcreting to be in accordance with the requirements of ACI 301 and ACI 305R.

2. Placement:

a. Comply with ACI 506.2.

b. Shotcrete to be applied with the nozzle held at a small upward angle not exceeding five degrees and constantly moving during application in a smooth motion with the nozzle pointing in a radial direction toward the center of the tank. The nozzle distance from the prestressing to be such that shotcrete does not build up or cover the front face of the wire until the spaces behind and between the prestressing elements are filled.

c. Total cover coat thickness to be controlled by shooting guide wires. Vertical wires to be installed under tension and spaced no more than 3-ft 0-inch apart to establish uniform and correct coating thickness. Wires of 18 or 20 gauge high tensile strength steel or a minimum 100 lb. monofilament line to be used. Wires to be removed after placement of the cover coat and prior to finishing.

3. Coating of steel diaphragm:

a. Cover steel diaphragm with a layer of shotcrete at least 1/2 IN thick prior to prestressing.

b. Total minimum coating over the steel diaphragm: 1-1/2 IN including diaphragm cover, wire cover and finish cover coat.

4. Coating over prestressing wire:

a. Individually encase each prestress wire in shotcrete of a thickness sufficient to provide a clear cover over the wire of at least 1/4 IN.

b. Apply a finish coat of shotcrete as soon as practicable after the last application of wire coat.

1) Total thickness of shotcrete: Not less than 1 IN over the wire.

c. Provide a natural gun finish.

F. Tolerances:

1. Out-of-plumb in total wall height: Plus or minus 1/2 IN.

2. Out-of-round in diameter: Plus or minus 1 IN.

G. Dome Roof:

1. Construction to be cast-in-place or precast construction. Shotcrete dome construction not permitted.

2. Columns or interior supports will not be allowed.

3. Minimum shell thickness to be proportioned for buckling, but not less than 3-inches for cast-in-place and 4-inches for precast and its associated joints.

4. Construct dome roof to proper spherical curvature.

a. Locate and configure construction joints to result in adequate strength.

b. Dome design to be based upon elastic spherical shell analysis with a rise to span ratio within the range of 1:10 to 1:14.

5. Design dome forms to resist all forces acting with respect to its sloped surface.

6. Do not remove any portion of formwork for domes until the concrete is of sufficient strength and until the full circumferential prestressing force has been applied to the dome ring.

7. Apply a coat of curing compound conforming to ASTM C309 to the exterior dome surface of cast-in-place concrete immediately after completion of the final finishing operation.

a. See Specification Section 03 31 31.

3.3 FINISHES

A. The tank to receive following finishes.

1. Concrete Floor Slab: Bull float and/or Fresno Finish.

2. Precast Wall Panels: Internal - Broom Finish.

3. Precast Dome Slots: Light Broom Finish.

4. Exterior Pneumatic Mortar or Nozzle Finish.

5. Cast - in - Place Dome Roof, Soffit: Form Finish.

6. Cast - in - Place Dome Roof, Surface: Broom Finish with non-skid surface in select areas shown on PLANS.

B. Non-skid surface to be created by embedding 5 lbs of 50 mesh dry silica sand per gallon into acrylic texture coating. A broom finish is not considered a non-skid coating.

C. Exterior wall and dome concrete to be a uniform color and texture.

3.4 DECORATIVE COATING

A. All exposed exterior precast dome surfaces shall be given a two-coat finish consisting of one coat of damp-proofing product such as “Tamoseal with AKKRO-7T” or equal, and one coat of “Tammscoat Smooth” or equal. All exterior exposed cast-in-place dome and all exterior exposed wall surfaces shall be given a two-coat finish of a non-cementitious 100% acrylic such as “Tammscoat Smooth”, Tnemec Envirocrete 156 or equal. Work shall be performed by workmen skilled in the application of these types of products. The Manufacturer’s application instructions shall be submitted to the Engineer for approval. The Tank Contractor shall confer with the Manufacturer’s representatives regarding application techniques and shall follow the Manufacturer’s instructions.

B. Surfaces to be coated to be clean, free of all laitance, dirt, grease, and foreign material. All defective surfaces to be filled and/or repaired before coating.

C. OWNER shall select color.

3.5 FIELD QUALITY CONTROL

A. Testing Reservoir Construction and Materials:

1. Foundation soil support: Place no fill until subgrade has been proofrolled and approved by Owner's representative.
2. Concrete:
   a. For precast wall and dome panels: One (1) set of five (5) cylinders for each concrete truck (approximately 10 CY), or fraction thereof placed in one (1) day, required.
   b. For cast-in-plane components like the monolithically poured floor and dome: One (1) set of five (5) cylinders for each 60 CY, or fraction thereof placed in one (1) day, required.
   c. Test one (1) cylinder at seven (7) days and two (2) at 28 days; hold two (2).
   d. With each set of cylinders:
      1) Make one (1) test for air-entrainment.
      2) One (1) test for slump.
3. Concrete testing: Comply with Specification Section 03 05 05.
4. Shotcrete:
   a. Test in accordance with ACI 506.2.
   b. Make tests from the shotcrete as it is being placed.
5. Prestressing: Test prestressing per requirements of 3.2.D.7 by Contractor.

B. Testing:

1. Upon completion of the tank, clean tank of any excess debris, and fill tank according to recommendations in the Geotechnical Report. Provision of water specified in section 01 30 00. Raw water may not be utilized for leak testing or disinfection unless approved by TCEQ. Approval shall be in the form of a written variance to Texas Administration Code Title 30 Chapter 290. Initial tank fill water will be supplied by the owner. If resting is required after initial test, Contractor shall pay for additional water used.
   a. Tank to remain filled for a period of at least 48 HRS to allow for absorption and initial settlement.
   b. After the initial period, add makeup water as required and continue to monitor tank settlement per recommendations in the Geotechnical Report.
2. Net drop in liquid level not to exceed the maximum allowable of 1/10th of 1 percent of the capacity per 24 HR period.

3. If the net drop in liquid level exceeds the maximum allowable, extend the liquid level test to a total of five (5) days.
   a. If at the end of five (5) days, the average net drop in liquid level does not exceed the maximum allowable, the test is considered satisfactory.
   b. If the net liquid loss exceeds the maximum allowable, the test is considered unsuccessful.
      1) Correct source of leakage and retest tank at the Contractor's expense.
      2) If there are defects in the tank, the repair procedure to be reviewed by Owner’s representative prior to implementation by Contractor.
4. Damp spots on the exterior wall surface are not permitted.
   a. Damp spots are defined as spots where moisture can be picked up on a dry hand.
   b. Locate the source of water movement through the wall and permanently seal.
   c. No leakage that includes visible flow through the wall-floor joint is permitted.
   d. Dampness on the top of the footing will not be construed as leakage.
5. Disinfection
   a. Prior to testing for leakage, thoroughly clean and flush tank interior. Remove all foreign matter from tank.
   b. Disinfect tank and all associated piping included in PLANS using Chlorination Method 1, Method 2, or Method 3 described in AWWA C652. Disinfection process to meet TCEQ regulatory requirements.
   c. Water for tank construction initial test to be provided by Owner. Contractor shall pay for any subsequent test as a result of an unsatisfactory test result. Raw water may not be utilized for leak testing or disinfection unless approved by TCEQ. Approval shall be in the form of a written variance to Texas Administrative Code Title 30 Chapter 290.
   d. Comply with the requirements of AWWA C652, Chlorination Method 1, Method 2, or Method 3 for the disposal of disinfection water (paragraphs 4.1.5 and 4.1.5.1).
   e. Coordinate with Owner the collection of water samples for bacteriological analysis. Owner to identify and hire independent testing lab to conduct collection of water samples and bacteriological analysis. Contractor to notify Owner when tank is ready for testing and coordinate with testing lab. Three consecutive, satisfactory water samples required. A satisfactory water sample is a sample analyzed and determined to meet State Department of Health criteria for bacterial analysis.

f. Repeat disinfection and water sampling procedures, if necessary, until three consecutive water samples meet State Department of Health criteria for bacterial analysis.

g. Water samples to meet TCEQ requirements for bacterial analysis for potable water systems before tank will be accepted.

END OF SECTION

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SECTION 33 16 15

RESERVOIRS: RENOVATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Reservoirs: exterior cleaning and coating includes:

1. Water blast clean the exterior surface of the dome, the dome ring, and the tank wall.
2. Perform any remedial work required on the tank dome and wall to provide a sound surface for the application of a water-resistant coating.
3. Apply two coats of a non-cementitious 100% acrylic coating to the exterior surface of the dome, the dome ring and the tank wall.
4. Remove, re-caulk and re-install center dome vent.

B. Reservoirs: instrumentation improvements include:

1. Demolition and removal of the existing top-mounted pressure transducers at GST No.1; installation of two (2) radar level detectors on the tank roof of GST No.1.

C. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 31 32 – Concrete Finishing and Repair of Surface Defects
4. Section 09 91 00 – Painting and Protective Coatings
5. Section 33 16 14 – Reservoirs Prestressed Concrete

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

C. Provide Bid Prices for alternative bid.

1. Alternative Bid Item No. 1: Contractor shall provide an alternative bid price for repairing, cleaning and painting the exterior surface of the tank;
2. Alternative Bid Item No. 2: Contractor shall provide an alternative bid price for removal of two level transducers and replacement with radar level devices to Woodlands PLC as shown on Plans.

1.3 REFERENCES

A. ICRI 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymers Overlays.

1.4 SUBMITTALS

A. Comply with requirements of Section 01 33 00 – Submittals.

B. Product Data: Submit manufacturer's product data, including surface preparation, application, and curing.

C. Coating Color Chart.

D. Applicator's Project References: Submit list of completed project references.

E. Warranty: Submit manufacturer's standard warranty.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store all materials in cool, dry conditions in the original unopened bags or cans, and in strict accordance with manufacturer's directions. Do not use materials that have been stored for periods longer than the manufacturer's recommended shelf life.

1.6 QUALITY ASSURANCE

A. Qualifications & Experience

1. The contractor shall be a specialist tank contractor experienced in the rehabilitation of AWWA D-110 tanks, having rehabilitated, in their own name, at least 10 AWWA-D110 tanks in the last 10 years and shall have restored at least five (5) tanks with deteriorated concrete / shotcrete walls and/or domes within the last five (5) years at least three (3) of which required the re-tensioning of and/or replacement of damaged prestress wire.

2. Singular Responsibility: The concrete and shotcrete restoration shall be performed by skilled personnel employed directly by the tank contractor.

B. Qualifications

1. Applicator: Use applicator experienced in the application of the specified coating for a minimum of 2-years on projects of similar size and complexity. Provide a list of completed projects including project name and location, name of engineer, name of coating manufacturer, and approximate quantity of coating applied.

a. Applicator's Personnel: Employ persons trained for the application of high-performance coating.

b. Singular Responsibility: The exterior coating system shall be applied using skilled personnel employed directly by the tank contractor.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Polyurethane Joint Sealant

1. Eucolastic 1NS as manufactured by Euclid Chemical, Cleveland, OH or approved equal.

B. Exterior Tank Coating

1. All exterior exposed concrete precast tank side walls to be given a two (2) coat finish consisting of one coat of “Tammscoat Smooth,” or equal cementitous water proofing product and one (1) coat of “Tammscoat” or equal non-cementitous 100 PCT acrylic. All exterior exposed cast-in-place dome and wall surfaces shall be given a two (2) coat finish of a non-cementous 100 PCT crylic of Tammsean or equal. Work to be performed by skilled workmen familiar with this type of work. The manufacturer’s application instructions to be submitted to the Engineer for approval. Contractor is to confer with the manufacturer's representatives regarding application techniques and to follow manufacturer's printed instructions.
2. Surfaces to be coated to be clean, free of all laitance, dirt, grease, and foreign material. All detective surfaces to be filled and/or repaired before coating.
3. Exterior wall and dome concrete to be a uniform color and texture. Color shall be as selected by the Owner.

C. Tank Accessories

1. Radar Level Indicator Location: As shown on PLANS.

PART 3 – EXECUTION

A. High Pressure Water Washing & Surface Preparation

1. High-pressure wash exterior surfaces of dome, dome ring, and tank wall to remove all foreign matter, dust, dirt, laitance or other surface contaminants. Minimum water pressure shall be 3,000 psi and the maximum water pressure shall be 7,000 psi.
2. After completion of the high pressure washing, low-pressure wash exterior surface as required with a 5% chlorine solution and thoroughly rinse with clean water to kill any algae, fungus or other surface contaminants.
3. Restore exterior dome and wall surface, as required, with high strength patching material to provide a sound surface for the application of the exterior tank coating.

4. Detail and fill any shrinkage cracks less than 1/16” with Tammscoat manufactured by Euclid Chemical by working the material into the crack with a brush.

5. Detail any shrinkage cracks great than 1/16” with Eucolastic 1 NS as manufactured by Euclid Chemical with conventional caulking equipment and striking the material flush with the surrounding surface. Crack detailing products can be applied over the existing coating

B. Mixing and Application of Exterior Tank Coating

1. Mix and apply the coating in strict accordance with the manufacturer’s directions.

2. Do not apply coating when the temperature is below 45°F, or when the temperature is expected to fall below 45°F within 24 hours after completing application.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage systems.
2. Storm drainage pipe.
3. Inlets, headwalls, flumes and flared end sections.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36 – Corrugated Steel Culverts and Underdrains.
   b. M190 – Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
2. ASTM International (ASTM):
   a. C14 – Concrete Culvert, Storm Drain, and Sewer Pipe.
   b. C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   c. C361 – Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
   d. C969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

3. Standard Specifications for Road and Bridge Construction for the State of Texas:
    a. Standard Details.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Layout drawings.
3. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
4. Certifications.
5. Test reports.
6. Submit all tests and certification in a single coordinated submittal.
    a. Partial submittals will not be accepted.

B. Submit schedules and details for structures and joints.

C. Operation and Maintenance Manuals:
1. See Specification Section 01 33 00 – Submittals for requirements for:
    a. The mechanics and administration of the submittal process.
    b. The content of Operation and Maintenance Manuals.

1.5 WARRANTY

A. Warrant that the infiltration will not exceed the amount specified in the Exfiltration Test paragraph in the FIELD QUALTIY CONTROL Article in PART 3 of this Specification Section during the one (1) year correction period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Cold applied asphalt joint:
    a. Kalktite 340 Compound.
    b. Tufflex.
    c. Plastico.

2. Preformed flexible pipe joint sealing compound:
    a. RAM-NEK.
    b. BIDCO C-56.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Reinforced Concrete Pipe (RCP):
1. Reinforced concrete culvert, storm drain and sewer pipe: ASTM C76, Classes III, IV, and V.

B. Concrete Pipe (CP):
1. Concrete culvert, storm drain, and sewer pipe: ASTM C14, Class 2.

C. RCP and CP Joint Sealer:
1. Preformed flexible pipe joint sealing compound.
2. Rubber gasket: ASTM C361.

D. Flared End Sections:
1. Conform to State of Texas specifications.
1. Bituminous coated: AASHTO M190, Type A.
2. Jointing: Same as pipe.

E. Corrugated Metal Pipe (CMP):
1. AASHTO M36, 16 GA.
2. Bituminous coated: AASHTO M190, Type A.
3. Jointing: Connecting bands of same base metal coated as pipe.

F. CMP Joint Sealer:
1. Cold applied asphalt joint compound.
2. Preformed flexible pipe joint sealing compound.

G. Concrete and Reinforcement for Inlets, Headwalls, and Flumes:
1. Conform to Drawings.

H. Concrete and Reinforcement for Concrete Flared End Sections:
1. Conform to Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Comply with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

3.3 FIELD QUALITY CONTROL

A. Verify and coordinate installation.

B. Exfiltration Test (per ASTM C969):

1. Perform an exfiltration test on each reach of sewer between manholes.
    a. Test the first reach after backfilling and prior to installing any of the remaining pipe, or any additional reach.
    b. Single or multiple reaches may be tested thereafter, at Contractor's option.
    c. Subject each manhole to at least one test.
    d. Provide all necessary piping between the reach to be tested and the water supply, and other necessary materials and equipment.
    e. Air testing may be allowed.
        1) Submit complete information to Owner’s representative for review describing the proposed test method, scheduling, and duration, including the method of testing manholes before beginning testing.
2. Procedure:
    a. Block off all manhole openings, except those connecting with the reach being tested.
    b. Fill the line.
        1) Average depth: 10 FT above invert, except as required by manhole depth.
        2) Depth at lower end: 25 FT maximum above crown.
        3) Depth at upper end: 5 FT minimum above crown.
    c. Add and measure water as required to maintain a constant level.
        1) Exfiltration: 100 GAL maximum per inch of nominal diameter per mile per day.
        2) Manholes are considered section of 48 IN pipe.

d. Maintain test for at least 2 HRS, or as long as necessary in Owner's representative's opinion, to locate all leaks.

3. Repair and retest any reach that exceeds the allowable exfiltration.

C. Infiltration Test:

1. If at any time prior to expiration of the correction or warranty period infiltration exceeds 200 GAL/IN of nominal DIA/mile/day, locate the leaks and make repairs.

D. Lamp Test:

1. Each section between manholes will be lamped by Owner's representative.
2. Furnish suitable assistants to help Owner's representative.
3. A minimum of 95 percent of a true circle will be required in the lamp test to indicate a properly constructed pipeline.
4. Repair any sections not passing the lamp test.

E. Post-Installation Television Inspection

1. Prior to final acceptance of newly constructed storm sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.
2. Gravity flow storm drains are required to have a straight alignment and uniform grade between manholes. Television inspections will be used to ensure proper joint alignment and that all obstructions have been removed from the storm sewer.
3. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter, which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.
4. Perform television inspection of storm sewers as follows:

a. Provide video in DVD format.

b. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each connection and where sewer transitions from one pipe material to another.

c. Videos shall be continuous for pipe segments between manholes. Do not leave gaps in videotaping of segment between manholes and do not show single segment on more than one DVD.

d. No flow is allowed in storm sewer while performing post-installation television inspection.

5. Permanently label each DVD with the following information:

Storm Sewer File No.: _____ Contractor's Name: Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation DVD No. _____ Date Televised: _____ Date Submitted: Basin No.

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length

6. For each DVD, provide completed TV Inspection Report, using inspection codes provided in City of Houston Standard Specification 02531. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.

7. Upon completion of DVD reviews by Owner's Representative, Contractor will be notified regarding final acceptance of pipe segment.

F. In case of conflict, do not relocate piping without prior approval from the Owner's representative.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 05 13

PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Process piping systems.
2. Utility piping systems.
3. Plumbing piping systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 09 91 00 – Painting and Protective Coatings.
4. Section 10 14 00 – Identification Devices.
5. Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.
6. Section 40 05 05 – Equipment: Basic Requirements.
7. Section 40 05 16 – Pipe Support Systems.
8. Section 40 05 23 – Valves: Basic Requirements.
9. Section 40 41 13 – Heat Tracing Cable.
10. Section 40 42 00 – Pipe, Duct, and Equipment Insulation.
11. Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.
12. Section 40 91 10 – Primary Elements and Transmitters.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):

a. M36, Corrugated Steel Culverts and Underdrains.

b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.

d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.

2. American Iron and Steel Institute (AISI).

3. American Society of Mechanical Engineers (ASME):

a. B16.3, Malleable Iron Threaded Fittings.

b. B16.5, Pipe Flanges and Flanged Fittings.

c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.

d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.

e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

f. B36.19, Stainless Steel Pipe.

g. B40.100, Pressure Gauges and Gauge Attachments.

4. ASTM International (ASTM):

a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.

c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

f. A197, Standard Specification for Cupola Malleable Iron.

g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

j. A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.

k. A536, Standard Specification for Ductile Iron Castings.

l. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.

m. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

n. A778, Standard Specification for Welded, Un-annealed Austenitic Stainless Steel Tubular Products.

o. B88, Standard Specification for Seamless Copper Water Tube.

p. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

q. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

r. C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

s. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

t. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

u. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

v. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

w. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

x. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

y. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.

z. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

aa. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

bb. F491, Standard Specification for Poly(Vinylidene Fluoride)(PVDF) Plastic-Lined Ferrous Metal Pipe and Fittings.

5. American Water Works Association (AWWA):

   a. B300, Standard for Hypochlorites.

   b. C200, Standard for Steel Water Pipe - 6 IN and Larger.

c. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.

d. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

e. C606, Standard for Grooved and Shouldered Joints.

f. C651, Standard for Disinfecting Water Mains.

g. C800, Standard for Underground Service Line Valves and Fittings.

6. American Water Works Association/American National Standards Institute (AWWA/ANSI):

a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings for Water.

b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.

7. Chlorine Institute, Inc. (CI):

a. Pamphlet 6, Piping Systems for Dry Chlorine.

8. Cast Iron Soil Pipe Institute (CISPI):

a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

9. International Plumbing Code (IPC).

10. National Fire Protection Association (NFPA):

a. 54, National Fuel Gas Code.

b. 69, Standard on Explosion Prevention Systems.

11. Underwriters Laboratories, Inc. (UL).

B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.4 DEFINITIONS

A. Hazardous Gas Systems: Digester gas, chlorine gas, sulfur dioxide gas, carbon dioxide gas, lab gases.

B. PVDF: Polyvinylidene fluoride.

1.5 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:

1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.6 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 - Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
      1) Attach technical product data on gaskets, pipe, fittings, and other components.
3. Fabrication and/or layout drawings:
   a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
      1) Dimensions of piping lengths.
      2) Invert or centerline elevations of piping crossings.
      3) Acknowledgement of bury depth requirements.
      4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
      5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
      6) Line slopes and vents.
   b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
      1) Dimensions of piping from column lines or wall surfaces.
      2) Centerline dimensions of piping.

3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.

4) Location and type of pipe supports and anchors.

5) Locations of valves and valve actuator type.

6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.

7) Acknowledgement of valve, equipment and instrument tag numbers.

8) Provisions for expansion and contraction.

9) Line slopes and air release vents.

10) Rough-in data for plumbing fixtures.

c. Schedule of interconnections to existing piping and method of connection.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 - Submittals for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittals:

1. Qualifications of lab performing disinfection analysis on water systems.

2. Test reports:

a. Copies of pressure test results on all piping systems.

b. Reports defining results of dielectric testing and corrective action taken.

c. Disinfection test report.

d. Notification of time and date of piping pressure tests.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.

1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.

