AGREEMENT AND SPECIFICATIONS

JOHN T. HICKERSON WRF
HEADWORKS BARSCREEN REPLACEMENT

BID NUMBER 40-23

VOLUME 1 OF 2

CONTRACT DOCUMENTS

APRIL, 2023

el paso WATER

Ivonne Santiago, Chair
Bryan R. Morris, Vice Chair
Charlie Intebi, Secretary-Treasurer
Kristina D. Mena, Member
Lisa Saenz, Member
Stephanie Block Uribarri, Member
Mayor Oscar Leeser, Ex-Officio Member

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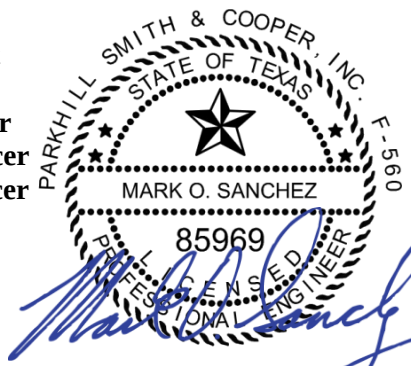
Marcela Navarrete, C.P.A., Vice President
Gilbert Trejo, P.E., Vice President
Felipe Lopez, P.E., Chief Operations Officer
Martin Noriega, P.E., Chief Operations Officer
Irazema S. Rojas, P.E., Chief Technical Officer



04/06/2023

CIP No. S090012
Eng. / Proj. ID 21-9001

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EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

PSB BID NO. 40-23

INFORMAL NOTICE

Sealed proposals for construction of John T. Hickerson WRF Headworks Barscreen Replacement Project will be received by the City of El Paso Water Utilities - Public Service Board at the Board's principal office located at 1154 Hawkins Boulevard or by mail to 1154 Hawkins Boulevard, El Paso, Texas, 79925 until May 30, 2023, 2:00 p.m. local time. **After 2:00 p.m., bids will not be accepted.** Bid Opening will occur at 2:30 p.m. and bids will be publicly opened and read aloud via the "GoToMeeting" format noted in Section 00020.

The work under this contract shall be for furnishing all labor, materials, transportation, and services for the construction and installation of the following work:

The project entails the removal and replacement of two (2) existing traveling rake barscreens, screenings and grit handling equipment, mechanical components for two (2) existing vortex grit removal units, associated piping, electrical, and controls; concrete demo and structural modifications necessary for installation of new screening equipment, furnish and installation of two (2)-6 mm perf plate screens, two (2) wash presses, one (1) shaftless horizontal conveyor, two (2) 20 CY Level Lodors, two (2) grit classifiers with integral cyclones, three (3) grit pumps, concrete retaining wall, electrical, controls and instrumentation for new equipment, corrosion protection coating of existing concrete structures, site pavement, grading and drainage improvements, site piping, testing and startup of new equipment, and coordination with plant. Improvements to be completed while plant remains in service.

Contract documents may be examined and obtained by accessing the following El Paso Water's website:
www.epwater.org/business_center/purchasing_overview/bids

If you have trouble accessing the Contract Documents, please contact the Purchasing Department of the El Paso Water Utilities, Public Service Board, at (915) 594-5628. Physical (hard) copies of the Contract Documents will **NO** longer be made available.

A pre-bid meeting will be held on May 2, 2023, at 10:00 a.m., local time *(see instructions at the end of Section 00020)*.

Each Bid shall be submitted in accordance with the Instructions to Bidders and be accompanied by a Bid Security in the amount of five percent of the amount bid.

The Successful Bidder states he or she must furnish a 100 percent (100%) Performance Bond and a 100 percent (100%) Payment Bond, in accordance with the Instructions to Bidders and the General Conditions.

Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque, sealed envelope marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. The Bid proposal package shall include one original, three copies and an electronic version of the bid, containing a copy of the full bid package submitted, saved on a USB drive.

By submission of the bid, Bidder fully understands the requirements of the Contract Documents and agrees to comply with all requirements thereof.

Wages paid on this project shall be not less than the minimum prevailing wage rates listed in the Contract Documents, Section 00840, General Wage Requirements.

The El Paso Water Utilities (EPWU) adheres to the Cone of Silence policy which prohibits any communication regarding the bid between potential bidders (and subcontractors) and EPWU Board Members, Staff, and assigned Consulting Engineers. The provisions do not apply to oral communications with Purchasing Agent or Administrative Analyst, provided the communications is limited strictly to matters of process or procedure already contained in the solicitation document, oral communications at pre-bid conferences, or communications in writing (email preferred) submitted to the Administrative Analyst in response to inquiries regarding the bid. In addition to any other penalties provided by law, violation of the Cone of Silence by any bidder shall render that bidder's bid voidable. Any person having personal knowledge of a violation of these provisions shall report such violations to the EPWU General Counsel and/or the Purchasing Agent in writing.

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

JOHN T. HICKERSON WRF HEADWORKS BARSCREEN REPLACEMENT

Bid Number 40-23

CITY OF EL PASO, TEXAS

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DESIGN PROFESSIONAL RESPONSIBILITY

The Specification Sections authenticated by my seal and signature are limited to the following:

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DESIGN PROFESSIONAL RESPONSIBILITY

The specification sections authenticated by my seal and signature are limited to the following:

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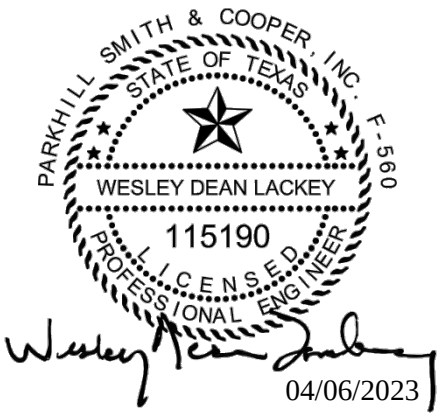
DESIGN PROFESSIONAL RESPONSIBILITY

The Specification Sections authenticated by my seal and signature are limited to the following:

DIVISION 40 – PROCESS INTEGRATION

40 77 00 Control Strategy



SECTION 00020

INVITATION TO BID

SECTION 00020

INVITATION TO BID

Sealed proposals for construction of John T. Hickerson WRF Headworks Barscreen Replacement Project, will be received by the City of El Paso Water Utilities - Public Service Board at the Board's principal office located at 1154 Hawkins Boulevard or by mail to 1154 Hawkins Boulevard, El Paso, Texas, 79925 until May 30, 2023, 2:00 p.m. local time. **After 2:00 p.m., bids will not be accepted.** Bid Opening will occur at 2:30 p.m. and bids will be publicly opened and read aloud via the "GoToMeeting" format noted at the end of this Section 00020.

The work under this contract shall be for furnishing all labor, materials, transportation, and services for the construction and installation of the following work:

The project entails the removal and replacement of two (2) existing traveling rake barscreens, screenings and grit handling equipment, mechanical components for two (2) existing vortex grit removal units, associated piping, electrical, and controls; concrete demo and structural modifications necessary for installation of new screening equipment, furnish and installation of two (2)-6 mm perf plate screens, two (2) wash presses, one (1) shaftless horizontal conveyor, two (2) 20 CY Level Lodors, two (2) grit classifiers with integral cyclones, three (3) grit pumps, concrete retaining wall, electrical, controls and instrumentation for new equipment, corrosion protection coating of existing concrete structures, site pavement, grading and drainage improvements, site piping, testing and startup of new equipment, and coordination with plant. Improvements to be completed while plant remains in service.

Contract documents may be examined and obtained by accessing the following El Paso Water's website:
www.epwater.org/business_center/purchasing_overview/bids

If you have trouble accessing the Contract Documents, please contact the Purchasing Department of the El Paso Water Utilities, Public Service Board, at (915) 594-5628. Physical (hard) copies of the Contract Documents will **NO** longer be made available.

A pre-bid meeting will be held on May 2, 2023 at 10:00 a.m., local time. *(see instructions at the end of this Section 00020)*.

Each Bid shall be submitted in accordance with the Instructions to Bidders and be accompanied by a Bid Security in the amount of five percent of the amount bid.

The Successful Bidder must furnish a 100 percent (100%) Performance Bond and a 100 percent (100%) Payment Bond, in accordance with the Instructions to Bidders and the General Conditions.

Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. The Bid proposal package shall include one original, three copies and an electronic version of the bid, containing a copy of the full bid package submitted, saved on a USB drive.

By submission of the bid, Bidder states he or she fully understands the requirements of the Contract Documents and agrees to comply with all requirements thereof.

Wages paid on this project shall be not less than the minimum prevailing wage rates listed in the Contract Documents.

The El Paso Water Utilities (EPWU) adheres to the Cone of Silence policy which prohibits any communication regarding the bid between potential bidders (and subcontractors) and EPWU Board Members, Staff, and assigned Consulting Engineers. The provisions do not apply to oral communications with Purchasing Agent or Administrative Analyst, provided the communications is limited strictly to matters of process or procedure already contained in the solicitation document, oral communications at pre-bid conferences, or communications in writing (email preferred) submitted to the Administrative Analyst in response to inquiries regarding the bid. In addition to any other penalties provided by law, violation of the Cone of Silence by any bidder shall render that bidder's bid voidable. Any person having personal knowledge of a violation of these provisions shall report such violations to the EPWU General Counsel and/or the Purchasing Agent in writing.

PRE-BID MEETING INSTRUCTIONS

The Pre-Bid meeting will be held at the John T. Hickerson WRF plant site on Tuesday, May 2, 2023, at 10:00 a.m. Mountain Standard Time. The plant is physically located near the intersection of I-10 and Executive Drive, at 701 Executive Center Blvd., El Paso, Texas, 79922. The meeting will be conducted at the plant administration building with a site visit to the project area afterwards. Bidders shall bring hard-hats, safety shoes, and safety vests to the pre-bid meeting if they want to attend the site visit afterwards.

BID OPENING INSTRUCTIONS

Bid Openings are now to be broadcast through "GoToMeeting" format.

To View Bid Opening Click the Link Below:

Bid No. 40-23 John T. Hickerson WRF Headworks Barscreen Replacement
May 30, 2023, 2:00 – 2:30 PM (America/Denver)

Please join my meeting from your computer, tablet or smartphone.
https://meet.goto.com/218479181

You can also dial in using your phone.
Access Code: 218-479-181
United States (Toll Free): 1 866 899 4679
United States: +1 (571) 317-3116

Get the app now and be ready when your first meeting starts:
https://meet.goto.com/install

SECTION 00100

INSTRUCTION TO BIDDERS

SECTION 00100

INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS *(Revised 3/18/96, 9/9/96, 4/21/97, 7/13, 10/16/20)*

Terms used in these Instructions to Bidders which are defined in the Standard General Conditions of the Construction Contract (EJCDC C-700, 2018 ed.) have the meanings assigned to them in the General Conditions. The term "Bidder" means the entity (such as a corporation, partnership, or sole proprietor) that submits a Bid directly to Owner, as distinct from a sub-bidder, who submits a Bid to a Bidder. The term "Successful Bidder" means the lowest, responsible, and responsive Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award. The term "Bidding Documents" includes the Advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form, the Bid Bond or other Bid Security, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids). Other terms are defined in this Section 00100.

Other terms used in the Bidding Documents and not defined elsewhere have the following meanings which are applicable to both the singular and plural thereof:

Texas Resident Bidder - A bidder whose principal place of business is in this state and includes a Contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Nonresident Bidder - A bidder whose principal place of business is not in this state but excludes a Contractor whose ultimate parent company or majority owner has its principal place of business in this state.

EPCWID #1 - El Paso County Water Improvement District #1 which authorizes dewatering into its facilities under certain terms and conditions and with whom the Owner has negotiated specific basic fees and procedures.

NADB – North American Development Bank

2. COPIES OF BIDDING DOCUMENTS *(Revised 10/16/20)*

2.1 Complete sets of the Bidding Documents stated in the Advertisement or Invitation to Bid may be obtained by accessing the following El Paso Water Utilities – Public Service Board (EPWU-PSB) website:

https://www.epwater.org/business_center/purchasing_overview/bids/construction

If you have trouble accessing the Contract Documents, please contact the Purchasing Department of the EPWU-PSB at (915) 594-5628. Physical (hard) copies of the Contract Documents will no longer be made available.

2.2 Complete sets of Bidding Documents must be used in preparing Bids; neither the Owner nor the Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.3 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. DETERMINING LOWEST RESPONSIBLE, RESPONSIVE BIDDER *(Revised 9/2/92, 2/25/94, 1/10/95. 5/22/95, 3/18/96, 9/9/96, 4/17/97, 6/17/97, 9/26/97, 12/10/97, 6/3/99, /10/99, 12/17/99, 3/13/00, 8/19/04, 1/18/10, 1/12/11,7/18/11, 11/2/16, 1/11/17, 9/27/17, 11/9/17, 7/23/18, 1/17/19, 10/16/20, 3/4/22)*

To demonstrate that the Bidder is responsible and able to perform the Work, each Bidder must be prepared to submit written evidence, such as financial data, previous experience, present commitments, and other data as may be called for below (or in the Supplementary Instructions). Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to Award of the Contract.

In determining the lowest responsible, responsive Bidder, in addition to price, the following elements will be considered:

(a) the quality, availability, and adaptability of the supplies, materials, equipment, or contractual services, to the particular use required;
(b) the number and scope of conditions attached to the bid;
(c) the ability, capacity, and skill of the entity to perform the contract or to provide the service required;
(d) whether the bidder can perform the contract and provide the service promptly, or within the time required, without delay or interference;
(e) the character, responsibility, integrity, reputation, and experience of the bidder;
(f) the quality of performance of previous services, or contracts;
(g) the previous and existing compliance by the bidder with laws relating to the contract or service;
(h) any previous or existing noncompliance by the bidder with specifications, or requirements relating to time of submission of specified data such as samples, models, drawings, certificates, or other information;
(i) the sufficiency of the financial resources and ability of the bidder to perform the contract or to provide the service;
(j) the ability of the bidder to provide maintenance, repair parts, and service for the use of the subject of the contract during the required one-year warranty period.
(k) the ability of the bidder to provide competent personnel for the job, as demonstrated by a listing of the names and the skills of experienced personnel who are currently employed by the bidder and who will be available for performing this work;
(l) the experience of the bidder in performing work similar in type, size and complexity to this project, as demonstrated by a listing of projects, with verifiable references (names, addresses, phone numbers, etc.), successfully completed.

MINIMUM GENERAL REQUIREMENTS - ALL CONSTRUCTION PROJECTS

QUALIFYING PROJECTS

Bidders on Qualifying Projects must provide a Safety Record consisting of: (1) copies of the bidder's OSHA Forms 300, 300A, and 301 for the last three calendar years (January – December); (2) the Establishment Search Results from the Occupational Safety and Health Administration's website (https://www.osha.gov/pls/imis/establishment.html); and (3) a completed and signed Contractor Pre-Qualification Form (Section 00301). A Qualifying Project is a project with a value greater than $100,000 or one that the Chief Technical Officer and Vice President of Operations and Technical Services determine poses a significant hazard.

EPWU will deem a bidder not responsible if the bidder (1) fails to provide a complete Safety Record; (2) received within the last three calendar years (January – December) six or more serious violations, one or more willful violations, or a single repeat of a serious violation; or (3) has experienced a workplace fatality in the last three calendar years (January – December), unless the bidder can demonstrate that the factors that caused the fatality were outside the bidder's control. A bidder, however, may fail the above criteria but still be deemed responsible if (1) no other appropriate bidder can be found; (2) the bidder is approved by the Chief Technical Officer and the Vice President of Operations and Technical Services; and

(3) the bidder agrees to implement the special safety procedures (which might include a requirement to work only with trained EPWU personnel present) that the Vice President of Operations and Technical Services establishes for the project.

PROJECTS WITH VALUE LESS THAN $1,000,000:

The Bidder, or at least two *Key Personnel employed by the Bidder, must demonstrate **Successful Completion of a project similar in nature and scope to this project within the past five years and a similar project with a value of at least one-third the value bid for this project.

PROJECTS WITH VALUE BETWEEN $1,000,000 AND $3,000,000:

The Bidder, **or** at least three *Key Personnel employed by the Bidder, must demonstrate **Successful Completion of one project similar in nature and scope to this project within the past five years and one similar project with a value of at least 50% of the value bid for this project.

PROJECTS WITH VALUE BETWEEN $3,000,000 AND $6,000,000:

The Bidder must demonstrate a minimum of four years of experience in projects similar in nature and scope to this project. At least four *Key Personnel employed by the Bidder must have a minimum of five years of experience in similar construction projects. The Bidder must demonstrate **Successful Completion during the last five years of at least one project comparable in nature and scope to this project and one similar project with a dollar value of at least 60% of the value bid for this project. The Bidder must have an employee, to be dedicated to this project, who is experienced in scheduling, with demonstrated ability in employing scheduling techniques similar to those to be used for this project.

PROJECTS WITH VALUE BETWEEN $6,000,000 AND $15,000,000:

The Bidder must have a minimum of five years of experience in projects similar in nature and scope to this project. At least four of the Bidder's *Key Personnel must have a minimum of five years of experience in similar construction projects. The Bidder must demonstrate **Successful Completion of at least two projects similar in nature and scope to this project and one similar project with a dollar value of at least 75% of the value bid for this project, both within the past five years. The Bidder must demonstrate that it has an experienced employee who will serve as the scheduler; who is dedicated to this project; who has successfully employed scheduling techniques appropriate for this project. At least two *Key Personnel for this project must have completed at least two projects, similar in scope and nature to the project being bid, as an employee of the Company bidding this project.

* KEY PERSONNEL: Defined as individuals who will be directly assigned to this project which includes, but is not limited to, the Bidder's Project Manager, the Project Superintendent, the Scheduler, the Bidder's Construction Engineer, and Supervisory personnel such as the Foremen who will be directly assigned to this project as well as similar Subcontractor Key Persons. Resumes of Key Personnel must be submitted and accepted by the Owner in order for Bidder to receive the Award.

** SUCCESSFUL COMPLETION: Defined as completion of a project on time, which generally means no more than thirty days later than the original contract time allocated. It also means within budget, which generally means within 5% of the original contract price. If there is any project submitted by the Bidder as qualifying, but which does not meet these requirements, in order to be fully responsive, the Bidder is required to submit detailed information on that project demonstrating what caused the increases to cost or time. The name and telephone numbers of the Design Engineer and the Client are to be provided for evaluation as to whether the project may be considered "successful". For any project where liquidated damages were assessed, the Bidder will not be considered to have been on time.

BIDDER MUST MEET THE FOLLOWING MINIMUM PROJECT SPECIFIC CRITERIA IN ORDER TO QUALIFY FOR AWARD OF THE BID:

1. This project involves construction inside an existing wastewater treatment plant headworks building/structure that is required to remain in service while work is being completed. Spaces where work is to occur contain hydrogen sulfide, low oxygen, and could be explosive. Current influent flows to the plant range from 2 MGD to 25 MGD. Plant has capability to divert flow away from designated work areas and existing enclosed flow areas have odor control. Bidder shall demonstrate that it has successfully completed at least two (2) project similar in nature and scope, with at least one in the last five (5) years, and a second one within the last ten (10) years. One of the two projects shall be 60% of the value bid for this project. Projects submitted shall demonstrate the following:
    a. Removal of existing barscreen(s), retrofit of concrete channels, and installation of new barscreen(s) inside an existing headworks building facility that remained in service while the work was being completed.
    b. Removal and replacement of motor, drive, paddles of an existing vortex grit removal chamber.
    c. Installation of grit pumps and associated piping.
    d. Removal and replacement of dual grit classifiers each with integral cyclone and dewatering, while continuing to provide grit classifying, washing, and dewatering at the capacity of at least one of the grit classifiers.
    e. Concrete rehab and protective coating application inside existing enclosed concrete structures containing hydrogen sulfide gas and low oxygen levels.
    f. Preparation and implementation of a confined entry and ventilation plan to insure non-hazardous workspace adjacent to a continuous raw wastewater flow inside an enclosed structure.
2. Bidder shall demonstrate that it has at least four (4) Key Personnel with a minimum of five (5) years' experience in projects similar in nature and scope to this project.
3. Bidder shall demonstrate that at least two (2) of its Key Personnel for this project completed (from start to finish) the projects listed in Criteria 1 above as an employee of the Company bidding this project.
4. The Bidder shall demonstrate that it has an experienced employee who will serve as the scheduler; who is dedicated to this project; and who has successfully employed scheduling techniques appropriate for this project.
5. The Bidder shall demonstrate that it has at least one (1) experienced employee or qualified subcontractor who is a Texas licensed master electrician, that has at least five (5) years of electrical installation experience in existing wastewater treatment plants similar in nature and scope to the project being bid.
6. Key Personnel required for this project are:
    a. Bidder's Project Manager
    b. Bidder's General Superintendent
    c. Bidder's Electrical Superintendent or Qualified Subcontractor
    d. Bidder's Health & Safety Officer responsible for preparing and implementing contractor's health and safety plan for the project and maintaining OSHA compliance (may be Superintendent, or other qualified person assigned to the project at all times).
    e. Bidder's Scheduler (may be project manager, or other qualified person assigned to the project)

EPWU CIP FUNDED PROJECTS
GOOD FAITH EFFORTS
TO OBTAIN MINORITY PARTICIPATION IN THIS PROJECT

The Utility's policy for its projects is to encourage the participation of Small Locally-Owned Businesses (SLBE), Minority Business Enterprises (MBE), and Women-Owned Business Enterprises (WBE). The utility's minimum goals for this project are:

25% FOR SMALL LOCALLY-OWNED BUSINESSES
10% FOR MINORITY-OWNED BUSINESSES
7% FOR WOMEN-OWNED BUSINESSES

The bidder must meet each of these three goals or demonstrate at the time of making the bid that he or she has made a good faith effort to meet each of the three goals in order to qualify for award of this project. The definition of a "Good Faith Effort" is described below. If the bidder fails to meet the goals, *and also fails to provide evidence that a good faith effort has been made to meet each goal*, the Owner reserves the right to request additional information from the bidder as support to Good Faith Effort documentation. The bidder may meet the requirement in one of three ways:

1. If goals in each category are fully achieved, bidder to provide all details of the actual participation in the Bid Proposal Form, Section 00300, where space has been provided for bidder's use.

2. If goals are partially achieved in each of the categories, bidder to provide the details of the actual participation in the Bid Proposal Form, and to provide evidence of the Good Faith Effort to meet each goal, as part of the bid proposal, at the time the bid is submitted.

3. If goals are not achieved, bidder to provide evidence of a demonstrated Good Faith Effort, as defined below, as part of the bid proposal, at the time the bid is submitted.

Although a single prime contractor, a subcontractor, or a supplier may be a Small Locally Owned Business and also a Minority Business or a Woman-Owned Business, each firm will be counted in only one category (SLBE, MBE, or WBE) for purposes of meeting these goals.

DEFINITIONS *(Revised 7/28/14, 10/16/20, 3/4/22)*

GOOD FAITH EFFORT: Documentation that minority firms were given a genuine opportunity to participate. Evidence of a Good Faith Effort must include copies of a reasonable number of letters sent to bona fide firms in each of the categories described showing the full details of the work solicited to be performed by the minority firm; copies of certified mail/return receipts, facsimile or e-mail confirmations of receipt, copies of responses to the letters, and copies of correspondence with the Chamber of Commerce, Small Business Administration, Minority Business Development Agency, MBE and WBE associations, and/or newspaper or trade magazine notices. Facsimile and e-mail confirmations of receipt must show sufficient information to identify the company name to which the solicitation was sent. Sample solicitation letters are included in Section 00310. The Owner's Purchasing Department has a listing of qualified firms in each of these categories, which are available on the Owner's website, https://www.epwater.org/business_center/purchasing_overview/become_a_hub_vendor.
Additional sources for locating Small Locally-Owned Business Enterprises, Minority-Owned Business Enterprises, and Women-Owned Business Enterprises: Texas Comptroller of Public Accounts http://www.window.state.tx.us/procurement/prog/hub/hub-reporting/, El Paso Hispanic Chamber of Commerce Minority Business Enterprise Center, https://ephcc.org/blog/other-resources/procurement-opportunities/.