1. Repair abrasions, scars, and blemishes.

2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

1.8 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Insulating unions:
   a. "Dielectric" by Epco.
2. Dirt strainers (Y type):
   a. Mueller (#351).
   b. Sarco.
   c. Armstrong.
3. Chemical strainers (Y type):
   a. Chemtrol.
   b. Asahi.
4. Dry disconnect couplings:
   a. Kamlock.
5. Dielectric flange kit:
   a. PSI.
   b. Maloney.
   c. Central Plastics.
6. Pipe saddles (for gage installation):
   a. Dresser Style 91 (steel and ductile iron systems).
   b. Dresser Style 194 (non-metallic systems).
7. Expansion joint at FRP and poly tanks:
   a. PROCO.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

A. Insulating Components:

1. Dielectric flange kits:
   a. Flat faced.
   b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
   c. Suitable for 175 psi, 210 DegF.
   d. 1/32 IN wall thickness bolt sleeves.
   e. 1/8 IN thick phenolic insulating washers.
2. Dielectric unions:
   a. Screwed end connections.
   b. Rated at 175 psi, 210 DegF.
   c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

B. Dirt Strainers:

1. Y-type.
2. Composition bronze.
3. Rated for test pressure and temperature of system in which they are installed.
4. 20 mesh Monel screen.
5. Threaded bronze plug in the blowoff outlet.
6. Threaded NPT end connections.

C. Strainers for Chemical Applications:

1. Y-type.
2. Strainers of same material, test pressure, and temperature rating as system in which strainer is placed.

D. Reducers:

1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

E. Protective Coating and Lining:

1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
2. Field paint pipe in accordance with Specification Section 09 91 00 – Painting and Protective Coatings.

F. Underground Warning Tape:

1. See Specification Section 10 14 00 – Identification Devices.

G. Pressure Gages:

1. See Specification Section 40 05 05 – Equipment: Basic Requirements and Specification Section 40 91 10 – Primary Elements and Transmitters.

H. Dry Disconnect Couplings:

1. Adapters:
   a. Male adapters: Size shown on Drawings.
   b. Adapters:
      1) Female NPT end connection for sludge and flush applications.
      2) Male NPT end connection for chemical applications.
   c. Construct adapters for sludge applications from cast iron or steel.
   d. Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene.
      1) Above 3 IN size, provide stainless steel units.
2. Couplers:
   a. Built-in valve and spring loaded poppet which close automatically when disconnected.
   b. Designed to remain with only one (1) arm locked in closed position.
   c. Construct couplers for sludge applications fabricated from material utilized for adapters.
   d. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.
      1) Above 3 IN, provide stainless steel units.
   e. Gasket: Compatible with conveyed liquid.
3. Dust caps: For all adapters.

I. Sacrificial Anode Cathodic Protection:

1. 3 LB magnesium sacrificial anodes, prepackaged in a cloth bag containing 75 percent hydrated gypsum, 20 percent bentonite and 5 percent anhydrous sodium sulphate.
2. TW 600 V or an HMWPE insulated copper lead attached to the anode.

J. Valves:

1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
   a. See Specification Section 40 05 23 – Valves: Basic Requirements

schedule for valve types 4 IN and above and for automatic valves used in each system.

2. See Specification Section 40 05 23 – Valves: Basic Requirements.

K. Expansion Joints at FRP and Poly Tanks:

1. Materials:

a. Bellows: PTFE-62.

b. Limit bolts and nuts: 316 stainless steel

c. Reinforcing rings: Stainless steel.

2. Pressure rating at 70 DegF: 70 psig.

3. Minimum axial movement: 3/8 IN.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 6 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 – Openings and Penetrations and as shown on Drawings.

C. When entering or leaving structures with buried piping, install restrained flexible joint as shown on plans.

1. Install second joint as shown on plans.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Laying Pipe In Trench:

1. Excavate and backfill trench in accordance with Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

2. Clean each pipe length thoroughly and inspect for compliance to specifications.

3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.

4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.

5. Except for first two (2) joints, before making final connections of joints, install two (2) full sections of pipe with earth tamped alongside of pipe or final with bedding material placed.

6. Lay pipe in only suitable weather with good trench conditions.
    a. Never lay pipe in water except where approved by Owner's representative.
7. Seal open end of line with watertight plug if pipe laying stopped.
8. Remove water in trench before removal of plug.

F. Lining Up Push-On Joint Piping:

1. Lay piping on route lines shown on Drawings.
2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
3. Observe maximum deflection values stated in manufacturer's written literature.
4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

G. Anchorage and Blocking:

1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
    a. Concrete blocks shall not cover pipe joints.
3. Provide bearing area of concrete in accordance with Drawing detail.

H. Install underground hazard warning tape per Specification Section 10 14 00 – Identification Devices.

I. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:

1. Expansion and contraction.
2. Operation and access to equipment, doors, windows, hoists, moving equipment.
3. Headroom and walking space for working areas and aisles.
4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 – Openings and Penetrations and as shown on the Drawings.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:

1. Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 16 – Pipe Support Systems.
2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
    a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.

1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.

1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage and Miscellaneous Piping:

1. Provide drip pans and piping at equipment where condensation may occur.
2. Hard pipe stuffing box leakage to nearest floor drain.
3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
    a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
    b. Hard pipe drainage to nearest floor drain.
4. Collect system condensate at drip pockets, traps and blowoff valves.
5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
    a. Size to handle application with 3/4 IN being minimum size provided.

I. Unions:

1. Install in position which will permit valve or equipment to be removed without

dismantling adjacent piping.

2. Mechanical type couplings may serve as unions.
3. Additional flange unions are not required at flanged connections.

J. Install expansion devices as necessary to allow expansion/contraction movement.

K. Provide full face gaskets on all systems.

L. Anchorage and Blocking:

1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

M. Equipment Pipe Connections:

1. Equipment - General:
   a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
   b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
   c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
      1) Provide tightening torque in accordance with manufacturer's recommendations.
   d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
   e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
   f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
   g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
   h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
      1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.

2) Realign as necessary, install flange bolts and make equipment connection.

i. Provide utility connections to equipment shown on Drawings, scheduled or specified.

2. Plumbing and HVAC equipment:

a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.

b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.

c. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.

1) Provide wheel handle stop valve at each laboratory sink water supply.

2) Minimum size: 1/2 IN.

d. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.

1) Size trap as required by IPC.

e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed.

N. Provide insulating components where dissimilar metals are joined together.

O. Instrument Connections:

1. See drawing details.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 ACCESS PROVISIONS

A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping and piping appurtenances requiring service.

B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 IN size.

C. Fabricate door and frame of minimum 14 GA, stretcher leveled stock, cadmium plated or galvanized after fabrication and fitted with screw driver lock of cam type.

D. Provide with key locks, keyed alike, in public use areas.

E. Furnish panels with prime coat of paint.

F. Style and type as required for material in which door installed.

G. Where door is installed in fire-rated construction, provide door bearing UL label required for condition.

3.5 CATHODIC PROTECTION

A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.

B. Make all connections from wire or cable by Thermit Cadwelding accomplished by operators experienced in this process.

C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50 percent of the straight line length.

D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.6 HEAT TRACING

A. See Specification Section 40 41 13 – Heat Tracing Cable.

3.7 PRESSURE GAGES

A. Provide at locations shown on the Drawings and specified.

B. See Specification Section 40 05 05 – Equipment: Basic Requirements.

3.8 FIELD QUALITY CONTROL

A. Pipe Testing - General:

1. Test piping systems as follows:

a. Test exposed, non-insulated piping systems upon completion of system.

b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.

c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.

d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.

2. Utilize pressures, media and pressure test durations as specified in Piping Specification Schedules.
3. Isolate equipment which may be damaged by the specified pressure test conditions.
4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.

   a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.

   b. Notify the Owner's representative 24 HRS prior to each test.

5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
6. Acknowledge satisfactory performance of tests and inspections in writing to Owner's representative prior to final acceptance.
7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:

1. Testing medium: Unless otherwise specified in the Piping Specification Schedules, utilize the following test media.

   a. Process and plant air systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
2 IN and smaller	75 psi or less	Air or water
2 IN and smaller	Greater than 75 psi	Water
Greater than 2 IN	3 psi or less	Air or water
Greater than 2 IN	Greater than 3 psi	Water

   b. Laboratory gases and natural gas systems: Cylinder nitrogen.

c. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 IN	Gravity	25 psig or less	Air or water
Above 48 IN	Gravity	25 psig or less	Water
All sizes	Pumped	250 psig or less	Water

2. Allowable leakage rates:

   a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.

   b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers (groundwater level is below the top of pipe):

      1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head on test section of 3 FT.

      2) Average head is defined from groundwater elevation to average pipe crown.

      3) Acceptable test head leakage rate for heads greater than 3 FT: Acceptable leakage rate (gallons per inch diameter per mile per day) = 115 x (actual test head to the 1/2 power).

   c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is above the top of pipe):

      1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 FT.

      2) Leakage rate at heads greater than 6 FT: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) = 82 x (actual head to the 1/2 power).

   d. Large diameter (above 48 IN) gravity plant piping systems shall have a maximum exfiltration of 25 gpd per inch-mile.

   e. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5 percent of the specified test pressure throughout the duration of the test.

   f. For low pressure (less than 25 psig) air testing, the acceptable time for loss of 1 psig of air pressure shall be:

PIPE SIZE (IN DIA)	TIME, MINUTES/100 FT
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3
48	7.6

3. Hydrostatic pressure testing methodology:

   a. General:

      1) All joints, including welds, are to be left exposed for examination during the test.

      2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.

      3) Provide temporary restraints for expansion joints for additional pressure load under test.

      4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.

      5) Do not paint or insulate exposed piping until successful performance of pressure test.

   b. Soil, waste, drain and vent systems:

      1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.

      2) Eliminate leaks before proceeding with work or concealing piping.

      3) Minimum test heights shall be 10 FT above highest stack inlet.

   c. Larger diameter (above 36 IN) gravity plant piping:

      1) Plug downstream end of segment to be tested.

         a) Provide bracing as required.

      2) Fill segment and upstream structure to normal operating level as per hydraulic profile.

3) Allow 24 HRS for absorption losses.

a) Refill to original level.

4) Provide reservoir to maintain constant head over duration of test.

5) Record reservoir water volume at beginning and end of test.

4. Natural gas systems - testing methodology:

a. Maintain specified test pressure until each joint has been thoroughly examined for leaks by means of soap suds and glycerine.

b. Wipe joints clean after test.

5. Air testing methodology:

a. General:

1) Assure air is ambient temperature.

b. Low pressure air testing:

1) Place plugs in line and inflate to 25 psig.

2) Check pneumatic plugs for proper sealing.

3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig greater than ground water that may be over the pipe.

a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and accuracy of 1 percent of full range.

4) Allow 2 minutes for air pressure to stabilize.

5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air supply to line segment.

6) Record pressure at beginning and end of test.

C. Dielectric Testing Methods and Criteria:

1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.

2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.9 CLEANING, DISINFECTION AND PURGING

A. Cleaning:

1. Clean interior of piping systems thoroughly before installing.

2. Maintain pipe in clean condition during installation.

3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
    a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
    b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
    c. Oxygen shall never be used.
6. Clean chlorine piping in accordance with CI Pamphlet 6.

B. Disinfection of Potable Water Systems:

1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
4. Flush each segment of system to provide flushing velocity of not less than 2.5 FT per second.
5. Dechlorination of disinfection waters and then drain flushing water to storm water.
    a. Do not drain flushing water to receiving stream without dechlorination.
6. Use continuous feed method of application.
    a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, coordinate with Owner on sampling and analysis of water. Owner shall select an independent laboratory that shall collect samples and test for bacteriological quality.
    a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system, if not provided directly to Owner by the testing lab.
    a. Ensure sampling and testing procedures are in full compliance to AWWA

C651, local water purveyor and applicable requirements of State of Texas.

10. Existing piping:
    a. Turn off gas supply.
    b. Vent line pressure outdoors.
    c. If section exceeds the following, then remaining gas shall be displaced with an inert gas.
        1) 50 FT for 2-1/2 IN pipe.
        2) 30 FT for 3 IN pipe.
        3) 15 FT for 4 IN pipe.
        4) 10 FT for 6 IN pipe.
        5) Any length for 8 IN or larger pipe.
11. New piping:
    a. Including but not limited to:
        1) All fuel gas piping.
        2) Digesters.
        3) Digester gas equipment.
        4) Fuel gas trains.
    b. Purge air filled system with fuel gas:
        1) Providing piping length is less than:
            a) 30 FT for 3 IN pipe.
            b) 15 FT for 4 IN pipe.
            c) 10 FT for 6 IN pipe.
            d) Any length for 8 IN and larger pipe.
        2) Providing a moderately rapid and continuous flow of fuel gas is introduced.
            a) Introduce fuel gas at one (1) end.
            b) Vent air at opposite end.
        3) Provided fuel gas flow is continuous without interruption until vented gas is free of air.
        4) The point of discharge shall not be left unattended during purging.
    c. If the piping is 3 IN or larger and exceeds lengths stated above.
        1) Purge air with inert gas in accordance with NFPA 54 and NFPA 69.
        2) Purge inert gas with fuel gas.

12. Discharge of purged gases:

    a. Open end of piping shall not discharge into confined spaces or areas where there are sources of ignition.

3.10 LOCATION OF BURIED OBSTACLES

A. Furnish exact location and description of buried utilities encountered and thrust block placement.

B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.

C. Include such information as location, elevation, coverage, supports and additional pertinent information.

D. Incorporate information on "As-Recorded" Drawings.

3.11 PIPE INSULATION

A. Insulate pipe and pipe fittings in accordance with Specification Section 40 42 00 – Pipe, Duct, and Equipment Insulation.

3.12 SCHEDULES

A. SPECIFICATION SCHEDULE - **SYSTEM 1**

1. General:

    a. Piping symbol and service:

        1) SH – Suction Header (Tank Outlet)

        2) TT – Tank to Tank Connection

        3) WCLB – Well Collection Line Buried (Tank Inlet)

    b. Test requirements:

        1) Test medium: Water.

        2) Pressure: see pipe schedule.

        3) Duration: 6 HRS.

    c. Gaskets:

        1) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.

        2) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

        3) Flanged joints (steel): Rubber, AWWA C207.

2. System components:
    a. Pipe size 24 IN through 30 IN:
        1) Exposed service:
            a) Material:
                (1) Flanged: Ductile iron, Class 200.
                (2) Grooved type joint system: Use pipe thickness per AWWA C606.
            b) Reference: AWWA/ANSI C115/A21.15.
            c) Lining: Cement.
            d) Coating: Paint.
            e) Fittings: AWWA/ANSI C110/A21.10 ductile iron fittings or AWWA/ANSI C110/A21.10, 250 psi rated gray iron fittings.
            f) Joints:
                (1) Flanged or grooved type mechanical coupling (AWWA C606) joints.
                (2) With both systems, provide screwed-on flanges at equipment, valves and structure penetrations.
        2) Buried service:
            a) Materials: Ductile iron, Class 200.
            b) Reference: AWWA/ANSI C151/A21.51.
            c) Lining: Cement.
            d) Coating: Bituminous.
            e) Fittings:
                (1) AWWA/ANSI C110/A21.10 ductile iron fittings or AWWA/ANSI C110/A21.10, 250 psi rated gray iron fittings.
                (2) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 IN to 16 IN.
            f) Joints: Push-on with mechanical (stuffing box type) joints at fittings and valves.

B. SPECIFICATION SCHEDULE - **SYSTEM 2**

1. General:
    a. Piping symbol and service:
        1) SW – Surface Water Line (Tank Inlet)
    b. Test requirements:
        1) Test medium: Water.

2) Pressure: see pipe schedule.

3) Duration: 6 HRS.

c. Gaskets:

1) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.

2) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

3) Flanged joints (steel): Rubber, AWWA C207.

2. System components:

a. Pipe size 16 IN:

1) Exposed service:

a) Material:

(1) Flanged: Ductile iron, Class 250.

(2) Grooved type joint system: Use pipe thickness per AWWA C606.

b) Reference: AWWA/ANSI C115/A21.15.

c) Lining: Cement.

d) Coating: Paint.

e) Fittings: AWWA/ANSI C110/A21.10 ductile iron fittings or AWWA/ANSI C110/A21.10, 250 psi rated gray iron fittings.

f) Joints:

(1) Flanged or grooved type mechanical coupling (AWWA C606) joints.

(2) With both systems, provide screwed-on flanges at equipment, valves and structure penetrations.

2) Buried service:

a) Material: Steel, fabricated pipe.

b) Reference: AWWA C200.

c) Lining: Cement.

d) Coating: Paint.

e) Fittings: AWWA C208.

f) Joints: Butt welded.

C. SPECIFICATION SCHEDULE - **SYSTEM 3**

1. General:

a. Piping symbol and service:

1) OF – Tank Overflow
2) DR – Tank Drain.

b. Test requirements:
1) Test medium: Water.
2) Duration: 6 HRS.

c. Gaskets and O-rings:
1) O-rings: Neoprene or rubber.
2) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.

2. System components:
a. Pipe size 3 in and greater :
1) Exposed service:
a) Materials:
(1) Flanged: Ductile iron, Class 53.
b) Reference: AWWA/ANSI C115/A21.15.
c) Lining: Cement.
d) Coating: Paint per applicable specification sections.
e) Fittings: AWWA/ANSI C110/A21.10 ductile iron.
f) Joints: Flanged joints.
2) Buried service:
a) Materials: Ductile iron, Class 53.
b) Reference: AWWA/ANSI C151/A21.51.
c) Lining: Cement.
d) Coating: Bituminous per applicable specification sections.
e) Fittings:
(1) AWWA/ANSI C110/A21.10 ductile iron.
(2) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 to 16 IN.
f) Joints: Push-on with mechanical (stuffing box type) joints at fittings and valves with restraints as required.

D. SPECIFICATION SCHEDULE - **SYSTEM 4**
1. General:
a. Piping symbol and service:

1) STM – Storm Drain.

b. Test requirements:

1) See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

c. Gaskets:

1) Push-on joints: Rubber, ASTM C443.

2. System components:

a. Pipe size 4 IN and greater:

b. Refer to Section 33 40 00.

1) Buried service up to 15 FT bury.

a) Material: Concrete, Class III Pipe.

b) Reference: ASTM C76.

c) Lining: None.

d) Coatings: None.

e) Fittings: Smooth or mitered fittings meeting ASTM C46.

f) Joints: Spigot/bell type joint with O-ring gasket to conform to ASTM C443.

3.13 OWNER TRAINING (NOT USED)

END OF SECTION

ATTACHMENT – PIPE SCHEDULE

LEGEND	DESCRIPTION	SYSTEM	PRESSURE		NOTES
			WORKING (psi)	TEST (psi)	
DR	Tank Drain	3	20	25	N/A
OF	Tank Overflow	3	20	25	N/A
SH	Suction Header	1, 3	75	125	System 1 - Exposed piping only unless otherwise shown on plans. System 3 - Buried/Exposed.
STM	Strom Drain	4	0	0	Class A-III
SW	Surface Water Line	2	75	125	System 1 - Exposed piping only unless otherwise shown on plans. System 3 - Buried/Exposed.
TT	Tank to Tank Connection	1, 3	20	30	System 1 - Exposed piping only unless otherwise shown on plans. System 3 - Buried/Exposed.
WCLB	Well Collection Line Buried	1, 3	75	125	System 1 - Exposed piping only unless otherwise shown on plans. System 3 - Buried/Exposed.

1. All buried pipe (other than Storm Drain and surface water line) shall be ductile iron (System 3), unless otherwise shown on Drawings.

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SECTION 40 05 16

PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe support and anchor systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 09 91 00 – Painting and Protective Coatings.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ANVIL International (ANVIL).
2. American Society of Mechanical Engineers (ASME):
   a. B31.1, Power Piping.
   b. B31.3, Process Piping.
3. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A510, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
   c. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
   d. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
4. American Welding Society (AWS):
   a. D1.1, Structural Welding Code - Steel.

5. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
    a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
    b. SP-69, Pipe Hangers and Supports - Selection and Application.

1.4 SUBMITTALS

A. Shop Drawings:
    1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
    2. Product technical data including:
        a. Acknowledgement that products submitted meet requirements of standards referenced.
        b. Manufacturer's installation instructions.
        c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
        d. Scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MANUFACTURED UNITS

A. Hanger Rods:
    1. Material:
        a. ASTM A36.
        b. ASTM A510, Grade 1020.
        c. ASTM A575, Grade M1020.
        d. ASTM A576, Grade 1020.
        e. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
    2. Continuously threaded.

3. Electro-galvanized or cadmium plated after threads are cut.
4. Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD, (LBS)
3/8 IN DIA (min)	610
1/2 IN DIA	1,130
5/8 IN DIA	1,810
3/4 IN DIA	2,710
7/8 IN DIA	3,770
1 IN DIA	4,960

B. Hangers:
1. Hangers for use directly on copper pipe: Copper or cadmium plated.
2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
3. Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE
All except noted	4 IN and less	ANVIL Figure 108 with Figure 114
All except noted	Over 4 IN	ANVIL Figure 590
Steam, condensate and hot water	All	ANVIL Figure 181, Figure 82

C. Concrete Inserts for Hanger Rods:
1. Continuous slots: Unistrut #P1000.
2. Individual inserts: ANVIL Figure 281.
3. Self-drilling expansion anchors: Phillips flush-end or snap-off end type.

D. Beam Clamps for Hanger Rods:
1. Heavy duty.
2. ANVIL Figure 134.

E. Trapeze Hangers for Suspended Piping:
1. Material: Steel.
2. Galvanized.
3. Angles, channels, or other structural shapes.
4. Curved roller surfaces at support point corresponding with type of hanger required.

F. Vertical Pipe Supports:
   1. At base of riser.
   2. Lateral movement:
      a. Clamps or brackets:

G. Expanding Pipe Supports:
   1. Spring hanger type.
   2. MSS SP-58.

H. Pipe Support Saddle:
   1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
   2. ANVIL Figure 264.

I. Pipe Support Risers:
   1. Schedule 40 pipe.
   2. Galvanized.
   3. As recommended by saddle manufacturer.

J. Pipe Support Base Plate:
   1. 4 IN larger than support.
   2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
   3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
   4. Collar welded to floor plate.
   5. Edges ground smooth.
   6. Assembly hot dipped galvanized after fabrication.

K. Pipe Covering Protection Saddle:
   1. For insulated pipe at point of support.
   2. ANVIL Figure 167, Type B.

L. Wall Brackets:
   1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.
   2. ANVIL Figure 199.

M. Pipe Anchors:
   1. For locations shown on the Drawings.
   2. 1/4 IN steel plate construction.

3. Hot dipped galvanized after fabrication.
4. Designed to prevent movement of pipe at point of attachment.

N. Pipe Guides:

1. For locations on both sides on each expansion joint or loop.
2. To ensure proper alignment of expanding or contracting pipe.
3. ANVIL Figure 256.