SMALL LOCALLY-OWNED BUSINESS ENTERPRISE (SLBE): A business corporation, partnership, joint venture, sole proprietorship, or other legal entity formed for the purpose of making a profit, has been located within the County of El Paso for at least twelve months and is 51% or more owned by residents of El Paso County; furthermore, that business must employ fewer than 100 employees or have annual gross sales of less than $7,000,000 and is not a subsidiary of a business which would not meet these guidelines.

MINORITY-OWNED BUSINESS ENTERPRISE (MBE): A business that is at least 51% owned and controlled by one or more citizens or lawful permanent residents of the United States who are either African American, Hispanic American, Asian American, Native American, or Service Disabled Veteran.

WOMEN-OWNED BUSINESS ENTERPRISE (WBE): A business that is at least 51% owned and controlled by one or more citizens or lawful permanent resident of the United States who are non-minority females.

The form entitled "Minority Certification and Participation Summary", which is located at the end of Section 00300, Bid Form, should be completed and submitted by the Successful Bidder within ten days of Notice of Award.

It is mandatory that bidder submit with his or her bid a fully executed bid proposal (including the tabulation of proposed subcontractors and suppliers), an original bid bond, the certificate of insurance availability, and minority participation categories reflecting bidder has met minority participation goals OR evidence of bidder's good faith effort to do so. Failure to submit these items with the bid will result in a finding that the bid is non-responsive, and the bid will be disqualified.

Evidence of bidder's good faith effort *or* evidence of *full* participation in each category is also required at the time of bid. Owner reserves the right to request additional information from the bidder as support to good faith effort documentation.

Bidders shall furnish a financial statement or other evidence of the Bidder's financial sufficiency to perform the contract, a sworn statement of his or her experience record, and a listing of the equipment available to him or any other statement or documentation required by the Owner or Owner's consultant as to his or her capability to complete the Work. The Post-Bid/Pre-Award Checklist and the Qualifications Statement may require submittal of additional documentation. PLEASE REVIEW THE CHECKLISTS PROVIDED AT THE END OF THIS SECTION 00100.

To assist the Owner in evaluating the Bidder's responsibility, the lowest responsive Bidder is required to complete and submit the "Qualification and Financial Disclosure Statement" found at the end of Section 00100 within five calendar days of the consulting Engineer's request. The Engineer will submit this document and any additional information received as requested by the consulting Engineer, to the Owner as an attachment to his or her Recommendation of Award.

The Checklists found at the back of this Section are provided to assist the Bidder in fulfilling these requirements.

The Purchasing Department will evaluate the responsiveness of the Bidder's submittal. Purchasing Agent will forward the bids and results of the Purchasing Department's evaluation to the consulting Engineer for further evaluation of responsiveness, qualifications of the Bidder and other related conditions of this Bid. Engineer will forward the results of the evaluation to the Owner in writing. Owner will review Engineer's evaluation and present its recommendation to the Public Service Board for award.

Bidder is required to submit information regarding his or her status as a "RESIDENT" or "NONRESIDENT" as shown on the spaces provided in the proposal form.

A "Nonresident Bidder" will not be awarded the Contract if the state of his or her principal place of business assesses a penalty against out-of-state bidders unless his or her bid is lower than the lowest bid submitted by a responsible Texas resident bidder by the same amount that a Texas resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located.

The terms "Texas Resident Bidder" and "Nonresident Bidder" shall the meanings set forth for those terms in Chapter 2252 of the Texas Government Code.

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE *(Revised 3/18/96, 4/21/97, 1/18/10, 1/12/11, 4/13, 10/16/20)*

4.1 It is the responsibility of each Bidder, before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site to become familiar with local conditions that may affect cost, progress, performance or furnishing of the Work, and to determine the character of equipment and facilities needed preliminary to and during the prosecution of the Work, (c) consider federal, state and local laws and regulations that may affect cost progress, performance or furnishing of the Work, (d) study and carefully correlate Bidder's observations with the Contract Documents, and (e) notify Engineer of all conflicts, errors, or discrepancies in the Contract Documents.

When information as to soil conditions, test borings, and existing underground and overhead utility locations is shown on the Plans, Specifications, Drawings, or in preliminary reports prepared by the Engineer or under the Engineer's direction, such information was obtained for the Owner. The correctness of such information is not guaranteed by the Owner or by the Engineer and in no event shall be considered as a part of the contract, an inducement to bidding, or a factor for computation of bids. If such information is used by the Bidder in preparing a proposal, the Bidder must assume all risks that conditions encountered in performing the Work may be different from the approximation shown. Owner hereby grants reasonable access to Bidder and/or his employees or contractors to examine the work site over which Owner has ownership or control.

4.2 Reference is made to the Supplementary General Conditions for identification of:

4.2.1 Those reports of explorations and tests of subsurface conditions at the site which have been utilized by Engineer in preparation of the Contract Documents.

4.2.2 Those drawings of physical conditions in or relating to existing surface and subsurface conditions (except Underground Facilities) which are at or contiguous to the site which have been utilized by Engineer in preparation of the Contract Documents.

Copies of such reports and drawings will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents. Technical data has been identified and established in the Supplementary General Conditions.

4.2.3 See SC 18.13. Those certain dewatering issues, procedures, payment terms, submittal requirements, and close out terms which are the responsibility of the Bidder, and which may impact Bidder's pricing of this Bid.

4.3 Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities or others, and Owner does not assume responsibility for the accuracy or completeness thereof.

4.4 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Facilities and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraphs 5.03 and 5.04 of the General Conditions, and as may be amended in the Supplementary General Conditions.

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

4.6 Each Bidder will be required to get permission from property owners to obtain access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes, clean up and restore the site to its former condition and to the satisfaction of the Engineer, upon completion of such explorations. Owner hereby grants reasonable access to Bidder and/or his employees or contractors to examine the work site over which Owner has ownership or control.

4.7 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 or storage of materials and equipment are to be provided by Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

4.8 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey to Bidder the understanding of all terms and conditions for performance and furnishing of the Work.

5. INTERPRETATIONS AND ADDENDA *(Revised 10/16/20, 3/4/22)*

5.1 Pursuant to the Cone of Silence policy, all questions about the meaning or intent of the Contract Documents are to be directed to the Purchasing/Contracts Department *(see Purchasing Contacts on EPWU website: https://www.epwater.org/business_center/purchasing_overview/bids/construction).* Interpretations or clarifications considered necessary by EPWU staff, Engineer, or Consultant in response to such questions will be issued by Addenda and will be posted on the EPWU website. Bidder will be responsible to check the website regularly for any addenda or additional information for the project. Questions received less than ten (10) days prior to the date for opening of Bids will not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications, either by EPWU staff, Engineer, or Consultant will be without legal effect.

5.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by Owner or Engineer, with Owner's approval.

6. BID SECURITY *(Revised 10/12/92, 2/25/93, 1/10/95, 5/22/95, 1/18/10, 7/13, 1/17/19, 10/16/20, 3/4/22)*

6.1 Each Bid must be accompanied by an original and notarized Bid security made payable to Owner in an amount of five percent of the Bidder's maximum Bid price and in the form of a certified or cashier's check or a Bid Bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions and Paragraph 6.01 of the Supplementary General Conditions.

6.2 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required contract security and insurance, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security, insurance, and other required contract documents within ten days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders 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 Agreement or the ninety-first day after the Bid opening, whereupon Bid security furnished by such Bidders will be returned. Bid security with Bids which are not competitive will be returned within seven days after the Bid opening.

The Bidder agrees by signing this Bid that he fully understands the requirements of the bid documents.

An incentive payment is available in the amount of $100 per day, up to a maximum of $300, for the Bidder's successful efforts in expediting delivery of fully compliant documents in a time period shorter than the 10-day maximum called out in the Notice of Award.

Should the Bidder fail to return the Agreements, acceptable Bonds, Insurance Certificates and insurance policies within ten days of receipt of the documents, the Utility may charge excess costs generated by such delay at the rate of $100 for each day of delay. In the event more than two reviews of insurance submittals are required by the Utility's Risk Manager, the Successful Bidder will additionally reimburse the Utility for those costs at the rate of $150 per hour which will apply to each fifteen-minute fraction thereof charged by the Risk Manager. These reimbursed costs will be deducted from the Bidders first Application for Payment or, in the event a Bid Bond is forfeited, such expenses may be reimbursed from the proceeds of the Bid Bond as part of the excess costs or re-procurement.

7. CONTRACT TIME

The number of Calendar Days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Time) are set forth in the Agreement. Completion within this time is of the essence in the performance of this contract.

8. LIQUIDATED DAMAGES *(Revised 3/18/96, 10/16/20)*

Provisions for liquidated damages, if any, are set forth in the Agreement and in the Supplementary General Conditions SC-11.11.

9. SUBSTITUTE OR "OR EQUAL" ITEMS

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item of material or equipment may be furnished or used by Contractor is acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the date of the Notice to Proceed. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in Paragraphs 7.05 and 7.06 of the General Conditions and may be supplemented in the General Requirements.

10. SUBCONTRACTORS, SUPPLIERS AND OTHERS *(Revised 10/12/92, 9/9/96, 12/10/97, 12/17/99, 7/13, 10/16/20)*

10.1 The Bidder is required to identify all Subcontractors and Suppliers; to provide the value of each proposed subcontract or purchase order; and to report their own and their subcontractor's business classification (Small Locally-Owned Business Enterprise, Minority Business Enterprise, Woman-Owned Business Enterprise, or Other). The Bidder shall submit with his or her Bid a list of all proposed Subcontractors and Suppliers. Space for this submittal is provided within the Bid Proposal, Section 00300. Use additional sheets as necessary. The Bidder is required to submit the MWBE Certification and Participation Summary Form with his or her Bid. If requested by Engineer or by Owner, Bidder shall provide an experience statement with pertinent information regarding similar projects and other evidence of qualifications for each such Subcontractor, Supplier, person, or organization. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, either Owner or Engineer may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute, in which case the apparent Successful Bidder shall submit an acceptable substitute, that Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution and Owner may consider such price adjustment in evaluating Bids and making the Contract Award.

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

10.3 The Bidder shall submit a Final Report of total payments made to each subcontractor and supplier, as part of the required close out documents.

This submittal shall be made as a condition precedent to Final Payment.

11. BID FORM *(Revised 10/16/20)*

11.1 The Bid Form is included with the Bidding Documents.

11.2 All blanks on the Bid Form must be completed in ink. Bids which do not have all blanks filled in or completed may be rejected at the Owner's option by Owner or Purchasing Agent.

11.3 Bids 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 if any must be affixed and officer’s signature must be attested by the secretary or an assistant secretary. The corporate address, state of incorporation, and state of principal place of business must be shown below the signature.

11.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title and authority to sign must appear under the signature and the official address of the partnership must be shown below the signature.

11.5 All names must be printed below the signature.

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

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

12. SUBMISSION OF BIDS *(Revised 10/16/20, 3/4/22)*

Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque, sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. The Bid proposal packet shall include one original, three copies and an electronic version of the bid, containing a full copy of the full bid package submitted, saved on a USB drive.

Any questions or clarifications pertaining to the bid documents, requirements, specifications, or terms and conditions of the bid or contract documents should be addressed via the Addendum process described above in Section 5. Any extraneous documentation, letters, explanations, limitations, commentary, conditions, or the like submitted with a Bid will ***NOT*** be considered or incorporated as the basis of any award. Bidder agrees to be held solely to the terms and conditions of these Bid documents; General and Supplementary Conditions (as may be amended from time to time); and any other documents identified by EPWU.

13. MODIFICATION AND WITHDRAWAL OF BIDS

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

13.2 If, within twenty-four hours after Bids are opened, any Bidder files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid; that the mistake is clerical; that the mistake is so serious that enforcement of the Bid would be unconscionable; and that the mistake has occurred despite the exercise of ordinary care; that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents.

14. OPENING OF BIDS

Bids will be opened and (unless obviously nonresponsive) read aloud publicly. An abstract of the amounts of the base Bids and major alternates (if any) will be made available to Bidders after the opening of Bids.

15. BIDS TO REMAIN SUBJECT TO ACCEPTANCE *(Revised 12/10/97, 1/18/10, 7/13, 10/16/20)*

All Bids will remain subject to acceptance for a minimum of 90 days after the day of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to that date. In the case of State, Federal, or NADBank-funded projects, all Bids will remain subject to acceptance for 90 days or such reasonable time as the funding agency may require.

16. AWARD OF CONTRACT *(Revised 3/18/96, 12/10/97, 10/9/98, 1/18/10, 10/16/20)*

16.1 Owner reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time or changes in the Work and the right to disregard all immaterial, nonconforming, nonresponsive, unbalanced, or conditional Bids. Also, Owner reserves the right to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to the Bidder, whether because the Bid is not responsive, or the Bidder is not responsible because the Bidder is deemed to be unqualified or of doubtful financial ability or fails to meet any other pertinent criteria established by Owner under Paragraph 3 hereof. Discrepancies in 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. Any bids submitted in which there is a material failure to

comply with the Bid requirements or specifications will be rejected and the contract will be awarded to the lowest responsible Bidder conforming to the specifications unless the Owner decides to reject all Bids.

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

16.3 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 Supplementary General Conditions or other sections of this bid document. Owner also may 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 the Notice of Award or as a substitute.

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

16.5 If the contract is to be awarded, it will be awarded to the lowest Bidder whose responsibility has been evaluated in accordance with these Instructions to Bidders.

16.6 If the contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within 90 days after the day of the Bid opening. In the case of State or Federally-funded projects, Owner will give the Successful Bidder a Notice of Award within 90 days after the day of the Bid opening, or such reasonable time as the funding agency may require.

17. CONTRACT SECURITY *(Revised 9/17/93; 3/18/96, 7/13, 10/16/20, 3/4/22)*

Paragraph 6.01 of the General Conditions and the Supplementary General Conditions set forth Owner's requirements as to performance and payment Bonds. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the required Performance and Payment Bonds and the Certificate of Insurance and insurance policies. A Payment Bond must be provided for contracts more than $50,000 in value. If the contract requires an expenditure of less than $100,000, the Owner reserves the right to waive the requirement for a Performance Bond, provided that payment is not due to the Contractor until the Work is completed and accepted by the Owner. Any provision in any bond furnished in attempted compliance with House Bill No. 31 that expands or restricts the rights or liabilities provided under this Act shall be disregarded and the provisions of this Act shall be read into that Bond.

18. SIGNING OF AGREEMENT

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within ten days after, Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds and a copy of the Certificate of Insurance along with a copy or copies of the actual Insurance policy or policies. Owner shall deliver fully signed final contract to Contractor when all pre-construction contract requirements have been met.

19. PRE-BID CONFERENCE *(Revised 10/16/20)*

A pre-bid conference will be held at 10:00 a.m., local time, on the 2nd day of May, 2023 at the plant site. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Owner will publish on the EPWater website such Addenda as Engineer considers necessary in response to questions arising at the conference.

20. SALES AND USE TAXES *(Revised 3/18/96, 4/13)*

Owner is exempt from Municipal and State Sales and Use Taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Contract Price. Refer to Supplementary General Conditions SC-7.10.B for additional information.

QUALIFICATION AND FINANCIAL DISCLOSURE STATEMENT

BIDDER:

_____

PROJECT NAME:

John T. Hickerson WRF Headworks
Barscreen Replacement

1. ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

1.2 How many years has your organization been in business under its present business name?

1.2.1 Under what other or former names has your organization operated?

1.3 If your organization is a corporation, answer the following:

1.3.1 Date of incorporation: _____

1.3.2 State of incorporation: _____

1.3.3 President's name: _____

1.3.4 Vice-president's name(s): _____

_____

1.3.5 Secretary's name: _____

1.3.6 Treasurer's name: _____

1.4 If your organization is a partnership, answer the following:

1.4.1 Date of organization: _____

1.4.2 Type of partnership (if applicable): _____

1.4.3 Name(s) of general partner(s): _____

1.5 If your organization is an individually owned sole proprietorship, answer the following:

1.5.1 Date of organization: _____

1.5.2 Name of owner: _____

1.6 If the form of your organization is other than those listed above, describe it and name the principals:

2. LICENSING

2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable. Indicate name, license number and expiration date for Master Electrician or other trade required under the Instructions to Bidders section of this Bid.

2.2 List jurisdictions in which your organization's partnership or trade name is filed.

3. EXPERIENCE *(Revised 3/18/96, 9/9/96, 12/10/97, 10/9/98, 7/13)*

3.1 List the categories of work that your organization normally performs with its own forces.

3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

3.2.1 Has your organization ever failed to complete any work awarded to it?

3.2.2 Are there any judgments, claims, arbitration proceedings, or suits pending or outstanding against your organization or its officers?

3.2.3 Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?

3.3 Within the last five years, has any officer or principal of your organization been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

3.4.1 State total worth of work in progress and under contract:

3.5 On a separate sheet, list the major projects your organization has completed in the past five

years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

3.5.1 State annual amount of construction work performed each year during the past five years:

3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization. Submit resumes of Key Personnel (as defined in Section 00100, Instructions to Bidders). By execution of this bid, the Bidder certifies that its Resident Superintendent has the authority to act on behalf of the Contractor at all times. No substitution shall be made without the written approval of the Owner and the Engineer based upon acceptance of the qualifications of the proposed substitute.

3.7 On a separate sheet, provide evidence that the Bidder meets the minimum criteria called out in Section 00100, Instructions to Bidders. Provide similar evidence for Subcontractors, if required by Bid or by Engineer.

3.8 Provide the MWBE CERTIFICATION SUMMARY FORM found at the end of Section 00300.

4. REFERENCES

4.1 Trade References:

4.2 Bank References:

4.3 Surety:

Name and telephone number of Bonding Company: _____

Name, telephone, and address of Agent: _____

_____

_____

5. FINANCING

5.1 Financial Statement

5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

a. Cash Flow Statement

b. Notes to Financial Statement

c. Auditor Statement

d. Comparison Statements, if available

5.1.2 Name and address of firm preparing attached financial statement, and date thereof.

5.1.3 Is the attached financial statement for the identical organization named on page one?

5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

6. SIGNATURE

6.1 To be executed by a Principal of the firm authorized to certify the foregoing information:

_____, being duly sworn, deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

6.2 Dated at _____ this _____ day of_____, 20___.

Name of Organization: _____

By: _____

_____
(Printed Name)

Title: _____

BID PROPOSAL CHECKLIST (packet should be submitted unbound and unstapled)		
Section 00100/00300	1.	MANDATORY: Signed Bid Form with all blanks filled in, including acknowledgement of any issued addenda and names of all Subcontractors and Suppliers.
Section 00100/00300	2.	MANDATORY: Original and Notarized Bid Security or Bond
Section 00100/00300	3.	MANDATORY: Certificate of Insurance Availability
Section 00100/00300	4.	MANDATORY: Names and categories (SMLB, MBE OR WBE) of all Subcontractors and Suppliers with SMLB, MBE OR WBE certifications
Section 00100/00310	5.	MANDATORY: Evidence of Good Faith Efforts if Minority Participation Goals are not met
Section 00100/00302	6.	MANDATORY: Texas Ethics Commission requirement, "Certificate of Interested Parties", Form 1295 – Contractor must have registered/completed on-line application
Section 00100/00301	7.	MANDATORY: Safety Record (Qualifying Projects only)
Section 00100/00303	8.	MANDATORY: Statement of Residency
Section 00100/00304	9.	MANDATORY: Statement of Non-Divestment from Israel
Section 00100/00300	10.	MANDATORY: Electronic version of the bid, containing a copy of the full bid package submitted on a USB Drive.
Section 00100/00300	11.	MANDATORY: Provide one original and three hard copies of the bid proposal submitted.

POST-BID/PRE-AWARD CHECKLIST		
Section 00100/00800 00810/00850	1.	MANDATORY: Evidence of Worker's Compensation Insurance Coverage: a Certificate of Insurance or Form DWC-81, DWC-82, DWC-83, DWC-84, DWC-85 or if self-insured, a coverage agreement filed with the Texas Worker's Compensation Commission's Division of Self Insurance Regulation.
Section 00100/00800 /00810	2.	MANDATORY: If employees provided by leasing company, evidence of Texas State License and copy of their Worker's Compensation policy. If no leased employees will be used, provide a letter on Contractor's letterhead stating so.
Section 00100	3.	MANDATORY: Financial Statements
Section 00100	5.	MANDATORY: Qualification Statement and Qualifications of Key Personnel (included in Section 00100)
Section 00100/00300	6.	MANDATORY: Updated Minority Certification and Participation Summary

SECTION 00300

BID FORM

SECTION 00300

BID FORM

PROJECT IDENTIFICATION: El Paso Water Utilities

John T. Hickerson WRF Headworks Barscreen Replacement

BID NO.: 40-23

Name and Address of OWNER:
El Paso Water Utilities
Public Service Board
1154 Hawkins Boulevard
P. O. Box 511
El Paso, Texas 79961

Name and Address of BIDDER:
_____
_____
_____
_____
_____

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an agreement with OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for ninety days after the day of Bid opening. In the case of State, Federal, or NADBank-funded projects, all Bids will remain subject to acceptance for 90 days or such reasonable time as the funding agency may require. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within ten days after the date of OWNER's Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   A. BIDDER has examined copies of all the Bidding Documents and of the following Addenda **(receipt of all which is hereby acknowledged)**:

Date	Number
_____	
_____	
_____	
_____	
_____	

B. BIDDER has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance, or furnishing of the Work.

C. BIDDER has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions, and accepts the determination set forth in Paragraph SC-5.03 of the Supplementary Conditions of the extent of the technical data contained in such reports and drawings.

D. BIDDER has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to supplement those referred to in "C." above) which pertain to the subsurface or physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of the Work as BIDDER considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Paragraph 5.03 of the General Conditions.

E. BIDDER has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities.

F. BIDDER has correlated the results of all such observations, examinations, investigations, explorations, tests, reports, and studies with the terms and conditions of the Contract Documents.

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

H. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

I. All prices quotes by the bidder shall be entirely in United States Currency (U.S. Dollars).

4. Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

********** HIGH IMPORTANCE **********

TEXAS ETHICS COMMISSION
REQUIREMENT

*****IN THE EVENT YOU RECEIVE AN AWARD OF THIS CONTRACT*****

Reference: FORM 1295 (revised 12/22/17) "Certificate of Interested Parties"

A business entity must file Form 1295 electronically with the Texas Ethics Commission using the Commission's online filing application, which can be found at:
https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

SEE INSTRUCTIONS: Form 1295 and Sample Form 1295 (Section 00302)

Item No.	Estimated Quantity	UOM	Brief Description Of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
1.	1	LS	Contractor Mobilization/Demobilization - Not to Exceed 5% of Bid	$_____	$_____
2.	1	LS	Project Site Pre-Construction Video	$_____	$_____
3.	2	EA	Furnish 6 mm Perf Plate screens, including control panel, sensors, transmitters, switches, manufacturer startup and training, O&Ms	$_____	$_____
4.	2	EA	Furnish 105 cf/hr Wash Press, including control panel, sensors, transmitters, switches, manufacturer startup and training, O&Ms	$_____	$_____
5.	1	EA	Furnish 210 cf/hr Horizontal Shaftless Conveyor, including control panel, sensors, transmitters, switches, manufacturer startup and training, O&Ms	$_____	$_____

Item No.	Estimated Quantity	UOM	Brief Description Of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
6.	2	EA	Furnish 20 cy Level Lodor, including control panel, sensors, transmitters, switches, manufacturers startup and training, O&Ms	$_____	$_____
7.	2	EA	Furnish grit classifier with integral cyclone, including controls, manufacturers startup and training, O&Ms	$_____	$_____
8.	3	EA	Furnish grit pumps, including controls, manufacturers startup and training, O&Ms	$_____	$_____
9.	2	EA	Furnish motor, drive, rotating shaft and paddle assembly, including associated controls for replacement of same on existing grit removal units	$_____	$_____
10.	1	LS	Furnish grit piping, valves, and appurtenances for replacement of grit piping associated with Items 7 & 8	$_____	$_____
11.	1	LS	Furnish and Perform Barscreen Channel Demo and Modifications for Installation of Two (2) Perf Plate Screens	$_____	$_____
12.	1	LS	Install equipment, associated piping, including removal of existing as required for installation, and provide testing and startup for Items 3-10	$_____	$_____
13.	5,917	SF	Furnish and Install 120 mil DFT corrosion protective coating on existing concrete surfaces as shown on the drawings, including surface preparation and concrete repairs, complete in place	$_____	$_____

Item No.	Estimated Quantity	UOM	Brief Description Of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
14.	1	LS	Furnish and Install Electrical, Instrumentation and Controls (not provided by equipment manufacturers); Install Instrumentation and Controls Provided by Equipment Manufacturers, complete for the project	$_____	$_____
15.	1	LS	Furnish and Install Site Work including reinforced concrete retaining wall, reinforced concrete ramp, reinforced concrete box culvert, site piping, trench safety, grading and drainage improvements, plant HMAC pavement, reinforced concrete support slabs for Level Lodor's, and barsceen supply water line outside the headworks building	$_____	$_____

TOTAL BID PRICE (ITEMS 1 THROUGH 15) $ _____

Quantities are not guaranteed.

If multiple awards are contemplated under a single bid document, an additional breakdown of bid amounts, subcontractors, and suppliers is required. It will also be necessary to adjust the MWBE Certification and Participation Summary Form accordingly.

In accordance with Section 151.311 of the Texas Tax Code (V.A.T.C.S.), regarding taxes on materials and services, and requiring a separated contract, the following is the breakdown of cost for materials and cost for labor for this bid:

MATERIALS TO BE INCORPORATED IN PROJECT NOT SUBJECT TO SALES TAX: $_____

LABOR TO BE INCORPORATED IN PROJECT NOT SUBJECT TO SALES TAX: $_____

RENTAL EQUIPMENT AND OTHER TAXABLE ITEMS: $_____

OTHER (I.E. BONDS, INSURANCE, CAPITAL EQUIPMENT, ETC.) $_____

***TOTAL CONTRACT:** **$_____**
***(TOTAL MUST EQUAL TOTAL BID PRICE)**

5. BIDDER agrees that the Work will be Substantially completed within 413 Calendar Days from the date when the Contract Time commences to run as provided in Paragraph 2.03 of the General Conditions, or by September 30, 2024, whichever occurs first; and as revised in Supplementary Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions, and as revised in the Supplementary Conditions, within 443 calendar days. Final completion includes CONTRACTOR'S resolution of all punch list items and CONTRACTOR'S submission of required close-out documentation. Any failure of the CONTRACTOR to complete the project within the contract time will be considered a material breach of this contract.

   BIDDER accepts the provisions of the Supplementary Conditions and the Agreement as to liquidated damages in the event of failure to complete the Work on time.

9. BIDDER MUST ANSWER THE FOLLOWING QUESTIONS: (Refer to INSTRUCTIONS TO BIDDERS for definitions.)

   9. Is the bidder that is making and submitting this bid a "RESIDENT BIDDER" or a "NONRESIDENT BIDDER"?

      Answer: _____

   B. If the bidder is a "NONRESIDENT BIDDER", does the state in which the Nonresident Bidder's principal place of business is located have a law requiring a Nonresident Bidder of that state to bid a certain amount of percentage under the bid or a Resident Bidder of that state in order for the nonresident bidder of that state to be awarded a contract on his or her bid in such state?

      Answer: _____

   C. If the answer to the question in Paragraph 6B above is "yes", then what amount or percentage must a Texas Resident Bidder bid under the bid of a Resident Bidder of that state in order to be awarded a contract on such bid in said state?

      Answer: _____

7. The following documents are attached to and made a condition of this Bid:

   A. Required Bid Security in the form of _____

   _____

   9. A tabulation of all Subcontractors who will provide labor at the site of the work or render services to the CONTRACTOR in or about the construction of the work and Suppliers and other persons and organizations is required to be identified in this Bid. Complete the following table, designating each as Small Locally-Owned Business Enterprise (SLBE), Minority Business Enterprise (MBE), Women-Owned Business Enterprise (WBE), or Other (not either SLBE, WBE MBE) is required. Only one category may be checked. Include the work item and value of work to be provided by the Prime Contractor, as well

as its category.

Tabulation of Subcontractors and Suppliers

SUBCONTRACTOR/SUPPLIER	WORK ITEM	SUBCONTRACT OR PURCHASE ORDER VALUE (If value is unknown, please list *Pending*)	SLBE	MBE	WBE	SBE	SBRA	OTHER
			Please check one box					
Prime Contractor:								

9. Will the Contractor meet the Small Locally Owned Business Enterprise, Minority Business Enterprise and Women-Owned Business Enterprise goals as required by these contract documents and the funding agencies?

YES _____ NO _____

If "YES", include above each of the firms to be used, their business status as a SLBE, MBE, or WBE, the proposed dollar value and type of work to be performed.

If "NO", documentation supporting good faith effort is required.

8. Communications concerning this Bid shall be addressed to the following named individual, address, telephone number, facsimile number, and e-mail address:

Name: _____

Address: _____

_____

Phone: _____ Fax: _____ E-mail: _____

9. The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General

Conditions.

SUBMITTED on _____, 20__.

If BIDDER is:

An Individual

By _____(SEAL)
(Name of Bidder)

_____
(Title) (Signature)

doing business as _____

Business Address: _____

_____

Phone No.: _____

A Partnership

By _____(SEAL)
(Firm Name)

_____
(Signature – general partner)

Business Address: _____

Phone No.: _____

A Corporation *(Revised 10/12/92, 1/7/93, 4/13, 3/1/22)*

By _____
(Corporation Name)

_____
(State of Incorporation and State of Principal Place of Business)

By _____
(Name of Person Authorized to Sign)

_____
(Title) (Signature)

(Corporate Seal)

Attest _____
(Secretary)

Business Address: _____

_____

Phone No.: _____

Federal Tax Identification Number: _____

When proposing as a Corporation, Bidder swears and affirms by signing this Bid that the proposing Corporation is currently in existence, is currently authorized to do business in the State of Texas (or State of incorporation) and that no franchise tax reports or payments are delinquent as of the date of this Bid Proposal. The Bidder will provide a Certificate of Account Status with the signed Contract Documents. See Section 00510, for the sample form which is to be obtained by the successful Contractor from the Texas (or other state) Comptroller of Public Accounts and submitted as part of the final, executed Contract Documents.

CERTIFICATION OF INSURANCE AVAILABILITY

Date _____

I, _____ (Name of Insurance Agent), certify that I have reviewed the insurance requirements listed in Article 5 of the Supplementary Conditions of the specifications for the John T. Hickerson WRF Headworks Barscreen Replacement (Name of Project), Bid No. 40-23, and further certify that _____ (Name of Bidder) has or can obtain the insurance coverage required by this Project so that a certificate of insurance and a copy(s) for the actual insurance policies can be submitted to the Owner within ten (10) days of the Notice of Award.

Signed _____

Title _____

Insurance Agency _____

Address _____

Telephone _____

MINORITY CERTIFICATION
AND
PARTICIPATION SUMMARY

(EPWU CIP FUNDED PROJECTS)

BID NUMBER: 40-23

BID TITLE: John T. Hickerson WRF Headworks Barscreen Replacement

I certify that the Small Locally Owned Businesses (SLBE), Minority (MBE) and Women's Business Enterprises (WBE) participating in this project are qualified in accordance with the Minority requirements included in the above listed Bid Documents and that we will ensure all consultants, contractors, suppliers, and subcontractors will comply with the Minority guidelines. Definitions of each category are found in the 00100, Instructions to Bidders Section. Attached are:

Solicitation Documents: _____ Proposed Subcontracts for the below listed firms: _____

SLBE, MBE, or WBE FIRM NAME	ADDRESS	PHONE	CONTRACT AMOUNT	SLBE	MBE	WBE

The attached documents outline the Good Faith Effort taken in complying with the Minority Guidelines.

_____ _____

CONTRACTOR SIGNATURE OF AUTHORIZED REPRESENTATIVE

_____ _____

DATE PRINTED NAME OF AUTHORIZED REPRESENTATIVE

SECTION 00301

CONTRACTOR PRE-QUALIFICATION FORM

CONTRACTOR PRE-QUALIFICATION FORM

EPWater requires any contractor who will work on EPWater Qualifying Projects, as well as subcontractors performing 20% of the work on a Qualifying Project, to demonstrate their ability to work safely. A Qualifying Project is a project with a value greater than $100,000 or one that the Chief Technical Officer and Vice President of Operations and Technical Services determine poses a significant hazard. This procedure allows EPWater to identify contractors that can perform site activities without compromising the safety or health of EPWater personnel.

Any contractor wishing to perform work on any Qualifying Project must complete this form and return with the bid package.

The information contained on this form will be evaluated and considered as a part of the overall selection process. Contractors who do not complete and submit this form will be considered non-responsive for any work they propose.

As part of this process, Contractors must certify that its employees have, or will have, appropriate training on the following subjects:

- Basic health and safety issues,
- the Contractor's health and safety programs, and
- the methods and techniques the Contractor will use on the project,
- Procedures for Contractor entrance into and exit from the area of work, and
- Informing EPWater about any unique hazards presented by the Contractor's work or found as a result of the Contractor's work.

Although EPWater will not ask for training documentation on each employee, EPWater requires that this documentation be available within twenty-four hours of request.

CONTRACTOR PRE-QUALIFICATION FORM

1.0 Company Name: _____

Address of Principal Place of Business: _____

Street: _____

City, State, Zip: _____

Telephone Number: _____

E-Mail: _____

2.0 Other Company Names Used: _____

3.0 Name(s) and Relationships of Parent Company, Affiliates, Subsidiaries, Partners:

Company: _____

Address: _____

City, State, Zip: _____

Relationship: _____

Company: _____

Address: _____

City, State, Zip: _____

Relationship: _____

4.0 Has the ownership in your company changed within the last three years? If so, please indicate who the previous owner was in the space below.

YES _____ NO _____

_____

_____

_____

_____

5.0 Please attach certificates showing the extent of coverage, exclusions, and deductibles for the following:

- General Business Liability Insurance Coverage
- Contractors Pollution Liability Insurance Coverage
- Professional Liability Insurance (limits and exclusions)
- Workers' Compensation Insurance Coverage

5.1 How long have you been covered by your current provider of Worker Compensation Insurance?

_____

CONTRACTOR PRE-QUALIFICATION FORM

6.0 Please transfer the numbers and rates of injuries and illnesses from your firm's OSHA No. 300 Logs to the table below:

Injuries & Illnesses in Year:	20___		20___		20___	
Type of Injury Statistic	#	Rate	#	Rate	#	Rate
Lost Workday Cases						
Restricted Workday Cases						
Medical Treatment (not First Aid) Cases						
Total Illness Cases						
Total Recordable Cases						
Employee Hours Worked in Year:						

6.1 List any fatalities your company has had in the last three calendar years (January-December). Include location, cause, and corrective action.

_____
_____
_____
_____
_____

7.0 Do you require that documented safety meetings be held for:

a. Field Supervisor? Yes_____No_____Frequency _____
b. Employees? Yes_____No_____Frequency _____
c. New Hires? Yes_____No_____Frequency _____
d. Subcontractors? Yes_____No_____Frequency _____

8.0 Will a corporate representative audit safety practices on this job?

YES_____ NO_____

8.1 Name _____ Title_____

8.2 How frequently will the representative visit the project?_____

8.3 Does the representative have the authority to take corrective action? Yes____ No____

8.4 To whom does the representative report?

Name _____ Title_____

CONTRACTOR PRE-QUALIFICATION FORM

9.0 Does the company have a health and safety plan? If yes, please give details.

_____

_____

_____

10.0 Describe the type and extent of training Contractor employees will have.

_____

_____

_____

10.1 What percentage of those employees will have this training? _____

11.0 Please give the name of the company's health and safety officer, if any.

_____

12.0 Attach a list of any State or Federal Health and Safety citations received in the past three years.

13.0 Signature of Company Officer: _____

Title: _____

Date: _____

SECTION 00302

CERTIFICATE OF INTERESTED PARTIES SAMPLE

INSTRUCTIONS – FORM 1295

*****IN THE EVENT YOU RECEIVE AN AWARD OF THIS CONTRACT*****

Effective January 1, 2016, a governmental entity may not enter into a contract requiring Board approval, unless the business entity submits a Disclosure of Interested Parties (Form 1295) prior to the convening Board awarding the contract.

The following definitions apply:

1. "Interested Party" means a person:
    a. Who has a controlling interest in a business entity with whom a governmental entity contracts, or;
    b. Who actively participates in facilitating the contract or negotiating the terms of the contract, including a broker, intermediary, adviser, attorney, or representative of, or agent for, the business entity.

2. "Intermediary" means a person who actively participates in the facilitation of the contract or negotiating the contract, including a broker, adviser, attorney, or representative of, or agent for, the business who:
    a. Receives compensation from the business entity for the person's participation;
    b. Communicates directly with the governmental entity or state agency on behalf of the business entity regarding the contact, and;
    c. Is not an employee of the business entity.

3. "Business Entity" means any entity, recognized by law, through which business is conducted, including a sole proprietorship, partnership, or corporation. "Business entity includes a for-profit or non-profit entity. The term does not include a governmental entity or state agency.

4. "Contract" includes an amended, extended, or renewed contract.

5. "Controlling Interest" means:
    a. An ownership interest or participating interest in a business entity by virtue of units, percentage, shares, stock, or otherwise, that exceeds ten (10) percent;
    b. Membership on the board of directors or other governing body of a bustiness entity of which the board or other governing body is composed of not more than ten (10) members, or;
    c. Service as an officer of a business entity that has four (4) or fewer officers, or serve as one of the four (4) officers most highly compensated by a business entity that has more than four (4) officers.

A business entity must file Form 1295 electronically with the Texas Ethics Commission using the Commission's online filing application, which can be found at:

https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

The business entity must print a copy of the completed form, which will include a certification of filing containing a unique certification number. "Section 6 - Unsworn Declaration" of Form 1295 must be signed by an authorized agent of the business entity. The business entity must then submit the completed, signed Form 1295 to El Paso Water.

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 **Name of business entity filing form, and the city, state and country of the business entity's place of business.**

2 **Name of governmental entity or state agency that is a party to the contract for which the form is being filed.**

3 **Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.**

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 **Check only if there is NO Interested Party.** ☐

6 **UNSWORN DECLARATION**

My name is _____, and my date of birth is _____.

My address _____, _____, _____, _____, _____.
(street) (city) (state) (zip code) (country)

I declare under penalty of perjury that the foregoing is true and correct.

Executed in _____ County, State of _____, on the _____ day of _____, 20_____.
(month) (year)

_____
Signature of authorized agent of contracting business entity
(Declarant)

ADD ADDITIONAL PAGES AS NECESSARY

Must file online at www.ethics.state.tx.us/File

SECTION 00303

STATEMENT OF RESIDENCY

STATEMENT OF RESIDENCY

The following information is required by El Paso Water Utilities – Public Service Board ("EPWU") in order to comply with the provisions of Texas Government Code §§ 2252.001 *et. seq.* Failure to provide the required information may constitute a basis for rejection of your bid. Bidders' cooperation in this regard will avoid costly time delays in the award of bids by EPWU. Failure to provide all required information may result in the apparent low bidder being considered non-responsive and non-responsible, and the second low bidder being considered for award.

Definitions

Resident Bidder: a person whose principal place of business is in the State of Texas, including a contractor whose ultimate parent company or majority owner has its principal place of business in the State of Texas.

Nonresident Bidder: a person who is not a resident.

Principal Place of Business in Texas: a permanent business office located in Texas from which a bid is submitted and from which business activities are primarily conducted for the organization other than submitting bids to governmental agencies, where at least one employee works for the business entity.

Bidder's Complete Company Name: _____

State the address of your principal place of business in the space provided below:

_____
_____
_____

State the nature of the business conducted at your principal place of business in the space provided below:

_____
_____
_____

State the number of employees you have at your principal place of business: _____

I swear and attest that the information provided above is true and correct as of the date _____ ("Bidder") submitted its bid on Bid No._____. I further attest that I am an authorized representative of Bidder or have been duly authorized to represent Bidder in this matter. I understand that the information provided is being relied on by EPWU in order for it to comply with state purchasing laws and will materially affect its decisions in this regard. Should the information provided be false or materially misleading, any contract entered into between EPWU and Bidder will be void and EPWU may pursue any legal claims it may have against Bidder.

[SIGNATURE ON NEXT PAGE]

By: _____

Name: _____

Title: _____

Company: _____

ACKNOWLEDGMENT

STATE OF _____ §
§
COUNTY OF _____ §

This instrument was acknowledged before me on the ____ day of _____, 20___, by _____, as _____ of_____, a _____.

_____

Notary Public, State of _____

My Commission Expires:

_____

SECTION 00304

STATEMENT OF NON-DIVESTMENT FROM ISRAEL

STATEMENT OF NONDIVESTMENT FROM ISRAEL

The following information is required by El Paso Water Utilities – Public Service Board ("EPWater") in order to comply with the provisions of Texas Government Code §§ 2270.002.

I swear and attest that the following is true and correct as of the date _____ ("Bidder") submitted its bid on Bid No. _____: Bidder does not boycott Israel and will not boycott Israel during the term of the contract should it be awarded to Bidder. I further attest that I am an authorized representative of Bidder or have been duly authorized to represent Bidder in this matter. I understand that the information provided is being relied on by EPWater in order for it to comply with State purchasing laws and will materially affect its decisions in this regard. Should it be discovered that the statement by Bidder contained herein is false, any contract entered into between EPWater and Bidder will be void and EPWater may pursue any legal claims it may have against Bidder.

By: _____
Name: _____
Title: _____
Company: _____

ACKNOWLEDGMENT

STATE OF _____ §
§
COUNTY OF _____ §

This instrument was acknowledged before me on the ___ day of _____, 20___, by _____, as _____ of _____, a _____.

_____

Notary Public, State of _____

My Commission Expires:

_____

SECTION 00310

MWBE SAMPLE SOLICITATION DOCUMENTS

ACME CONSTRUCTION

10518 Burr Oak Drive
San Antonio, Texas 78609

512-557-7089
Fax 512-557-2097

January 5, 2008

CERTIFIED MAIL / RETURN RECEIPT REQUESTED

Amazing Results Landscape and Supply Company
111 Red Rock Terrace
Lignite, Texas 72533

Gentlemen:

We are actively seeking MWBE Contractors and suppliers for work to be done under Project Number 123456, Sewer System Improvements, City of Anywhere, Texas. The work will consist of utility worm, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials.

Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698.

All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008.

Sincerely,

John Q. Doe, Project Director
Acme Construction

EXAMPLE

Amazing Results
Landscaping

January 12, 2008

Mr. John Q. Doe, Project Director
Acme Construction
10518 Burr Oak Drive
San Antonio, Texas 78609

RE: PROJECT NO. 123456, ANYWHERE TEXAS SEWER SYSTEM IMPROVEMENTS PROJECT

Dear Mr. Doe:

We wish to submit the following bid for the above mentioned project:

St. Augustine sod – 900 square yards at $1.75 per square yard $1,575.00
(Includes installation, rolling, fertilizing, and days of watering)

Hydro-Mulch – 15 acres at $1,175 per acre $17,625.00
(5-acre minimum pre trip; No water; No maintenance; areas that do not germinate will be reseeded) Proper watering is the responsibility of customer.

Hay Bales – We will furnish and install at a rate of $15.00 per bale

We look forward to hearing from you concerning our bid. Thank you.

Sincerely,

Theodore T. "Red" Robbins
Manager

*** * * * A Certified MBE FIRM * * * ***

1111 Red Rock Terrace
Lignite, Texas 72533
(512) 489-5678 (800) 549-0000
(512) 489-5679 fax
www.amazingresults.com

EXAMPLE

ACME CONSTRUCTION

10518 Burr Oak Drive
San Antonio, Texas 78609

512-557-7089
Fax 512-557-2097

January 5, 2008

CERTIFIED MAIL / RETURN RECEIPT REQUESTED

Rider Excavation Services
7856 Dry Gulch
Little Indian Mound, Texas 74561

Gentlemen:

We are actively seeking MWBE Contractors and suppliers for work to be done under Project Number 123456, Sewer System Improvements, City of Anywhere, Texas. The work will consist of utility worm, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials.

Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698.

All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008.

Sincerely,

John Q. Doe, Project Director
Acme Construction

EXAMPLE

Rider Excavation Services

January 8, 2008

Mr. John Q. Doe, Project director
Acme Construction
10518 Burr Oak Drive
San Antonio, Texas 78609

RE: PROJECT NO. 123456
ANYWHERE TEXAS SEWER SYSTEM IMPROVEMENTS PROJECT

Dear Mr. Doe:

Thank you for your letter of January 5, 2008 requesting bids for the Anywhere, Texas Sewer System Improvements Project. We will not be submitting a bid because we are scheduled to begin work on another project that is projected to start on approximately the same date as ours.

We appreciate the opportunity to participate in your project. Please contact us again for any future projects.

Sincerely,

Easy Rider President
Rider Excavation Services

EXAMPLE

7856 Dry Gulch
Little Indian Mound, Texas 74561
512-767-9818 ph 512-767-9800 fax

10518 Burr Oak Drive
San Antonio, Texas 78609

512-557-7089
Fax 512-557-2097

January 5, 2008

CERTIFIED MAIL / RETURN RECEIPT REQUESTED

Shadow Paving
P. O. Box 903
Pharr, Texas 72579

Gentlemen:

We are actively seeking MWBE Contractors and suppliers for work to be done under Project Number 123456, Sewer System Improvements, City of Anywhere, Texas. The work will consist of utility worm, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials.

Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698.

All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008.

Sincerely,

John Q. Doe, Project Director
Acme Construction

EXAMPLE

SHADOW PAVING

January 8, 2008

Acme Construction
John Q. Doe, Project Director
10518 Burr Oak Dr.
San Antonio, TX 78609

Dear Mr.Doe:

Thank you for your letter of January 5, 2008 requesting a bid for the paving portion of the Anywhere, Texas Sewer System Improvements Project. Because of the distance of the project from our offices, we will not be interested in submitting a bid.

We appreciate your interest in our services. Please keep us in mind for future projects that may require expertise and services.

Sincerely,

Elmer A. Paver

Office Manager, Shadow Paving

EXAMPLE

10518 Burr Oak Drive
San Antonio, Texas 78609

512-557-7089
Fax 512-557-2097

January 5, 2008

CERTIFIED MAIL / RETURN RECEIPT REQUESTED

Construction Trades Newsletter
100 Someplace Dr.
P. O. Box 500
Anywhere, Texas 08654

Attn: Ms. Glory Everett, Editor

Dear Ms. Everett:

Please publish the following in the "Public Notices" section of your weekly newsletter on the following dates: 1/11/08; 1/18/08; 1/25/08; and 2/1/08.

"Acme Construction is soliciting subcontract and material bids in connection with the Improvements to the Sewer System for the City of Anywhere, Texas. Qualified MBE and WBE firms are encouraged to submit bids in response to this invitation. The work will consist of utility work, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials. Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698. Telephone No. 512-557-2091, Fax 512-557-2090. All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008".

Please bill Acme Construction, 10518 Burr Oak Drive, San Antonio, Texas 78609. The person authorizing the placement of this ad is B. J. Tenfold. If you have any questions, you may contact Mr. Tenfold at 512-557-7000.

Sincerely,

B. J. Tenfold
Manager of Accounts

EXAMPLE

ACME CONSTRUCTION

10518 Burr Oak Drive
San Antonio, Texas 78609

512-557-7089
Fax 512-557-2097

January 5, 2008

CERTIFIED MAIL / RETURN RECEIPT REQUESTED

Anywhere Weekly Courier
1111 Main Street
P. O. Box 1
Anywhere, Texas 08654

Attn: Mr. Bucky Beaver, Circulation Manager

Dear Mr. Beaver:

Please publish the following in the "Public Notices" section of your weekly newspaper editions on the following dates: 1/11/08; 1/18/08; 1/25/08; and 2/1/08.

"Acme Construction is soliciting subcontract and material bids in connection with the Improvements to the Sewer System for the City of Anywhere, Texas. Qualified MBE and WBE firms are encouraged to submit bids in response to this invitation. The work will consist of utility work, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials. Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698. Telephone No. 512-557-2091, Fax 512-557-2090. All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008".