2.3 DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions.

1. Provide 5 to 1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:

1. ASME B31.3.
2. MSS SP-58 and MSS SP-69.
3. Except where modified by this Specification Section.

E. For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:

1. ASME B31.1.
2. MSS SP-58 and MSS SP-69.

F. Check all physical clearances between piping, support system and structure.

1. Provide for vertical adjustment after erection.

G. Support vertical pipe runs in pipe chases at base of riser.

1. Support pipes for lateral movement with clamps or brackets.

H. Place hangers on outside of pipe insulation.

1. Use a pipe covering protection saddle for insulated pipe at support point.
2. Insulated piping 1-1/2 IN and less: Provide a 9 IN length of 9 LB density fiberglass insulation at saddle.
3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of 9 LB density fiberglass insulation on saddle.

I. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 4 IN.

J. Pipe Support Spacing:

1. General:

a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.

b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.

c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.

2. Steel, stainless steel, cast-iron pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

3. Copper pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
2-1/2 and less	5
3 thru 6	10
8 and greater	15

4. PVC pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/4 and less	3
1-1/2 thru 3	4
4 and greater	5

* Maximum fluid temperature of 120 DegF.

5. Support each length and every fitting:

a. Bell and spigot piping:

1) At least one (1) hanger.

2) Applied at bell.

b. Mechanical coupling joints:

1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.

6. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.
7. Provide continuous support for nylon tubing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
   1. Included in this requirement are movements from:
      a. Trap discharge.
      b. Water hammer.
      c. Similar internal forces.

B. Weld Supports:
   1. AWS D1.1.
   2. Weld anchors to pipe in accordance with ASME B31.3.

C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

D. Inspect hangers for:
   1. Design offset.
   2. Adequacy of clearance for piping and supports in the hot and cold positions.
   3. Guides to permit movement without binding.
   4. Adequacy of anchors.

E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
   1. Install concrete inserts as concrete forms are installed.

G. Welding:
   1. Welding rods: ASTM and AWS standards.
   2. Integral attachments:
      a. Include welded-on ears, shoes, plates and angle clips.
      b. Ensure material for integral attachments is of good weldable quality.

3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.

H. Field Painting:

1. Comply with Specification Section 09 91 00 – Painting and Protective Coatings.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 05 23

VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valving, actuators, and valving appurtenances.
2. Specification Section is applicable to:
   a. See valve schedule in the attachment.
   b. Add tagging for new valves per valve schedule and requirements in specification section 10 14 00 Identification Devices.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 09 91 00 - Painting and Protective Coatings.
4. Section 10 14 00 - Identification Devices.
5. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.
6. Section 40 50 15 - Butterfly Valves.
7. Section 40 50 20 - Ball Valves.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B1.20.1, Pipe Threads, General Purpose.
   b. B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
   c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   d. B16.34, Valves-Flanged, Threaded and Welding End.

2. ASTM International (ASTM):
   a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   c. D638, Standard Test Method for Tensile Properties of Plastics.
   d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
   f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
3. American Water Works Association (AWWA):
   a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
   b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Standard for Rubber-Seated Butterfly Valves.
   d. C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).
   e. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
   f. C542, Standard for Electric Motor Actuators for Valves and Slide Gates.
   g. C515, Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
   h. C550, Standard for Protective Coatings for Valves and Hydrants.
   i. C606, Standard for Grooved and Shouldered Joints.
4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. MG 1, Motors and Generators.

1.4 DEFINITIONS

A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
   1. CWP: Cold water working pressure.

2. SWP: Steam working pressure.
3. WOG: Water, oil, gas working pressure.
4. WWP: Water working pressure.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Valve pressure and temperature rating.
   d. Valve material of construction.
   e. Special linings.
   f. Valve dimensions and weight.
   g. Valve flow coefficient.
   h. Project specific wiring and control diagrams for electric or cylinder actuators. Wiring diagrams shall clearly identify terminations for power, control, and instrumentation field wiring. Refer to plans for specific requirements.
   i. Motor data – duty rating, insulation class, HP, full load amps, voltage, opening/closing times, etc.
3. Test reports.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 – Submittals for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittals:

1. Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:

1. Provide actuators as shown on Drawings or specified.
2. Counter clockwise opening as viewed from the top.
3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
6. Extension stem:
    a. Install where shown or specified.
    b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
    c. Pin all stem connections.
    d. Center in valve box or grating opening band with guide bushing.
    e. Connect stem to valve actuator with single universal joint with greased sealed bearings.

B. Buried Valve Actuators:

1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover rated for traffic load.
2. Box base to enclose buried valve gear box or bonnet.
3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.

4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key and handle.
5. Extension stem:
    a. Provide for buried valves greater than 4 FT below finish grade.
    b. Extend to within 6 IN of finish grade.
6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown otherwise.

C. Plastic Valve Vault:
1. Provide in non-traffic areas only on valve applications 3-1/2 IN and less.
2. Nominal 7-1/2 IN DIA top section.
3. Design unit for screw type extension section having nominal 9 IN DIA bell.
4. Cast iron ring and lid.
5. Constructed of injection molded polyolefin compound with fibrous inorganic component reinforcing and UV stabilization.
6. Armor Access Boxes.

D. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate and globe valves.
    a. Size handwheels for valves in accordance with AWWA C500.
3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
    a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
    b. Provide at least two (2) levers for each type and size of valve furnished.
4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
    a. Cadmium-plated chain looped to within 3 FT of finish floor.
    b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.

8. Provide cast iron floor stands where shown on Drawings.
    a. Stands to be furnished by valve manufacturer with actuator.
    b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.

E. Submerged Actuators:
1. Mount the valve actuator on top of an extension bonnet 3 FT above any adjacent personnel access.
2. The valve and bonnet connection shall be flanged and watertight.
3. Provide a top brace support for the bonnet.
    a. Mount the brace 6 IN below the top of the wall as shown.
4. Materials:
    a. Extension bonnet: Cast iron ASTM A126 or steel.
    b. Brace and anchor bolts: Type 304 stainless steel.

F. Portable Valve Operator
1. Provide portable valve operator when required in drawings.
2. Approved Manufacturers
    a. EH Wachs or equal
3. Provide handheld, 110 V, 1 Phase electric valve operator.
4. Capable of operating valves from 6 inches to 60 inches.
5. Provide adjustable torque control with a peak torque of 800 ft/lbs, with two stage reduction, planetary aluminum gearbox.
6. Manufacturer to provide telescoping valve key with 4’-9’ range. Also provide 3’ extensions. All valve keys to be rated at 850 ft/lbs.
7. Motor control to have the following options:
    a. 2 speed gear box
    b. Overload reset button
    c. On/off, forward/reverse and neutral options
    d. GFI (ground fault interrupter) with test and reset
8. Provide built-in digital revolution counter with push button reset counts.
9. Contractor responsible for providing portable cart mounted gas powered electric generator for use with valve operator.

2.4 FABRICATION

A. End Connections:
1. Provide the type of end connections for valves as required in the Piping

Schedules presented in Specification Section 40 05 13 or as shown on the Drawings.

2. Comply with the following standards:
   a. Threaded: ASME B1.20.1.
   b. Flanged: ASME B16.1 Class 125 unless otherwise noted or AWWA C207.
   c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
   d. Soldered: ASME B16.18.
   e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

C. Nuts, Bolts, and Washers:
   1. Wetted or internal to be bronze or stainless steel.
      a. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

E. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Painting Requirements: Comply with Specification Section 09 91 00 – Painting and Protective Coatings for painting and protective coatings.

C. Setting Buried Valves:
   1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
   2. Set valves and valve boxes plumb.
   3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
   4. Install in closed position.
   5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
   6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

E. For grooved coupling valves, install rigid type couplings or provide separate support to prevent rotation of valve from installed position.

F. Install electric or cylinder actuators above or horizontally adjacent to valve and gear box to optimize access to controls and external handwheel.

G. For threaded valves, provide union on one (1) side within 2 FT of valve to allow valve removal.

H. Install valves accessible for operation, inspection, and maintenance.

3.2 ADJUSTMENT

A. Adjust valves, actuators and appurtenant equipment to comply with Specification Section 01 75 00 – System-Start Up.

1. Operate valve, open and close at system pressures.

B. For all 120 Vac and 480 Vac electric actuators, employ and pay for services of valve actuator manufacturer's field service representative to:

1. Inspect valve actuators covered by this Specification Section.

2. Supervise adjustments and installation checks:

a. Open and close valves electrically under local manual and demonstrate that all limit switches are properly adjusted and that switch contacts are functioning properly by verifying the inputs are received at the remote input/output (RIO) panels or local control panel as appropriate.

b. Position modulating valves electrically under local manual control and demonstrate that the valve position feedback potentiometer is properly adjusted and that the feedback signal is received at the RIO panels or local control panel as appropriate.

c. Simulate a valve position command signal at the RIO panel or local control panel as appropriate and demonstrate that the valve is controlled to the desired position without excessive hunting.

3. Provide Owner with a written statement that the valve actuator manufacturer has verified that the actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted and that the valve actuator responds correctly to the valve position command.

3.3 SPARE PARTS

A. Provide a minimum of one spare actuator for each size of actuator provided.

3.4 SCHEDULES

A. Valves less than 4 IN are not scheduled but type and size are defined on Drawings in plan, section, or schematic.

B. Legend of abbreviations

Connections

FLG	Flanged
MJ	Mechanical Joint
VIC	Victaulic
PO	Push-On
SW	Socket Solvent Weld
T	Threaded

Actuator

CW	Chain Wheel
HW	Handwheel
L	Lever
M	Motor
PNEU	Pneumatic
HYD	Hydraulic
N	2” Nut

Buried/Exposed

B	Buried
E	Exposed

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

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Valve Schedule												
Tagging												
Division	Facility	Area	Subarea	Equip Code	Unit #	Equip #	Size (in)	Pres/Temp Rating (psi/deg F)	Conn.	Actuator	Buried / Exposed	Notes
WD	GWP04	GST	GST2	BFV	02	001	24	150	FLG	N	B	WCLB (Tank Inlet)
WD	GWP04	GST	GST2	BFV	02	002	16	150	FLG	HW	E	SW (Tank Inlet)
WD	GWP04	GST	GST2	BFV	02	003	24	150	FLG	N	B	SH (Tank Outlet)
WD	GWP04	GST	GST2	BFV	02	004	24	150	FLG	N	B	DR
WD	GWP04	GST	GST2	BFV	02	005	24	150	FLG	N	B	TT
WD	GWP04	GST	GST2	FV	02	001	24	30	FLG	N	B	OF/STM
WD	GWP04	GST	GST2	BV	02	001	2	30	FLG	HW	E	Spare 2” Flange
WD	GWP04	GST	GST2	BV	02	002	4	30	FLG	HW	E	Level Gauge

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SECTION 40 20 13

PIPE: MISCELLANEOUS STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe, fittings, and appurtenances for nonpotable service lines and potable water service lines. Stainless steel piping is described in Section 40 20 77 – Pipe: Stainless Steel.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 09 91 00 – Painting and Protective Coatings.
4. Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

C. This section is not applicable to water lines unless specifically noted in the drawings, this specification, or other specifications.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
   b. B1.2, Gages and Gaging for Unified Inch Screw Threads.
   c. B16.3, Malleable Iron Threaded Fittings.
   d. B16.5, Pipe Flanges and Flanged Fittings.
   e. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
   f. B16.11, Forged Steel Fittings, Socket Welding and Threaded.
   g. B31.1, Power Piping.
   h. B31.3, Process Piping.
   i. B31.9, Building Services Piping.

j. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

2. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. A181, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
   d. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   e. A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
   f. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   g. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   h. B6, Standard Specification for Zinc.
   i. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
3. American Water Works Association (AWWA):
   a. C200, Standard for Steel Water Pipe - 6 IN and Larger.
   b. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel water Pipeline - Enamel and Tape - Hot Applied.
   c. C205, Standard for Cement-Mortar Lining and Coating for Steel Water Pipe - 4 IN and Larger - Shop Applied.
   d. C206, Standard for Field Welding of Steel Water Pipe.
   e. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
   f. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
   g. C209, Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   h. C210, Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
   i. C213, Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   j. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.

k. C222, Standard for Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.

l. C606, Standard for Grooved and Shouldered Joints.

m. M11, Steel Pipe - A Guide for Design and Installation.

4. Society of Automotive Engineers (SAE):

a. AMS-QQ-P-416, Cadmium Plating Electro deposited.

B. Qualifications:

1. Application of lining and coating materials including preparation of surfaces, priming, and lining and coating of pipe, fittings, and specials, in shop, repairs of any damage to lining or coating occurring during shipment or any other time, and field lining and coating of ends where linings or coatings have been held back for welded field joints, shall be done by established and recognized pipe company acceptable to Owner's representative.

2. Use only certified welders meeting procedures and performance outlined in ASME Section IX, AWWA C200 Section 3.3.3 and other codes and requirements per local building and utility requirements.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

3. Factory test reports.

4. If mechanical grooved type coupling system is used, submit piping, fittings, and appurtenant items which will be utilized.

5. Coating manufacturer's qualifications.

6. Welders certificates.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Flanged adaptors:

a. Rockwell (Style 913 (steel)).

b. Dresser (Style 128 (steel)).

2. Insulating couplings:
    a. Rockwell (Style 416).
    b. Dresser (Style 39).
3. Reducing couplings:
    a. Rockwell (Style 415).
    b. Dresser (Style 62).
4. Transition coupling:
    a. Rockwell (Style 413).
    b. Dresser (Style 62).
5. Compression sleeve coupling:
    a. Rockwell (Style 411 (steel)).
    b. Dresser (Style 38 (steel)).
6. Mechanical couplings and fittings:
    a. Victaulic (Style 07 or 77).
    b. S.P. Fittings.
7. Vibration isolation equipment connections for natural gas:
    a. Flexonics (Model 401H).
8. Flexible connectors for hot water equipment:
    a. Flexonics (FLG Series).
    b. Thermo Tech (F/J/R Series).
9. Factory-applied plastic or epoxy coatings:
    a. "Encoat" Division of Energy Coating Company.
    b. "Scotchkote" Division of 3M Company.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. All materials used in steel piping systems defined in Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements shall meet or exceed pressure test requirements specified for each respective system.

B. Steel Pipe (Fabricated Type):
    1. AWWA C200:
        a. ASTM A36, Grade C steel plate.
        b. ASTM A283, Grade D steel plate.

c. ASTM A572, steel plate.

d. ASTM A1011, steel sheet.

C. Steel Pipe (Mill Type): ASTM A53, Type E or S.

D. Fittings (For Fabricated Pipe): AWWA C208.

E. Fittings (For Mill Type Pipe):

1. ASTM A234.
2. ASME B16.3, ASME B16.5, ASME B16.9, ASME B16.11.

F. Flanges (Fabricated Pipe):

1. AWWA C207
2. Flange material: ASTM A283, Grade C or D, ASTM A181, Grade 1.
3. Flange finish: Flat faced.

G. Flanges (Mill Type Pipe):

1. ASME B16.5.
2. Flat faced.
3. Slip-on flanges.

H. Nuts and Bolts:

1. Buried: 316 Stainless.
2. Exposed: Mechanical galvanized ASTM B695, Class 40.
3. Heads and dimensions per ASME B1.1.
4. Threaded per ASME B1.1.
5. Project ends 1/4 to 1/2 IN beyond nuts.

I. Gaskets: See individual piping systems in Specification Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

2.3 MANUFACTURED UNITS

A. Couplings:

1. Flanged adaptors:

a. Steel or carbon steel body sleeve, flange, followers and Grade 30 rubber gaskets.

b. Provide units specified in Article 2.1 - ACCEPTABLE MANUFACTURERS.

c. Flanges meeting standards of adjoining flanges.

d. Tie bolt assembly.

1) For pipe 14 IN and larger.

2) Minimum four (4) bolts equally spaced around the pipe and extending from cast steel lugs welded on the pipe to lugs welded on the coupling middle ring.

e. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.

2. Compression sleeve coupling:

a. Steel sleeve, followers Grade 30 and rubber gaskets.

b. Provide units specified in Article 2.1 - ACCEPTABLE MANUFACTURERS.

c. Flanges meeting standards of adjoining flanges.

d. Tie bolt assembly.

1) For pipe 14 IN and larger.

2) Minimum four (4) bolts equally spaced around the pipe and extending from cast steel lugs welded on the pipe to lugs welded on the coupling middle ring.

e. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.

f. Provide field coating for buried couplings per AWWA C203.

3. Mechanical coupling joint:

a. Use of mechanical grooved (AWWA C606) type couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 40 05 13.

b. Utilize units defined in Article 2.1 - ACCEPTABLE MANUFACTURERS.

2.4 ACCESSORIES

A. Heating Water Application:

1. For steel heating lines, provide braided, flanged stainless steel connectors for connection to equipment.

2. Provide pump connectors with stainless steel construction, rubber filled bellows and flanged end connections.

B. Natural Gas Equipment Isolator: 316L stainless steel, T-321 stainless steel braid with connections compatible with joints in piping system.

2.5 FABRICATION

A. Provide piping (mill or fabricated) for use in the Project with minimum wall thicknesses as follows:

1. 1/8 - 5 IN DIA pipe: Schedule 40.

2. 6 - 10 IN DIA pipe: 3/16 IN.

3. 12 - 14 IN DIA pipe: 7/32 IN.
4. 16 - 48 IN DIA pipe: 1/4 IN.
5. 54 - 60 IN DIA pipe: 5/16 IN.
6. 66 - 72 IN DIA pipe: 3/8 IN.
7. Sizes through 24 IN are nominal OD.
    a. Sizes greater than 24 are ID.
8. Wall thicknesses indicated are for standard weight pipe.
    a. Design pipe in accordance with operating pressures shown in Piping Schedules for a design stress limited to 50 percent of yield.

B. Furnish cast parts with lacquer finish compatible with finish coating.

C. Furnish without outside coating of bituminous material any exposed pipe scheduled to be painted.

D. Fabricated Fittings:
1. AWWA C208.
2. Assure ratio of radius of bend to diameter of pipe equal to or greater than 1.0.
3. Minimum number of pieces:
    a. Less than 30-Deg deflection: 2.
    b. 30-Deg to less than 45-Deg deflection: 3.
    c. 45-Deg to less than 60-Deg deflection: 4.
    d. 60-Deg through 90-Deg deflection: 5.

E. Taper cement mortar linings as required for valve interfacing.

F. Protective Coatings and Linings:
1. Pipe Linings:
    a. AWWA C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied.
    b. AWWA C205, Standard for Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop Applied.
    c. AWWA C210, Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
    d. AWWA C213, Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
    e. AWWA C222, Standard for Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.

f. AWWA C224, Standard for Two-Layer Nylon-11-Based Polyamide Coating System for the Interior and Exterior of Steel Water Pipe, Connections, Fittings, and Special Sections.

g. AWWA C602, Standard for Cement–Mortar Lining of Water Pipelines—4 In. (100 mm) and Larger In Place.

2. Pipe Coatings:

a. Synthetic primer with hot coat enamel into which single layer of asbestos-felt wrap is bonded and finished with one (1) coat whitewash or single wrap of kraft paper in accordance with AWWA C203 Section 2.

b. Synthetic primer with heated tape in accordance with AWWA C203 Section 3.

c. Synthetic primer with hot coat enamel and bonded double asbestos felt wraps in accordance with AWWA C203.

d. Synthetic primer with hot coat enamel and reinforced cement-mortar shield in accordance with AWWA C203 Appendix A Section A1.4.

e. Synthetic primer with hot coat enamel, fibrous-glass mat and bonded asbestos-felt wrap in accordance with AWWA C203 Appendix A Section A1.5.

f. Reinforced cement-mortar in accordance with AWWA C205.

g. Primer and prefabricated cold-applied tape in accordance with AWWA C209.

h. Epoxy in accordance with AWWA C210.

i. Fusion-bonded epoxy in accordance with AWWA C213.

j. Cold applied type in accordance with AWWA C214.

k. Painting and protective coatings in accordance with Specification Section 09 91 00.

l. Polyurethane in accordance with AWWA C222.

m. Galvanizing in accordance with ASTM B6.

n. 3M "Scotchkote" or Energy Coatings Company "Encoat" in accordance with manufacturer's recommendations.

2.6 SOURCE QUALITY CONTROL

A. Testing:

1. Shop hydrostatic test fabricated steel pipe and fittings.

2. Field hydrostatic test all pipe as specified in Specification Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Steel pipe may only be used for exposed piping unless otherwise noted on the Drawings. Steel pipe shall not be used for buried pipe, unless approved by the Engineer.

C. Joining Methods - Flanges:

1. Facing method:
    a. Insert slip-on flange on pipe.
    b. Assure maximum tolerances for flange faces from normal with respect to axis of pipe is 0.005 IN per foot of flange diameter.
    c. Test flanges after welding to pipe for true to face condition and reface, if necessary, to bring to specified tolerance.
2. Joining method:
    a. Leave 1/8 to 3/8 IN of flange bolts projecting beyond face of nut after tightening.
    b. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, tank, and other interconnecting piping systems.
    c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.
        1) Allow one (1) flange free movement in any direction while bolts are being tightened.
    d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
    e. Gradually tighten flange bolts uniformly to permit even gasket compression.
    f. Do not overstress bolts to compensate for poor installation.

D. Joining Method - Welded Joints:

1. Perform welding in accordance with AWWA C206 and this Specification Section.
2. For flange attachment perform in accordance with AWWA C207.
3. Have each welding operator affix an assigned symbol to all his welds.
    a. Mark each longitudinal joint at the extent of each operator's welding.
    b. Mark each circumferential joint, nozzle, or other weld into places 180 degrees apart.

4. Welding for all process piping shall conform with ASME B31.3.
    a. Welding of utility piping 125 psi and less shall be welded per ASME B31.9.
    b. Utility piping above 125 psi shall conform to ASME B31.1.
5. Provide caps, tees, elbows, reducers, etc., manufactured for welded applications.
6. Weldolets may be used for 5 IN and larger pipe provided all slag is removed from inside the pipe.
7. Weld-in nozzles may be used for branch connections to mains and where approved by Owner's representative.
8. Use all long radius welding elbows for expansion loops and bends.
9. Use long radius reducing welding elbows 90 degree bends and size changes are required.

E. Joining Method - Couplings:
1. Compression sleeve:
    a. Install coupling to allow space of not less than 1/4 IN but not more than 1 IN.
    b. Provide harnessed joint.
        1) Use joint harness arrangements detailed in AWWA M11.
    c. Design harness assembly with adequate number of tie rods for test pressures indicated in Section 40 05 13 and allow for expansion of pipe.
    d. Provide ends to be joined or fitted with compression sleeve couplings of the plain end type.
    e. Grind smooth welds the length of one (1) coupling on either side of joint to be fitted with any coupling.
    f. Assure that outside diameter and out-of-round tolerances are within limits required by coupling manufacturer.
2. Mechanical coupling:
    a. Arrange piping so that pipe ends are in full contact.
    b. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
    c. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

F. Joining Method - Threaded and Coupled (T/C):
1. Provide T/C end conditions that meet ASME B1.2 requirements.
2. Furnish pipe with factory-made T/C ends.