Please bill Acme Construction, 10518 Burr Oak Drive, San Antonio, Texas 78609. The person authorizing the placement of this ad is B. J. Tenfold. If you have any questions, you may contact Mr. Tenfold at 512-557-7000.

Sincerely,

B. J. Tenfold
Manager of Accounts

EXAMPLE

THE STATE OF TEXAS }
COUNTY OF GHI }

Before me Homer Shortcut, a Notary Public in and for GHI County, Texas on this day personally appeared Bucky Beaver, Circulation Manager for Small Town Newspapers Group, Inc., publishers of the Anywhere Weekly Courier, who being by me duly sworn did depose and say that said newspaper has been published continuously for more than fifty-two weeks prior to the first insertion of this Legal Notice Number 879 at GHI County, Texas and the attached printed copy of the legal notice is a true copy of the original and was printed weekly on the following date(s): 1/11/08; 1/18/08; 1/25/08; 2/1/08.

_____
Circulation Manager
Anywhere Weekly Courier
Small Town Newspaper Group, Inc.

Appeared and sworn to before me on this
21st day of January, 2008

_____
NOTARY PUBLIC in and for the State of Texas
My Commission expires 12/28/2010

Legal Notice as Published

Acme Construction is soliciting subcontract and material bids in connection with the Improvements to the Sewer System for the City of Anywhere, Texas. Qualified MBE and WBE firms are encouraged to submit bids in response to this invitation. The work will consist of utility work, concrete, paving, fencing, landscaping, masonry, excavation and trucking, barricades, back-hoe work and supplies and materials. Plans and specifications may be viewed or obtained at the project engineer's general offices, Bing, Campbell and Associates, 19510 Jackson Blvd., Muleshoe, Texas 76698. Telephone No. 512-557-2091, Fax 512-557-2090. All bids must be submitted to the above mentioned address by Noon, Friday, February 16, 2008.

EXAMPLE

SECTION 00500

STANDARD FORM OF AGREEMENT

BETWEEN OWNER AND CONTRACTOR

SECTION 00500

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

THIS AGREEMENT is dated as of the _____ day of _____ in the year 20___ by and between El Paso Water Utilities-Public Service Board, a component unit of the City of El Paso, a Texas municipal corporation (hereinafter called OWNER), and _____ (hereinafter called CONTRACTOR). OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1. WORK

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

JOHN T. HICKERSON WRF HEADWORKS BARSCREEN REPLACEMENT

The work under this contract shall be for furnishing all labor, materials, transportation and services for the construction and installation of the following work:

The project entails the removal and replacement of two (2) existing traveling rake barscreens, screenings and grit handling equipment, mechanical components for two (2) existing vortex grit removal units, associated piping, electrical, and controls; concrete demo and structural modifications necessary for installation of new screening equipment, furnish and installation of two (2)-6 mm perf plate screens, two (2) wash presses, one (1) shaftless horizontal conveyor, two (2) 20 CY Level Lodors, two (2) grit classifiers with integral cyclones, three (3) grit pumps, concrete retaining wall, electrical, controls and instrumentation for new equipment, corrosion protection coating of existing concrete structures, site pavement, grading and drainage improvements, site piping, testing and startup of new equipment, and coordination with plant. Improvements to be completed while plant remains in service.

ARTICLE 2. ENGINEER

The Project has been designed by Parkhill who is hereinafter called ENGINEER and who is to act as OWNER's representative, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 3. CONTRACT TIME *(Revised 9/2/92, 10/9/98, 6/3/99, 4/13, 10/16/20)*

3.1 The Work will be Substantially completed within 413 Calendar Days from the date when the Contract Time commences to run as provided in Paragraph 4.01 of the General Conditions, or by September 30, 2024, whichever occurs first; and as revised in Supplementary Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions, and as revised in the Supplementary Conditions, within 443 calendar days. Final completion includes CONTRACTOR'S resolution of all punch list items and CONTRACTOR'S submission of required close-out documentation. Any failure of the CONTRACTOR to complete the project within the contract time will be considered a material breach of this contract.

3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss and public inconvenience if the Work is not completed and the submittals are not submitted within the times specified in Paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER the sum of Two Thousand Dollars ($2,000) for each Calendar Day that expires after the time specified in the Agreement for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER One Thousand One Hundred Sixty Dollars ($1,160) for each Calendar Day that expires after the time specified in the Agreement for completion and readiness for final payment.

ARTICLE 4. CONTRACT PRICE *(Revised 10/12/92, 6/7/93; 2/13/97)*

4.1 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents in current funds, per the attached CONTRACTOR's Bid in accordance with the below listed separate charges:

MATERIALS TO BE INCORPORATED IN PROJECT NOT SUBJECT TO SALES TAX: $_____

LABOR TO BE INCORPORATED IN PROJECT NOT SUBJECT TO SALES TAX: $_____

RENTAL EQUIPMENT AND OTHER TAXABLE ITEMS: $_____

OTHER (I.E. BONDS, INSURANCE, CAPITAL EQUIPMENT, ETC.) $_____

***TOTAL CONTRACT:** $_____
*** (TOTAL MUST EQUAL TOTAL BID PRICE)**

ARTICLE 5. PAYMENT PROCEDURES *(Revised 5/14/96, 7/13, 10/16/20, 3/4/22)*

CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions and Article 15 of the Supplementary Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

5.1 Progress Payments. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by ENGINEER for Work which is completed in accordance with the terms and conditions of the Contract Documents. All progress payments will be on the basis of the progress of the Work measured by the schedule of values established in Paragraph 2.03 and referenced in Paragraph 2.05 of the General Conditions (and in the case of Unit Price Work based on the number of units completed and accepted) or, in the event there is no schedule of values, as provided in the General Requirements. Each invoice, regardless of contract type, shall contain a summary indicating the budget, the current invoiced amount, less a withholding of a 5% retainage amount, and the billed to date figure.

Prior to Substantial Completion, progress payments will be made in an amount equal to the percentages indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall recommend, or OWNER may withhold, in accordance with Paragraph 15.06 of the General Conditions.

Ninety-five percent of Work completed (ninety percent for contracts under $400,000.00), including 95 percent of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in Paragraph 15.01 of the General Conditions).

5.2 Final Payment. Upon final completion and acceptance of the Work in accordance with Article 15 of the General and Supplementary Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said Article.

ARTICLE 6. CONTRACTOR'S REPRESENTATIONS *(Revised 10/12/92, 7/13, 11/9/17, 10/16/20, 3/4/22)*

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

6.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

6.2 CONTRACTOR has studied carefully all reports of explorations and tests of subsurface conditions and drawings of physical conditions which are identified in the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions, and accepts the determination set forth in Paragraph SC-5.03 of the Supplementary Conditions of the extent of the technical data contained in such reports and drawings.

6.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in Paragraph 6.2 above) which pertain to the subsurface or physical conditions at or contiguous to the site or otherwise which may affect the cost, progress, performance or furnishing of the Work necessary for the performance or furnishing

of the Work at the Contract Price, specifically within the provisions of Paragraph 5.03 of the General Conditions. CONTRACTOR understands that the correctness of such information is not guaranteed by the OWNER or the ENGINEER and CONTRACTOR understand(s) that the conditions encountered in performing the work may be different from the approximations shown.

6.4 CONTRACTOR has reviewed all information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the location of said Underground Facilities as determined by his or her own field investigations. CONTRACTOR understands that the correctness of such information is not guaranteed by the OWNER or the ENGINEER and CONTRACTOR understand that the conditions encountered in performing the work may be different from the approximations shown.

6.5 CONTRACTOR has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

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

6.7 CONTRACTOR affirms it is not a foreign-owned company that is owned or controlled by citizens of or directly controlled by the government of China, Iran, North Korea, Russia or a designated country pursuant to Chapter 2274 of the Texas Government Code. Additionally, CONTRACTOR affirms it is not a company that is headquartered in China, Iran, North Korea, Russia, or a designated country pursuant to Chapter 2274 of the Texas Government Code.

6.8 CONTRACTOR affirms it does not boycott Israel and will not boycott Israel during the term of the Agreement.

6.9 In accordance with Chapter 2274 of the Texas Government Code, CONTRACTOR affirms that it does not boycott energy companies and will not boycott energy companies during the term of the Agreement.

6.10 In accordance with Section 2274.002 of the Texas Government Code, CONTRACTOR affirms that it does not have a practice, policy, guidance or directive that discriminates against a firearm entity or firearm trade association and will not discriminate during the term of the Agreement against a firearm entity or firearm trade association.

ARTICLE 7. CONTRACT DOCUMENTS *(Revised 11/16/94, 1/12/11, 7/13, 11/2/16, 10/16/20, 3/4/22)*

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

7.1 CONTRACTOR's Bid (Section 00300)

7.2 Agreement (Section 00500)

7.3 Performance and Payment Bonds, and Certificate of Insurance, and insurance policies identified as Sections 00610, 00630 and 00650.

7.4 Notice of Award.

7.5 General Conditions (Section 00700)

7.6 Supplementary Conditions (Section 00800)

7.7 Supplement for Special-Funded Project (Section 00805) – NOT APPLICABLE

7.8 General Wage Rates (Section 00840)

7.9 Specifications bearing the title Project Manual for the Construction of John T. Hickerson WRF Headworks Barscreen Replacement, consisting of division numbers 1 through 46.

7.10 Drawings consisting of a cover sheet and sheets listed in the Index to Drawings, each sheet bearing the following general title:

CITY OF EL PASO, TEXAS
EL PASO WATER UTILITIES - PUBLIC SERVICE BOARD

John T. Hickerson WRF Headworks Barscreen Replacement

(Drawings not attached to this Agreement.)

7.11 Addenda numbers _____ to _____, inclusive (not attached to this Agreement.)

7.12 Documentation submitted by CONTRACTOR prior to Notice of Award (Pages_____ to _____, inclusive).

7.13 Contractor Health and Safety Plan

7.14 The Instructions to Bidders, Information Available to Bidders, Bid Form and Bid Security, as well as any supplements to the Bid Form.

7.15 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents pursuant to Paragraphs 11.01 of the General Conditions.

7.16 The documents listed in Paragraphs 7.2 et. seq. above are attached to this Agreement (except as expressly noted otherwise above).

There are no Contract Documents other than those listed above in this Article 7. The Contract Documents may only be amended, modified or supplemented as provided in Paragraphs 11.01 of the General Conditions.

ARTICLE 8. MISCELLANEOUS

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

8.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically, but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be

limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

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

ARTICLE 9. OTHER PROVISIONS *(Revised 3/4/22)*

9.1 It is agreed that should any dispute arise under this Contract which culminates in litigation, venue of that suit shall be in a court of competent jurisdiction sitting in El Paso County, Texas. The court shall apply the laws of the State of Texas in construing and interpreting the terms of this Contract and the Contract Documents.

9.2 In case any one or more of the provisions contained in this Agreement shall, for any reason, be held to be invalid, illegal, or unenforceable in any respect, that invalidity, illegality, unenforceability shall not affect any other provisions and this Agreement shall be construed as if such invalid, illegal, or unenforceable provisions had never been included, and the Agreement provisions shall be read and interpreted so as to harmonize with the Agreement itself.

9.3 The captions or headings of paragraphs in this Contract are for convenience only and shall not be considered in constraining the provisions hereof if any question of intent should arise.

9.4 For NADBank-funded projects, Contractor agrees to indemnify and hold harmless North American Development Bank (NADB) and each of its directors, officers, employees, agents and representatives (collectively, "NADB's Associated Persons") against all claims for death, personal injury, damages, or other relief against NADB or NADB's Associated Persons, including costs, expenses and attorney's fees, resulting from negligence or willful acts or failure to act by the Contractor.

9.5 In accordance with Sections 552.371 and 552.372 of the Texas Government Code, the following language is included, and applicable in contracts that require or result in the expenditure of public funds of at least $1,000,000:

CONTRACTING INFORMATION. CONTRACTOR must preserve all contracting information related to this Agreement as provided by the records retention schedule requirements applicable to the OWNER for the duration of this Agreement. CONTRACTOR will promptly provide the OWNER any contracting information related to this Agreement that is in the custody or possession of the CONTRACTOR on request of the OWNER. On completion of this Agreement, CONTRACTOR will either provide at no cost to the OWNER all contracting information related to this Agreement that is in the custody or possession of the CONTRACTOR or preserve the contracting information related to this Agreement as provided by the records retention requirements applicable to the OWNER.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR and ENGINEER. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR or by ENGINEER on their behalf.

This Agreement will be effective on _____, 20___.

OWNER: El Paso Water Utilities
Public Service Board of
the City of El Paso, Texas

By _____
Purchasing Agent

Address for giving notices:

1154 Hawkins Boulevard
El Paso, Texas 79925

Date Signed _____

CONTRACTOR: _____

_____

_____

By _____

Name: _____

Title: _____

Address for giving notices:

_____

_____

Date Signed _____

Federal Tax I.D. No. _____

Agent for service or process:

_____

INSTRUCTIONS FOR EXECUTING CONTRACT

If the CONTRACTOR be a corporation, the following certificate should be executed:

I,_____, certify that I am the_____of the corporation named as CONTRACTOR hereinabove; that, _____ who signed the foregoing Contract on behalf of the CONTRACTOR was then,_____ of said Corporation; that said Contract was duly signed for and in behalf of said Corporation by authority of its governing body and is within the scope of its corporate powers.

_____

Corporate Seal

If the Contract is signed by the secretary of the corporation, the above certificate should be executed by some other officer of the corporation under the corporate seal. In lieu of the foregoing certificate, there may be attached to the Contract copies of so much of the records of the corporation as will show the official character and authority of the officers signing, duly certified by the Secretary or Assistant Secretary under the corporate seal to be true copies.

The full name and business address of the CONTRACTOR should be inserted and the Contract shall be signed with his or her official signature. Please have the name of the signing party or parties typewritten or printed under all signatures to the Contract.

If the CONTRACTOR should be operating as a partnership, each partner should sign the Contract. If the Contract is not signed by each partner, there should be attached to the Contract a duly authenticated Power of Attorney, or other appropriate resolution or document evidencing the signer's (signers') authority to sign such Contract for and in behalf of the partnership.

If the CONTRACTOR is an individual, the trade name (if the CONTRACTOR is operating under an assumed or trade name) should be indicated in the Contract and the Contract should be signed by such individual. If signed by one other than the CONTRACTOR, there should be attached to the Contract a duly authenticated Power of Attorney evidencing the signer's authority to execute such Contract for and in behalf of the CONTRACTOR.

CONTRACT SUBMITTAL CHECKLIST (The following items must be submitted within **10** calendar days of the Notice of Award unless stated otherwise in the General or Supplemental Conditions)	
	1. Executed Agreement
	2. Payment and Performance Bonds
	3. Insurance Certificate and Policies. Policies should be sent in electronic format, email to: rguevara@epwater.org, with copy to becky.ramirez@hubinternational.com (Owner's Risk Manager) and to Purchasing.Info@epwater.org.
	4. If employees provided by leasing company, evidence of Texas State License and copy of their Worker's Compensation policy. If no leased employees will be used, provide a letter on Contractor's letterhead stating so.
	5. Certificate of Account Status (paid franchise taxes)
	6. Final/Updated (if applicable) Minority Certification and Participation Summary
	7. Preliminary Schedule of Values
	8. Preliminary Construction Schedule
	9. Schedule of Shop Drawings
	10. Trench Safety System (sealed by a Professional Engineer)
	11. Trench Safety Plan
	12. Stormwater Pollution Prevention Plan (NOT REQUIRED)
	13. Traffic Control Plan (NOT REQUIRED)
	14. Health and Safety Plan

- **Deliver all items to the OWNER's Purchasing Department**
- **Deliver electronic copies of items 7-14 to EPWater Project Manager**

SECTION 00510

CERTIFICATE OF ACCOUNT STATUS SAMPLE

TEXAS COMPTROLLER OF PUBLIC ACCOUNTS

SUSAN COMBS • COMPTROLLER • AUSTIN, TEXAS 78774

July 30, 2007

CERTIFICATE OF ACCOUNT STATUS

EXAMPLE

THE STATE OF TEXAS
COUNTY OF TRAVIS

I, Susan Combs, Comptroller of Public Accounts of the State of Texas, DO HEREBY CERTIFY that according to the records of this office

is, as of this date, in good standing with this office having no franchise tax reports or payments due at this time. This certificate is valid through the date that the next franchise tax report will be due November 15, 2007.

This certificate does not make a representation as to the status of the corporation's Certificate of Authority, if any, with the Texas Secretary of State.

This certificate is valid for the purpose of conversion when the converted entity is subject to franchise tax as required by law. This certificate is not valid for the purpose of dissolution, merger, or withdrawal.

GIVEN UNDER MY HAND AND
SEAL OF OFFICE in the City of
Austin, this 30th day of
July 2007 A.D.

Susan Combs
Texas Comptroller

Taxpayer number:
File number:

Form 05-304 (Rev. 02-03/14)

SECTION 00610

PERFORMANCE BOND

TEXAS STATUTORY PERFORMANCE BOND

(Penalty of this Bond must be 100% of Contract Amount)
Public Work – State of Texas

STATE OF TEXAS }
COUNTY OF_____ } BOND NUMBER_____

KNOW ALL MEN BY THESE PRESENTS:

That _____ (hereinafter called the Principal), as Principal and _____, a corporation organized and existing under the laws of the State of _____, and whose principal office is located in the City of _____, and duly authorized to do business in the State of Texas (hereinafter called the Surety).

As Surety, are held firmly bound unto El Paso Water Utilities / Public Service Board, hereinafter called the Owner), in the penal sum of _____ Dollars ($_____) for the payment of which sum well and truly to be made, we bind ourselves, our 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___, a copy of which is hereto attached and made a part hereof, for _____.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, 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 and all liabilities on this Bond shall be determined in accordance with the provisions thereof to the same extent as if it were copied at length herein.

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

_____

BY: _____
Principal

WITNESS:

_____ BY: _____
Surety

SECTION 00630

PAYMENT BOND

PAYMENT BOND

Public Work – State of Texas

STATE OF TEXAS }
COUNTY OF_____ } BOND NUMBER_____

KNOW ALL MEN BY THESE PRESENTS:

That _____ of the City of _____, County of _____ and State of _____ (hereinafter called the Principal), and _____ authorized under the laws of the State of Texas to act as Surety on bonds for Principals (hereinafter called the Surety) are held firmly bound unto El Paso Water Utilities / Public Service Board, hereinafter called the 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 _____ _____ to which Contract is hereby referred to and made 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 pay all claimants supplying labor and material to him or a subcontractor 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 and all liabilities on this Bond shall be determined in accordance with the provisions of said Chapter 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 the work performed thereunder, or the plans, specifications or drawings accompanying the same, shall in anywise affect its obligation on this Bond and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder.

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

_____

BY: _____
Principal

WITNESS:

_____ BY: _____
Surety

SECTION 00650

CERTIFICATE OF LIABILITY INSURANCE

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
	PHONE (A/C, No, Ext): -	FAX (A/C, No):
	E-MAIL ADDRESS:	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A :	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED

Specimen/Sample Certificate Form

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	☐ CLAIMS-MADE ☐ OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
								$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	☐ UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	☐ EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						☐ WC STATU-TORY LIMITS ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? ☐	N / A					E.L. EACH ACCIDENT	$
	(Mandatory in NH)						E.L. DISEASE - EA EMPLOYEE	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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SECTION 00660
ENGINEER'S CERTIFICATE OF
SUBSTANTIAL COMPLETION

EL PASO WATER UTILITIES - PUBLIC SERVICE BOARD

ENGINEER'S CERTIFICATE OF SUBSTANTIAL COMPLETION

JOHN T. HICKERSON WRF HEADWORKS BARSCREEN REPLACEMENT
BID NO. 40-23

(TO BE FILLED OUT AND SUBMITTED BY ENGINEER)

The above-referenced project is substantially complete as of _____, 20____. Exceptions and/or items requiring additional work are indicated as follows:

The following documents are required contract submittals. Certificate of Final Completion and Final Payment will *not* be issued until all submittals listed below are received and correct (pursuant to contract requirements).	
1. Contractor's Waiver of Claim/Lien (GC 15.06.A.3)	
2. *Original* Consent of Surety to Final Payment (GC 15-06.A.2.a)	
3. Copy of Release to Contractor from EPWID#1 for Dewatering Fees, if applicable (SC 18.13.E)	
4. Completed Operations Insurance Letter (coverage for at least 2 years after final payment (GC 6.03.B.3 and SC-6.03.C.6)	
5. Delivery to the Engineer of all Operating & Maintenance Manuals, Guarantees, Certificates of Inspection, and Marked-up As-Builts or Record Drawings, if applicable (GC 10.07.D and GC 15.06.A.1)	
6. Final Report of Total Payments to subcontractors and suppliers	
7. Evidence of Payment of Final Water Bill and Return of Water Meter	
8. Ensure that *Certified* Payrolls for entire contract period for contractor and all subcontractors, including "Final" (SC 7.11.D.5) payroll from each, are entered in the Utility Automated Payroll Software program and ensure that all outstanding corrections and/or evidence of restitution have been submitted	
9. Warranty/Guarantee, if applicable	
10. NPDES Requirements (NOT), if applicable	

EPWU Engineering Division Manager

Project Engineer of Record

Date

Date

SECTION 00680
CONTRACTOR'S CLOSE-OUT CHECKLIST

CONTRACTOR'S PROJECT CLOSE-OUT SUBMITTALS CHECKLIST

The following documents are required contract submittals for the Close-Out of this project. Contractor is contractually required to submit the following in one packet to the Engineer for review. Certificate of Final Completion and Final Payment will not be issued until all submittals listed below are received and correct.

REQUIRED ITEM	INCLUDED
1. Final Change Order (if applicable)	
2. Contractor's Waiver of Lien (GC 15.06.A.3)	
3. *Original* Consent of Surety to Final Payment (GC 15.06.A.2.b)	
4. Copy of Release to Contractor from EPWID#1 for Dewatering Fees, if applicable (SC 18.13.E)	
5. Completed Operations Insurance Letter (coverage for at least 2 years after final payment (GC 6.03.B.3 and SC 6.03.C.6)	
6. Transmittal Letter of Delivery to Engineer of all Operating & Maintenance Manuals, Guarantees, Certificates of Inspection, and Marked-up As-Builts or Record Drawings, if applicable (GC 10.07.D and GC 15.06.A.1)	
7. Final Report of Total Payments to Subcontractors and Suppliers	
8. Final Certified Payrolls (list 'Final' atop the payrolls) (SC 7.11.D.5). Submit any and all outstanding corrections and/or evidence of paid restitution.	
9. Warranty/Guarantee, if applicable	
10. NPDES Requirements (NOT), if applicable	
11. Paid Final Water Bill, Completed Meter and Removal Forms for Fire Hydrant Meter	

* All items must be submitted and received as a complete packet. An incomplete packet will be returned.

When all items have been received and approved by EPWater, the assigned Project Compliance Specialist will notify Project Engineer, Consultant Engineer, and Contractor. At that time, Contractor may submit the Final Pay Application to Consultant Engineer. Consultant Engineer will provide the Certificate of Final Completion and the approvable Final Pay Application to the Project Compliance Specialist for processing and closing of project.

SECTION 00700

GENERAL CONDITIONS (EJCDC C0700, 2018 ED)

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

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

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

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

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

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

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

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

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

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

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

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

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

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

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will 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.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

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

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

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

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

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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

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

5.02 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

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

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

5.03 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

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

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

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

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

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

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

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

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

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

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

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

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

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

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

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

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

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

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

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

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

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

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

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

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. 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 Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

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

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

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

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

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

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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

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

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

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

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

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

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

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

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

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

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

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

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

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

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

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

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

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall 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, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

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

C. *Review of Applications*

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

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

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

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

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

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is 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.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00800

SUPPLEMENTARY GENERAL CONDITIONS

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SUPPLEMENTARY CONDITIONS
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INTRODUCTORY STATEMENT

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2018 Edition). All provisions which are not so amended or supplemented remain in full force and effect.

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

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

SC-1.01.A.4 Add the following sentence to Paragraph 1.01.A.4:

The term “Offer” has the same meaning as the term “Bid”.

SC-1.01.A.5 Add the following sentence to Paragraph 1.01.A.5

The term “Offeror” has the same meaning as the term “Bidder”.

SC-1.01.A.10.e Add the following sentence to Paragraph 1.01.A.10.e

When submitted, a Claim must be signed by the Designated Authorized Representative.

SC-1.01.A.51 Add the following paragraph as reference 1.01.A.51:

Designated Authorized Representative — the representative authorized by the party filing the Claim to execute legally-binding agreements on behalf of that party. For Owner, the Designated Authorized Representative shall be the Chief Technical Officer, a Vice President, or President and Chief Executive Officer. For Contractor, the owner or its designee authorized pursuant to a power of attorney.

SC-1.01.A.52 Add the following paragraph as reference 1.01.A.52:

Health and Safety Plan — The part of the Contract Documents prepared by Contractor that describes safety procedures for the Work, identifies the Contractor’s safety representative required by Paragraph 6.14.A, and certifies that the Contractor’s employees have received or will receive training prior to the commencement of the Work on (1) basic health and safety issues; (2) the Health and Safety Plan; (3) the methods and techniques the Contractor will use on the Project; (4) procedures for Contractor entrance into and exit from the Site(s); and (5) informing Owner about any unique hazards presented by the Work or found as a result of the Work.

ARTICLE 2 - PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following in its place:

A. Owner shall provide to Contractor an electronic version of a fully executed copy of the contract documents.

2.03 *Before Starting Construction*

SC-2.03.B Add the following new paragraph immediately after Paragraph 2.03.A.3

B. *Health and Safety Plan*. Contractor shall submit a copy of Health and Safety Plan fifteen (15) days before mobilization. No Work shall proceed until the Owner has accepted the Health and Safety Plan.

2.04 *Pre-Construction Conference; Designation of Authorized Representatives*

SC-2.04.B Amend the first sentence of Paragraph 2.04.B to read as follows:

At or prior to this conference Owner and Contractor each shall designate, in writing by Owner and in writing by Contractor as a submittal, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract.

2.05 *Acceptance of Schedules*

SC-2.05.A Amend the first sentence of Paragraph 2.05.A to read as follows:

At the preconstruction conference indicated in Paragraph 2.04 or other time acceptable to the parties and Engineer, Engineer and Contractor will review the acceptability to Engineer, as provided below, of the schedules submitted in accordance with Paragraph 2.03.A.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC-3.01.C Delete Paragraph 3.01.C in its entirety.

SC-3.03.B.1 Add the following to new paragraph immediately after Paragraph 3.03.B:

SC-3.03.B.1 In resolving such conflicts, errors, and discrepancies, the Contract Documents will be given precedence in the following order: Change Orders, Field Orders, Addenda, Agreement, Performance Bond and Payment Bond, Supplementary Conditions, General Conditions, Specifications and Drawings. Numerical dimensions shown on the Drawings shall govern over scaled dimensions on the Drawings. This Paragraph SC-3.03.B.1 is not, however, a definitive enumeration of what comprises the "Contract Documents", which definitive enumeration is indicated in the Agreement.

ARTICLE 4 - COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01.A Amend the third sentence of paragraph 4.01.A by changing the word "60th" to read as "90th".

4.03 *Reference Points*

SC-4.03.A Amend the third sentence of Paragraph 4.03.A to read as follows:

Contractor shall report to Engineer when a reference point, including property boundary stakes or monuments, or an elevation benchmark, is disturbed, lost, or destroyed, or requires relocation because of necessary changes in grades or locations. Contractor shall be responsible for accurately replacing or relocating such reference points by a professional land surveyor licensed by and registered in the State of Texas.

4.05 *Delays in Contractor's Progress*

SC-4.05.C Amend Paragraph 4.05.C by adding the following subparagraphs:

5. Weather-Related Delays

   a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Time, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.

   b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

      1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

         i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds 1-inch over a 24-hour period of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference).

ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: wind chill factor equal or less than 25-degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: equal or greater than 110-degrees Fahrenheit.

iii) Suspension (greater than 4 hours) or postponement of construction due to high wind advisory/warning that has been issued and does not allow construction activities to continue.

2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by the El Paso International Airport weather monitoring station located at 6701 Convair Road in El Paso, Texas.

3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the Foreseeable Bad Weather Days table, Exhibit A included in SC-4.05.5.b.4.

4) Foreseeable Bad Weather Days:

i) Foreseeable Bad Weather Days (Standard Baseline) is defined as the normal number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

ii) The Foreseeable Bad Weather Days are as follows:

Exhibit A

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	3	3	2	3	4	8	8	6	5	3	4

5) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the Standard Baseline table in Exhibit A - Foreseeable Bad Weather Days will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

ARTICLE 5 - SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

SC 5.01.D Add the following new paragraph immediately after paragraph 5.01.C:

SC-5.01.D All work associated with special provisions of easements shall be performed in accordance with the Contract Documents, unless the Contract Documents indicate that easement provisions govern. Should the actions of Contractor or Subcontractors or Suppliers cause the Work to be delayed to the point that the ending date of an easement is exceeded, Contractor shall reimburse Owner for additional costs required to extend the period of rights to the easement to complete the Work. Such delay shall be considered to be within the control of Contractor, in accordance with paragraph 4.05.

5.02 *Use of Site and Other Areas*

SC-5.02.E Add the following new paragraph immediately after Paragraph 5.02.D:

SC-5.02.E *Dust Control*

1. Contractor shall not cause or allow dust-generating operations, earthmoving operation, use of property, or other operation that results in fugitive dust emissions that exceed the limits prescribed by the authority having jurisdiction, in accordance with Texas Administrative Code Title 30, Part 1, Chapter 111, Subchapter A, Division 4, Rule 111.145. Contact City of El Paso Environmental Management Division at (915) 212-6000 for additional information regarding nuisance fugitive dust emissions from the Site.
2. Provide necessary equipment and materials to apply sufficient dust suppressants, properly clean all vehicle "track-out" areas on and adjacent to the Site, and provide adequate physical stabilizations of soils to comply with requirements of earthmoving permits and approved dust control plan or activities, if any.
3. Contractor shall pay fines and civil penalties imposed by authorities having jurisdiction and incurred by Owner because of Contractor's violation of earthmoving permits and dust control plans or activities.
4. Implement measures to control fugitive dust emissions from the Site in compliance with earthmoving permit and Laws and Regulations.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Study El Paso Water-John T. Hickerson Wastewater Treatment Plant Retaining Wall Structure El Paso, El Paso County, Texas LOI File No. 21-413	January 10, 2022	Soil Bores Study included in the Technical Specifications at the end of Section 31 20 00.10 "Earth Moving for Facility"

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
No Drawings Available		

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at the El Paso Water Utilities' website:

www.epwater.org/business_center/purchasing_overview/bids

SC-5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following in its place:

SC-5.06.A No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

SC-5-06.B Not Used.

ARTICLE 6 - BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01.A Delete Paragraph 6.01.A and 6.01.B in their entirety and insert the following in place of:

SC-6.01.A Except as provided in this Paragraph SC-6.01.A, Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds and certificates of insurance as are required by the Contract Documents. Certificates of insurance shall be in the form prescribed by the Contract Documents. Conditions under which a payment bond and/or performance bond are required are as follows:

1. Payment bond is required when the contract award is in excess of $50,000, and;
2. Performance Bond is required when the contract award is in excess of $100,000.

   (Note: Contract value is excess of $100,000, both bonds are required.)

SC-6.01.B Delete Paragraph 6.01.C in its entirety and insert the following in its place:

SC-6.01.B. All bonds shall be in the form prescribed by the Contract Documents, except as provided otherwise by Laws and Regulations including, but not limited to, Chapter 2253 of the Texas Government Code and Article 7.19-1 of the Texas Insurance Code. The bonds shall be executed by surety which shall be authorized and admitted to do business in the State of Texas, licensed by the State of Texas to issue surety bonds, and carry an A.M. Best Key rating of not less than A VIII. If the amount of the bond is in excess of ten percent of surety's capital and surplus, surety shall furnish to Owner a written certification that surety has insured that portion of surety's risk that exceeds ten percent of surety's capital and surplus with one or more reinsurers who are duly authorized, accredited or trusteed to do business in the State of Texas. If any portion of surety's obligation is reinsured, the amount reinsured shall not exceed ten percent of the reinsurer's capital and surplus. Surety and the reinsurer(s) shall furnish additional information and documentation, if any, required by Owner for Owner to determine whether surety or its reinsurer(s) comply with the requirements of this Paragraph SC-6.01.B. All bonds signed by an agent or attorney-in-fact shall be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

6.02 *Insurance - General Provisions*

SC-6.02.G Delete Paragraph 6.02.G in its entirety and insert the following in its place:

SC-6.02.G Not Used.

6.03 *Contractor's Insurance*

SC-6.03.C Add the following immediately after Paragraph 6.03.C.1:

a. In addition to the individuals or entities specified above, include as additional insured, or loss payees as their interest may appear, the following:

1) None.

SC-6.03.C Add the following immediately after Paragraph 6.03.C.5:

SC-6.03.C.5 If, at any time, the required insurance policies are canceled, terminated, or modified so that the insurance is not in full force and effect as required under the Contract Documents, Owner may terminate for cause in accordance with Paragraph 16.02 of the General Conditions or, where possible, obtain insurance coverage equal to that required by the Contract Documents, the full cost of which will be charged to Contractor and deducted from any payments due Contractor.

a. Each Contractor shall require his subcontractors, at all tiers, to carry insurance coverages satisfactory to the Contractor and to provide evidence of such insurance as specified herein.

For purposes of this Bid, a Payment Bond will be required in an amount equal to the Bid Price and a Performance Bond will be required in a like amount.

SC-6.03.C.6 Add the following immediately after Paragraph 6.03.C.5:

SC-6.03.C.6 Contractor shall furnish to Owner and each other additional insured identified in the Contract Documents, to whom evidence of insurance has been issued, evidence satisfactory to Owner and other such additional insured of continuation of such insurance at final payment and for a duration thereafter equal to the correction period required under Paragraph 15.08.

SC-6.03.D Add the following new Paragraph 6.03.D:

D. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation and Employer's Liability Insurance:
   a. State: Statutory

   b. Employer's Liability: In accordance with Table 00800-1 of these Supplementary Conditions.

c. *Terminology*: The following terms are not defined but when used in this Paragraph SC-6.03.D for workers' compensation insurance, and have the meanings indicated below:

1) Certificate of coverage: A copy of a certificate of insurance, a certificate of authority to self-insure, issued by the Texas Workers Compensation Commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-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. Contractor shall not execute TWCC Forms 83 or 85 or other form that precludes coverage under Contractor's policy if Contractor hires a Subcontractor or service provider without worker's compensation insurance.

2) Duration of the Project: Is the time from the Contractor's beginning work on the Project until the time Contractor's and Subcontractor's obligations under the Contract Documents are fully complete.

3) Contractor and Subcontractors (as indicated in Texas Labor Code §406.5096) includes all persons or entities performing all or part of the Work, regardless of whether that person or entity contracted directly with Contractor and regardless of whether that person or entity 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. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to the Project. "Services" does not include activities unrelated to the Project, such as food or beverage vendors, office supply deliveries, and delivery of portable toilets or portable sanitary facilities.

d. Comply with the following relative to Worker's Compensation and Employer's Liability insurance:

1) *Waiver of Subrogation Relative to Workers' Compensation Insurance*: The policy shall be endorsed to provide that insurer waives any right of subrogation that insurer may acquire against Owner, Engineer, Engineer's consultants, and others named in the Contract Documents as additional insured relative to Contractor's liability insurance, by reason of any payment made on account of injury, including death resulting therefrom, sustained by an employee of the insured.

2) If workers employed on the Work will be employed through a leasing company, furnish evidence of leasing company's State of Texas license and a copy of leasing company's Worker's Compensation policy insuring its employees (including sole proprietors, partners, supervisors, and executive officers) who perform work in the State of Texas.

3) Contractor shall furnish coverage, based on proper reporting of classification codes and payroll amounts and filing of coverage agreements, which meets the statutory requirements of Texas Labor Code §401.011(44) for all employees of Contractor performing the Work or services on the Project, for the duration of the Project.

4) Contractor shall furnish to Owner a certificate of coverage prior to being awarded the Contract.

5) If the coverage period shown on the Contractor's current certificate of coverage ends during the Contract Times, Contractor shall, prior to the end of the coverage period, furnish to Owner a new certificate of coverage indicating that coverage has been extended; furnish updated certificate of coverage throughout the duration of the Project.

6) *Subcontractors and Workers' Compensation and Employee Liability Insurance*:

   a) Contractor shall contractually require each Subcontractor to comply with the workers' compensation and employer's liability insurance requirements of the Contract Documents, to same extent such requirements are binding on Contractor.

   b) Obtain from each Subcontractor and furnish to Owner a certificate of coverage, prior to that Subcontractor beginning work on the Project. Not later than seven days after receipt by Contractor, furnish updated, valid certificate of coverage for each Subcontractor throughout the duration of the Project.

7) Retain Contractor's and Subcontractors' required certificates of coverage for the duration of the Project.

8) Contractor shall notify Owner in writing, in accordance with Paragraph 18.01, within 10 days after Contractor knew or should have known, of a change that materially affects the provision of coverage of any entity performing work or services on the Contract.

9) Post at the Site a notice, in the text, form, and manner prescribed by the Texas Workers' Compensation Commission, informing persons performing work or services on the Contract that they are required to be covered, and stating how a person may verify coverage and report lack of coverage. Such posted notice does not satisfy other posting requirements imposed by the Act or other commission rules in the State of Texas. Such notice shall be printed with a title in text that is not less than 30-point bold type, with and other text in not less than 19-point non-bold type, and shall be in English, Spanish, and other languages, if any, common to the workers at the Site. Text for the notices shall be as indicated by the Commission on the sample notice without changes.

10) By executing the Agreement or furnishing or causing to be furnished a certificate of coverage, Contractor represents to Owner that employees of Contractor and Subcontractors who will perform work or services on the Contract will be covered by workers' compensation coverage for the duration of the Project; that such coverage will be based on proper reporting of classification codes and payroll amounts; and that coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Furnishing false or misleading information may subject Contractor to

    administrative penalties of authorities having jurisdiction, criminal penalties, civil penalties of authorities having jurisdiction, and other civil actions.

11) Contractor's failure to comply with one or more workers' compensation insurance provisions is a breach of the Contract by Contractor, entitling Owner to terminate for cause in accordance with Paragraph 16.03, unless otherwise provided by Laws and Regulations.

12) If any provision of the Workers' Compensation and Employee Liability insurance requirements of the Contract Documents, or its application to any person or circumstance, is held invalid, the invalidity does not affect other provisions or applications of this rule that can be given effect without the invalid provision or application, and to this end the provisions of this rule are declared to be severable.

2. Contractor's General Liability under Paragraphs 6.03 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of Contractor. General Liability coverage shall be for not less than the limits indicated in Table 00800-1 of these Supplementary Conditions.

3. Automobile Liability under Paragraph 6.03 of the General Conditions: Shall be for not less than the limits indicated in Table 00800-1 of these Supplementary Conditions.

4. Umbrella Liability:

    a. Contractor shall purchase and maintain, until final payment by Owner, Umbrella Liability Insurance. Such insurance shall insure against all claims in excess of the limits provided under workers' compensation and employer's liability, general liability insurance, and automobile liability policies. The limits of umbrella liability shall be in accordance with Table 00800-1 of these Supplementary Conditions.

5. *Table of Minimum Liability Insurance Coverage Limits*: The limits of liability insurance shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations. The limits of coverage under Paragraph 6.03 vary with the Contract Price as indicated in Table 00800-1:

TABLE 00800-1				
LIMITS OF COVERAGE FOR ALL CONSTRUCTION PROJECTS	AUTOMOBILE (6.03) {Combined Single Limit} Per Accident	COMMERCIAL GENERAL LIABILITY (6.03) {Combined Single Limit} Per Project	WORKERS' COMPENSATION (6.03) {Employers' Liability} Per Accident Per Employee Per Disease	UMBRELLA (SC-6.03) {Combined Single Limit}
CONTRACT PRICE LESS THAN $100,000: Occurrence *General Aggregate Products/Completed Operations Aggregate	$300,000	$ 500,000 $ 500,000 $1,000,000	$ 500,000 $ 500,000 $ 500,000	Not applicable
CONTRACT PRICE EQUAL TO $100,000 OR GREATER AND LESS THAN $500,000: Occurrence *General Aggregate Products/Completed Operations Aggregate	$500,000	$ 500,000 $1,000,000 $1,000,000	$ 500,000 $ 500,000 $ 500,000	Not applicable
CONTRACT PRICE EQUAL TO OR GREATER THAN $500,000 AND UP TO AND INCLUDING $10,000,000: Occurrence *General Aggregate Products/Completed Operations Aggregate	$1,000,000	$1,000,000 $2,000,000 $2,000,000	$1,000,000 $1,000,000 $1,000,000	$2,000,000 $2,000,000
CONTRACT PRICE GREATER THAN $10,000,000: Occurrence *General Aggregate Products/Completed Operations Aggregate	$1,000,000	$1,000,000 $2,000,000 $2,000,000	$1,000,000 $1,000,000 $1,000.000	$5,000,000 $5,000,000

6.04 *Builder's Risk and Other Property Insurance*

NOTE TO SPECIFIER:

Edit property insurance requirements in SC-6.04, below, to suit the Project, as directed by the Owner. Engineer shall contact Owner's Risk Manager, Rebecca Ramirez, at (915) 496-8465, to discuss the Project and obtain from Owner requirements of additional coverages (if any), as indicated below. Complete the following as appropriate for the Project.

SC-6.04 Delete Paragraph 6.04 in its entirety and insert the following in its place:

SC-6.04 *Property Insurance*

A. Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of full replacement cost of the work. This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, Engineer, and other individuals or entities identified herein, and the officers, directors, members, partners, employees, agents and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured, additional insured, or loss payee as their interest may appear;

a. In addition to the individuals or entities specified above, include as additional insured, or loss payees as their interest may appear, the following:

1) None

2. be written on a Builder's Risk “all-risk” policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood);

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

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

5. allow for partial utilization of the Work by Owner.

6. include testing and start-up; and

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

B. Contractor shall purchase and maintain equipment breakdown insurance which will include the interests of Owner, Contractor, Subcontractors, Engineer, and other individuals or entities identified as additional insured or loss payees in this Paragraph SC-6.04, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured, additional insured, or loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph SC-6.04 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured or loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph SC-6.05.

D. The risk of loss within any deductible amount applicable to the policies of insurance purchased in accordance with this Paragraph SC-6.04 will be borne by Contractor, Subcontractors, or others suffering such loss.

E. Contractor shall purchase and maintain flood insurance upon the Work in the amount of the full replacement cost of the Work.

6.05 *Property Losses; Subrogation*

SC-6.05 Delete Paragraph 6.05 in its entirety and insert the following in its place:

SC-6.05 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph SC-6.04 will protect Owner, Contractor, Subcontractors, Engineer, and all other individuals or entities identified in Paragraph SC-6.04 to be listed as insureds or additional insured or loss payees (and the officers, directors, members, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of loss or damage the insurers will have no rights of recovery against any of the insureds or additional insured or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors,

Engineer, and all other individuals or entities identified in Paragraph SC-6.04 to be listed as insureds or additional insureds or loss payees (and the officers, directors, members, partners, employees, agents and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, Engineer, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire and other perils whether or not insured by Owner, and.

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03 or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage, or consequential loss referred to in Paragraph SC-6.05.B shall contain provisions to the effect that in the event of payment of any such loss, damage or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, Engineer, and the officers, directors, members, partners, employees, agents and other consultants and subcontractors of each and any of them.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be Monday through Friday, 7 a.m. to 5 p.m.
2. Owner's legal holidays are as recognized by the City of El Paso.

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as any hours over 40 hours per week and / or any hours worked on legal holiday. For these occasions a multiplier of 1.5 shall be applied to an hourly rate of $142.00/hr.

SC-7.03.E Add the following new paragraph immediately after paragraph 7.03.D:

SC-7.03.E for work financed in whole or in part by loans or grants from, or loans insured or guaranteed by, the United States or any agency or instrumentality thereof under any statute of the United States providing wage standards for such work, the provisions of the Contract Documents are subject to the applicable provisions of the Contract Work Hours and Safety Standards Act, 40 U.S.C.A. §327 et seq. Contractor and Subcontractor shall not require or allow any laborer or mechanic to be employed on the Work in excess of forty hours in any work week unless such laborer or mechanic receives compensation at a rate not less than one-and-one-half times his or her basis rate of pay for hours worked in excess of forty hours in such work week. Except as may be otherwise required by law, all claims pertaining to the classification of labor employed on the project shall be decided by Owner's governing body or other duly designated official.

7.07 *Concerning Subcontractors and Suppliers*

SC 7.07.N Add the following new paragraphs immediately after Paragraph 7.07.M:

SC-7.07.N Contractor shall perform, with his organization and with the assistance of workers under Contractor's immediate superintendence, not less than 40 percent of the Contract Price, exclusive of Work not commonly found in contracts for similar construction which require specialized knowledge, craftsmanship, or equipment not ordinarily available in the organizations of contractors performing construction similar in nature to the Work. The value of the Work, exclusive of said items, will be interpreted as the value of labor, equipment, superintendence, and only those portions of materials and equipment incorporated into the Work that are related to the Contract's direct labor requirements.

7.09 *Permits*

SC-7.09.B Add the following new paragraph immediately after Paragraph 7.09.A:

SC-7.09.B TPDES Permit and Related Permits and Requirements

1. The 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 stormwater pollution prevention measures throughout the construction period.

2. Contractor's responsibilities are as follows:

    a. Prepare a Storm Water Pollution Prevention Plan (SWPPP) in compliance with Laws and Regulations.

    b. Obtain a signed certification statement from all Subcontractors responsible for implementing erosion and sedimentation controls and other best management practices for the Site that are part of the SWPPP. Such statement shall indicate that the Subcontractor understands the permit requirements. The certified statement forms shall be attached to and become part of the SWPPP.

    c. Fill out the TCEQ's "Construction Site Notice" form, which is Attachment 2 to the TPDES General Permit TXR150000 (form available from Owner or on the Internet at http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr152d2.pdf ,and post it near the main entrance of the Site, or at multiple postings if the Work is linear. Submit a copy of the completed Construction Site Notice form to Owner and Engineer.

d. Maintain erosion/sedimentation controls and other protective measures identified in the SWPPP in effective operating condition.

e. Perform inspections every 14 days and after every half-inch of rainfall, 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 stormwater, erosion, sedimentation controls that are in need of maintenance or repair.

3) Locations of stormwater, erosion, sedimentation controls that are not performing, failing to operate, or are inadequate.

4) Locations where additional stormwater, erosion, sedimentation controls are needed.

f. Continuously maintain at the Site a copy of the SWPPP (with updates, as described below) and inspection reports.

g. Update the SWPPP as necessary to comply with TPDES permitting requirements, which includes noting changes in erosion, and 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.

h. Upon Substantial Completion or establishment of permanent cover over disturbed soil areas (if such cover is established after Substantial Completion), submit TPDES records to Owner.

7.10 *Taxes*

SC-7.10.B Add the following new paragraph immediately after Paragraph 7.10.A:

SC-7.10.B Exemption from State of Texas sales tax may be obtained on materials and equipment incorporated into the Work and supplies required to perform the Work. Owner is an organization which qualifies for such exemption pursuant to provisions of Article 20.04(F) of the Texas Limited Sales, Excise and Use Tax Act. In accordance with Texas House Bill 11, Contractor may purchase, materials, equipment, and supplies consumed in the performance of the Work by issuing to Suppliers an exemption certificate in lieu of the tax, said exemption certificate complying with State of Texas Comptroller's Ruling No. 95-0.07. Such exemption certificate(s) issued by Contractor in lieu of the sales will be subject to the provisions of the State of Texas Comptroller's Ruling No. 95-0.09 as amended to be effective October 2, 1968. Exemption certificate may be obtained from Owner's Purchasing Agent.