3. Field cut additional threads full and clean with sharp dies.
4. Leave not more than three (3) pipe threads exposed at each branch connection.
5. Ream ends of pipe after threading and before assembly to remove burrs.
6. Use Teflon thread tape on male thread in mating joints.

G. Support exposed piping in accordance with Specification Section 40 05 13.

H. Install buried piping per Specification Section 40 05 13.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Specification Section 40 05 13.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 40 20 16

PIPE: DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ductile iron piping, fittings, and appurtenances.
2. Specification Section is applicable to:
    a. See pipe schedule per specification section 40 05 13.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
    a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
    b. B16.1, Cast Iron Pipe Flanges and Flanged Fittings - Classes 25, 125 and 250.
2. ASTM International (ASTM):
    a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
3. American Water Works Association (AWWA):
    a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
    b. C606, Standard for Grooved and Shouldered Joints.

4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
    a. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
    b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings for Water.
    c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
    d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
    e. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
    f. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. Society of Automotive Engineers (SAE):
    a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 13.
3. Certification of factory hydrostatic testing.
4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Flanged adaptors:
    a. Rockwell (Style 913 (steel)).
    b. Dresser (Style 128 (steel)).
2. Compression sleeve coupling:
    a. Rockwell (Style 431 (cast)).
    b. Dresser (Style 153 (cast)).
3. Mechanical coupling:
    a. Victaulic (Style 31).

b. Tyler.

4. Glass lining:
   a. Ceramic Coating (Non-Stick Glass Lining).
   b. Permutit (SG-14 Glass Lining).
5. Insulating couplings:
   a. Rockwell (Style 416).
   b. Dresser (Style 39).
6. Reducing couplings:
   a. Rockwell (Style 415).
   b. Dresser (Style 62).
7. Transition coupling:
   a. Rockwell (Style 413).
   b. Dresser (Style 62).
8. Polyethylene encasement tape:
   a. Chase (Chasekote 750).
   b. Kendall (Polyken 900).
   c. 3 M (Scotchrap 50).
9. Restrained joints:
   a. American (Lock Fast) - 12 IN and below.
   b. US Pipe (TR-Flex) - 4 IN to 54 IN.
   c. American (Lock Fast) - Above 12 IN.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Ductile Iron Pipe:
   1. AWWA/ANSI C115/A21.15.
   2. AWWA/ANSI C150/A21.50.
   3. AWWA/ANSI C151/A21.51.

B. Fittings and Flanges:
   1. AWWA/ANSI C110/A21.10.
   2. AWWA/ANSI C115/A21.15.
   3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Nuts and Bolts:

1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for buried application.
2. Exposed: Mechanical galvanized ASTM B695, Class 40.
3. Heads and dimensions per ASME B1.1.
4. Threaded per ASME B1.1.
5. Project ends 1/4 to 1/2 IN beyond nuts.

D. Gaskets: See individual piping system requirements in Specification Section 40 05 13.

E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.

F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.

G. See Piping Schedules in Specification Section 40 05 13.

2.3 MANUFACTURED UNITS

A. Couplings:

1. Flanged adaptors:
   a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
   b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.
   c. Supply flanges meeting standards of adjoining flanges.
   d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
2. Compression sleeve coupling:
   a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
   b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.
   c. Supply flanges meeting standards of adjoining flanges.
   d. Entire assembly to be rated for test pressure specified on piping schedule for each respective application.
   e. Provide field coating for buried couplings per AWWA C203.
3. Mechanical couplings:
   a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Specification Section 40 05 13.
   b. Utilize units defined in the ACCEPTABLE MANUFACTURERS Article.

2.4 FABRICATION

A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.

B. Furnish cast parts with lacquer finish compatible with finish coat.

C. Glass Lining:

1. Minimum two-coat process.
    a. Base coat heated to solidly fuse glass to pipe surface.
    b. Subsequent coat(s) heated to form integral bond with preceding coat.
2. Final finish parameters:
    a. Thickness: 8-12 mils.
    b. Hardness: Above 5 on MOHS scale.
    c. Density: 2.5-3.0 grams per cubic centimeter.
    d. Metal to lining bonding: Capable of withstanding strain of 0.0001 IN/IN without damage to lining.
3. Complete compatibility between fittings and piping.

2.5 LININGS AND COATINGS

A. Where specified in piping schedule, provide linings to a minimum thickness of 40 mils.

1. Polyethylene, "Polybond" by American Pipe.
2. Polyurethane, "Polythane" by U.S. Pipe.
3. Ceramic epoxy, "Protecto 401" by U.S. Pipe.
4. Calcium aluminate, "Sewper Coat" by Griffin Pipe.

2.6 SOURCE QUALITY CONTROL

A. Factory Test:

1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joining Method - Push-On Mechanical (Gland-Type) Joints:

1. Install in accordance with AWWA/ANSI C111/A21.11.
2. Assemble mechanical joints carefully according to manufacturer's recommendations.

3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
4. Do not overstress bolts.
5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.

B. Joining Method - Push-On Joints:

1. Install in accordance with AWWA/ANSI C151/A21.51.
2. Assemble push-on joints in accordance with manufacturer's directions.
3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
   a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.

C. Joining Method - Flanged Joints:

1. Install in accordance with AWWA/ANSI C115/A21.15.
2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
3. Make flange faces flat and perpendicular to pipe centerline.
4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
5. Allow one (1) flange free movement in any direction while bolts are being tightened.
6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
7. Gradually tighten flange bolts uniformly to permit even gasket compression.

D. Joining Method - Mechanical Coupling Joint:

1. Arrange piping so that pipe ends are in full contact.
2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Flange Adaptors 12 IN and Less:
   1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
   2. Drill holes not more than 1/8 IN larger than diameter of stud projection.

F. Cutting:
   1. Do not damage interior lining material during cutting.
   2. Use abrasive wheel cutters or saws.
   3. Make square cuts.
   4. Bevel and free cut ends of sharp edges after cutting.

G. Support exposed pipe in accordance with Specification Section 40 05 13.

H. Install restrained joint systems where specified in Specification Section 40 05 13 under specific piping system.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Specification Section 40 05 13.

END OF SECTION

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SECTION 40 20 26

PIPE: REINFORCED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforced concrete pipe (RCP).

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Reinforced concrete pipe (RCP):
   a. ASTM International (ASTM):
      1) C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
      2) C361, Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
      3) C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
      4) C497, Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
      5) C655, Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
   b. American Water Works Association (AWWA):
      1) C302, Standard for Reinforced Concrete Pressure Pipe, Noncylinder Type.
      2) C651, Standard for Disinfecting Water Mains.

2. Installation and testing:
    a. American Water Works Association (AWWA):
        1) M9, Installation of Concrete Pipe.

B. Conduct testing methods to evaluate physical properties of pipe in full compliance with ASTM C497.
    1. Report full results test showing compliance with referenced standard.

C. Determine acceptability of RCP in all diameters and classes by appropriate ASTM plant tests, including such test to indicate specified design strengths have been met prior to shipment.
    1. Conduct three-edged bearing test as specified to determine the loading to produce a 0.01 IN crack extending 12 IN or more.
        a. Complete bearing test prior to shipment date of lot tested.
    2. Conduct crushing test, as specified on cured concrete cylinders.
        a. Achieve specified 28 day design compressive strength prior to shipment date of lot tested.

1.4 SYSTEM DESCRIPTION

A. Provide each pipe, fitting, special appurtenance with a plainly and permanently waterproofed, marked identification.
    1. Include but not necessarily limit markings to the following:
        a. Size and class of pipe, pressure rating in compliance with referenced standards.
        b. Date of manufacture.
        c. Manufacturer's trademark.
        d. Manufacturer's name.
        e. Full details on fittings and pipe schedule regarding angles of change, reduction.
        f. Special notations and tagging of special items in regard to line location.

1.5 SUBMITTALS

A. Shop Drawings:
    1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
    2. Product technical data including:
        a. Acknowledgement that products submitted meet requirements of standards referenced.
        b. Manufacturer's installation instructions.

c. Concrete materials:

1) Chemical and physical properties.

2) Mix design.

d. Reinforcement cage and steel cylinders for special designs not utilizing table values contained in references standards.

1) Chemical and physical properties.

2) Area of steel.

3) Cage configuration.

e. Joint details.

f. Connection details.

g. Tabulated laying schedule.

1) Reference to project stationary and invert elevations.

2) Identify pressure zones, each of design pressure or transient loading zones applicable, and point of change from one (1) zone to another.

3) Pipe diameter.

4) Pipe wall thickness.

h. Test reports: Include six (6) copies of D (0.01) - Load and Failure Test Reports, cylinder compression test results, and joint tests (if required).

i. Alkalinity tests:

1) The alkalinity of the cover concrete shall be determined by the manufacturer and verified by an independent testing laboratory at intervals determined by Owner’s representative.

2) Two drill hole samples shall be obtained and tested from a single pipe section for each day's production for each pipe diameter produced during the first week of production.

a) The alkalinity of the test pipe section shall be computed as the average of the two (2) drill samples.

b) After the first week of production, one (1) pipe section shall be drilled, sampled, and tested for each pipe diameter produced for each week's production.

3) The exact procedure of obtaining samples, analyzing them, and the method of calculation of the resultant AZ factor will be submitted to the Owner’s representative for approval prior to commencing testing.

j. Pipe lining or coating certification letters.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 FABRICATION

A. Provide non-pressure service or gravity drainage piping meeting or exceeding ASTM C76, or ASTM C506 for RCAP, Class as noted in schedule, with varying lengths a minimum of 7 FT long.

1. Each lot shall consist of a single diameter and strength designation manufactured by essentially the same process.
2. Provide RCP for non-pressure service or gravity drainage with sealed joints using continuous rubber gaskets conforming to the requirements of ASTM C443 or ASTM C361.
3. Type of joint shall be spigot groove type joint with O-ring gasket (R/C).
   a. United States Bureau of Reclamation Type R/4.
   b. Ensure that the rubber gasket will perform as the sole element to make the joint watertight.

B. Provide plant and process pressure service piping meeting or exceeding ASTM C361 where indicated.

1. Provide sealed joints using continuous rubber gasket conforming to requirements of ASTM C361.
2. Type of joint shall be spigot groove type joint with O-ring gasket or steel end ring joint with spigot groove and O-ring gasket.
   a. United States Bureau of Reclamation Type R/4 and R/2, respectively.
3. Ensure that rubber gasket joint will perform as the sole element to make the joint watertight.

C. Provide pressure service RCP for internal hydrostatic pressures of 55 psi or less in full compliance with AWWA C302.

1. Provide sealed joints using continuous rubber gasket conforming to requirements of ASTM C361.
2. Type of joint shall be steel end ring joint with spigot groove and O-ring gasket.
   a. United States Bureau of Reclamation Type R-2.

D. Provide steel and ring joint with spigot groove and O-ring gasket designated as an R/S joint conforming to requirements of ASTM C361 for all jacked-in-place sewer pipe.

2.3 COATINGS

A. Interior Pipe Coating:

1. Plastic lined RCP:

a. Concrete pipe shall be provided with plastic linings at the location shown on the plans.

1) The plastic lining shall cover 270 degrees of the inside diameter of the pipe with the unlined portion of the pipe centered on the bottom invert.

b. Plastic lining shall be Amer-Plate T-Lock Liner as manufactured by Ameron, or Atlas Steuler Bekaplast.

c. Plastic lining shown on the profile shall be considered incidental to the manufacture of the RCP and cost shall be included in the bid item to furnish and install sewer pipe.

d. The plastic lining shall consist of a PVC compound and shall have a thickness of at least 0.065 IN and shall have integrally molded T-shaped ribs which securely anchor the lining to the pipe.

1) Color: White.

e. All work in connection with the installation of the plastic lining in concrete pipe shall be performed in strict conformity with the lining manufacturer's recommendations.

1) Liner sheets shall be fastened in place securely in the forms for the concrete pipe before reinforcing steel or concrete is placed.

f. For field connections between lengths of pipe, either an extended flap of the lining or a separate joint strip of lining material wide will be acceptable.

1) Field joints shall be made by heat welding.

2) The flaps or joint strips for field joints shall be of the same thickness and composition as the plastic lining installed in the pipe.

3) All adhesive, welding materials, separate strips of lining material for field joints, and other materials required for field jointing shall be furnished by the lining material manufacturer.

g. The joint between sections of plastic lined pipe shall be prepared in the following manner before making the lining joint:

1) The inside joint shall be filled and carefully pointed with

cement mortar for the full circumference of the pipe.

a) The mortar shall not, at any point, extend into the pipe beyond a straight line connecting the surfaces of the adjacent pipe sections.

2) No lining joint shall be made until after the trench has been backfilled.

a) Pipe joints must be dry before lining joints are made.

b) All mortar and other foreign material shall be removed from lining surfaces adjacent to the pipe joint.

h. Field joints in the lining at pipe joints may be either of the following described types:

1) The joint shall be made with a separate 4 IN wide joint strip and two (2) 1 IN wide welding strips.

a) The 4 IN strip shall be centered over the joint, secured to the lining with an adhesive compound and welded along each edge to adjacent liner sheets.

b) The width of the space between the ends of pipe lining material shall not exceed 2 IN.

c) The 4 IN joint strip shall overlap the lining in each pipe a minimum of 1 IN.

2) The joint shall be made with a lining flap extending about 3 IN beyond the spigot end of the pipe.

a) One welding strip is required.

b) The joint flap shall overlap the lining in the adjacent pipe a minimum of 1 IN.

c) An adhesive compound shall be used to hold the flap in place during welding.

d) The flap shall be protected from damage during installation.

e) Excessive tension and distortion in bending back the strip to expose the distortion in bending back the strip to expose the pipe joint during laying and joint mortaring shall be avoided.

i. All joints between pipe and wall fittings in manholes and between wall fitting and lining of manhole walls, where lining is required, shall be made by one (1) of the two (2) ways described above.

j. All welding of joints shall be in strict conformity with the recommendations of the lining manufacturer.

k. Care shall be taken in handling and transporting plastic lined pipe to prevent damage to the liner plate.

   1) No interior hooks or other interior lifting device shall be used in handling the pipe; all handling requiring lifting shall be done by exterior slings.

   2) Damaged pipe will not be installed unless repaired to the satisfaction of the Owner's representative.

l. The manufacturer of plastic liner plate shall submit to the Owner's representative for approval, samples of each type of sheet and strip proposed for use, together with a list of all ingredients from which the sheets and strips are to be compounded.

   1) Said list shall show the percentage of each ingredient used in the formulation.

m. After the pipe is installed in the trench and backfilled, all surfaces covered with plastic lining, including welds, shall be tested with an electric holiday detector.

   1) The voltage and specific methods of testing shall be as recommended by the manufacturer of the lining material.

   2) In addition, all welds shall be physically tested by nondestructive probing.

   3) All patches over holes, or repairs to the liner wherever damage has occurred, shall be installed in conformity with the instructions and recommendations of the lining manufacturer.

n. The Contractor shall furnish qualified personnel and equipment to holiday test in the presence of the Owner's representative.

o. Each transverse welding strip which extends to a lower edge of the liner shall be tested.

   1) The welding strip shall extend 2 IN below the liner to provide a tab.

   2) A 10 LB pull shall be applied to each tab.

   3) The force shall be applied normal to the face of the structure by means of a spring balance.

   4) Liner adjoining the welding strip shall be held against the concrete during application of the force.

   5) The 10 LB pull shall be maintained if a weld failure develops, until no further separation occurs.

   6) Defective welds shall be retested after repairs have been made.

7) Tabs shall be trimmed away neatly after the welding strip has passed inspection.

8) Inspection shall be made within two (2) days after joint has been completed.

2. Polymorphic resin pipe lining compound:

a. Polymorphic resin pipe lining compound manufactured by Quantum may be supplied as an alternative to the plastic lining above.

1) The entire inside of the pipe shall be coated with the Quantum coating at the locations shown on the Plans.

b. The lining Contractor shall be responsible for the complete performance of the system.

1) Application of lining compound.

a) Surface preparation:

(1) All interior barrel and joint surface areas will be exposed to sewer liquids and gases shall be prepared for lining by removal of laitance, form oil, loose, foreign or deleterious materials which will adversely affect the bond of the lining compound to the pipe surface.

(2) Removal shall be accomplished by abrasive blasting the pipe to provide a clean, open, sound surface.

b) Atmospheric and substrate conditions:

(1) The lining must be applied on a dry, frost-free, surface and shall not be applied when the ambient temperature is below 10 DegF.

(2) The barrel of the pipe shall be blown off with dry, clean, compressed air to remove sand, dust or other loose material immediately prior to application of the prime coat.

c) Application:

(1) After blasting and cleaning, all joint and barrel surfaces shall be primed by applying a thin coat of thoroughly mixed clear Quantum resin extended 10 percent with styrene.

(a) Coverage of the primer shall be 300-500 SF per gallon.

(b) This will produce a dry film thickness of approximately 5 mils.

(2) The lining compound shall then be applied to the barrel of the pipe.

(a) The lining compound shall be applied in one (1) or more coats to obtain a continuous and smooth integral lining with a minimum dry film thickness of 60 mils.

(3) A top coat of clear resin shall be applied as the final seal coat to barrel and joint surfaces.

(a) Minimum dry film thickness shall be 5 mils.

(b) Minimum total dry film thickness on barrels shall be 70 mils.

(4) The coated pipe section shall not be delivered to the site or installed until approval is obtained from the lining Contractor.

d) Holiday detection:

(1) All interior barrel surfaces shall be thoroughly inspected for holidays (pinholes) using an electronic, low voltage instrument specifically designed for the purpose.

(2) A high voltage detector shall not be used, i.e., in excess of 100 V.

e) The lining Contractor shall verify in writing to the Owner the coating has been applied and tested according to the manufacturer's recommendations with any repairs required being done at that time.

(1) The lining Contractor shall warrant the pipe lining for a period of five (5) years against corrosion or deterioration of the pipe.

B. Other Protective Coatings: Coat exposed metal surfaces, steel joint rings, flange connection outlets, and other metal surfaces with self-curing inorganic zinc coating to a finished dry thickness of 2 mils.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 13.

B. Observe all recommendations in accordance with AWWA M9 for installation, delivery, and storage of pipe material.

3.2 CURVES AND FITTINGS

A. Curves:

1. Observe Drawings for details regarding changes in direction.

   a. Where changes of direction by curvature is acceptable, perform curve by deflecting pipe at each joint within the permissible joint deflection allowance recommended by the manufacturer.

2. R = L/2(Tan 1/2 D/N) where R = radius of curvature, feet; L=average laid length of pipe sections measured along the centerline, feet; D = total deflection angle of curve, degrees; N = number of pipe with pulled joints; D/N = total deflection of each pipe, degrees.

   a. Check D/N from manufacturer.

3. Employ the use of special radius (beveled or mitered) pipe where deflected straight pipe will not provide a short enough change in radius.

B. Fittings:

1. In addition to straight pipe or radius pipe, furnish bends, tees, adapters, closure pieces, and other fittings or specials shown on Drawings or required to complete the work.

   a. Design fittings to provide same strength as the adjacent piping.

2. Fittings to be smooth or mitered providing mitered angles do not exceed 22-1/2 Degrees and fitting has an R/d greater or equal to 1, where R = radius of bend, IN; d = diameter of pipe, IN.

3.3 CONNECTIONS WITH EXISTING WORK

A. See Specification Section 40 05 13.

B. Observe procedures outlined in AWWA C651 for cutting into or repairing existing mains.

3.4 THRUST AND ANCHOR BLOCKING

A. Install cast in place concrete blocking at all bends or install restrained joints.

3.5 PRESSURE AND LEAKAGE TEST

A. General: Subject pipe to the required in-place tests.

B. Exfiltration Test:

1. Before backfilling around RCP, plug lower end of both extremities of pipe section subjected to test.

   a. Fill piping with water to manhole rim of highest manhole in the section, and let water stand until pipe has reached its maximum absorption and until trapped air has opportunity to escape.

      1) Allow 4 HRS.

b. After pipe has achieved maximum absorption, refill piping with water to the minimum head level.

c. After 15 minute intervals, record the difference in elevation of water surface and convert to gallons.

d. Achieve maximum exfiltration less than 200 GAL per inch of diameter per mile of pipe per 24 HRS.

C. Infiltration Test:

1. Perform and observe following testing criteria and procedures for non-pressure service or gravity drainage piping for compliance to infiltration allowances.

a. Ensure infiltration is less than 200 GAL per inch diameter per mile per 24 HRS.

D. Joint Air Test:

1. Perform joint air test on each joint laid prior to backfilling.

2. Conduct tests as follows:

a. Provide equipment used for joint testing manufactured by Lanas, Cherny.

b. Each joint shall be tested successfully.

c. Set joint tester over joint to be tested so that the two (2) inflation tubes straddle the joint.

d. Inflate inflation tubes to 25 psig to seal off joint to be tested.

e. Apply air pressure into void between inflation tubes until pressure reaches 4 psig.

f. After pressure has stabilized, bleed air pressure back to 3.5 psig.

g. Record time required for pressure to drop from 3.5 psig to 2.5 psig.

1) A minimum of five (5) readings will be required for each test.

h. If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than 10 seconds, presume the joint to be free from defect.

1) When the time is less than 10 seconds pipe breakage, joint leakage or leaking tester seals are indicated and an inspection must be made to determine the cause.

2) The Contractor shall effect such repairs as may be required to accomplish a successful air joint test.

i. Air test joint before the pipe has been backfilled.

1) Perform air testing as pipe installation progresses.

2) At no time shall pipe installation exceed 500 FT from the latest joint tested.

j. After a manhole to manhole reach has been installed and backfilled the joint testing procedure will be used on approximately every fifth joint or as directed by the Owner's representative.

k. If any joint fails the initial joint test, the joint shall be removed and reinstalled until the joint test is successful.

1) If the joint fails the second test following backfilling, the joint shall be repaired as described in subparagraph below.

l. No visible leaks shall be allowed after installation of the pipe and testing.

1) All visible leaks shall be repaired using an approved non shrink grout in areas with no groundwater and pressure injected expansive sealant when the groundwater table will be above the pipe after installation.

3.6 DISINFECTION OF POTABLE WATER MAINS

A. For potable water mains, observe disinfection methods described in Specification Section 40 05 13.

END OF SECTION

SECTION 40 20 46

PIPING: UNDERGROUND, PREFABRICATED, INSULATED AND JACKETED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Underground, prefabricated, insulated and jacketed piping with flexible joints.

B. Related Specification Sections include but are not necessarily limited to the following:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 31 21 33 - Trenching, Backfilling, and Compacting for Utilities.
4. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.
5. Section 40 20 13 - Pipe: Miscellaneous Steel.
6. Section 40 20 16 - Pipe: Ductile.
7. Section 40 20 77 - Pipe: Stainless Steel.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. See Specification Section 40 05 13.

B. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B31.1, Power Piping.
2. ASTM International (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   b. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

1.4 SYSTEM DESCRIPTION

A. Provide underground piping for heating water system piping.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 13.
3. Product technical data including:
    a. Complete system layout and details:
        1) Indicating amount of expansion.
        2) Indicating provisions for system expansion.
    b. Anchorage.
    c. Component details.
    d. Location of miscellaneous fittings including anchors and seals.
    e. Gland seals.
    f. Field closures.
    g. Location of field joints.
    h. Detail of requirement for two (2) flexible joint systems at each structure.
        1) Instructions for assembly of these joints.
4. Detailed piping and penetration drawings.
    a. Minimum scale 1/2 IN equal 1 FT.
    b. Details to be specific and to include:
        1) Flexible joint details.
        2) Floor and foundation elevations.
        3) Final grades.
        4) Anchors.
        5) Sleeves.
        6) Seals.
        7) Crossovers and related items.
5. Provide anchor block sizes.

6. Provide copy of stress analysis for proposed system in accordance with ASME B31.1.
7. Factory test report.
8. Field hydrostatic test report.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Ricwil piping systems, Intergy, Inc., Brecksville, Ohio.
2. Perma-pipe, Midwesco Inc., Niles, Illinois.
3. Rovanco Corporation, Joliet, Illinois.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Service Pipe:

1. Steel per Section 40 20 13.
2. Carbon steel, ASTM A53, Grade B.

B. Insulation:

1. Foamed urethane.
2. "K" factor less than or equal to 0.15 Btu/HR SF/DegF/IN at 75 DegF.
3. Density greater than or equal to 1.8 LB/CF.
4. Thickness greater than or equal to 1 IN.
5. Provide additional thickness in expansion loops to maintain minimum 1-1/2 IN thickness after pipe expansion.

C. Vapor Seal Jacket:

1. Jacket may be either of the following:
   a. Fiberglass reinforced plastic:
      1) Machine coated.

2) Continuous multi-directional tension filament wound.
3) Polyester resin.
4) Ultraviolet inhibitors added.
5) Minimum thickness 0.120 IN.

b. Polyvinyl chloride:
1) Type 1, Class 1 PVC.
2) Conforms to ASTM D1785.
3) Minimum thickness 0.120 IN.
4) Ultraviolet inhibitors added.

D. End Seal for Polyvinyl Chloride Jacket:
1. Compression fitted rubber seal.

E. Flexible Joints:
1. Comply with Specification Section 40 05 13.
2. 150 LB flanges.
3. 321 stainless steel innertube.
4. Braided stainless steel wire shield rated for 150 psi at 250 DegF.
5. Shrink wrap outer cover.

F. Fabricated Manholes:
1. Shell 8 GA corrugated galvanized steel.
2. Outer corrosion coating:
3. Interior coating:

G. Anchors:
1. Steel plate minimum 1/4 IN thick.
2. Coat exposed steel with jacket material.
3. Concrete collar.

2.3 ACCESSORIES

A. Pipe Accessories:
1. End seals.
2. Gland seals.
3. Elbows.
4. Tees.
5. Field joint closures.

6. Insulated flexible joint system.
7. Factory-fabricated expansion/contraction loops and anchors to prevent moisture ingress.

B. Wall Penetration Accessories:

1. Wall sleeve with water stop and seals per Specification Section 01 73 20.

2.4 FABRICATION

A. Preinsulated Pipe:

1. Fabricate preinsulated pipe in 40 FT straight lengths without fittings where possible.
2. Factory fabricate preinsulated pipe sections with fittings capable of absorbing expansion with anchors and other accessories to job dimensions.
3. Polyvinyl chloride jacketed pipe:
   a. End seal for each joint.

B. Manholes:

1. Factory fabricate watertight, vented manholes with 3 IN diameter access hatch with watertight cover and access ladder.
2. Pipe insulation and jacket in manholes to be the same as the pipe system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Observe manufacturer's recommendation for handling, cutting, jointing, installing, and testing.

B. Trenching, Backfilling, and Compaction:

1. See Specification Section 31 21 33.
2. Comply with manufacturer's recommendations where they are more stringent.

C. Anchors:

1. Provide anchors at each take-off point, between expansion loops and as required by the system.
2. Anchors to be welded to the pipe and extend beyond the jacket.

D. Expansion Loops:

1. Provide expansion loops as required for system integrity.

2. Provide elbows with flexibility for maximum pipe movement.

3. Provide pipe guides at expansion loops and between loops to assure longitudinal pipe movement.

3.2 FIELD QUALITY CONTROL

A. Tests:

1. See Specification Section 40 05 13.

B. Manufacturer's Field Service:

1. Factory-trained field service person present for minimum of three (3) working days including two (2) site visits.

2. Factory-field service person visits to provide instruction for installation and testing and to verify installation is being performed in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 40 20 77

PIPE: STAINLESS STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. General work included in this Section:

1. Stainless steel tubing, piping, fittings and appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
   a. B16.5, Pipe Flanges and Flanged Fittings.
   b. B31.1, Power Piping.
   c. B36.19, Stainless Steel Pipe.
2. American Society for Testing and Materials (ASTM):
   a. A182, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.
   b. A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   d. A320, Standard Specification for Alloy Steel Bolting Materials for Low Temperature Service.
   e. A380 – Standard Specification for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

f. A530, Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.

g. A774, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

h. A778, Welded Unannealed Austenitic Stainless Steel Tubular Products.

i. A967 – Standard Specification for Chemical Passivation Treatment for Stainless Steel Parts.

3. American Water Works Association (AWWA).

a. M11, Steel Pipe - A Guide for Design and Installation

1.4 SUBMITTALS

A. Certification and Testing consistent with Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

B. Shop Drawings consistent with Section 01 33 00 – Submittals and including:

1. See Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.
2. Installation instructions for expansion bellows.
3. Fabrication details and welding procedure specifications for all work to be done under this Section.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Compression Fittings:

a. Imperial

b. Swagelok

c. Approved equal

2. Pressed Connection Piping:

a. Victaulic Press-fit

b. Viega ProPress

3. Expansion Joints (Air Piping):

a. Victualic

b. Anaconda

c. Pathway.

4. Split Ring Couplings (Air Piping)
    a. Victualic Depend-o-Lok
    b. Approved equal
5. Anti-Sieze Compound
    a. Nickel Anti-Seize Compound 725 by A.W. Chesterton
    b. Permatex Nickel Anti-Seize Compound, ITW Devcon

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MATERIALS

A. Tubing: ASTM A269.
    1. Filler material: Extra low carbon (ELC) with 0.03 percent maximum carbon.
    2. Type 304L or 316L as scheduled in Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

B. Pipe:
    1. ASTM A778, Type 304L or 316L (as scheduled in Section 40 05 13)

C. Pipe Fittings:
    1. ASTM A774, Type 304L or 316L (as scheduled in Section 40 05 13)

D. Flanges:
    1. Flat faced.
    2. Welding neck or slip on type.
    3. ASTM A182, Type 304L or 316L, type to match piping system.

E. Nuts, Bolts and Washers:
    1. ASTM A320, Type 316.
    2. Two nuts provided for 1 IN DIA bolt applications and larger

F. Expansion Joints:
    1. Bellows: Stainless steel, type to match piping system

G. Liner: Stainless steel, type to match piping system.
    1. Flanges: Stainless steel, type to match piping system.
    2. Control Tie-Rods: Stainless steel, type to match piping system.

H. Split Ring Couplings:
    1. Body and hardware: Stainless steel, type to match piping

I. Compression Sleeve Couplings:
    1. Per Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements except

stainless steel construction, type to match piping system.

J. Dismantling Couplings:

1. Per Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements except stainless steel construction, type to match piping system.

K. Insulating Flange Sets:

1. 1/16 IN thick plastic.
2. Full length bolt sleeves.
3. 1/8 IN thick insulating washers and flat washers for each flange bolt

L. Coupling and Flange Gasket Material:

1. See Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements and Pipe Schedule.

2.3 FABRICATION

A. Shop welding of fabrications shall be done according to the procedures and by welders certified per ASME Section IX. Welds shall be done by an inert gas shielding process using only extra low carbon filler metals. Welds shall have a bead height of no more than 1/16 IN. Butt welds shall have 00 percent penetration to the interior backside of the weld joint.

B. All tube, piping, fitting product to be immersion pickled subsequent to manufacturing and fabrication operations and prior to shipping.

1. Pickling solution of 6-10 percent nitric acid and 3-4 percent hydrofluoric acid.
2. Temperature and exact concentrations to be such only a modest etch is produced but all oxidation and ferrous contamination is removed from metal surface.
3. All pickling solution residues are to be neutralized after pickling.

C. Diameter tolerance and wall thickness tolerance are to conform to ASTM A530. Wall thickness shall be as scheduled in Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements. Inside pipe diameter shall be a minimum of the nominal pipe diameter specified.

D. Joints.

1. Shop welded circumferential buttweld joints.
2. Flat faced flanges, Class 150.
3. ANSI B16.1, Class 150.

E. Expansion Joints:

1. Fabricate for 15 psi internal pressure and 250 DegF operation.
2. Ensure aerial travel in expansion joints of 3.1 IN minimum for 15,000 cycles or 5.2 IN for 1000 cycles.

3. Furnish each assembly with minimum four control tie rods.
4. Fabricate with 125 LB flanged end connections.

F. Split Ring Couplings

1. Double arch cross section
2. Material thickness shall be 0.12 IN minimum
3. Rigid or expansion type as scheduled in 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.
4. Restraint rings shall be factory welded to pipe.

2.4 SHOP TESTING

A. Testing

1. Hydrostatic test pipe and fittings in accordance with AWWA C200.
2. Test 5 percent of all welds using ultrasonic or radiography testing performed by an independent certified welding inspector.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect and verify condition of piping and appurtenances. Installation constitutes installer's acceptance of condition for satisfactory installation.

3.2 PREPARATION

A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.

B. Ensure ends of pipe to be fitted with flanges have all protrusions ground flush.

3.3 INSTALLATION

A. Ensure all pipe cutting, threading and jointing conforms to requirements of ANSI B31.1. Lubricate all pipe threads with Teflon tape.

B. Shop pipe and fitting assemblies shall be connected using flanges, couplings, and other methods as scheduled in Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements. Field welding will not be allowed unless approved in specific locations by the Owner’s Representative.

C. Welding:

1. Provide welds sound and free from embedded scale or slag, and tensile strength at weld not less than pipe.
2. Perform butt welds only with an inert gas shielded process.
3. Adequate inert gas protection is to be provided to the top and under or backside of the weld to protect from atmospheric contamination.

4. Filler metal is to be applied to all manually-performed welds appropriate for the base material being welded.
5. Only inert gas shielded welding processes are to be used for spool fabrication.
6. Provide butt welds with 100 percent penetration to the interior or back side of the weld joint.
7. Weld reinforcement on both sides of the weld are to be smooth, uniform and no more than 1/16 IN in height.

D. Joining Method - Flanges:

1. Apply anti-seize compound to all hardware.
2. Leave 1/8 to 3/8 IN flange bolts projecting beyond face of nut after tightening. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, and other systems. Tighten bolts evenly around pipe until following range of torques are achieved:

Bolt Size, IN	Ranges of Torque, FT-LB
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

E. Compression Sleeve Couplings:

1. Install coupling to allow space of not less than 1/4 IN but no more than 1 IN.
2. Provide harnessed joint unless otherwise shown on Drawings or specified. Use joint harness arrangements detailed in AWWA M11 or as indicated on Drawings.

F. Expansion Joints and Split Ring Couplings:

1. Install in accordance with manufacturer's instructions.
2. Install when outside temperature is between 50 to 70 Degf.

3.4 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

3.5 CLEANING

A. Clean in accordance with Section 40 05 13 – Pipe and Pipe Fittings: Basic Requirements.

3.6 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 41 13

HEAT TRACING CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat tracing cable as required for heat tracing of pipes as indicated on the Drawings.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 26 05 00 – Electrical: Basic Requirements.
4. Division 40 – Process Integration.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data:

a. Power requirements for each circuit based upon actual length of heat trace and maintained temperature.

b. Circuit breaker rating based upon inrush current at minimum expected start-up temperature.

c. Length of heat tape for each pipe size and run.

d. Coordinate and verify length and Watts/FT of heat tape required based upon pipe size and insulation thickness.

1) Include the calculations to support the heat tape output.

e. See Specification Section 26 05 00 – Electrical: Basic Requirements for additional requirements.

3. Fabrication and/or layout drawings:

a. Wiring diagrams showing physical locations of thermostats and heat trace power supply.

B. Operation and Maintenance Manual:

1. See Specification Section 01 33 00 – Submittals for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

C. Miscellaneous:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Test reports: Megger test results.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cable such that it is not exposed to sunlight or other UV rays.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Thermon.

2. Chemelex Division; Raychem Corp.

3. Chromalox.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 HEAT TRACING

A. Design Parameters:

1. Pipe diameter, length and material: See Drawings and Division 40 – Process Integration Specification Sections.

2. Flange, valve, pipe support size: See Drawings and Division 40 – Process Integration Specification Sections.

3. Pipe insulation type and thickness: See Drawings and Division 40 – Process Integration Specification Sections.
4. Temperatures requirements:
   a. Low ambient temperature for the specific location: 0 DegF.
   b. Start-up temperature (alarm thermostat set point):
      1) Water/wastewater lines: 40 DegF.
   c. Maintain temperature (power thermostat set point):
      1) Water/wastewater lines: 40 DegF.
   d. High temperature exposure with power off: 110 DegF.
5. Wind factor for the specific location: 10 MPH.
6. Electrical requirements:
   a. Voltage: 120 V.
   b. Circuit breaker: Field coordinate if other than 20A GFEPCI type.
7. Safety factor: 10 percent.

B. Self-regulating or power-limiting parallel circuit construction consisting of an inner core of conductive material between parallel copper bus wires, with inverse temperature - conductivity characteristics with metal overbraid.

C. Thermostats adjustable between 35 and 200 DegF minimum with maximum differential range of 9 DegF, furnished complete with NEMA 4 enclosures in all areas, stainless steel temperature bulb and capillary.

D. All necessary or required components and accessories, such as power connection boxes, end seals, straps, tape and fitting brackets.

E. In non-corrosive and non-hazardous locations, insulation shall be Polyolefin.

F. In corrosive, hazardous and hydrocarbon locations insulation shall be Fluoropolymer (Teflon).

PART 3 - EXECUTION

3.1 PREPARATION

A. Install materials after piping has been tested and approved.

3.2 INSTALLATION

A. Insulate and heat trace wet pipe systems as indicated on Drawings.

B. Install materials in accordance with manufacturer's instructions.

1. Each circuit shall not exceed the manufacturer's recommended maximum length.

C. For metallic piping:

1. Heat tracing shall be installed completely wired.
2. Cut heat trace to lengths as required and secure to pipe with glass or polyester fiber tape.

D. For non-metallic piping:

1. Allow for extra heat trace output because non-metallic pipe has a lower heat transfer.
    a. Heat tracing shall be installed completely wired.
2. Cut heat trace to lengths as required and secure to pipe with aluminum tape throughout the length of the trace.

E. Protection and Control Requirements:

1. Protection by a GFEPCI circuit breaker.
    a. Breaker amperage rating shall be coordinated with Contractor when different than the Contract Drawings.
2. Provide an ambient sensing thermostat for power and line sensing thermostat for alarm.
3. The alarm thermostat shall be placed on the opposite end of the circuit from the power thermostat or power connection to allow for annunciation of partial failure of a circuit or the loss of power from a tripped GFEPCI circuit breaker.
4. Provide a monitoring module that monitors the voltage (circuit breaker status) to each circuit.
5. The alarm from the alarm thermostat and monitor module shall be annunciated on the indicated control system.

3.3 TESTING

A. Megger the cables at the manufacturer's recommended voltage level three (3) times.

1. Before installation.
2. After attachment to pipe, but before insulation is installed.
3. After pipe insulation is installed, but before energization.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 42 00

PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation:

a. Piping insulation.

b. Duct insulation.

c. Equipment insulation.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):

a. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus.

b. C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

c. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

d. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

e. C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

f. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

g. C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

h. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

i. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

j. E96, Standard Test Methods for Water Vapor Transmission of Materials.

k. F25, Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas.

2. National Fire Protection Association (NFPA):

a. 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

3. Underwriters Laboratories, Inc. (UL):

a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation instructions.

c. Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.

3. Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.

4. Certifications: Products will meet the requirements of the Contract Documents.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Elastomeric insulation:
   a. Rubatex.
   b. Armstrong.
2. Fiberglass insulation:
   a. Certainteed Corporation.
   b. Schuller (Manville).
   c. Owens Corning.
   d. Knauf.
3. PVC jacket:
   a. Ceel-Co.
   b. PIC Plastics.
4. Equipment insulation:
   a. Certainteed Corporation.
   b. Schuller (Manville).
   c. Owens Corning.
5. Ductwork insulation:
   a. Certainteed.
   b. Schuller (Manville).
   c. Owens Corning.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 PIPING INSULATION - ELASTOMERIC

A. General:

1. Insulation fire and smoke hazard ratings for composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation), as tested by procedure ASTM E84, NFPA 255 and UL 723, not exceeding:
   a. Flame spread: 25.
   b. Smoke developed: 100.
2. Accessories (adhesives, mastics, cements, and tapes): Same component ratings as listed above.
3. Indicate on product labels or their shipping cartons: Flame and smoke ratings do not exceed above requirements.
4. Permanent treatment of jackets or facings to impart flame and smoke safety is required.

a. Water-soluble treatments are prohibited.

5. Insulated shields at pipe support points.

B. Pipe, Fitting, and Valve Insulation:

1. Flexible elastomeric closed cell pipe insulation.

a. Average thermal conductivity not to exceed 0.27 (Btu-IN)/(HR-FT^2-DegF) at mean temperature of 75 DegF, temperature range -40 to 220 DegF; permeability not to exceed 0.20 by ASTM E96; water absorption 3 percent by ASTM D1056 and ozone resistance.

2. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.3 PIPING INSULATION - FIBERGLASS

A. Pipe and Fitting Insulation:

1. Preformed fiberglass pipe insulation:

a. Density: 4 LBS/CF.

b. Temperature rated: 650 DegF.

c. Average thermal conductivity not to exceed 0.22 (Btu-IN)/(HR-FT^2-DegF) at mean temperature of 75 DegF.

d. Fire hazard rating:

1) UL 723, ASTM E84, NFPA 255.

2) Flame spread not exceeding 25 and smoke developed not exceeding 100.

2. Moisture adsorption:

a. ASTM C553.

b. Not greater than 0.5 percent moisture by volume when exposed to moisture laden air at 120 DegF and 96 percent RH.

3. Fungi and bacteria resistance:

a. ASTM C665.

b. Does not breed or promote growth.

c. Flame attenuated glass fibers bonded with thermosetting resin.

4. Piping jackets (general applications):

a. Aluminum: 16 mil embossed aluminum.

b. PVC: Preformed 0.028 IN thick PVC jackets fabricated from B.F. Goodrich PVC sheeting V-66 with proven resistance to ultraviolet degradation when temperatures do not exceed the limits of PVC.

c. Piping jacket not required on concealed piping.

5. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.4 EQUIPMENT INSULATION

A. Insulation for Equipment:

1. Fire hazard classification:

a. UL 723, ASTM E84, NFPA 255.

b. Flame spread not exceeding 25 and smoke developed not exceeding 100.

2. Provide minimum insulation thickness conforming to Schedules, or as shown on Drawings.

2.5 DUCTWORK INSULATION: FIBERGLASS

A. Flexible Insulation:

1. Scheduled thickness: Schuller (Manville) Microlite.
2. Factory-applied foil scrim vapor barrier facing.
3. Average thermal conductivity not to exceed 0.27 (Btu-IN)/(HR-FT^2-DegF) at a mean temperature of 75 DegF (installed).
4. Minimum density: 0.75 LB/CF.
5. Fire hazard classification:

a. UL 723, ASTM E84, NFPA 255.

b. Flame spread not exceeding 25 and smoke developed not exceeding 100.

B. Semi-Rigid Insulation for Indoor Installation:

1. Scheduled thickness Schuller (Manville) #814 SPIN-GLASS fiberglass duct insulation.
2. Factory applied vapor barrier facing-white scrim foil.
3. Average thermal conductivity not to exceed 0.23 (Btu-IN)/(HR-FT^2-DegF) at a mean temperature of 75 DegF.
4. Minimum density: 3.0 LB/CF.
5. Moisture adsorption:

a. ASTM C553.

b. Not greater than 0.5 percent moisture by volume when exposed to moisture laden air at 120 DegF and 96 percent RH.

C. Semi-Rigid Insulation for Outdoor Installation:

1. Outside ducts: Surface with scheduled thickness of Schuller (Manville) 800 Series SPIN-GLASS #815 fiberglass duct insulation.

2. Factory-applied foil scrim vapor barrier facing.
3. Average thermal conductivity not to exceed 0.23 (Btu-IN)/(HR-FT^2-DegF) at mean temperature of 75 DegF.
4. Minimum density: 3 LBS/CF.
5. Finish with Benjamin Foster #4610 weatherproof mastic with white glass fabric membrane.
6. Fungi and bacteria resistance:
   a. ASTM C665.
   b. Does not breed or promote growth.