7.11 *Laws and Regulations*

SC-7.11.C Remove last sentence on Paragraph 7.11.C. "If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim in its entirety."

SC-7.11.D Add the following new paragraph immediately after Paragraph 7.11.C:

SC-7.11.D *Minimum Prevailing Wage Rates*

1. Wage rates paid to workers employed in performing the Work at the Site, including Contractor and Subcontractor employees, shall not be less than the following:

   a. Minimum prevailing wage rates of the City of El Paso, Texas. The prevailing minimum wage rate determination, comprised of 13 pages, applicable to the Project is part of the Contract Documents.

   b. Federal Davis-Bacon minimum prevailing wage rates, comprised of 13 *****pages, which is part of the Contract Documents. Comply with 40 USC 31 and 29 CFR Parts 1, 3, and 5. (*****See El Paso Wage Rates)

   When a labor classification is included in both the City of El Paso and federal minimum prevailing wage rate determinations, Contractor shall pay the higher of the two minimum prevailing wage rates for that labor classification. Contractor shall be aware of changes in the minimum prevailing wage rates applicable to the Work and shall pay the minimum prevailing wages at no additional cost to Owner. Contractor shall post the schedule of classifications and wage rates at conspicuous locations at the Site. Such schedule shall also show deductions, if any, required by law to be made from wages earned by laborers and mechanics engaged on the Work.

2. Contractor shall give preference to hiring qualified local residents for work as laborers and mechanics on the Project. Employees shall be bona-fide residents of the United States of America.

3. Contractor and Subcontractors shall pay each of their employees, engaged in the Work in full, not less often than once per week, and without deductions or subsequent rebates on any account, except for deductions mandated by law.

4. Contractor, and Subcontractors shall keep a complete payroll record indicating the name, address, and Social Security number of each employee engaged in the Work, together with the classification of work in which the employee is engaged, the hourly wage rate paid, number of deductions made from such wages and total amount paid to the employee. Submit to Owner one copy of each such payroll record, for the period for

which payment is requested, with each Application for Payment. Each payroll record shall bear the affidavit of the employer certifying, under oath, that such payroll is a true, complete, and accurate report of the wages earned and paid to each employee engaged in the Work, that no deductions from any wages due each employee, except as set out on the payroll, have been directly or indirectly made, and that no rebates, either direct or indirect, have been nor will be required of an employee.

5. Certified payroll reports shall indicate for each worker whether the labor performed was performed under the Building, Heavy, Highway, or Water and Sewer Line Prevailing Wage Rate scale. Certified payroll reports shall be submitted for the complete Contract period and, for weeks where no Work was performed, negative reports shall be submitted, marked "No Work Performed". Clearly mark "FIRST PAYROLL" on the first payroll submitted, and clearly mark "FINAL PAYROLL" on the last payroll submitted for the Contract.

6. Apprentices will be work only under a bona fide apprenticeship program registered with the U.S. Department of Labor. A copy of such program shall be submitted to Owner, together with current certification or evidence of registration with the U.S. Department of Labor, Bureau of Apprenticeship and Training, for each apprentice engaged in the Work.

7. Contractor shall, when requested by Owner, submit additional certification and documentation (such as copy of cancelled check or an Employee Restitution Receipt Form) indicating that employee has received back compensation due.

8. Contractor and Subcontractors in violation of this provision are subject to a penalty of $60 per day for each worker that is paid less than the rate specified in the Project's applicable prevailing wage rates.

APPLICATION OF DESIGNATED WAGE RATES:

On January 12, 2022, El Paso El Paso water Utilities-Public Service Board adopted new Prevailing Wage Rates for Building construction. These rates supersede any previous wage rates for building construction adopted by City Council. The City has adopted Davis-Bacon Wage Rates for all other construction.

Highway Construction	Site preparation, grading, fencing, and highway construction
Heavy Construction	Construction other than road work or water and sewer line installation; i.e., plant facilities, process equipment, pump stations, lift stations, electrical work, etc.
Water/Sewer Line Construction	Installation of water and sewer lines to within five (5) feet of any building
Building Construction	Construction within an envelope of five feet from a building

Source of Wage Rates for Contract::

<u>BUILDING</u>	<u>HEAVY, HIGHWAY, & WATER/SEWER</u>
Building Wage Rate Determination Adopted by EPWater-PSB 1/12/22	
Most Current Davis-Bacon Building Wage Scale	Most Current Davis-Bacon Wage Scale for El Paso County

SC-7.11.E Add the following new paragraph immediately after Paragraph 7.11.D:

SC-7.11.E *Mandatory for Building Projects with Contract Price Over $100,000 – Apprentices*

1. In accordance with resolution adopted on November 9, 1999 by the El Paso City Council regarding apprenticeship programs on City projects, Contractor and Subcontractors shall:

   a. Sponsor or participate in a U.S. Department of Labor (DOL) certified apprenticeship program for all job classifications utilized on the Project which are apprenticeable occupations as defined by DOL regulations and which appear on the "schedule of categories of apprentices" kept on file in the office of the City of El Paso's Capital Improvement Department;

   b. Pay wage rates and benefits in accordance with the applicable apprenticeship program;

   c. Comply with the DOL requirements for ratio of apprentices to journeymen;

   d. Hire registered apprentices enrolled in a DOL-certified apprenticeship program in all job classifications utilized on the Project which are apprenticeable occupations as defined by DOL regulations and which are designated for City projects on the "schedule of categories of apprentices" kept on file in the office of the City of El Paso Director of Capital Improvement Department. Helpers, unregistered apprentices, and other substitutes shall not perform apprentice-level work in place of registered apprentices.

2. Contractor shall post the applicable prevailing wage rate schedules at the Site in a prominent location readily accessible to the workers throughout the Project. Contractor shall post a notice to be provided by the City of El Paso Director of Capital Improvement Department regarding prevailing wage rates and the City of El Paso's apprenticeship program, in English and in Spanish, which shall be posted at the Site with the prevailing wage rates.

3. Contractor shall submit to Owner the names of all apprentices employed on the Work; verification of their status as registered apprentices; documentation regarding apprentice's proper wage rates; and documentation regarding journeyman-to-apprentice ratios for each trade as determined by the apprenticeship program.

4. No worker shall be discharged by Contractor or Subcontractor, or in any other manner be discriminated against, because such worker has filed an inquiry or complaint, instituted legal or equitable proceeding, or has

testified or is about to testify in such proceeding under, or relating to, the apprenticeship program.

5. Contractor and Subcontractors shall allow immediate entry into all areas of the Site by Owner or Owner's agents and representatives displaying or presenting proper identification to Contractor's Site superintendent or their representative. Owner or their representative may visit the Site to determine adherence to these requirements, Contractor and Subcontractors shall allow access to personnel and apprenticeship program books and records and access to employees to be interviewed at random, at any time and for any reasonable duration to determine compliance with these provisions, including the apprenticeship programs.

6. Owner reserves the right to terminate for cause in accordance with Paragraph 16.02 if Contractor or Subcontractor breaches any of provisions of the Contract Documents regarding apprenticeship programs.

7. Apprentices shall be allowed to work at less than the predetermined rate for the work they performed when apprentice(s) are employed pursuant to, and individually-registered in, a bona-fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration Bureau; or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program but who has been certified by the Bureau of Apprenticeship & Training, or a state apprenticeship agency where appropriate, to be eligible for probationary employment as an apprentice.

8. The allowable ratio of apprentices to journeymen on the Work in any craft classification shall not be greater than the ratio permitted to the Contractor or Subcontractor as to the entire work force under the registered program. Any apprentice performing the Work in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the City Wage Scale for the work actually performed.

9. Contractor shall submit to Owner's Contract Administrator with sufficient information, which demonstrates that apprentices are employed pursuant to, and individually registered in, a bona-fide apprenticeship program. A copy of such program shall be submitted to Owner as well as the current certification for each individual assigned to the Work and appearing on the payrolls for that Contract. Every apprentice must be paid at not less than the rates specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the City wage determination. Workers not registered in a bona-fide apprenticeship program shall be paid not less than the applicable wage rate in the City Wage Scale for the classification of work actually performed. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the program does not specify fringe benefits, they must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Bureau of Apprenticeship & Training determines that a different practice

prevails for the applicable apprentice classification, fringe benefits shall be paid in accordance with that determination.

10. If the Bureau of Apprenticeship & Training or a state apprenticeship agency recognized by the Bureau, withdraws approval of a program, Contractor shall not employ apprentices at less than the applicable City rate for the work performed until an acceptable program is approved and evidence provided.

7.13 *Safety and Protection*

SC-7.13.B.1 Add following new subparagraph immediately after Paragraph 7.13.B:

SC-7.13.B.1 Contractor's safety representative shall be identified in submittal to Owner and Engineer for acceptance prior to commencement of Work at the Site. Name and qualifications of proposed substitute, if any, shall be submitted to Owner for acceptance.

SC-7.13.G Replace the word "safety program" with "Health and Safety Plan."

SC-7-13.H Replace the word "safety program" with "Health and Safety Plan."

SC-7.13.K Add the following new subparagraphs immediately after Paragraph 6.13.J:

SC-7.13.K Within twenty-four hours of receiving a request from Owner, Contractor shall furnish to Owner documentation substantiating representations made in the Health and Safety Plan including, but not limited to, that each of the Contractor's employees has received training on the Health and Safety Plan as well as any other training necessary to competently effectuate the Health and Safety Plan. Select Contractor project management staff shall complete the El Paso Water Online Contractor Orientation, (Course 19ELPWC) available at www.hasc.com, before start of construction.

SC-7.13.L Owner maintains a drug and alcohol-free workplace in accordance with the Drug-free Workplace Act of 1988. Contractor shall publicize a statement notifying employees on the Work that the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited in the workplace, including at the Site.

SC-7.13.M Owner maintains specific rules regarding smoking on Owner's properties. Contractor shall adhere to such rules at the Site.

SC-7.13.N Owner maintains specific rules regarding firearms and Contractor shall adhere to such rules at the Site.

SC-7.13.O Owner maintains specific rules regarding traffic safety on Owner's properties. Contractor shall adhere to such rules at the Site.

7.16 *Submittals*

SC-7.16.G Add the following new paragraphs immediately after Paragraph 7.16.F:

SC-7.16.G For each Contractor submittal required under the Contract Documents, Engineer will review one initial submittal and one resubmittal at no cost to Contractor. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, Samples, or other submittals requiring approval or acceptance, and Contractor shall reimburse Owner for Engineer's charges for labor and expenses for such time.

SC-7.16.H In the event that Contractor requests a change of a previously approved or previously accepted submittal, Contractor shall reimburse Owner for Engineer's charges for Engineer's review time unless the need for such change is beyond Contractor's control.

ARTICLE 9 - OWNER'S RESPONSIBILITIES

9.11 *Evidence of Financial Arrangements*

SC-9.11 Delete Paragraph 9.11 in its entirety and insert the following in its place:

SC-9.11 Not used

9.13 *Owner's Site Representative – Not Used*

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Add a new paragraph immediately after Paragraph 10.03.B that is to read as follows:

SC-10.03.C Resident Project Representative (RPR) will be Owner's and/or Engineer's employee or agent at the Site, will act as directed by and under the supervision of Owner and/or Engineer, and will confer with Owner and/or Engineer regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with Owner and/or Engineer and Contractor keeping Owner advised as necessary. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner with the knowledge of and under the direction of Engineer.

1. Duties and Responsibilities to RPR:

a. Schedules: Review the Progress Schedule, Schedule of Submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

b. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.

c. *Safety Compliance*: Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

d. Liaison:

1) Serve as Engineer's liaison with Contractor, working principally through Contractor's superintendent, and assist in providing understanding of the intent of the Contract Documents.

2) Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

3) Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

e. Shop Drawings and Samples:

1) Record date of receipt of Shop Drawings and Samples that are received at the Site.

2) Receive Samples that are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

3) Advise Engineer and Contractor of the commencement of any Work requiring a Shop Drawing or Sample if the submittal has not been approved by Engineer.

f. Review of Work, Rejection of Defective Work, Inspections, and Tests:

1) Conduct observations of the Work in progress on the Site to assist Engineer in determining if the Work is, in general, proceeding in accordance with the Contract Documents.

2) Report to Engineer when RPR believes that any Work is unsatisfactory, faulty, or defective or does not conform generally to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test, or approval required to be made; and advise Engineer of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection, or approval.

3) Verify that tests, equipment, and systems startups, and operating and maintenance training are conducted in the presence of appropriate Owner's personnel and that Contractor maintains adequate records thereof; and observe, record, and report to Engineer appropriate details relative to the test procedures and startups.

4) Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

5) Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to Engineer.

g. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

h. Modifications: Consider and evaluate Contractor's suggestions for modifications to Drawings or Specifications and report with RPR's recommendations to Engineer. Transmit to Contractor decisions issued by Engineer.

i. Records:

1) Maintain at the Site orderly files for correspondence, reports of job conferences, Shop Drawings and Samples, and reproductions of original Contract Documents including all Addenda, Change Orders, Field Orders, work change directives, additional Drawings issued subsequent to the execution of the Agreement, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project-related documents.

2) Keep a record recording Contractor's hours on the Site, weather conditions, data relative to questions on Change Orders or changed conditions, list of visitors to the Site, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

3) Record names, addresses, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

4) The RPR shall prepare a daily report or keep a daily diary that records weather conditions, the contractor's daily work activities, and specific observations. The RPR shall regularly photograph the work. The RPR shall maintain orderly files of correspondence, reports of job conferences, change orders, field orders, work change directives, daily reports and/or diaries, photographs and other similar documents. These documents shall be filed in Consultant's project record file. They shall be made available to Owner upon receipt of request from Owner and, if available, uploaded to cloud-based construction management software applications (or any other construction management software applications made available).

j. Reports:

1) Furnish Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and Schedule of Submittals.

2) Consult with Engineer in advance of scheduled major tests, inspections, or start of important phases of the Work.

3) Prepare draft of proposed Change Orders, obtaining backup documents from Contractor, and provide recommendations to Engineer regarding Change Orders and Field Orders.

4) Report immediately to Engineer and Owner upon the occurrence of any Site accident, any Hazardous Environmental Condition, emergencies, or acts of God endangering the Work, or property damage by fire or other cause.

k. Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedure for their submission, and submit recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

l. Certificates, Maintenance and Operation Manuals: During the course of the Work, verify that certificates, maintenance and operation manuals, and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Engineer for review and forwarding to Owner prior to final payment for the Work.

m. Completion:

1) Before Engineer issues a certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

2) Observe whether Contractor has arranged for inspections required by Laws and Regulations, including but not limited to those to be performed by public authorities having jurisdiction over the Work.

3) Conduct final inspection in the company of Engineer, Owner, and Contractor, and prepare a final list of items to be completed or corrected.

4) Observe that all items on final list have been completed or corrected and make recommendations to Engineer concerning acceptance of the Work.

2. The RPR shall not:

a. Authorize any deviation from the Contract Documents or substitution of materials or equipment, including "or equal" items.

b. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

c. Undertake any of the responsibilities of Contractor, Subcontractors, or Contractor's superintendent.

d. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction, unless such advice or directions are specifically required by the Contract Documents.

e. Advise on, issue directions regarding, or assume control over safety precautions and programs in connection with the Work.

f. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

g. Authorize Owner to occupy the Project in whole or in part.

h. Authorize the use of any Unmanned Aircraft System (UAS or drone) without prior consent and authorization from Owner.

i. Participate in specialized field or laboratory tests, or inspections conducted by others except as specifically authorized by Engineer.

ARTICLE 11 - CHANGES TO THE CONTRACT

11.02 *Change Orders*

SC-11.02.C Add the following new paragraph immediately after Paragraph 11.02.B:

SC-11.02.C Change Order requests shall be accompanied by Contractor's time impact analysis for the Change Order request to be reviewed.

11.03 *Work Change Directives*

SC-11.03.A.1 Add the following new subparagraphs immediately after Paragraph 11.03.A:

SC-11.03.A.1 Without invalidating the Contract, OWNER may, by written Work Change Directive, using the Cost of the Work method, 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 being adjusted as necessary. "Cost of the Work" means a basis of payment for the direct performance of Work with payment based on the actual cost of the labor, equipment and materials furnished and consideration for overhead and profit as set forth in Section 13.01, below. A Work Change Directive shall be used in the absence of complete and prompt agreement on the terms of a Change Order. Where practicable, any items of Work that may be agreed upon, prior to the performance of Work under this Section, will be included in a separate Change Order.

SC-11.03.A.2 If the Work Change Directive provides for an adjustment to the Contract Amount, the adjustment shall be based on the method provided in paragraph 13.01. The estimated value of the work issued under each individual Work Change Directive shall not exceed five (5) percent of the original contract price.

SC-11.03.A.3 A Work Change Directive shall be effective immediately and shall be recorded later by preparation and execution of an appropriate Change Order.

SC-11.03.A.4 Upon receipt of a Work 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 the Work for OWNER'S approval. Upon such approval, CONTRACTOR must promptly commence and make continuous progress in the Work. The OWNER reserves the right to withhold payment for low production or lack of progress.

11.07 *Change of Contract Price*

SC-11.07.C.2.c Delete 27 percent and replace with 25 percent.

SC-11.11 Add the following new paragraph immediately after Paragraph 11.10:

SC-11.11 Liquidated Damages:

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

B. Liquidated Damages Relative to Substantial Completion and Readiness for Final Payment: Owner and Contractor recognize that time is of the essence as stated in Paragraph SC-11.11.A above and that Owner will suffer financial loss if the Work is not completed within the Contract Times for Substantial Completion, completion and readiness for final payment, and Milestones (if any) specified in the Contract Documents, plus any changes thereof allowed in accordance with Article 11 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration preceding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $2,000 for each day that expires after the time specified in the Contract Documents for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $1,160 for each day that expires after the time specified in the Contract Documents for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 12 - CLAIMS

SC-12.01.B Add the following immediately after Paragraph 12.01.B:

SC-12.01.B.1 In the event a delay Claim arises due to Standby Equipment Costs, Contractor must notify, through an RFI, Engineer and Owner no later than 72-hours in advance of such claim at which time Contractor, Engineer and Owner will evaluate the progress of the Work and determine if no other Work can be performed. Once that determination has been made, official response from Engineer and Owner acknowledging the delay at which point the Standby time will commence.

ARTICLE 13 - COST OF WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 In Paragraph SC-13.01.A, delete the last sentence and replace with:

The provisions of this Paragraph 13.01 are used for three distinct purposes:

SC-13.01 Add the following new paragraph immediately after Paragraph 13.01.A.2:

SC-13.01.A.3 If neither of the methods defined in paragraphs 13.01.A.1 nor 13.01.A.2 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 Work Change Directive, using the Cost of the Work method, and payment will be made as described below:

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of Rental Rate Blue Book. Equipment or machinery with a value of less than $1,000 will be considered small tools.

SC-13.01 Add the following new subparagraphs immediately after Paragraph 13.01.B.5.i:

SC-13.01.B.5.j Standby Equipment Costs: Standby equipment time will not exceed 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 Payment for standby equipment will be made in accordance with 13.01.B.5.c except that:

SC-13.01.B.5.j.(1) Contractor-Owned Equipment. For Contractor-owned machinery, trucks, power tools, or other equipment, Standby will be paid at 50% (to account for the removal of operating costs) of the rate established under 13.01.B.5.c.(2). Standby costs will not be allowed during periods when the equipment would have otherwise been idle.

SC-13.01.B.5.j.(2) Equipment Not Owned by the Contractor. For equipment rented from a third party not owned by the Contractor, Standby will be paid at the invoice daily rental rate, excluding operating cost, which includes fuel, lubricants, repairs, and servicing.

The Owner reserves the right to limit the daily standby rate to comparable rates established under 13.01.B.5.c.(2). Standby will be paid for equipment operators when included on the invoice and equipment operators are actually on standby. Standby costs will not be allowed during periods when the equipment would have otherwise been idle.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $1,000.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

   a. the extended price of a particular item of Unit Price Work amounts to 10 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent from the estimated quantity of such item indicated in the Agreement; and

   b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

SC-14.02 Add the following new subparagraphs to Paragraph 14.02.B:

1. Re-Inspection Fees

   a. Pay fees to the Owner to compensate the Owner's Representative as identified in Article 10 of the General Conditions for reinspection of the Work required by the failure of the Work to comply with the claims of status of completion made by the Contractor.

b. Owner may withhold the amount of these fees from the Contractor's final payment as stipulated in Article 15 of the General Conditions.

c. Cost for additional inspections will be billed to the Owner by the Owner's Representative for the actual hours required for the reinspection and preparation of related reports in accordance with the rates provided in the Supplemental Conditions SC-7.03.

2. Fees for Inspections Outside Normal Working Hours

a. If some or all of the Work has been determined to be required to be performed outside the normal working hours and or beyond the standard 40-hour work week as defined by Article 7 of the General Conditions, the Contractor is required to:

1) Notify the Owner in advance of their intent to work outside regular working hours or working days;

2) Determine if the work to be performed will require observation by the Owner's Representative or other agencies prior to covering the Work;

b. Pay fees to the Owner to compensate the Owner's Representative as identified in Article 10 of the General Conditions for inspection of the Work performed outside normal working hours;

c. Owner may withhold the amount of these fees from the Contractor's final payment as stipulated in Article 15 of the General Conditions.

d. Cost for inspections will be billed to the Owner by the Owner's Representative for the actual hours required for the inspection and or observation of the work and preparation of related reports in accordance with the rates provided in the Supplemental Conditions SC-7.03.

ARTICLE 15 - PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

SC-15.01.D.1 Thirty days after presentation of the Application for Payment to Owner by Contractor with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 15.01.E) become due, and when due will be paid by Owner to Contractor.

SC-15.01.D.1.(a) The thirty days' time will commence immediately after Owner acknowledges receipt of the Application for Payment from Contractor.

SC-15.01.D.1.(b) If upon review of the Application for Payment the Owner encounters any error (including, but not limited to, clerical, grammatical, informational, etc…) or lacks documentation as required by the Contract Documents, the Application for Payment will be deemed incomplete and the Owner will reject the Application for

Payment. The Owner will immediately notify the Contractor and Engineer the reason for the rejection of the Application for Payment. The thirty days' time allotted will reset and recommence once a corrected Application for Payment is received by Owner from Contractor.

SC-15.01.F Add the following new Paragraph 15.01.F:

SC-15.01.F For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06 *Final Payment*

SC-15.06.B Delete the first sentence and replace with the following:

If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing **to Owner** Engineer's recommendation of final payment and **inform Contractor Final Payment Application is ready to be submitted to Owner for payment**.

SC-15.06.E Delete Paragraph 15.06.E in its entirety and replace with the following:

E. Final Payment Becomes Due: Upon receipt from **Contractor of an approvable Application for Final Payment** and accompanying documentation, Owner shall set-off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including, but not limited to, set-offs for liquidated

damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Contractor. An approvable application for final payment shall include Contractor and Subcontractor payrolls for the period covered in the final Application for Payment; an update of progress against the accepted Progress Schedule; and such other items as the Engineer may reasonably require.

15.08 *Correction Period*

SC-15.08 Add the following new Paragraph 15.08.G:

G. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be one (1) year after Substantial Completion.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

16.02 *Owner May Terminate for Cause*

SC-16.02.A.5 Add the following new paragraphs immediately after Paragraph 16.02.A.4:

SC-16.02.A.5 If the Contract or any part thereof is sublet or assigned to another party by Contractor, without the written consent of Owner and surety that issued the performance bond and payment bond.

ARTICLE 17 - FINAL RESOLUTIONS OF DISPUTES

SC-17.02 Add the following new paragraphs immediately after Paragraph 17.01:

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a

reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without

the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02:

17.03 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18 - MISCELLANEOUS

SC-18.11 Add the following new paragraph immediately after Paragraph 18.10:

SC-18.11 *Use of Unmanned Aerial/Aircraft Systems (UAS)*

A. The use of an UAS on all Owner property is strictly prohibited unless the following are met:

1. The proposed flight is solely for purposes of Utility operations
2. Authorization has been received from Owner to operate on or above Owner property
3. All of the necessary federal, state, and local approvals have been acquired
4. Compliance with federal, state, and local laws are met
5. The Contractor has filed a flight plan with AirMap or any other Owner-approved Unmanned Aircraft System Traffic Management (UTM) ecosystem for uncontrolled operations that is separate from, but complementary to, the FAA's Air Traffic Management (ATM) system prior to flight operations
6. The proposed flight does not photograph, video, or monitor in any way areas where members of the general public would have a reasonable expectation of privacy

B. Any person or vendor, including but not limited to third parties seeking to operate a UAS on or above Owner property or at an Owner-sponsored

event must submit a completed UAS (Drone) Use Approval Form to the Owner at least 10 business days in advance.