D. Provide minimum insulation thickness conforming to Schedule, or as shown on Drawings.

E. Duct Interior Lining Board:
1. Acoustical performance: Minimum noise reduction coefficients (NRC) is 0.45 when tested in accordance with ASTM C423 on ASTM F25 mounting.
2. Fire hazard classification:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread not exceeding 25 and smoke developed not exceeding 100.
3. Service temperature:
   a. ASTM C411.
   b. Cooling and heating ducts up to 200 DegF.
4. Velocity rating:
   a. ASTM C1071.
   b. Maximum average air velocity is rated at 600 fpm.
5. Moisture adsorption:
   a. ASTM C553.
   b. Not greater than 0.5 percent moisture by volume when exposed to moisture laden air at 120 DegF and 96 percent RH.
6. Fungi and bacteria resistance:
   a. ASTM C665.
   b. Does not breed or promote growth.
7. Size and performance:
   a. ASTM C518 and ASTM C177.

b. 1 IN thickness, long textiled glass-type fibers firmly bonded by thermosetting resin.

c. At 75 DegF mean temperature, the k value, expressed as (Btu-IN)/(HR-FT^2-DegF) does not exceed 0.27.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Piping below ground covered with earth will not be insulated except as specified in Specification Section 40 20 46.
2. Consider ductwork, piping and equipment as exposed, except as otherwise indicated.
3. Consider ductwork, piping and equipment in walls, partitions, floors, pipe chases, pipe shafts and duct shafts as concealed.
   a. Consider ductwork, piping and equipment above ceilings as concealed.
4. Provide release for insulation application after installation and testing is complete.
   a. Apply insulation on clean, dry surfaces after inspection.
5. Provide insulation continuous through wall, roof and ceiling openings, pipe hangers, supports and sleeves.
6. Provide insulation with vapor barrier for piping, ductwork and equipment where surfaces may be cooler than surrounding air temperatures.
   a. Provide vapor barrier (0.17 perm-IN; ASTM C553) continuous and unbroken.
   b. Hangers, supports, anchors, and related items that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
7. Apply specified adhesives, mastics and coatings at the manufacturer's recommended coverage per unit volume.

C. Piping Insulation - Elastomeric:

1. Slip insulation on pipe prior to connection.
   a. Whenever the slip-on technique is not possible provide insulation neatly slit and snapped over the pipe.
2. Fabricate and install fitting cover insulation according to manufacturer's recommendations.

3. Seal joints, slits, miter-cuts and other exposed edges of insulation with adhesive, recommended by the insulation manufacturer, to ensure complete vapor barrier.

D. Piping Insulation - Fiberglass:

1. Apply over clean dry pipe.
   a. Butt all joints together firmly.
2. Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the insulation manufacturer.
3. Insulate fittings, valves, and flanges with insulation thickness equal to adjacent pipe.
4. PVC pipe jacket:
   a. Apply jacketing with a minimum of 1 IN overlap.
      1) Weld longitudinal and circumferential seams with adhesives as recommended by manufacturer.
   b. Provide slip-joints every 30 FT and between fittings if distance exceeds 8 FT.
      1) Construct slip-joints by overlapping jacket sections 6 to 10 IN.
   c. Provide premolded PVC covers of same material and manufacturer as jacket for fittings, valves, flanges, and related items in insulated piping systems.
5. Aluminum pipe jacket:
   a. Field-applied aluminum jacket with vapor-sealed longitudinal and butt joints.
   b. Provide smooth and straight joint with a minimum 2 IN overlap.
   c. Secure joints with corrosion-resistant screws spaced 0.25 to 0.50 IN back from edge.
   d. Center spacing of screws 5 IN maximum or as required to provide smooth tight-fitted joints.
   e. Place joints on least exposed side of piping to obtain neat appearance.

E. Equipment: Install per manufacturer's instructions.

F. Ductwork Insulation - Fiberglass:

1. Flexible insulation:
   a. Butt edges tightly.
      1) Secure insulation with Benjamin Foster 85-20 adhesive applied in 6 IN strips on 12 IN centers and/or pins, applied on not more than 18 IN centers so that the insulation conforms to the duct surfaces uniformly and firmly.

b. Seal joints with facing overlap or 4 IN wide strips of like facing material adhered and stapled in place.

c. Properly seal any penetration in vapor barrier facing with Benjamin Foster 85-20.

d. Cut insulation slightly longer than the perimeter of the duct to ensure full thickness at corners.

2. Semi-rigid insulation and duct interior lining board:

a. Impaling over pins.

1) Apply insulation with edges tightly butted.

2) Apply insulation with mechanically welded fasteners to the duct and secured with speed clips.

3) Clip pins off close to clip.

4) Space pins as required to hold insulation firmly against duct surface, but not less than one (1) pin per 1.5 SF.

5) Seal joints and speed clips with 3 IN wide strip of facing adhered with Benjamin Foster 85-20 adhesive.

b. If the welded pin method is impossible, secure insulation to the duct with Benjamin Foster 85-20 adhesive.

1) Cover the entire surface of duct with adhesive.

2) Use corner metal angle to protect edge of insulation.

3) Protect edge of insulation.

4) Seal joints as above.

G. Install interior duct lining board as indicated above.

1. Overall length shall be as indicated on the Drawings or a minimum of 10 LF past any type of air supply fan.

3.2 REPAIR

A. Whenever any factory applied insulation or job-applied insulation is removed or damaged, replace with the same quality of material and workmanship.

3.3 SCHEDULES

A. Refrigeration Lines (35-60 DegF):

1. Elastomeric.

2. 1/2 IN thickness for lines 1 IN and smaller.

B. Pipe, Fittings and Valves:

1. Fiberglass.

APPLICATION	PIPE SIZE	THICKNESS	JACKET
Roof Drainage	2-1/2 to 6 IN	1/2 IN	PVC
Hot Water (domestic)	6 IN and less	3/4 IN	PVC
Cold Water (domestic)	3 IN and less	3/4 IN	PVC
	Over 3 IN	1 IN	
Heating Water (120 - 230 DegF)	6 IN and less	1 IN	PVC
Refrigeration Lines (35 - 60 DegF)	Over 1 IN	1 IN	PVC
Chilled Water (35 - 60 DegF)	4 IN and less	1 IN	PVC
	Over 4 IN	1-1/2 IN	
Steam (0-15 psig)	1 IN and less	1 IN	PVC
	1-1/4 IN to 4 IN	1-1/2 IN	
	Over 4 IN	2 IN	
Steam (15 to 60 psig)	1 IN and less	1-1/2 IN	Alum
	1-1/4 IN to 2 IN	2 IN	
	2-1/4 IN to 4 IN	2-1/2 IN	
	Over 4 IN	3 IN	
Steam (60 -125 psig)	1 IN and less	1-1/2 IN	Alum
	1-1/4 IN to 2 IN	2 IN	
	2-1/2 IN to 4 IN	2-1/2 IN	
	Over 4 IN	3-1/2 IN	
Steam Condensate	2 IN and less	1 IN	PVC
	2-1/2 IN to 6 IN	1-1/2 IN	
	Over 6 IN	2 IN	
Condensate Vent	2 IN and less	1 IN	PVC
	2-1/2 IN to 6 IN	1-1/2 IN	
	Over 6 IN	2 IN	

APPLICATION	PIPE SIZE	THICKNESS	JACKET
Steam Exhaust	2 IN and less	1 IN	Alum
	2-1/2 IN to 6 IN	1-1/2 IN	
	Over 6 IN	2 IN	

C. Equipment:

EQUIPMENT	INSULATION SYSTEM
Hot water and steam, heating equipment, heat exchangers, air separators, strainers, condensate, receivers	2 IN fiberglass insulation. Glass mesh jacket adhered and coated with two (2) coats of Foster 30-36 white insulation coatings.
Hot water pumps, flash tanks, compression tanks	Uninsulated
Below drain pans serving cooling coils, pre-heat systems, domestic water heaters	1 IN flexible elastomeric closed cell sheet.
Emergency generator exhaust pipe and muffler and boiler breeching	2-1/2 IN mineral wool 1200 DegF or equal held in place with stainless steel bands. Field applied 0.05 IN aluminum jacket. Aluminum jacket not to exceed 150 DegF.
Cold water meter	Uninsulated

D. Ductwork:

1. Fiberglass.

DUCT SERVICE	INSULATION AND THICKNESS
Outside air and supply air downstream of heat recovery units, outside building	2 IN semi-rigid for outdoor installation

DUCT SERVICE	INSULATION AND THICKNESS
Outside air ducts, inside building	1-1/2 IN semi-rigid with vapor barrier
Supply air ducts downstream of cooling coils	1 IN flexible with vapor barrier
Exhaust air ducts upstream of heat recovery units, inside building	1-1/2 IN semi-rigid
Exhaust air ducts upstream of heat recovery units, outside building	1-1/2 IN semi-rigid for outdoor installation
All other ductwork	Uninsulated

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 50 05

GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 40 05 23 - Valves: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
   b. B 62 – Standard Specification for Composition Bronze or Ounce Metal Casting.
   c. D 429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
   d. B 763 – Standard Specification for Copper Alloy Sand Casting for Valve Application.
2. American Water Works Association (AWWA):
   a. C 500 – Standard for Metal-Seated Gate Valves for Water Supply Service.
   b. C 509 – Standard for Resilient-Seated Gate Valves for Water Supply Service.
   c. C 515 – Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

d. C 550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit manufacturer's product data for proposed valves for approval.

C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.5 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. All valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1½ Inches in Diameter and Smaller: 125 psig or 250 psig to match adjacent piping; bronze; rising-stem; single-wedge; disc type; screwed ends.

D. Coatings for Gate Valves 2 Inches and Larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 Inches to 12 Inches in Diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 225 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide double disc valves. Comply with following requirements unless otherwise specified in Drawings:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded

connection isolated from water by compressed rubber around opening.

2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.
6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.
7. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.
9. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

F. Gate Valves Extension Stem: When shown of Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

G. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

H. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve not permitted unless otherwise approved by Owner’s Representative.

I. Provide flanged joints when valve is connected to steel or PCCP.

J. Key valve stem into the operator nut.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Operation. Do not use valves for throttling without prior approval of manufacturer.

B. Do not install gate valves inverted or with the stems sloped more than 45 degrees from the upright unless the valve was ordered and manufactured specifically for this orientation.

3.2 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each riser, use only 6-inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.3 DISINFECTION AND TESTING

A. In the presence of Owner's Representative, perform disinfection of valves and appurtenances and test as required by Section 33 13 00 – Disinfection of Water Lines.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.4 PAINTING OF VALVES

A. Paint valves in accordance with Section 09 91 00 Painting and Protective Coatings.

3.5 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 50 15

BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Butterfly valves.
2. Specification Section is applicable to:
   a. WD-GWP04-GST-GST2-BFV-02-001
   b. WD-GWP04-GST-GST2-BFV-02-002
   c. WD-GWP04-GST-GST2-BFV-02-003
   d. WD-GWP04-GST-GST2-BFV-02-004
   e. WD-GWP04-GST-GST2-BFV-02-005
   f. WD-GWP04-GST-GST1-BFV-01-002A

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 23 - Valves: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.
2. ASTM International (ASTM):
   a. A48, Standard Specification for Gray Iron Castings.
   b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   c. A276, Standard Specification for Stainless Steel Bars and Shapes.

d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

e. A436, Standard Specification for Austenitic Gray Iron Castings.

f. A536, Standard Specification for Ductile Iron Castings.

g. B148, Standard Specification for Aluminum-Bronze Sand Castings.

3. American Water Works Association (AWWA):

a. C504, Standard for Rubber-Seated Butterfly Valves.

4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

a. SP-67, Butterfly Valves.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 40 05 23.

3. For valves 8 IN and larger, furnish "Affidavit of Compliance" with Owner in accordance with AWWA C504.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. DeZurik.

2. Clow.

3. Mueller.

4. Pratt.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 BUTTERFLY VALVES (AWWA C504)

A. Comply with AWWA C504.

B. Materials:

1. Valve bodies:
   a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.
   b. Wafer valves may be constructed of ASTM A48, Class 40 cast iron.
2. Valve shafts:
   a. Stainless steel, 18-8, Type 304 or 316.
3. Valve discs:
   a. Potable and nonpotable water:
      1) ASTM A48, Class 40 cast iron.
      2) ASTM A536, Grade 65-45-12 ductile iron.
      3) ASTM A436, Type 1 alloy cast iron.
      4) Bronze in accordance with AWWA C504.
   b. Wastewater and similar applications:
      1) ASTM A436, Type 1 alloy cast iron.
      2) ASTM A536, Grade 65-45-12 ductile iron.
      3) ASTM A436, Type 1 alloy cast iron.
      4) Bronze in accordance with AWWA C504.
   c. Air and similar applications: ASTM A48, Class 40 cast iron.
4. Valve seats:
   a. Potable and nonpotable water below 150 DegF:
      1) Natural rubber.
   b. Potable and nonpotable water and wastewater and air below 180 DegF:
      1) Buna-N.
   c. Heating water and air 180 to 250 DegF.
      1) EPDM.
5. Mating surfaces:
   a. Valves less than 30 IN: ASTM A276, 18-8, stainless steel or bronze.
   b. Valves 30 IN and larger: ASTM A276, 18-8, stainless steel.

C. Design Requirements:

1. Seat type:
   a. Resilient.
   b. Comply with AWWA C504.
2. Exposed and submerged valves 3 IN through 20 IN.
   a. Body type: Wafer or short body flange (laying length may vary from AWWA C504).
   b. Equip wafer type with fully tapped anchor lugs drilled per ASME B16.5.
3. Exposed and submerged valves 24 IN and larger:
   a. Body type: Short body flange.
   b. Working pressure: Rated for 150 psi (Class 150B per AWWA C504).
4. Direct buried valves:
   a. All valves: Working pressure rated for 150 psi (Class 150B per AWWA C504).

2.3 BUTTERFLY VALVES (MSS SP-67)

A. Comply with MSS SP-67.

B. Materials:

1. Valve bodies:
   a. Wafer body: Cast iron ASTM A126, Class B.
   b. Lug body: Ductile iron, ASTM A395.
2. Valve shaft or stem:
   a. Stainless steel, ASTM A276, Type 316.
3. Valve disc:
   a. Ductile iron, ASTM A395, nickel plated.} {Aluminum bronze, ASTM B148, Alloy 954.
4. Valve seat:
   a. Water and air below 180 DegF:
      1) Buna-N.
   b. Water and air 180 to 250 DegF:
      1) EPDM.
   c. Valve seat shall be a full body seat isolating stem and body from flow.

C. Design Requirements:
   1. Exposed and submerged valves 3 IN through 20 IN.
      a. Body type: Wafer.
      b. Working pressure: Rated for 150 psi.
      c. Equip with fully tapped anchor lugs drilled per ASME B16.5.
   2. Exposed and submerged valves 24 IN and larger:
      a. Body type: Short body flange.
      b. Working pressure: Rated for 150 psi.

2.4 ACCESSORIES

A. Refer to Drawings and/or valve schedule for type of actuators.
   1. Furnish actuator integral with valve.
B. Refer to Specification Section 40 05 23 for actuator requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 23.

END OF SECTION

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SECTION 40 50 20

BALL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Specification Section is applicable to:
   a. WD-GWP04-GST-GST2-BV-02001
   b. WD-GWP04-GST-GST2-BV-02002

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 40 05 23 – Valves: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A48, Standard Specification for Gray Iron Castings.
   b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   c. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. American Water Works Association (AWWA):
   a. C507, Standard for Ball Valves, 6 IN through 48 IN.
3. Federal Specification (FS):
   a. WW-V-35C, Valve, Ball.

4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
   a. SP-72, Ball Valves with Flanged or Butt-Welding Ends for General Service.
   b. SP-110, Ball Valves; Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.4 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 23 – Valves: Basic Requirements.
   3. Test results for AWWA valves.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 00 – Submittals for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 METALLIC BALL VALVES 1/4 TO 3 IN DIA

A. Comply with FS WW-V-35C Type II, Class A.
B. Acceptable Manufacturers:
   1. Apollo.
   2. Jamesbury.
   3. Watts.
   4. Stockham.
   5. Nibco.

C. Materials:

1. Body: Bronze.
2. Stem, stem gland nut: Brass.
3. Ball: Brass, chrome plated.
4. Seats, stuffing box ring, and thrust washer: Reinforced Teflon.
5. Handle: Vinyl coated or zinc- or cadmium-plated steel.

D. Design Requirements:

1. Rated for 400 psi and 250 DegF, WOG for threaded end applications and 285 psi WOG and 150 psi saturated steam service for flanged end applications.
2. Handles showing direction of opening.
3. Stuffing boxes capable of being repacked under pressure and adjustable for wear.
4. Stem with reinforced Teflon stuffing box ring and blowout-proof design.
5. Renewable reinforced Teflon seats.
6. Ball design which does not allow media contact with stem.
7. Balancing stop for all applications.
8. Bodies with mounting pad for applications requiring actuators.

2.3 PLASTIC BALL VALVES: 1/2 IN TO 4 IN DIA

A. Acceptable Manufacturers:

1. Chemtrol.
2. Spears.
3. ASAHI/America.

B. Materials:

1. Body, stem, ball, handle, end connectors:
   a. PVC ASTM D1784-12454B to match carrier pipe in pipe schedule.
2. Ball Seat: Teflon.
3. O-rings:
   a. Viton
   b. PTFE encapsulated fluorocarbon.

C. Design Requirements:

1. Rated at 250 psi at 75 DegF.
2. Double or "true union" design.

3. Blocks both directions, upstream and downstream.
4. Union nut capable of compensating for seat wear.
5. Body with mounting pad for actuators where required.
6. Capable of being disconnected at downstream end under full line pressure.
7. Sodium hypochlorite service:
   a. Provide "vented" ball valves for all service with greater than 5 percent concentrated sodium hypochlorite.

2.4 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuators.
   1. Furnish actuator integral with valve.

B. Refer to Specification Section 40 05 23 – Valves: Basic Requirements for actuator requirements.

2.5 SOURCE QUALITY CONTROL

A. Shop test ball valves in accordance with AWWA C507.

B. Furnish record of test.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 23 – Valves: Basic Requirements.

3.2 FIELD QUALITY CONTROL

A. For AWWA C507 ball valves, and in accordance with Specification Section 01 75 00 employ and pay for services of equipment manufacturer's field service representative(s) to:
   1. Inspect equipment covered by this Specification Section.
   2. Supervise adjustments and installation checks.
   3. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
   4. Conduct startup of equipment and perform operational checks.
   5. Provide Owner with a written statement that manufacturer's equipment has been installed properly, has been started up, and is ready for operation by Owner's personnel.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 40 90 00

INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic requirements for complete instrumentation system for process control.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 10 14 00 – Identification Devices.
4. Division 26 – Electrical.
5. Section 26 05 19 – Wire and Cable: 600 Volt and Below.
6. Section 40 90 00 – Instrumentation for Process Control Basic Requirements

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Canadian Standards Association (CSA).
2. FM Global (FM).
3. The International Society of Automation (ISA):
   a. 7.0.01, Quality Standard for Instrument Air.
   b. S5.1, Instrumentation Symbols and Identification.
   c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
   d. S5.4, Standard Instrument Loop Diagrams.
   e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
4. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

5. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
6. National Institute of Standards and Technology (NIST).
7. Underwriters Laboratories, Inc. (UL):
   a. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

B. Qualifications:
1. Instrumentation subcontractor:
   a. Experience:
      1) Have satisfactorily provided a control system for a minimum of five (5) projects of similar magnitude and function.

C. Miscellaneous:
1. Comply with electrical classifications and NEMA enclosure types shown on Drawings or other Contract Documents.

1.4 DEFINITIONS

A. Architecturally finished area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.

B. Non-architecturally Finished Area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.

C. Hazardous Areas: Class I, II or III areas as defined in NFPA 70.

D. Highly Corrosive and Corrosive Areas: Rooms or areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.

E. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.

F. Instrument Air Header: The segment of air supply piping and tubing which transports air from the compressed instrument air source through the branch isolation valve of any takeoff (branch) line.

G. Branch Line: The segment of air supply piping and tubing which transports air from the outlet of the air header branch isolation valve through an air user's isolation valve.

H. Intrinsically Safe Circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under test conditions as prescribed in UL 913.

I. Calibrate: To standardize a device so that it provides a specified response to known inputs.

1.5 SYSTEM DESCRIPTION

A. Control System Requirements:

1. This Specification Section provides the general requirements for the instrument and control system.

2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.

B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.

C. Single Instrumentation Subcontractor:

1. Furnish and coordinate instrumentation system through a single instrumentation subcontractor.

   a. The instrumentation subcontractor shall be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of Drawings and Operation and Maintenance Manuals, start-up, training, demonstration of substantial completion and all other aspects of the control system.

2. Ensure coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

1.6 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Submittals shall be original printed material or clear unblemished photocopies of original printed material.

   a. Facsimile information is not acceptable.

3. Limit the scope of each submittal to one (1) Specification Section.

   a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.

   b. Do not provide any submittals for Specification Section 40 90 00 – Instrumentation for Process Control Basic Requirements.

4. Product technical data including:
   a. Equipment catalog cut sheets.
   b. Instrument data sheets:
      1) ISA S20 or approved equal.
      2) Separate data sheet for each instrument.
   c. Materials of construction.
   d. Minimum and maximum flow ranges.
   e. Pressure loss curves.
   f. Physical limits of components including temperature and pressure limits.
   g. Size and weight.
   h. Electrical power requirements and wiring diagrams.
   i. NEMA rating of housings.
   j. Submittals shall be marked with arrows to show exact features to be provided.
   k. Provide copy of factory calibration results and a unique calibration curve for each flowmeter.
5. Loop diagrams per ISA S5.4 as specified in Specification.
6. Comprehensive set of wiring diagrams as specified in Specification.
7. Panel fabrication drawings as specified in Specification.
8. PLC/DCS equipment drawings.
9. HMI graphics.
10. Nameplate layout drawings.
11. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
    a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
12. All Shop Drawings shall be modified with as-built information/corrections.
13. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
    a. Furnish electronic files on CD-ROM or DVD-ROM media.
    b. Drawings in AutoCAD format.
14. Provide a parameter setting summary sheet for each field configurable device.

15. Certifications:
    a. Documentation verifying that calibration equipment is certified with NIST traceability.
    b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.
        1) Certification documentation is required for all equipment for which the specifications require independent agency approval.
16. Testing reports: Source quality control reports.

B. Operation and Maintenance Manuals:
    1. See Specification Section 01 33 00 – Submittals for requirements for:
        a. The mechanics and administration of the submittal process.
        b. The content of Operation and Maintenance Manuals.
    2. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

1.8 SITE CONDITIONS

A. Unless designated otherwise on the Drawings, area designations are as follows:
    1. Outdoor area:
        a. Wet.
        b. Corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
        c. Below grade vaults and manholes:
            1) Subject to temporary submergence when specifically designated on the Drawings or Specifications.
    2. Architecturally finished area:
        a. Dry.
        b. Noncorrosive unless designated otherwise on the Drawings or in the Specification Sections.
        c. Nonhazardous unless designated otherwise on the Drawings or in the Specification Sections.
    3. Non-architecturally finished area: As designated elsewhere on the Drawings or in the Specification Sections.

1.9 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

A. Provide enclosures/housing for control system components in accordance with the following:

1. Areas designated as wet: NEMA Type 4.
2. Areas designated as wet and/or corrosive: NEMA Type 4X.
3. Areas designated as Class I hazardous, Groups A, B, C, or D as defined in NFPA 70:
   a. NEMA Type 7 unless all electrical components within enclosure utilize intrinsically safe circuitry.
      1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.
4. Areas designated as Class II hazardous, Groups E, F, or G as defined in NFPA 70:
   a. NEMA Type 9 unless all electrical components within enclosure utilize intrinsically safe circuitry.
      1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.
5. Either architecturally or non-architecturally finished areas designated as dry, noncorrosive, and nonhazardous: NEMA Type 12.
6. Areas designated to be subject to temporary submersion: NEMA 6P.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. System Operating Criteria:

1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two (2) cycles per minute or a magnitude of movement of 0.5 percent full travel.
2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.

4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.
6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.

2.3 ACCESSORIES

A. Provide identification devices for instrumentation system components in accordance with Specification Section 10 14 00 – Identification Devices.

B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Clarifiers, Digesters, Reservoirs, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes. NO TOP PENETRATIONS ALLOWED.

B. Install electrical components per Division 26 – Electrical.

C. Panel-Mounted Instruments:

1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

D. See Specification Section 26 05 19 – Wire and Cable: 600 Volt and Below.

3.2 FIELD QUALITY CONTROL

A. See Specification Section 01 75 00 – System Start-Up.

B. Maintain accurate daily log of all start-up activities, calibration functions, and final setpoint adjustments.

1. Documentation requirements include the utilization of the forms located at the end of this Specification Section.
   a. Loop Check-out Sheet.
   b. Instrument Certification Sheet.
   c. Final Control Element Certification Sheet.

C. In the event that instrument air is not available during calibration and testing, supply either filtered, dry, instrument quality air from a portable compressor or bottled, dry, instrument quality air.

1. Do not, under any circumstances, apply hydrostatic test to any part of the air supply system or pneumatic control system.

D. Pneumatic Signal Tubing Testing:

1. Before the leak test is begun, blow clean with dry air.
2. Test signal tubing per ISA 7.0.01, except for tubing runs of less than 10 FT where simple soap bubble testing will suffice.
3. If a leak is detected, repair the leak and repeat the leak test.
4. After completion of the leak test, check each signal line for obstructions.
    a. If any are indicated, remove and retest.

E. Instrumentation Calibration:

1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
3. Calibrate in accordance with the manufacturer's specifications.
4. Bench calibrate pressure and temperature gages.
    a. Field mount gage within seven (7) days of calibration.
5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent.
    a. Check for both increasing and decreasing input signals to detect hysteresis.
6. Replace any instrument which cannot be properly adjusted.
7. Stroke control valves with clean dry air to verify control action, positioner settings, and solenoid functions.
8. Calibration equipment shall be certified by an independent agency with traceability to NIST.
    a. Certification shall be up-to-date.
    b. Use of equipment with expired certifications shall not be permitted.
9. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.

F. Loop check-out requirements are as follows:

1. Check control signal generation, transmission, reception and response for

all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.

a. Use actual signals where available.

b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.

1) Verify that readings at all loop components are in agreement.

2) Make corrections as required.

a) Following any corrections, retest the loop as before.

2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.

3. Check all interlocks to the maximum extent possible.

4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.

G. Provide verification of system assembly, power, ground, and I/O tests.

H. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

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ADMINISTRATIVE OFFICE
P.O. Box 329 • Conroe, Texas 77305
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Loop Check-out Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	Page 1 of 2
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
Project No.:	10050-211-134	Date: 12/19/98	
Control Loop No.	107		

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.
P201 Start Sig				VFD-107	21, 22	PLC Cab	103, 104
P201, Speed inp				VFD-107	27, 28	PLC Cab	67, 68, 69
P201 Start out				VFD-107	31, 32	PLC Cab	72, 73, 74
Press transmit	PIT-107	JS	--	PIT-107	+ / -	PLC Cab	98, 99, 100

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT
MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR	PI-107A	SI-107				
EQUIP STATUS	P201 ON	P201 OFF	V-107 open	V-107 close		
ALARM POINT	PAH-107					

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION
H-O-A sel sw	HS-107A	VFD-107				
L-O-R sel sw	HS-107B	@ P201				
S/S switch	HS-107C	MCC	HS-107D	MCC		

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point
PAH-107	120 psi				
SC-107		2.0	5.0	0.2	80 psi

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

(1) HS-107B in Local: (a) start/stop operation via HS-107A and HS-107C, D (b) Manual/auto operation via HS-107A. In auto, pump stopped on hi press, started on lo press. (2) HS-107B in Remote: Observed operation from PLC-pump stopped on hi press, started on lo press. (3) Observed V-107 open/close automatically in accord with pump run condition. (4) Observed all indications and terminations shown above. (5) Tuned SC-107

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by: Joe Smith (Work Performed By) Date: 12/19/98

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Loop Check-out Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	Page 2 of 2
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
Project No.:	10050-211-134	Date: 12/19/98	
Control Loop No.	107		

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.
V-107 open ZS				ZSO-107	+ / -	PLC Cab	112, 113
V-107 close ZS				ZSC-107	+ / -	PLC Cab	114, 115

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT
MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR						
EQUIP STATUS	ZOI-107	ZCI-107				
ALARM POINT						

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

Checked terminations and verified indications shown above.

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by: Joe Smith (Work Performed By) Date: 12/19/98

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Loop Check-out Sheet

Project Name:	Owner's Project No. (if applicable):	Page of
Project Owner:	Regulatory Agency Project No. (if applicable):	
Project No.:	Date:	

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT
MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR						
EQUIP STATUS						
ALARM POINT						

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by:_____ Date:_____
(Work Performed By)

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Instrument Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
Project No.	10050-211-134	Date:	12/19/98
Control Loop No.:	222		
Instrument Tag No.	TSH-222	Transmitter/gauge span:	
Manufacturer:	ACE, Inc.	Switch set-point:	50 F
Model No.	TL-2983-SH5	Switch dead band:	5 F
Serial No.	10293583	Switch range:	32-200 F

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%						
25%						
50%						
75%						
100%						
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	INPUT	OUTPUT	ERROR (% of range)	INPUT	OUTPUT	ERROR (% of range)
High (Increasing input)	49.8 F	Contact Close	0.1%	45.1 F	Contact Open	0.2%
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): 1.0% Switch Range

Remarks:

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Temperature (dry block) calibrator	Hart Scientific XL5897T	0.1 F	Yes

Certified by: Joe Smith Date Certified: 12/19/98

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Instrument Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
Project No.	10050-211-134	Date:	12/19/98
Control Loop No.:	106		
Instrument Tag No.	PIT-106A	Transmitter/gauge span:	0-200 psi
Manufacturer:	ACE, Inc.	Switch set-point:	
Model No.	1275-X	Switch dead band:	
Serial No.	3049569TSH	Switch range:	

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%	0.00 psi	4.02 mA	0.13	0.00 psi	4.00 mA	0.00
25%	50.00 psi	8.00 mA	0.00	50.00 psi	8.01 mA	0.06
50%	100.00 psi	12.01 mA	0.06	100.00 psi	12.00 mA	0.00
75%	150.00 psi	16.00 mA	0.00	150.00 psi	16.01 mA	0.06
100%	200.00 psi	20.00 mA	0.00	200.00 psi	19.99 mA	0.06
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	INPUT	OUTPUT	ERROR (% of range)	INPUT	OUTPUT	ERROR (% of range)
High (Increasing input)						
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): 0.15% span

Remarks: Adjusted zero-otherwise no adjustments required

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Pressure calibrator	Hathaway/Beta XL5946P	0.025% full scale	Yes
Pressure module	Hathaway/Beta XL5948P-6:0-150 psi	0.025% full scale	Yes

Certified by: Joe Smith Date Certified: 12/19/98

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Instrument Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
Project No.	Date:
Control Loop No.:	
Instrument Tag No.	Transmitter/gauge span:
Manufacturer:	Switch set-point:
Model No.	Switch dead band:
Serial No.	Switch range:

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	**INPUT**	**OUTPUT**	**ERROR (% of span)**	**INPUT**	**OUTPUT**	**ERROR (% of span)**
0%						
25%						
50%						
75%						
100%						
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	**INPUT**	**OUTPUT**	**ERROR (% of range)**	**INPUT**	**OUTPUT**	**ERROR (% of range)**
High (Increasing input)						
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): _____

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by: _____ Date Certified: _____

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Final Control Element Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
Project No.	10050-211-134	Date:	12/19/98
Control Loop No.:	056		

Tag No.	LCV-056A
Description:	Control Valve
Manufacturer:	ACE, Inc.
Model No.	XYZ-123
Serial No.	748569AP2

Actuator:	Pneumatic: X	Electric:
Positioner:	Direct: X	Reverse:
Positioner:	Input: 9-15 psi	Output: 0-100%
I/P Converter:	Input: 4-20 mA	Output: 3-15 psi
Valve to	Open	on air failure
Valve to	Open	on power failure

I/P CONVERTER

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%	4.00 mA	3.01 psi	0.08	4.00 mA	3.02 psi	0.17
25%	8.00 mA	6.04 psi	0.33	8.00 mA	6.05 psi	0.42
50%	12.00 mA	9.00 psi	0.00	12.00 mA	9.01 psi	0.08
75%	16.00 mA	11.97 psi	0.25	16.00 mA	12.03 psi	0.25
100%	20.00 mA	14.99 psi	0.08	20.00 mA	14.99 psi	0.08

Specified I/P converter accuracy: 0.50% % of span.

FINAL CONTROL ELEMENT

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	TRAVEL	ERROR (% of full travel)	INPUT	TRAVEL	ERROR (% of full travel)
0%	9.00 psi	0%	-	9.00 psi	0%	-
25%	10.50 psi	25%	-	10.50 psi	25%	-
50%	12.00 psi	50%	-	12.00 psi	50%	-
75%	13.50 psi	75%	-	13.50 psi	75%	-
100%	15.00 psi	100%	-	15.00 psi	100%	-

Remarks: LCV-056A is not furnished with position transmitter, so travel checks were visual.

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Multi-fct calibrator	Fluke-XL743B	0.01% Rdg + 0.015% FS	Yes
Pressure Module	Fluke-XL700POS (0-30")	0.05% FS	Yes

Certified by: Joe Smith Date Certified: 12/19/98

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San Jacinto River Authority
ADMINISTRATIVE OFFICE
P.O. Box 329 • Conroe, Texas 77305
(T) 936.588.1111 • (F) 936.588.3043

Final Control Element Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
Project No.	Date:
Control Loop No.:	

Tag No.	Actuator: Pneumatic: _____ Electric: _____
Description:	Positioner: Direct: _____ Reverse: _____
Manufacturer:	Positioner: Input: _____ Output: _____
Model No.	I/P Converter: Input: _____ Output: _____
Serial No.	Valve to _____ on air failure
	Valve to _____ on power failure

I/P CONVERTER

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%						
25%						
50%						
75%						
100%						

Specified I/P converter accuracy: _____ % of span.

FINAL CONTROL ELEMENT

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	TRAVEL	ERROR (% of full travel)	INPUT	TRAVEL	ERROR (% of full travel)
0%						
25%						
50%						
75%						
100%						

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by: _____ Date Certified: _____

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SECTION 40 91 10

PRIMARY ELEMENTS AND TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flow components.
2. Pressure components.
3. Level components.
4. Temperature components.
5. Analytical components.
6. Speed components.
7. Pipe, tubing and fittings.
8. Instrument valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Gas Association (AGA):
   a. Gas Measurement Committee Report #3.
2. American Iron and Steel Institute (AISI).
3. American National Standards Institute (ANSI).
4. American Society of Mechanical Engineers (ASME):
   a. B16.5, Pipe Flanges and Flanged Fittings.
   b. B31.1, Power Piping.

c. PTC 19.3, Instruments and Apparatus, Part 3 Temperature Measurement.

d. PTC 19.5, Application of Fluid Meters, Part 2.

e. Section II, Part A SA-182, Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

f. Section II, Part A SA-479, Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

5. ASTM International (ASTM):

   a. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

   b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

   c. A182, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

   d. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

   e. A276, Standard Specification for Stainless Steel Bars and Shapes.

   f. A479, Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

   g. B16, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.

   h. B75, Standard Specification for Seamless Copper Tube.

   i. B124, Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.

   j. B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

   k. B453, Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod, Bar, and Shapes.

6. Federal Communications Commission (FCC)

   a. 47 CFR 15, Radio Frequency Devices.

7. Instrumentation, Systems, and Automation Society (ISA):

   a. MC96.1, Temperature Measurement Thermocouples.

   b. S82.03 – Safety Standard for Electrical and Electronic Process Measurement and Control Equipment.

8. National Electrical Manufacturers Association (NEMA):

   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

9. US Department of Interior Bureau of Reclamation (USDIBR):

    a. Water Measurement Manual.

1.4 SYSTEM DESCRIPTION

A. The instruments specified in this Specification Section are the primary element components for the control loops shown on the "I" series Drawings.

1. These instruments are integrated with other control system components specified under Specification Section 40 90 00 – Instrumentation for Process Control: Basic Requirements series to produce the functional control defined in the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 – Submittals for requirements for:

    a. The mechanics and administration of the submittal process.

    b. The content of Operation and Maintenance Manuals.

1.6 WARRANTY

A. Standard manufacturer’s warranty

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 PRESSURE COMPONENTS

A. Pressure Gage:

1. Acceptable manufacturers:

    a. Ashcroft.

    b. NoShok

2. Materials:

    a. Bourdon tube, socket, connecting tube: 316 stainless steel.

b. Case: Phenolic.

c. Pressure snubber:

1) Filter disc: 316 stainless steel

2) Housing: 316 stainless steel.

3. Accessories:

a. Provide stainless steel ball valve at point of connection to equipment and at panel if panel mounted.

b. Utilize pressure snubbers with porous metal discs to provide pulsation dampening on gage applications as shown on schedule.

c. Provide 1/2 IN stainless steel antisiphon pigtail inlet connection for hot water and steam applications.

4. Design and fabrication:

a. All components suitable for service at:

1) 250 DegF.

2) The maximum process temperature to which the gage is to be exposed.

b. Provide viewer protection from element rupture.

c. Calibrate gages at jobsite for pressure and temperature in accordance with manufacturer's instructions.

d. Unless otherwise required by codes, provide stem mounted or flush mounted, as required, with dial diameter as follows:

PIPE SIZE	DIAL SIZE	GAGE CONNECTION
1-1/2 IN or less	2-1/2 IN	1/4 IN
Larger than 1-1/2 IN	4-1/2 IN	1/2 IN

e. Equip with white faces, black numerals and black pointers.

f. Gage tapping position to be clear of equipment functions and movements, and protected from maintenance and operation of equipment.

1) Gage to be readable from an accessible standing position.

g. Gage accuracy: 1 percent of full range.

h. Select gage range so that:

1) The normal operating value is in the middle third of the dial.

2) Maximum operating pressure does not exceed 75 percent of the full scale range.

B. Diaphragm Seal: **(NOT USED)**

1. Acceptable manufacturers:
   a. Ashcroft.
   b. Ametek.
2. Materials:
   a. Lower housing: 316 stainless steel.
   b. Diaphragm material: 316 stainless steel.
3. Design and fabrication:
   a. Isolates instrument from process fluids which are corrosive or contain solids.
   b. Upper housing with bleed screw.
   c. Lower housing with flushing connection.
   d. Fill fluid:
      1) Utilize halocarbon fill for process applications involving strong oxidizing agents.
         a) Agents include but are not limited to: Cl2, KMNO4, FeCl, NaOH, and NaOCl.
      2) Utilize manufacturer's standard fill for other applications.
         a) Ensure fill is suitable for application temperatures.
   e. Process connections:
      1) Instrument: 1/2 IN NPT.
      2) Process: 0.5 IN female NPT.
      3) PVC pipe applications: Use a socket weld connection.
4. Installed where specified or shown on Drawings.

2.3 LEVEL ELEMENTS

A. Non-Contact Type Radar Level Transmitters:

1. Acceptable manufacturers:
   a. Rosemount 5400 Series.
   b. VEGA VEGAPULS 64.
2. Materials:
   a. Antenna:
      1) Dielectric rod: Hastelloy C.
      2) Horn: Hastelloy C.

b. Housing: Aluminum or plastic.

c. O-rings: Viton

d. Flanges: 316 stainless steel (INCLUDE CHAMPION FLANGE AS REQUIRED

3. Design and fabrication:

a. Transmit and receive radar signal. Maximum beam angle signal 7 degrees.

b. Comply with FCC 47 CFR 15.

c. Two-wire, 24 Vdc loop-powered.

d. Output signal: 4-20 mA.

e. False target rejection.

f. Gain adjustments to maximize performance.

g. Operating temperature:

1) -40 to 175 DegF.

2) Display operating temperature: -5 to 160 DegF.

h. Humidity: 0-99 percent, non-condensing.

i. Linearity: +/-0.4 IN or 0.1 percent of tank height (whichever is greater).

j. Measured error: +/-0.4 IN or 0.1 percent of tank height (whichever is greater; performance will degrade slightly within 60 IN of antenna).

k. Resolution: 0.1 IN.

l. Repeatability: +/-0.2 IN or 0.05 percent of tank height.

m. Response time: Less than 1 second.

n. Flanges (if utilized): ASME B16.5.

o. Display with keypad.

p. Configuration capability: Provide with either pushbuttons and display or handheld communicator.

2.4 PIPE, TUBING, AND FITTINGS

A. Acceptable Manufacturers:

1. Tube fittings:

a. Parker CPI.

b. Swagelok.

B. Instrument Tubing and Fittings:
   1. Material:
      a. Tubing: ASTM A269, Grade TP 316 stainless steel.
      b. Straight fittings: 316 stainless steel per ASME SA-479 or ASTM A276.
      c. Shaped bodies: ASME SA-182 F316 stainless steel.
   2. Design and fabrication:
      a. Tubing:
         1) Seamless.
         2) Fully annealed.
         3) Maximum hardness: 80 Rb.
         4) Free from surface scratches and imperfections.
         5) Diameter: 1/2 IN OD unless specified otherwise.
         6) Wall thickness:
            a) Meet requirements of ASME B31.1, Paragraph 122.3.
            b) Minimum 0.049 IN for 1/2 IN OD tubing.
      b. Fittings:
         1) Flareless.
         2) Compression type.

C. Instrument Piping:
   1. For applications where the instrument is supported solely by the sensing line, (e.g., pressure gauge directly mounted to process line) utilize piping as specified below.
      a. Diameter: 1/2 IN unless specified otherwise.
      b. Schedule 80.
      c. 316 stainless steel

D. Pneumatic Signal Tubing:
   1. Material: Copper per ASTM B75.
   2. Design and fabrication:
      a. Soft annealed.
      b. Free from surface scratches and imperfections.
      c. Wall thickness:
         1) 0.030 IN for 1/4 IN OD.
         2) 0.035 IN for 3/8 IN OD.

E. Pneumatic Tube Fittings:

1. Material:

a. Straight fittings: Brass per ASTM B16 and ASTM B453.

b. Shaped bodies: Brass per ASTM B124 Alloy 377 or ASTM B283.

2. Design and fabrication:

a. Flareless.

b. Compression type.

2.5 INSTRUMENT VALVES

A. Process instrument multi-valve manifolds, isolation, vent and blow-down valves:

1. Acceptable manufacturers:

a. Swagelok

2. Materials:

a. Packing:

1) 450 DegF and above: Graphite.

2) Below 450 DegF: Graphite or Teflon.

b. Body: 316 stainless steel per ASTM A479.

c. Stem: 316 stainless steel per ASTM A276.

d. Ball: 316 stainless steel per ASTM A276.

e. Support rings: 316 stainless steel per ASTM A276.

f. Seats:

1) Metal:

a) 316 stainless steel per ASTM A276.

2) Soft:

a) Teflon, Delrin.

b) Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.

3. Design and fabrication:

a. Either of the following:

1) Ball valve with 1/4 turn activation.

2) Free-swiveling ball stem.

b. Provide body wall thickness sufficient for process design conditions per ASME B31.1.

c. Temperature: Manufacturer's temperature rating for all components shall exceed process design conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install instrument mounting pipe stands level and plumb.

C. Instrument Valves:

1. Orient stems for proper operation.
2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.
3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line.
   a. When cool, reassemble the valves.
5. Support each valve individually.
   a. The tubing system does not qualify as support for the valve.

D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

E. Keep foreign matter out of the system.

F. Remove all oil on piping and tubing with solvent before piping and tubing installation.

G. Plug all open ends and connections to keep out contaminants.

H. Tubing Installation:

1. General:
   a. Install such that tube shows no sign of crumpling, bends of too short a radius, or flattening, etc.
   b. Make tube runs straight and parallel or perpendicular to the floor, equipment and piping runs.
   c. For liquid and steam applications, slope continuously from the process to the instrument with a minimum slope of 0.50 IN per foot.
   d. For gas and air applications, slope continuously from the instrument to the process with a minimum slope of 0.50 IN per foot.
   e. If the sensing line cannot be continuously sloped, install high point vents and low point drains.
   f. Keep instrument tubing clean during all phases of work.

g. Blow out with clean, dry, oil-free air immediately before final assembly.

h. Cut by sawing only and debur.

2. Bending:

a. Make each bend with tube bender of the correct size for the tube.

b. Make all bends smooth and continuous.

c. Rebending is not permitted.

d. Make bends true to angle and radius.

e. Maintain a true circular cross section of tubing without buckling or undue stretch of tube wall.

f. Allowable tolerance for flattening out of tubing bends: Maximum of 8 percent of the OD for stainless steel tubing.

g. Minimum bending radius for stainless steel tubing:

TUBE OD, INCHES	MINIMUM BENDING RADIUS, INCHES
1/4	9/16
3/8	15/16
1/2	1-1/2

h. Minimum bending radius for type L, hard (drawn) copper:

TUBE OD, INCHES	MINIMUM BENDING RADIUS, INCHES
3/8	1-3/4
1/2	2-1/2

3. Tubing support:

a. Intermittently support by clamping to support angle.

b. Install supports to be self-draining, supported by hangers, or cantilevered from walls or structural beams.

c. Support at 5 FT-0 IN maximum spans for horizontal or vertical runs.

d. Use tubing trays in areas where spans between supports are greater than 5 FT and for all signal tubing support.

e. Support each tubing tray at 10 FT maximum spans.

f. Align tubing in orderly rows and retain in the tray by bolted clips.

1) The use of spring or speed clips is not acceptable.

g. Maintain order of the tubing throughout the length of the tray.

h. Locate angle, channel and tray installation to protect tubing from spills and mechanical damage.

i. Locate support members to clear all piping, conduit, equipment, hatchways, monorails, and personnel access ways and allow access for equipment operation and maintenance.

j. Support trays to prevent torsion, sway or sag.

k. Permanently attach supports to building steel or other permanent structural members.

l. Arrange supports and trays so that they do not become a trough or trap.