C. The applicable Owner Representative (PM) who is an employee of the Owner will process the request for UAS use. After review and assessment of the request, the requestor will be notified of a decision or receive a request of additional information within five (5) business days.

1. If approved, the PM will email a copy of the approved form to the Owner's Utility Security and Emergency Response (USER) Coordinator.

D. The USER Coordinator will advise El Paso Police Department (EPPD) and Airport Operations (if the UAS will be near or entering restricted flight space) of UAS activity for situational awareness.

1. If approved, a copy of the UAS Approval Form must be in possession by the pilot in command at all times during flight activity and must be presented to any EPWater official or representative with control or jurisdiction over the activity, upon request.

E. The USER Coordinator will maintain a copy of the UAS (Drone) Use Approval Forms.

F. Exceptions and Deviations

1. Contractors will be limited to the collection, use, retention, or dissemination of images and videos of Owner's critical infrastructure acquired by UAS.

2. The Owner's Utility Chief Operations Officer may waive the 10-business day notification requirement as deemed necessary.

3. UAS operators must only conduct approved flights under favorable conditions. If unforeseen circumstances develop (e.g. adverse weather) under which operations cannot be conducted in a safe manner, the operation must postpone the flight and request an extension from the Project Manager within 3 business days of the original date. If the extension is not requested within three (3) business days, a new UAS Approval Form must then be completed and submitted.

4. The use of UAS for hobby or recreational use on all EPWater property is always strictly prohibited. Using a UAS to take photographs or videos for personal use is considered recreational use and is prohibited.

SC-18.12 Add the following new paragraph immediately after Paragraph 18.10:

SC-18.12 *Working Near Utilities*

A. *Construction Adjacent to High Voltage Electric Lines:*

1. Contractor shall comply with Laws and Regulations, including U.S. Occupational Safety and Health Administration (OSHA) safety standards regarding construction adjacent to high-voltage electric lines and facilities, including trenching, crane operations, final grading, and other associated work which may result in impaired clearance to an existing electrical line or facility.

2. It is a violation of OSHA regulations to operate equipment in a manner that results in persons or equipment coming within ten feet of an energized electric line. Such Laws and Regulations are enforced by OSHA, and violators are subject to penalties imposed under federal Law.

3. Texas Law prohibits function or activity where it is possible for the person performing such activity to come within six feet of an overhead power line.

4. Contractor shall notify the El Paso Electric Company in writing of Contractor's anticipated dates and times when such work is scheduled. Written notification of El Paso Electric Company shall be at least six working days prior to each scheduled activity near El Paso Electric Company power lines and facilities, so that El Paso Electric Company personnel can coordinate with Contractor to provide proper clearance of energized electric lines. No other type of notice will be acceptable and work shall not be initiated until proper clearance and arrangements are confirmed by Contractor with the El Paso Electric Company.

5. Submit written notification to:

   Raul Guel, Distribution Engineering Design
   El Paso Electric Company
   P. O. Box 982
   El Paso, Texas 79960
   (915) 543-4015

6. Simultaneously submit one copy of the notification letter to Owner's Contracts Development Manager and retain copy in Contractor's file.

7. Below are selected El Paso Electric Company phone numbers:

Claims Director	(915) 543-4158
Trouble & Emergencies	(915) 543-5720
Field Services/Power Consultants	(915) 543-2255
Cable Locator	(915) 543-4051

B. Construction Adjacent to Gas Lines: Contractor shall comply with the One-Call Notification and System Protection Program developed by Southern Union Gas Company, and with State Damage Prevention Law, HB 2295:

☐ Contact Texas Gas Co. not less than two working days before commencing excavation activities

☐ Determine exact location of all underground utilities by safe and acceptable means

☐ Employ the two-foot safety rule

☐ Utilize "Professional Excavator's Manual" as revised

SC-18.13 Add the following new paragraph immediately after Paragraph 18.12:

SC-18.13 *EPCWID #1 Dewatering Permit Requirements*

A. A license agreement for "Discharge of Foreign Waters into District Drain Ditches" is required between Owner and the El Paso County Water Improvement District (EPCWID) #1 before Contractor may begin dewatering operations. Contractor shall be a co-licensee with Owner. Terms and conditions of the license agreement are applicable to Contractor, who will function, relative to the license EPCWID #1 agreement only, as an agent of Owner, by preparing an approvable plan and carrying out the terms of the plan and the EPCWID #1 license agreement. Contractor shall, to the extent permitted by law, defend and hold harmless Owner, its employees, insurers and agents; and the Engineer and Engineer's consultants, and their employees, officers, insurers, and agents from claims arising out of damages caused by actions, or inactions, of Contractor or as a result of EPCWID's exercise of any or all options given it under the license agreement.

B. Contractor shall prepare and submit to Engineer a "Dewatering Plan", a "Final Schedule for Dewatering", and an estimate of fees due EPCWID #1. Submit "Dewatering Plan" within 15 days of the date that the Contract Times commence running. "Dewatering Plan" shall include the estimated quantities of dewatering for each month of the Contract, the design capacity and number of pumps to be used by Contractor, and the point(s) of dewatering pump discharge. Engineer will review for acceptability the "Dewatering Plan" and, when the submittal is acceptable to Engineer, Engineer will forward it, through Owner, to EPCWID #1. Prepare and submit the submittal and schedule the Work so that Owner receives the "Dewatering Plan" submittal not less than 14 days before the start of dewatering operations at the Site. Owner will pay the fees as estimated in the "Dewatering Plan".

C. Estimate the dewatering fees on the following basis:

1. Drain maintenance fee of $1,000 for each six months a discharge occurs. Fee for maintenance is non-refundable. Subsequent semi-annual fee payments are payable to Owner by Contractor in advance of each respective six-month period.

2. Dewatering fee at the rate of $150 per acre-foot of water discharged. For a month in which the discharge exceeds the amount estimated under the "Dewatering Plan", Contractor shall advise Owner and Engineer in writing, that such excess fees may be due so that the Owner may consider its liability for, and take action to make payment of, such excess fees to EPCWID #1. Owner will pay such excess fees only to the extent that such fees are incurred through no fault of Contractor.

D. Samples of the discharge water shall be tested by a qualified testing laboratory hired by Contractor. Submit to Engineer results of total dissolved solids (TDS) tests, which Engineer will transmit to EPCWID #1. Submit to Engineer and Owner monthly reports of discharge quantities and quality (TDS and sulfates), which specific requirements may be more particularly indicated in the Specifications and in the associated discharge permit; Engineer will transmit monthly reports to EPCWID #1.

E. Contractor will not be eligible for final payment by Owner until final dewatering fees based upon actual quantities and damages (if any) due EPCWID # 1 have been paid and payment due from Contractor has been made. A "Final Release" from EPCWID # 1 shall be received by Owner as a condition precedent to Contractor applies for final payment.

SC-18.14 Add the following new paragraph(s) immediately after Paragraph 18.12:

SC-18.14 *Railroads*

A. *Union Pacific Railroad Company Contractor's Right of Entry*: Contractor shall acquire and pay all associated expenses (including railroad company inspection fees), Contractor's right-of-entry from, the Union Pacific Railroad Company. Refer to Union Pacific Railroad's "Contractor's Right of Entry" form and its exhibits, included in the Project Manual following these Supplementary Conditions. Right-of-entry requirements are interrelated with the railroad liability insurance requirements, and both are Contractor's cost responsibility. Contractor shall acquire railroad company's authorization prior to commencing work in the railroad right-of-way. Submit to Owner and Engineer executed copies of Contractor's "Right of Entry" form prior to commencing work on railroad property.

B. *Railroad Liability Insurance*: Contractor shall obtain Railroad Liability Insurance in the form and amount required by the Union Pacific Railroad Company. Such insurance shall be in effect and cover all necessary work and operations required of Contractor within the railroad right-of-way.

Refer to the railroad's "Contractor's Right of Entry" form and its exhibits. Insurance requirements of this paragraph are interrelated with the right-of-entry requirements in Paragraph SC-18.14.A and is Contractor's responsibility.

C. For clarification of the requirements and costs of railroad permits and insurance, contact:

Manager Utilities Work
Union Pacific Railroad Company
Contracts and Real Estate Department
1400 Douglas Street STOP 1690
Omaha, Nebraska 68179-1690
Phone: (402) 544-8620
Fax: (402) 501-1519

SC-18.15 Add the following new paragraph immediately after Paragraph 18.14:

SC-18.15 Texas Water Development Board (TWDB) contracts require that all Contractors and subcontractors maintain project costs in a manner consistent with generally accepted accounting principles. All records are to be maintained for a minimum period of three years and beyond that minimum period if litigation, a claim, or an audit is in process, or if audit findings are not resolved. The three-year period will begin upon completion of final payment.

***** END OF SUPPLEMENTARY CONDITIONS *****

REQUIRED WORKERS' COMPENSATION COVERAGE

(Title must be 30 point font & bold lettering)

(19 point font from here on)

The law requires that each person working on this site or providing services related to this construction project must be covered by workers' compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other service related to the project, regardless of the identity of their employer or status as an employee."

"Call the Texas Workers' Compensation Commission at 512-440-3789 to receive information on the legal requirements for coverage, to verify whether your employer has provided the required coverage, or to report an employer's failure to provide coverage."

* THE ABOVE SIGN TO BE PROVIDED IN BOTH ENGLISH AND SPANISH WITHOUT ANY ADDITIONAL WORDS OR CHANGES AND SHALL BE POSTED AT THE PROJECT SITE. REFER TO PARAGRAPH SC-6.03.D.1 OF THE SUPPLEMENTARY CONDITIONS (DOCUMENT 00800 IN THE CONTRACT DOCUMENTS).

SECTION 00810

EPWU CONTRACTOR INSURANCE COVERAGE CHECKLIST

Contractor Insurance Check List

Project	John T. Hickerson WRF Headworks Barscreen Replacement			
Bid Number	40-23			
Job Description				
Contract Cost				
Final Completion				
Contractor				
Engineer				
Insurance Agent				
Performance & Payment Bonds	**Bond Limit :**			
	Surety:			
	Certified copy of Authority to Act		☐ Yes	☐ No
	Countersigned by Agent		☐ Yes	☐ No
Workers' Compensation	**Insurance Company / A.M. Best Rating**			
	Policy Period	From:	To:	
	Employers Liability Limits required			
	Employers Liability Limits provided			
	Waiver of Subrogation		☐ Yes	☐ No
	30 Days Notice of Cancellation		☐ Yes	☐ No
	If Employees Leased:			
	– Employee Leasing Company		☐ Yes	☐ No
	– Texas State License		☐ Yes	☐ No
	– Copy of Workers' Compensation Policy		☐ Yes	☐ No
Commercial General Liability	**Insurance Company / A.M. Best Rating**			
	Policy Period	From:	To:	
	Limits required			
	Limits provided			
	Products/Completed Operations – 2 Years after completion		☐ Yes	☐ No
	Personal Injury – Employment Exclusion deleted		☐ Yes	☐ No
	Contractual		☐ Yes	☐ No
	Broad Form Property Damage		☐ Yes	☐ No
	XCU		☐ Yes	☐ No
	Additional Insured		☐ Yes	☐ No
	30 Days Notice of Cancellation		☐ Yes	☐ No
Business Auto	**Insurance Company / A.M. Best Rating**			
	Policy Period	From:	To:	
	Limits required			
	Limits provided			
	Symbol 1		☐ Yes	☐ No
	Additional Insured		☐ Yes	☐ No
	30 Days Notice of Cancellation		☐ Yes	☐ No
Umbrella	**Insurance Company / A.M. Best Rating**			
	Policy Period	From:	To:	
	Limits required			
	Limits provided			
	Follow Form – Additional Insureds and Waivers of Subrogation		☐ Yes	☐ No
	30 Days Notice of Cancellation		☐ Yes	☐ No

Contractor Insurance Check List

Builder's Risk/Installation Floater	**Insurance Company / A.M. Best Rating**			
	Policy Period	From:	To:	
	Limits required			
	Limits provided			
	Deductible			
	– All Risk		☐ Yes	☐ No
	– Flood		☐ Yes	☐ No
	– Earthquake		☐ Yes	☐ No
	– Testing		☐ Yes	☐ No
	– Offsite Storage		☐ Yes	☐ No
	– Transit		☐ Yes	☐ No
	– Additional Interests		☐ Yes	☐ No
	– Waiver of Subrogation		☐ Yes	☐ No
Boiler & Machinery	– **If required**			
Certificates of Insurance	– **All coverages**			
Certified Copies of Policies	– **All policies**			
Requirements	**Additional Insureds – Owner, Engineer and Engineer's Consultants on:**			
	– CGL		☐ Yes	☐ No
	– Auto		☐ Yes	☐ No
	– Umbrella		☐ Yes	☐ No
	Waiver of Subrogation (Workers' Compensation) – Owner, Engineer and Engineer's Consultants		☐ Yes	☐ No
	30 Days Notice of Cancellation to Owner & Engineer by Certified Mail on:			
	– WC		☐ Yes	☐ No
	– CGL		☐ Yes	☐ No
	– Auto		☐ Yes	☐ No
	– Umbrella		☐ Yes	☐ No
	– Builder's Risk		☐ Yes	☐ No
	– B&M (If required)		☐ Yes	☐ No
	Builder's Risk/Installation Floater – Include Additional Insured interests & Waiver of Subrogation in favor of :			
	– Owner		☐ Yes	☐ No
	– Contactor		☐ Yes	☐ No
	– Subcontractor		☐ Yes	☐ No
	– Engineer		☐ Yes	☐ No
	– Engineer's Consultants		☐ Yes	☐ No
Other				

Notice: This checklist is provided as a guide only and is not a substitute for the insurance requirements included in the EPWU contract. EPWU strongly advises contractors provide a copy of the contract insurance requirements to their insurance agents, consultants and providers to ensure their insurance coverages meet the contract insurance requirements.

SECTION 00820

EPWU STANDARD APPLICATION FOR PAYMENT

APPLICATION FOR PAYMENT NO. ___

Check One: PARTIAL ____ FINAL ____

OWNER: El Paso Water Utilities
Public Service Board
1154 Hawkins Blvd.
El Paso, Texas 79925

PROJECT: _____

BID NO.: _____

PURCHASE ORDER: _____

ORIGINAL CONTRACT AMOUNT: $_____

NET CHANGE BY CHANGE ORDERS: $_____

CONTRACT SUM TO DATE: $_____

THROUGH CHANGE ORDER NO. _____

NOTICE TO PROCEED: _____

CONTRACT TIME: _____ Calendar Days

REVISED: _____ Calendar Days

ELAPSED TIME: _____ Calendar Days

CONTRACT COMPLETION DATE: _____

REVISED COMPLETION DATE: _____

SUBSTANTIAL COMPLETION DATE: _____

FINAL COMPLETION DATE: _____

WORK COMPLETED:	$ _____	*See Attached Pay Item Schedule*
MATERIALS STORED:	$ _____	*Attach Invoices, Documentation*
TOTAL EARNED:	$ _____	
LESS RETAINED: ___ %	- $ _____	
LESS PREVIOUS PAYMENTS:	- $ _____	
NET DUE THIS ESTIMATE:	**$** _____	*Attach Certified Payroll LCP Tracker Report this Period*

CONTRACTOR'S CERTIFICATION:

The undersigned CONTRACTOR certifies that (1) all previous progress payments received from OWNER on account of work done under the contract referred to above have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with work covered by prior applications for payment; and (2) title to all materials and equipment incorporated in said work or otherwise listed in or covered by this application for payment will pass to Owner at time of payment free and clear of all liens, claims, security interests and encumbrances (except such as covered by bond acceptable to OWNER).

CONTRACTOR: _____ By: _____

Title: _____

Date: _____

RECOMMENDED:

CONSTRUCTION MANAGER: _____

By: _____

Date: _____

APPROVED:

By: _____

Title: _____

Date: _____

SECTION 00825

EPWU STANDARD APPLICATION FOR PAYMENT

(CONTINUATION PAGE)

AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, containing
Contractor's signed Certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NUMBER:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G÷C)	BALANCE TO FINISH (C-G)	RETAINAGE
			FROM PREVIOUS APPLICATION (D+E)	THIS PERIOD					

SECTION 00830

PAY APPLICATION CHECKLIST

PAY APPLICATION CHECK LIST

REQUIRED ITEM/PROCESS	INCLUDED
1. Three original Pay Applications are included/submitted and are on the standard EPWU form (CM 11343A in the bid document).	
2. Substantial and Final Completion due dates listed match the bid document.	
3. Project adjustments (e.g., price, quantity, time, etc.) reflected in Work Directives or unexecuted Change Orders are NOT included in the Pay Application.	
4. If charges for paid materials are included in the Pay Application, include paid invoices for the stored material.	
5. Updated Construction Schedule is included	
6. Payrolls to be entered in the Utility Automated Payroll Software program, which include the following:	
a. For 'Negative Payrolls' during week(s) of no work performed, state, "No Work Performed" on those payrolls.	
b. If apprentices are used, submit DOL certification, apprenticeship programs and training periods for each apprentice. (Note: The DOL certificates expire every 90 days and must be renewed and current. If a current DOL certificate is not submitted for each apprentice, the employee must be paid the Journeyman's rate).	

If all requirements are not met or included in the Pay Application package, the Pay Application will be returned for revisions, and payment will not be made until EPW's receipt of 'approvable' Pay Application.

SECTION 00840

GENERAL WAGE REQUIREMENTS

SECTION 00840

GENERAL WAGE REQUIREMENTS

The following Wage Decision(s) will be utilized for this project. **A Wage Rate for one or both Wage Decisions for a construction type(s) included in the Contract Document, the Contractor is required to indicate on his Certified Payroll Reports, the Wage Decision description/construction type under which the works being reported. The wage decision(s) is/are attached to this form.**

CONSTRUCTION TYPE / WAGE DECISION	PORTION OF PROJECT FOR WHICH THE WAGE DECISION IS APPLICABLE
El Paso Water Utilities – Public Service Board 2020 Building Construction Trades Wage Rates Adopted by Public Service Board January 12, 2022	Construction within an envelope of five feet from a building.
City of El Paso 2016 Paving and Street Construction, Dirt Work, Heavy Construction, Pipeline Work, Highway Wage Rates Adopted by El Paso City Council February 28, 2017	All other Construction.

EL PASO WATER
2020 Building Construction Trades Wage Rates

CLASSIFICATION	BASE WAGE	BENEFITS	HOURLY PREVAILING WAGE RATE	(8 HOURS) PER DIEM WAGE RATE
Asbestos/Lead Abatement/Mold Remediation	31.51	12.06	43.57	348.56
Automatic Fire Sprinkler Fitter, Certified	30.64	21.68	52.32	418.56
Block, Brick, and Stone Mason	17.97	0.00	17.97	143.76
Carpenters – Acoustical Ceiling Installation	17.36	0.00	17.36	138.88
Carpenter – Rough	17.64	0.00	17.64	141.12
Carpenter – All Other Work	17.40	0.00	17.40	139.20
Caulker / Sealers	11.29	0.00	11.29	90.32
Cement and Concrete Finishers	16.30	0.00	16.30	130.40
Commercial Truck Driver	14.75	0.00	14.75	118.00
Communication/Security Technician	16.50	2.12	18.62	148.96
Crane and Heavy Equipment Operator	31.05	0.00	31.05	248.40
Door & Hardware Specialist	12.00	1.35	13.35	106.80
Drywall and Ceiling Tile Installers	14.40	0.00	14.40	115.20
Drywall Finishers & Tapers	15.55	0.00	15.55	124.40
Electrician	22.70	7.32	30.02	240.16
Elevator Installers and Repairers	31.35	15.10	46.45	371.60
Fence Erectors – Include with Skilled Labor	10.00	0.00	10.00	80.00
Floor Layers- Carpet and Resilient	12.87	0.00	12.87	102.96
Floor Layers- Specialty	13.00	0.00	13.00	104.00
Floor Layers - Wood	11.50	0.00	11.50	92.00
Glaziers	15.86	1.00	16.86	134.88
Hazardous Materials Removal Workers	10.00	0.00	10.00	80.00
Heating, Air Conditioning and Refrigeration Service Technician	31.14	12.43	43.57	348.56
Insulation Workers – Mechanical	31.26	11.96	43.22	345.76
Irrigator – Landscape, Certified	15.28	0.00	15.28	122.24
Laborer	13.13	0.58	13.71	109.68
Locksmith	12.00	1.35	13.35	106.80
Mechanic	17.00	0.00	17.00	136.00
Painters - Building	13.86	0.00	13.86	110.88
Paper Hanger	14.00	0.00	14.00	112.00
Pipe Layer (Utility)	18.00	0.00	18.00	144.00
Pipe Fitters and Steamfitters	23.53	9.02	32.55	260.40
Plaster, Stucco, Lather and EIFS Applicator	16.82	0.00	16.82	134.56
Plumber/ Medical Gas Installer	31.39	10.77	42.16	337.28
Reinforcing Iron and Rebar Workers	22.69	0.00	22.69	181.52
Roofers	16.00	0.00	16.00	128.00
Scaffolding Erector	13.69	0.00	13.69	109.52
Sheet Metal Workers	27.16	0.00	27.16	217.28
Structural Iron and Steel Workers / Metal Building Erector	25.57	13.24	38.81	310.48
Tile Setters	13.86	0.00	13.86	110.88

2020 BUILDING DEFINITIONS

1	**Asbestos/Lead Abatement/Mold Remediation**	Assembles work platform and seals off work area, using plastic sheeting and duct tape. Positions mobile decontamination unit or portable showers at entrance of work area. Positions portable air evacuation and filtration system inside work area. Cuts and scrapes asbestos, mold or paint from surfaces, using knife and scraper. Assists in demolition and deconstruction activities of buildings. Shovels asbestos, mold or paint into plastic disposal bags and seals bags, using duct tape. Cleans work area of loose asbestos, mold or paint, using vacuum, broom, and dust pan. Places asbestos, mold or paint in disposal bags and seals bags, using duct tape, loads bags into truck. Cleans and maintains tools, sampling equipment and lab equipment. Responsible for keeping site and grounds clean and neat. Performs daily equipment checks. Picks up necessary supplies and tools from warehouse as directed. Loads and unloads scrap materials into trucks and roll off boxes. Performs work safely in accordance with departmental safety procedures and operates equipment safely. Reports any unsafe work condition or practice to supervisor. Performs other related and non-related duties as assigned.
2	**Automatic Fire Sprinkler Fitter, Certified**	Sprinkler Fitters specialize in piping associated with fire sprinkler systems. These types of systems are required to be installed and maintained in accordance with strict guidelines, usually National Fire Protection Association (NFPA) standards, in order to maintain compliance with building and fire codes. Sprinkler Fitters work with a variety of pipe and materials including: plastic, copper, steel, cast iron, and ductile iron. The fire suppression piping may contain: water, air, antifreeze, fire retardant foam, gas, or chemicals for hood systems. Sprinkler systems installed by Sprinkler Fitters can include but not limited: to underground supply, standpipes, fire pumps as well as overhead piping systems.
3	**Block, Brick, and Stone Mason**	Lay and bind building materials, such as: brick, structural tile, concrete block, cinder block, glass block, and terra-cotta block, with mortar and other substances to construct, or repair walls, partitions, arches, sewers, and other structures. Classify installers of mortarless segmental concrete masonry wall units. Constructs partitions, fences, walks, fireplaces, chimneys, smokestacks, et cetera using stone, marble, granite, slate. Cutting, grouting, and pointing of materials listed above which is necessary shall be part of this classification.
4	**Carpenters – Acoustical Ceiling Installation**	Construct, erect, install or repair acoustical ceiling grid, ceiling tile, and other items laid in acoustical grid.
5	**Carpenter – Rough**	Construct, erect, install, or repair structures and fixtures made of wood, such as concrete forms; building frameworks, including partitions, joists, studding, and rafters; wood stairways, window and door frames. May also install cabinets, and siding. Include brattice builders who build doors or brattices (ventilation walls or partitions) in underground passageways to control the proper circulation of air through the passageways.