4. Routing and orientation:

a. Route to maintain a minimum headroom clearance of 8 FT.

b. Locate and orient valves and specialties so that they are accessible for operation and maintenance from the operating floor.

1) Do not route through or over equipment removal areas, below monorails or cranes nor above or below hatches.

5. Expansion and vibration provisions:

a. Provide horizontal expansion loops at the process connections.

b. Route tubing parallel to relative motion through sleeved supports that allow linear tube movement.

c. Cold springing of tubing to compensate for thermal expansion is prohibited.

d. Utilize flexible hoses to connect pneumatic tubing to air users which may move or vibrate.

I. Air Supply:

1. Connect all instruments requiring air to air supply piping and tubing.

2. Provide connections as follows:

a. Terminate branch supply line not more than 36 IN from the device with a 1/2 IN isolation valve.

b. For remaining line, use 1/4 or 3/8 IN tubing of a length to allow for normal equipment movement and vibration.

c. Use flexible hoses to connect pneumatic tubing to air users which may experience significant movement or vibration.

d. Make branch connections to individual instruments from the top of the supply header.

e. Purge instrument air piping of extraneous material by blowing clean, dry, oil-free air through the system prior to final connection.

J. Threaded Connection Seals:
   1. Use Tite-Seal or acceptable alternate.
   2. Use of lead base pipe dope or Teflon tape is not acceptable.
   3. Do not apply Tite-Seal to tubing threads of compression fittings.

K. Capillary Tubing:
   1. Route capillary tubing in tubing tray.
   2. Install capillary tubing with a 2 IN minimum bend radius which does not kink or pinch the capillaries.
   3. Do not cut or disconnect at any point.
   4. Coil excess capillary tubing and secure at the instrument.

L. Temperature Elements:
   1. Assemble in the following sequence:
      a. Remove temperature sensor sheaths and terminal blocks from the head and nipple assembly.
      b. Connect nipple and head to thermowell installed in the pipe.
      c. Insert sheath and terminal block until it seats in the thermowell.
      d. Connect to the head.

M. Instrument Mounting:
   1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
   2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
   3. Mount instruments level, plumb, and support rigidly.
   4. Mount to provide:
      a. Protection from heat, shock, and vibrations.
      b. Accessibility for maintenance.
      c. Freedom from interference with piping, conduit and equipment.
   5. Outdoor mounting
      a. Mount any LED or LCD display such that the lighted part faces north and/or east. If this is not possible, the display must be protected from the sun via a sun shade, sun shield, etc.

3.2 OWNER TRAINING

A. Provide on-site training in accordance with Specification Section 01 75 00 – System Start-Up.

END OF SECTION

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Division	Facility	Area	Subarea	Equip Code	Unit #	Equip #	Description	Low Limit	High Limit	Engr. Units	Off State	On State	P&ID	Instr. Detail	I/O Type	Spec	2, 3, 4 wire	PLC No.	Panel /Field	Instr. Types	MAKE - MODEL	Process Conditions	Assessories
WD	GWP04	GST	GST1	LIT	01	001	GST Radar Level Transmitter	0	26	FT	-	-	02I601	02I501	AI	40 91 10	2	GROUND WATER PUMP STATION	F	RADAR LEVEL CONTROLLER	-	EXISTING FLANGE	PROPOSED ALTERNATIVE BID ITEM #2
WD	GWP04	GST	GST1	LIT	01	002	GST Radar Level Transmitter	0	26	FT	-	-	02I601	02I501	AI	40 91 10	2	GROUND WATER PUMP STATION	F	RADAR LEVEL CONTROLLER	-	EXISTING FLANGE	PROPOSED ALTERNATIVE BID ITEM #2
GR	GWP04	GST	GST2	LIT	02	001	GST Radar Level Transmitter	0	26	FT	-	-	02I602	02I501	AI	40 91 10	2	SURFACE WATER	F	RADAR LEVEL CONTROLLER	-	FLANGE	PROPOSED
WD	GWP04	GST	GST2	LIT	02	001	GST Radar Level Transmitter	0	26	FT	-	-	02I602	02I501	AI	40 91 10	2	GROUND WATER PUMP STATION	F	RADAR LEVEL CONTROLLER	-	FLANGE	PROPOSED
WD	GWP04	GST	GST2	LIT	02	002	GST Radar Level Transmitter	0	26	FT	-	-	02I602	02I501	AI	40 91 10	2	GROUND WATER PUMP STATION	F	RADAR LEVEL CONTROLLER	-	FLANGE	PROPOSED
WD	GWP04	GST	GST2	ZS	02	001	GST Hatch No. 1 Intrusion Alarm	-	-	-	ALARM	NORMAL	02I602	02I501	DI	-	2	GROUND WATER PUMP STATION	F	HATCH DOOR CONTACT	-	-	PROPOSED
WD	GWP04	GST	GST2	ZS	02	002	GST Hatch No. 2 Intrusion Alarm	-	-	-	ALARM	NORMAL	02I602	02I501	DI	-	2	GROUND WATER PUMP STATION	F	HATCH DOOR CONTACT	-	-	PROPOSED
WD	GWP04	GST	GST2	ZS	02	003	GST Hatch No. 3 Intrusion Alarm	-	-	-	ALARM	NORMAL	02I602	02I501	DI	-	2	GROUND WATER PUMP STATION	F	HATCH DOOR CONTACT	-	-	PROPOSED
WD	GWP04	GST	GST2	LG	02	001	GST2 Tank Level Indication	-	-	-	-	-	-	-	-	41 91 10	-	N/A	F	LOCAL INDICATOR	ASHCROFT MONEL HOUSING 4-1/2 INCH DIAL	-	PROPOSED

Division	Facility	Area	Subarea	Equip Code	Unit #	Equip #	Description	Type	Low Limit	High Limit	Engr Units	Off State	On State	PLC	Rack	Slot	Point	Comments
WD	GWP04	GST	GST 1	LIT	01	001	GST Radar Level Transmitter	AI	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	Alternate Bid Item No. 2
WD	GWP04	GST	GST 1	LIT	01	002	GST Radar Level Transmitter	AI	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	Alternate Bid Item No. 2
WD	GWP04	GST	GST 1	LI	01	001	GST Radar Level Transmitter	AO	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	Alternate Bid Item No. 2
WD	GWP04	GST	GST 1	LI	01	002	GST Radar Level Transmitter	AO	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	Alternate Bid Item No. 2
GR	GWP04	GST	GST 2	LIT	02	001	GST Radar Level Transmitter	AI	0	26	FT	-	-	SURFACE WATER	-	-	-	-
WD	GWP04	GST	GST 2	LIT	02	001	GST Radar Level Transmitter	AI	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	-
WD	GWP04	GST	GST 2	LIT	02	002	GST Radar Level Transmitter	AI	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	-
WD	GWP04	GST	GST 2	LI	02	001	GST Radar Level Transmitter	AO	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	-
WD	GWP04	GST	GST 2	LI	02	002	GST Radar Level Transmitter	AO	0	26	FT	-	-	GROUNDWATER PUMP STATION	-	-	-	-
WD	GWP04	GST	GST 2	ZS	02	001	GST Hatch No. 1 Intrusion Alarm	DI	-	-	-	HATCH OPENED	HATCH CLOSED	GROUNDWATER PUMP STATION	0	3	4	-
WD	GWP04	GST	GST 2	ZS	02	002	GST Hatch No. 2 Intrusion Alarm	DI	-	-	-	HATCH OPENED	HATCH CLOSED	GROUNDWATER PUMP STATION	0	3	5	-
WD	GWP04	GST	GST 2	ZS	02	003	GST Hatch No. 3 Intrusion Alarm	DI	-	-	-	HATCH OPENED	HATCH CLOSED	GROUNDWATER PUMP STATION	0	3	6	-

SECTION 40 99 00

SURGE PROTECTION DEVICES (SPD) FOR INSTRUMENTATION AND CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type IC1 SPD - Dedicated 120 Vac circuit, series connection, control panel mounted.
2. Type IC2 SPD - Individual equipment plug-in device (point of use protection).
3. Type IC3 SPD - Discrete 120 Vac control signal, control panel mounted.
4. Type IC4 SPD - Analog instrumentation signal, field mounted.
5. Type IC5 SPD - Analog instrumentation signal, control panel mounted.
6. Type IC6 SPD - Combination 120 Vac circuit and analog signal, field mounted.
7. Type IC7 SPD - Discrete low voltage control signal, control panel mounted.
8. Type IC8 SPD - Data line, control panel mounted.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   b. C62.45, Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

2. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. LS 1, Low Voltage Surge Protection Devices.
3. Underwriters Laboratories, Inc. (UL):
    a. 497B, Standard for Safety Protectors for Data Communications and Fire-Alarm Circuits.
    b. 1283, Standard for Safety Electromagnetic Interference Filters.
    c. 1363, Standard for Safety Relocatable Power Taps.
    d. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:

1. Provide devices for a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
2. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.4 DEFINITIONS

A. Clamping Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.

B. Let-Through Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:

1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.
2. Listed by mode, since number and type of components in any SPD may vary by mode.

E. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

F. Surge Current per Phase:

1. The per phase rating is the total surge current capacity connected to a given phase conductor.
2. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
    a. The N-G mode is not included in the per phase calculation.

G. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 120 V system the L-N peak voltage is 170 V).

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. For named products, submit only a catalog cut sheet.
    a. For all other products, submit the data required below.
3. See Specification Section 40 90 00.
4. Product technical data for non-specified models:
    a. Manufacturer's experience.
    b. Standard catalog cut sheet.
    c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
    d. Create a Product Data Sheet for each different model number of SPD provided.
        1) Data in the Product Data Sheet heading:
            a) SPD Type per PART 2 of this Specification Section.
            b) Manufacturer's Name.
            c) Product model number.
        2) Data in the Product Data Sheet body:
            a) Column one: Specified value/feature of every paragraph of PART 2 of this Specification Section.
            b) Column two: Manufacturer's certified value confirming the product meets the specified value/feature.
        3) Data in the Product Data Sheet closing:
            a) Signature of the manufacturer's official (printed and signed).
            b) Title of the official.
            c) Date of signature.

B. Operation and Maintenance Manual:

1. See Specification Section 01 33 00 for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

1.6 WARRANTY

A. The manufacturer shall provide a minimum of a five (5) year Limited Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturer's model numbers listed in the individual product paragraphs below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 TYPE IC1 SPD

A. Approved Products:

1. Cutler Hammer AGSHW CH-120N-15-XS.

2. EDCO HSP121BT-1RU.

3. MTL MA15/D/1/SI.

4. Phoenix Contact SFP 1-20/120AC (2856702).

B. Standards: UL 1449.

C. Design:

1. General:

a. Mounted internally to control panels for point-of-use loads.

b. MOV based or multi-stage hybrid solid state high performance suppression system.

c. Designed for series connection.

d. Enclosure: Metallic or plastic, flange or DIN rail mounting.

e. Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.

f. Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.

2. Operating voltage: 120 Vac.

3. Operating current: 15 A minimum.
4. Operating frequency: 45 to 65 Hz.
5. Modes of protection: All modes, L-N, L-G and N-G.
6. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
7. Maximum surge current: 20,000A per phase, 10,000A per mode minimum.
8. Minimum repetitive surge current capacity: 1000 impulses with no degradation of more than 10 percent deviation of the clamping voltage.
9. Fusing: Optional integral unit level and/or component level short circuit and/or thermal overload protection.
    a. External protection as recommended by manufacturer.
10. Maximum clamping voltages, dynamic test with voltages measured from the zero voltage reference and 90 degree phase angle:

		IEEE C62.41		
System Voltage	**Test Mode**	**B Comb. Wave**	**A Ring Wave**	**UL 1449**
L-N = 120 V	L-N	400 V	300 V	330 V
	L-G	500 V	400 V	400 V
	N-G	500 V	400 V	400 V

2.3 TYPE IC3 SPD

A. Approved Products:
    1. EDCO DRS-130RMS.
    2. MTL MA-15/D/1/SI.
    3. MTL SD-150X.
    4. Phoenix Contact PT 2x1VA-120AC-ST (2839185) with PT BE/FM (2839282) base for non-isolated wiring.
    5. Phoenix Contact PT-2 PE/S-120 AC-ST (2839334 with PT-BE/FM (2839282) base for isolated wiring.
B. Standards: UL 497B or UL 1449.
C. Design:
    1. General:
        a. Mounted internally to control panels for point-of-use loads.
        b. Multi-stage hybrid solid state high performance suppression system.
        c. Designed for series connection.
        d. Enclosure: Metallic or plastic, flange or DIN rail mounting.

e. Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.

f. Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.

2. Operating voltage: 120 Vac.

3. Operating current: 3 A minimum.

4. Operating frequency: 45 to 65 Hz.

5. Modes of protection: L-N; when ground conductor is present L-G and N-G.

6. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.

7. Maximum surge current: 6000 A per phase, 3000A per mode minimum.

8. Minimum repetitive surge current capacity:

   a. The SPD shall meet one (1) of the following:

      1) 1000 occurrences of a 200A, 10x1000 microsecond waveform.
      2) 400 occurrences of a 500A, 10x1000 microsecond waveform.
      3) 100 occurrences of a 400A, 10x700 microsecond waveform.
      4) 100 occurrences of a 2000A, 8x20 microsecond waveform.

9. Maximum clamping voltages, measured from the zero voltage reference:

   a. The SPD shall meet one (1) of the following:

      1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
      2) IEEE B3 combination wave: 250 percent of system voltage.
      3) IEEE B3 ring wave: 200 percent of system peak voltage.
      4) IEEE A3 ring wave: 200 percent of system peak voltage.
      5) Mode N-G clamping voltage may be 175 percent higher than the L-G levels.

2.4 TYPE IC4 SPD

A. Approved Products:

1. Cutler Hammer DPIPE S0362.

2. EDCO SS64-036-1, SS64-036-2, SS65-036-1 or SS65-036-2.

3. MTL TP48-NDI.

4. Phoenix Contact S-PT1-2PE-24DC (2818122).

B. Standards: None.

C. Design:

1. General:
    a. For protection of field mounted equipment connected to 4-20mA analog signal loops.
    b. Mounted directly to an unused conduit entry on a process transmitter housing.
    c. Multi-stage hybrid solid state high performance suppression system.
    d. Designed for series connection.
    e. Enclosure: 1/2 IN to 3/4 IN stainless steel conduit pipe nipple.
2. Operating voltage: 24 Vdc
3. Modes of protection: All modes, L-L and L-G.
4. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
5. Maximum surge current: 10,000 A.
6. Minimum repetitive surge current capacity:
    a. The SPD shall meet one (1) of the following:
        1) 1000 occurrences of a 200A, 10x1000 microsecond waveform.
        2) 400 occurrences of a 500A, 10x1000 microsecond waveform.
        3) 100 occurrences of a 400A, 10x700 microsecond waveform.
        4) 100 occurrences of a 2000A, 8x20 microsecond waveform.
        5) 10 occurrences of a 10,000A, 8x20 microsecond waveform.
7. Maximum clamping voltages, L-L:
    a. The SPD shall meet one (1) of the following:
        1) 400A, 10x700 microsecond waveform: 400 percent of system voltage.
        2) 10,000A, 8x20 microsecond waveform: 400 percent of system voltage.
        3) IEEE B3 combination wave: 250 percent of system voltage.
8. Maximum clamping voltages, L-G:
    a. The SPD shall meet one (1) of the following:
        1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
        2) 10,000A, 8x20 microsecond waveform: 200 percent of system voltage.
        3) IEEE B3 combination wave: 300 percent of system voltage.

2.5 TYPE IC5 SPD

A. Approved Products:

1. Cutler Hammer DHW2P036.
2. EDCO DRS-036 or PC642C-036 with PCB1B base.
3. MTL SD32 or SD32X.
4. Phoenix Contact PT 2x2-24DC-ST (2838228) with PT 2x2-BE (2838208) or PT 2x2+F-BE (2839224) base.

B. Standards: UL 497B.

C. Design:

1. General:
   a. Mounted internally to control panels for protection of equipment connected to analog signal loops.
   b. Multi-stage hybrid solid state high performance suppression system.
   c. Designed for series connection.
   d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
   e. Field connection: The unit shall have external terminal screws for line and ground conductors.
2. Operating voltage: 24 Vdc .
3. Modes of protection: All modes, L-L and L-G.
4. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
5. Maximum surge current: 10,000 A.
6. Minimum repetitive surge current capacity:
   a. The SPD shall meet one (1) of the following:
      1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
      2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.
      3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
      4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
      5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.
7. Maximum clamping voltages, L-L:
   a. The SPD shall meet one (1) of the following:
      1) 400A, 10x700 microsecond waveform: 400 percent of system voltage.
      2) 10,000A, 8x20 microsecond waveform: 400 percent of system voltage.
      3) IEEE B3 combination wave: 225 percent of system voltage.

8. Maximum clamping voltages, L-G:
    a. The SPD shall meet one (1) of the following:
        1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
        2) 10,000A, 8x20 microsecond waveform: 200 percent of system voltage.
        3) IEEE B3 combination wave: 300 percent of system voltage.

2.6 TYPE IC6 SPD

A. Approved Products:
    1. EDCO SLAC-12036.
    2. MTL TPAC-4W.
    3. Phoenix Contact BXT-N4X 4-Wire.
B. Product:
    1. Field mounted for protection of field mounted equipment connected to 120V power and 4-20mA analog signal loops.
    2. Type IC1 and Type IC5 SPDs mounted in a common enclosure.
    3. Enclosure: Metallic or non-metallic NEMA 4X.

2.7 TYPE IC7 SPD

A. Approved Products:
    1. Cutler Hammer DDIN Series.
    2. EDCO DRS Series.
    3. MTL SD Series.
    4. Phoenix Contact: PT Series.
B. Standards: UL 497B.
C. Design:
    1. General:
        a. Mounted internally to control panels for protection of equipment connected to a discrete signal.
        b. Multi-stage hybrid solid state high performance suppression system.
        c. Designed for series connection.
        d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
        e. Field connection: Provide unit with external terminal screws for line and ground conductors.
    2. Operating voltage: 24 Vdc or 24 Vac or 120 Vac

3. Modes of protection: All modes:
   a. AC applications: L-N, L-G, N-G
   b. DC applications: Pos-Neg, Pos-Gnd, Neg-Gnd.
4. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
5. Maximum surge current: 10,000 A.
6. Minimum repetitive surge current capacity:
   a. The SPD shall meet one (1) of the following:
      1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
      2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.
      3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
      4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
      5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.
7. Maximum clamping voltages, L-L (Pos-Neg):
   a. The SPD shall meet one (1) of the following:
      1) 400A, 10x700 microsecond waveform: 400 percent of system voltage.
      2) 10,000A, 8x20 microsecond waveform: 400 percent of system voltage.
      3) IEEE B3 combination wave: 250 percent of system voltage.
8. Maximum clamping voltages, L-G:
   a. The SPD shall meet one (1) of the following:
      1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
      2) 10,000A, 8x20 microsecond waveform: 200 percent of system voltage.
      3) IEEE B3 combination wave: 300 percent of system voltage.

2.8 SOURCE QUALITY CONTROL

A. Performance tests to be performed or independently verified by a certified testing laboratory.

B. The SPD are to be tested as a complete SPD system including: Integral unit level and/or component level fusing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type IC1 SPD:
   1. Provide on the following applications:
      a. Incoming 120 V power to all control panels.
   2. Connected in series with the panel's or equipment's branch circuit.
   3. Provide fuse protection as recommended by manufacturer.
   4. Flange mount or DIN rail mount in control panel.
   5. Connect all SPDs in the panel to the same grounding point.

C. Type IC3 SPD:
   1. Provide on the following applications:
      a. 120 V discrete PLC signals into a control panel from float switches, position switches, etc., where the device is mounted outdoors or in a remote building or structure from the control panel and where the control conductors are routed above grade or underground.
      b. 120 V discrete PLC signals into a control panel from float switches, position switches, etc., where both the device and control panel are mounted outdoors and the control conductors are routed above grade or underground.
   2. Connected in series with the equipment.
   3. Provide fuse protection as recommended by manufacturer.
   4. Flange mount or DIN rail mount in control panel.
   5. Connect all SPDs in the panel to the same grounding point.

D. Type IC4 SPD:
   1. Provide on the following applications:
      a. Loop powered transmitter (flow, level, etc.) where the transmitter is mounted outdoors or in a remote building or structure from the control panel and the signal conductors are routed above grade or underground.
      b. Loop powered transmitter (flow, level, etc.) where both the transmitter and control panel are mounted outdoors and the signal conductors are rounted above grade or underground.
   2. Connect in series with the equipment.
   3. Attach to spare conduit entry of transmitter or inline of conduit at the transmitter.
   4. Bond transmitter to a grounded structure or provide a ground rod.
   5. Ground shield at control panel end.
   6. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.

E. Type IC5 SPD:

1. Provide on the following applications:
    a. Incoming 4-20mA signals into a control panel from transmitters (flow, level, etc.) where the transmitter is mounted outdoors or in a remote building or structure from the control panel and the signal conductors are routed above grade or underground.
    b. Incoming 4-20mA signals into a control panel from transmitters (flow, level, etc.) where both the transmitter and control panel are mounted outdoors and the signal conductors are routed above grade or underground.
2. Connect in series with the equipment.
3. Flange mount or DIN rail mount in control panel.
4. Connect all SPDs in the control panel to the same grounding point.
5. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.

F. Type IC6 SPD:

1. Provide on the following applications:
    a. Outdoor field mounted transmitter (flow, level, etc.) that requires 120 V power and provides a 4-20mA signal to a control panel where the conductors are routed above grace or underground.
2. Connect in series with the equipment.
3. Mounted adjacent to equipment.
4. Bond transmitter to a grounded structure or provide a ground rod.
5. Ground shield at control panel end.
6. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.

G. Type IC7 SPD:

1. Provide on the following applications:
    a. Low voltage (e.g., 24 Vac, 24 Vdc) discrete PLC signals into a control panel from float switches, position switches, etc., where the device is mounted outdoors or in a remote building or structure from the control panel and where the control conductors are routed above grade or underground.
    b. Low voltage (e.g., 24 Vac, 24 Vdc) discrete PLC signals into a control panel from float switches, position switches, etc., where both the device and control panel are mounted outdoors and the control conductors are routed above grade or underground.
2. Connect in series with the equipment.

3. Flange mount or DIN rail mount in control panel.
4. Connect all SPDs in the control panel to the same grounding point.

END OF SECTION

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