6	**Carpenter – All Other Work**	Construct, erect, install or repair cabinets and other fixtures or structures requiring a high level of workmanship. Includes Cabinetmakers and Bench Carpenters – cut, shape, and assemble wooden articles or set up and operate a variety of woodworking machines, such as power saws, jointers, and mortisers to surface, cut or shape lumber or to fabricate parts for wood products**.** Perform related duties such as trim work.
7	**Caulker/Sealers**	Applies water proofing agents or caulk to a variety of structures and materials.
8	**Cement and Concrete Finishers**	Smooth and finish surfaces of poured concrete, such as floors, walks, sidewalks, roads, or curbs using a variety of hand and power tools. Align forms for sidewalks, curbs, or gutters; patch voids; use saws to cut expansion joints. Classify installers of mortarless segmental concrete wall units.
9	**Commercial Truck Driver**	Drive a truck, van or tractor-trailer combination to transport and deliver goods, or materials in liquid, loose, or packaged form. May be required to unload truck.
10	**Communication/Security Technician**	Set-up, re-arrange, or remove switching and dialing equipment used in central offices. Service or repair telephones and other communication equipment on customers' property. May install equipment in new locations or install wiring and telephone jacks in buildings under construction. Install, program, maintain, and repair security and fire alarm wiring and equipment. Ensure that work is in accordance with relevant codes. Exclude "Electricians" who do a broad range of electrical wiring.
11	**Crane and Heavy Equipment Operator**	A worker who operates a crane or other types of heavy equipment to hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber-tired. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
12	**Door and Hardware Specialist**	Installs or repairs doors, hardware and accessories. Are responsible for the installation of contract commercial hardware and custom architectural grade wood doors, steel doors and frames for all Prevailing Wage jobs. Shall be trained by their employer's, employer's apprenticeship, or in factory training classes in the proper methods and techniques and requirements for the installation of Architectural Grade commercial wood and metal doors, frames and hardware in conformance with all local, state, and federal code.
13	**Drywall and Ceiling Tile Installers**	Apply plasterboard, or other wallboard to ceilings, or interior walls of buildings. Apply or mount acoustical tiles or blocks, strips, or sheets of sound-absorbing materials to ceilings and walls of buildings to reduce or reflect sound. Materials may be of decorative quality. Includes metal stud framing. Exclude "Carpet Installers", "Carpenters – Acoustical Ceiling Installation", and "Tile and Marble Setters".
14	**Drywall Finishers and Tapers**	Seal joints between plasterboard or other wallboard, including bedding and texturing, to prepare wall surface for painting or papering.

15	**Electrician**	Plan and execute the layout and installation of electrical conduit, switch panels, buss bars, outlet boxes, electrical wires and cables, lighting standards, lighting fixtures, receptacles, switches, and other electrical devices and apparatus necessary for the complete electrical installation. To include the installation of cabling, wire, conduits and end devices for Temperature Control, Building Automation, and Energy Management Systems, et cetera. Includes installation of photovoltaic solar panels.
16	**Elevator Installers and Repairers**	Assemble, install, repair, or maintain electric or hydraulic freight or passenger conveyances including but not limited to elevators, escalators, dumbwaiters, moving walks and wheelchair lifts.
17	**Fence Erectors - Include with Skilled Labor**	Erect and repair metal and wooden fences and fence gates around highways, industrial establishments, residences, or farms, using hand and power tools. Excludes rock and stone fences.
18	**Floor Layers – Carpet and Resilient**	Apply blocks, strips, or sheets of shock-absorbing, sound-deadening, or decorative coverings to floors. Lay and install carpet from rolls, tiles or blocks on floors. Install padding and trim flooring materials. Installs variety of soft floor materials including vinyl and VCT. Exclude wood floors and specialty floors.
19	**Floor Layers - Specialty**	Prepares surface, installs and finishes specialty floor material such as manufactured or engineered and laminated wood.
20	**Floor Layers - Wood**	Install, scrape and sand wooden floors to smooth surfaces using floor scraper and floor sanding machine, and apply coats of finish to include gymnasium and bowling alleys.
21	**Glaziers**	Installs glass in windows skylights, store fronts and display cases, or on surfaces such as: building fronts, interior walls, ceilings and table tops. The installation, setting, cutting, preparing, fabricating, distributing, handling or removal of the following: glass and glass substitutes used in place of glass, pre-glazed windows, retrofit window systems, mirrors, curtain wall systems, window wall systems, cable net systems, canopy systems, structural glazing systems, unitized systems, interior glazing systems, photovoltaic panels and systems, suspended glazing systems, louvers, skylights, entranceway systems including doors and hardware, revolving and automatic door systems, patio doors, store front systems including the installation of all metals, column covers, panels and panel systems, glass hand rail systems, decorative metals as part of the glazing system, and the sealing of all architectural metal and glass systems for weatherproofing and structural reasons, vinyl, molding, rubber, lead, sealants, silicone and all types of mastics in wood, iron, aluminum, sheet metal or vinyl sash, doors, frames, stone wall cases, show cases, book cases, sideboards, partitions and fixtures. Performs other related duties.

22	**Hazardous Materials Removal Workers**	Identify, remove, pack, transport, or dispose of hazardous materials, including asbestos, lead-based paint, waste oil, fuel, transmission fluid, radioactive materials, contaminated soil, mold, et cetera. Specialized training and certification in hazardous materials handling or a confined entry permit are generally required. May operate earth-moving equipment or trucks.
23	**Heating, Air Conditioning and Refrigeration Service Technician**	Repair and service heating, central air conditioning, or refrigeration systems, including oil burners, hot-air furnaces, heating stoves, and air handlers. (Installation of systems is performed by sheet metal worker). Includes HVAC mechanic.
24	**Insulation Workers – Mechanical**	This work includes the preparation, alteration, application, removal, hauling, erection, assembling, molding, spraying, pouring, mixing, hanging, adjusting, repairing, dismantling, reconditioning, maintenance, finishing, and/or weatherproofing of cold or hot thermal insulations with such materials as may be specified when those materials are to be installed for thermal purposes in voids, or to create voids, or on either piping, fittings, valves, boilers, ducts, flues, tanks, vats and equipment, or on any hot or cold surfaces for the purpose of thermal control or to be installed for sound control purposes mechanical devices, equipment, piping, surfaces related in an integral way to the insulation of such mechanical devices, equipment and piping. This work also includes all labor connected with insulation for; temperature control, personnel protection, safety and/or prevention of condensation. This work also includes all labor connected with hauling, distribution and cleanup of materials on the job premises. All thermal tape, pads, metered fittings (insulation, metal or plastic), batts and lags.
25	**Irrigator- Landscape, Certified**	Certified by TCEQ to install watering systems in various sizes and grades of lawn in order to maintain sufficient pressure and to insure even dispersal of water.
26	**Laborer**	Performs manual duties in all phases of construction. Demolition (interior and exterior), Flagging and Traffic Control, General Clean-Up, Air and Power Tool Operators (Including chipping guns, jackhammers and tampers), all material handling and clean-up, except refractory, chute/hose operator, raking, shoveling and vibrating, raking, shoveling, luting, ironing, dumping and spreading, trenching, material handling, back filling (*Equipment Operators Incidental to Laborers' scope of work). Landscape or maintain grounds of property using equipment as needed. Workers typically perform a variety of tasks, which may include any combination of the following: sod laying, mowing, trimming, planting, watering, fertilizing, digging, raking, sprinkler repair, and installation of mortarless segmental concrete masonry wall units. Does not ordinarily perform work permitting exercise of independent judgment or without close direction by other workers.
27	**Locksmith**	Self-explanatory.

28	**Mechanic**	Maintains and repairs construction tools and equipment.
29	**Painters - Building**	Paint walls, equipment, buildings, bridges, and other structural surfaces, using brushes, rollers, and spray guns. May remove old paint to prepare surface prior to painting. May mix colors or oils to obtain desired color or consistency. Exclude "Paperhangers."
30	**Paper Hanger**	Measures, cuts, and hangs wallpaper and Fiber Reinforced Paneling.
31	**Pipe Layer (Utility)**	Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, makes threaded and flanged connections. Installs valves and other accessories. Performs other related duties.
32	**Pipe Fitters and Steamfitters**	Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Includes pressurized lines and flow lines for gas, air, and oil found in industrial settings.
33	**Plaster, Stucco, Lather, and EIFS Applicator**	Apply interior or exterior plaster, stucco, or similar materials. May also set ornamental plaster**.** Applies acoustical plaster, interior and exterior plastering of stone imitation or any patented materials when cast. Molds and sets ornamental plaster and trim and runs ornamental plaster cornice and molding.
34	**Plumbers/ Medical Gas Installer**	Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Assemble, install, alter, and repair pipelines or pipe systems that carry medical gases or liquids. Specialized training and certification required.
35	**Reinforcing Iron and Rebar Workers**	Position and secure steel bars or mesh in concrete forms in order to reinforce concrete. Includes post-tensioning. Use a variety of fasteners, rod-bending machines, blowtorches, and hand tools.
36	**Roofers**	Cover roofs of structures with shingles, tile, slate, asphalt, aluminum, wood, metal and related materials. May spray roofs, sidings, and walls with material to bind or seal sections of structures. Includes metal and membrane roofs.

37	**Sheet Metal Workers**	Fabricate, assemble, install, and repair sheet metal products and equipment, such as ducts, seal the system, pressure test and test and balance , control boxes, drainpipes, architectural sheet metal, hangers, brackets, used in the installation of sheet metal, and installs grills, registers, and furnace casings. Work may involve any of the following: setting-up and operating fabricating machines to cut, bend, and straighten sheet metal, operating soldering equipment to join sheet metal parts; inspecting, assembling, and smoothing seams and joints of burred surfaces, including metal flashings, gutters, canopies, soffit's, louvers, skylights and custom metal roofs. Installs warm air furnaces except where necessary piping for gas, or oil is performed under the plumbing and pipefitting classification. Include sheet metal duct installers who install prefabricated sheet metal ducts used for heating, air conditioning, or other purposes. Fire life safety, damper inspection, stairwell pressurization. May install other heating and cooling devices which are in connection with duct systems.
38	**Structural Iron and Steel Workers/Metal Building Erector**	Rigging, raise, place, and unite iron or steel, prefabricated metal buildings precast concrete, precast "tilt-up" panels, concrete and steel bridge members, concrete decking, ornamental iron, hand rails, stairs, curtain wall/glass framework, girders, columns, beams, and other structural members to form completed structures or structural frameworks using hand tools, power tools, and hoisting equipment. Erects frame of building, using hoist. Bolts steel frame members together. Attaches wire and insulating materials to framework. Attaches sheet metal panels to framework including standing seam sheets. Installs and trims sheet metal on prefabricated metal buildings, using cutting torch, power saw, and tin snips. Rigging of heavy equipment, assembly and disassembly of cranes. May erect metal storage tanks. Exclude "Reinforcing Iron and Rebar Workers".
39	**Tile Setters**	Apply hard tile, terrazzo tile and veneer to walls, floors, and ceilings. Includes surface preparation as necessary.
40	**Scaffolding Erector**	Erection of a temporary elevated platform (both supported and suspended) and its supporting structure (including points of anchorage) to be used for supporting employees or material or both.

- **Welder -** Receives rate prescribed for craft performing operation to which welding is incidental.
- **Fork Lift and Man Lift (boom and scissor) -** Receives rate prescribed for craft performing operation to which operation of this equipment is incidental.

CITY OF EL PASO, TEXAS

2016 Paving and Street Construction, Dirt Work, Heavy Construction, Pipeline Work, Highway Wage Rates

CLASSIFICATION	BASE WAGE PER HOUR	TOTAL FRINGES PER HOUR	HOURLY PREVAILING WAGE RATE	(8 HOURS) PER DIEM WAGE RATE
Asphalt Distributor Operator	14.64	0.00	14.64	117.12
Asphalt Paving Machine Operator / Spreader Box Operator	14.20	0.00	14.20	113.60
Asphalt Raker	12.99	0.00	12.99	103.92
Backhoe Operator	15.95	0.00	15.95	127.60
Concrete Finishers (Paving and Structures)	13.88	0.00	13.88	111.04
Crane Operator, Lattice Boom	17.50	0.00	17.50	140.00
Crane Operator, Hydraulic	17.50	0.00	17.50	140.00
Electrician	23.09	0.00	23.09	184.72
Excavator Operator	16.10	0.00	16.10	128.80
Form Builder/Setter	15.02	0.00	15.02	120.16
Form Setter (Paving and Curb)	12.86	0.00	12.86	102.88
Front End Loader	14.82	0.00	14.82	118.56
Laborer	11.89	0.00	11.89	95.12
Laborer (Skilled)(Utility)	13.65	0.00	13.65	109.20
Mechanic	17.50	0.00	17.50	140.00
Motor Grader Operator (Fine)	17.54	0.00	17.54	140.32
Pipe Layer	12.94	0.00	12.94	103.52
Reinforcing Steel Setter (Structure and Paving)/ Structural Steel Worker	17.00	0.00	17.00	136.00
Rock Mason	12.00	0.00	12.00	96.00
Roller Operator	13.70	0.00	13.70	109.60
Servicer	14.33	0.00	14.33	114.64
Truck Driver, Single Axle	13.19	0.00	13.19	105.52
Truck Driver, Tandem Axle	15.32	0.02	15.34	122.72
Utility Operator Grade 1	12.00	0.00	12.00	96.00
Utility Operator Grade 2	13.95	0.00	13.95	111.60
Welder, Certified/ Structural Steel Welder	13.83	0.00	13.83	110.64

All persons required to be licensed or certified must meet those qualifications to be paid the associated rate.

February 28, 2017

2016 HEAVY / HIGHWAY DEFINITIONS

1	**Asphalt Distributor Operator**	Drives distributor truck, sets spray bars and operates valves and levers to control distribution of bituminous material for highway surfacing. May oil, grease or otherwise service and make adjustments to equipment as needed. Performs other related duties.
2	**Asphalt Paving Machine Operator/Spreader Box Operator**	Operates paving machine that spreads and levels asphaltic concrete on highway. Controls movement of machine, raises and lowers screed, regulates width of screed. Operates spreader box by adjusting hopper and strike-off blade so that gravel, stone or other material may be spread to a specific depth on road surface during seal coat and surface treatment operations. May oil, grease, service and make adjustments to equipment as needed. Performs other related duties.
3	**Asphalt Raker**	Distributes asphaltic materials evenly over road surface by hand-raking and brushing material to correct thickness; may control screed to regulate width and depth of materials; directs Laborers (skilled and unskilled) when to add or take away material to fill low spots or to reduce high spots.
4	**Backhoe Operator**	Operates a rubber-tired machine mounted with a backhoe bucket on one end and a loader bucket on the other end. Used for excavating ditches and structures, laying pipe and precast concrete structures, carrying material in the loader bucket, and general excavation and backfill. May also be equipped with hydraulic attachments. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
5	**Concrete Finisher (Paving and Structures)**	Finishes the exposed surfaces of fresh concrete paving, median barrier and every element of concrete structures. Operates bridge deck finishing machine. Forms and finishes edges and joints. Finishes concrete curbs and gutters. Finishes exposed surface of concrete after forms have been removed by patching imperfections with fresh concrete, rubbing surface with abrasive stone, and directing others in removing excess or defective concrete with power tools. Performs other related duties.
6	**Crane Operator, Lattice Boom**	A worker who operates a lattice boom type crane to hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber tired. May include placement of rock riprap, clamshell, dragline, pipe and pile driving operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
7	**Crane Operator, Hydraulic**	A worker who operates a hydraulic telescoping boom type crane to hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber-tired. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

8	**Electrician**	Plan and execute the layout and installation of electrical conduit, switch panels, buss bars, outlet boxes, electrical wires and cables, lighting standards, lighting fixtures, receptacles, switches, and other electrical devices and apparatus necessary for the complete installation of wiring systems, works on overhead distribution systems and underground distribution systems. Includes installation of photovoltaic solar panels.
9	**Excavator Operator**	Operates a crawler or rubber-tired machine mounted with an excavator bucket. Used for excavating ditches and structures, laying pipe and precast concrete structures, loading trucks and placing rock riprap. May also be equipped with various hydraulic attachments. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
10	**Form Builder/Setter**	Works from plans to build, assemble, fit together, align, plumb, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks forms while concrete is being placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties. Includes guardrail installation.
11	**Form Setter (Paving and Curb)**	Fits together, aligns and sets to grade metal and wooden forms for placement for concrete paving and curbs. Works with survey crew to set stringline for paving, curb and gutter and curb. Performs other related duties.
12	**Front End Loader**	Operates a rubber-tired, skid steer or crawler type tractor with an attached scoop type bucket on front end. Machine is used to load materials from stockpiles, excavation, charging batch plants, loading and unloading trucks. May be used with attachments in lieu of the bucket. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
13	**Laborer**	A general term used on construction work covering many unskilled classifications requiring work of a physical nature. Performs a variety of work ranging from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, under the supervision of qualified personnel. Cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, assists pipelayers, works with dirt crew keeping construction layout stakes out of the way of dirt-moving equipment. May fine grade excavation and ditches, shovels hot asphalt material. May use power tools and other necessary equipment in demolition work under the supervision of qualified personnel. Does not ordinarily perform work permitting exercise of independent judgment or without close direction by other workers. Installs and maintains erosion control. Performs other related duties.

14	**Laborer (Skilled) (Utility)**	Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. Directs laborers in pouring concrete. Erects trench shoring and bracing. Installs, operates, and maintains watering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. Is more or less a general utility construction worker. May be a second step in learning a skill. Includes Concrete/Granite Pump Operator, Concrete Saw Operator, Fence Erector, Flagger, and Sign Erector. Performs other related duties.
15	**Mechanic**	Assembles, assist set up, adjusts and maintains and repairs all types of construction equipment and trucks. May perform the duties of a welder in repair of equipment. Performs other related duties.
16	**Motor Grader Operator (Fine)**	Operates motor grader. Performs many of the same duties of Motor Grader, Rough, but in addition performs finish grade work to bluetops or other close specification control. This work is subject to strict inspection and must conform closely to specifications. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
17	**Pipe Layer**	Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, makes threaded and flanged connections. Installs valves and other accessories. Performs other related duties.
18	**Reinforcing Steel Setter (Structure and Paving)/ Structural Steel Worker**	Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. Erects and places reinforcing steel and fabricated structural steel members, such as girders, plates, diaphragms, lateral bracing, and unites them permanently to form a completed structural steel unit, including reinforcing members. Fastens steel members together by welding or bolting. May include dismantling and erecting large units of equipment. Gives direction to reinforcing steel worker apprentice or utility laborers. Performs other related duties.
19	**Rock Mason**	Constructs partitions, fences, walls, using rock. Cutting, grouting and pointing of materials listed above which is necessary shall be part of this classification. May also build or repair rock retaining walls, cutting or placing of rock in mortar or other similar material.
20	**Roller Operator**	Operates a self-propelled machine with either steel wheels or pneumatic tires which is used to compact and smooth bituminous and flexible base materials and compact earth fills, subgrade, and all other types of materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

21	**Servicer**	Drives a truck which carries various fuels, oils, greases and filters. Must have knowledge of and is responsible for the correct oiling and greasing and changing of filters on equipment according to manufacturers' specifications. Uses compressed air grease guns, wrenches and other tools. May make adjustments to clutches, brakes and other mechanical items. Keeps record of service for preventive maintenance records. . May require a Commercial Driver's License if driving truck on public highways. Performs other related duties.
22	**Truck Driver, Single Axle**	Drives a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.
23	**Truck Driver, Tandem Axle**	Drives a tandem axle powered vehicle. Hauls dirt, rock, aggregates or other material. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.
24	**Utility Operator Grade 1**	Clam, ditching machine, side booms (except those in Grade 2), operator on dredges, cleaning machine, coating machine, , blending machine, water-kote machine, equipment welder, track tractor, derrick, dragline, shovel, motor grader rough grade, Crawler tractor, foundation drill operator, crawler and truck mounted, and piledriver.
25	**Utility Operator Grade 2**	Pipe, gin truck or winch truck with poles when used for hoisting, side boom (cradling rock drill), tow tractor, farm tractor road boring machine, fork lift **(industrial type)**, pot fireman (power agitated), straightening machine, boring machine, bombardier (track or tow rig), , hydrostatic testing operator, scraper, stalking machine, plant mix pavement roller operator, plant mix pavement, pneumatic motor operator. Concrete paving curing, float, texturing machine, subgrade trimmer, slip-form machine, milling machine, self-propelled sweeping machine, trenching machine, directional drill, , trenching, screening plant, and joint sealer. Off Road Hauler, Pavement Marking Machine Operator Reclaimer/Pulverizer Operator, Slurry Seal or Micro-Surfacing Machine Operator.
26	**Welder, Certified/ Structural Steel Welder**	Certified by the American Welding Society to perform structural steel welding. Operates welding equipment. Welds structural steel girders and diaphragms. May weld permanent metal deck forms. Cuts, lays-out, fits and welds metals or alloyed metal parts to fabricate or repair equipment. Welds the joints between lengths of pipe for oil, gas or other types of pipelines. May assist in welding of permanent metal deck forms. Performs other related duties.

SECTION 00850

TEXAS WORKERS' COMP FORMS DWC81-DWC85

TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION
7551 Metro Center Drive, Suite 100
Austin, Texas 78744

If you are not certain whether all parties meet the requirements for entering into this agreement, you may wish to consult an attorney.

AGREEMENT BETWEEN GENERAL CONTRACTOR AND SUBCONTRACTOR
TO PROVIDE WORKERS' COMPENSATION INSURANCE

Notice of Agreement

The undersigned General Contractor and the undersigned Subcontractor hereby agree that the General Contractor ☐ will withhold ☐ will not withhold the cost of workers' compensation insurance coverage from the Subcontractor's contract price and that, for the purpose of providing workers' compensation insurance coverage, the General Contractor will be the employer of the Subcontractor and the Subcontractor's employees. This agreement makes the General Contractor the employer of the Subcontractor and the Subcontractor's employees only for the purposes of workers' compensation laws of Texas and for no other purpose.

TERM (DATES) OF AGREEMENT: FROM: _____

TO: _____

LOCATION OF EACH AFFECTED JOB SITE (OR STATE WHETHER THIS IS A BLANKET AGREEMENT):

_____

_____

_____

ESTIMATED NUMBER OF EMPLOYEES AFFECTED: _____

THIS AGREEMENT SHALL TAKE EFFECT NO SOONER THAN THE DATE IT IS SIGNED.
Texas Labor Code, Texas Workers' Compensation Act, Section 406.123

General Contractor's Affirmation

_____
Federal Tax I.D. Number

If the General Contractor's workers' compensation carrier changes during the effective period of coverage, it is advisable for the General Contractor to file this form with the new insurance carrier.

_____ _____ _____
Signature of General Contractor Date Address (Street)

_____ _____
Printed Name of General Contractor Address (City, State, Zip)

Subcontractor's Affirmation

_____
Federal Tax I.D. Number

_____ _____ _____
Signature of Subcontractor Date Address (Street)

_____ _____
Printed Name of Subcontractor Address (City, State, Zip)

The General Contractor should retain the original. Legible copies of this agreement should be filed with the general contractor's workers' compensation insurance carrier and the Division within 10 days of the date of execution. If the General Contractor is certified self-insured, a copy should be filed with the Division's Self-Insurance Regulation service area. An agreement is not considered filed if it is illegible or incomplete. Filing may be accomplished by mail or facsimile transmission. The Subcontractor must also retain a copy of the agreement.

Division Date Stamp Here

TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION
7551 Metro Center Drive, Suite 100
Austin, Texas 78744

If you are not certain whether all parties meet the requirements for entering into this agreement, you may wish to consult an attorney.

CHECK ☐ BOX OF STATEMENT THAT APPLIES

☐ AGREEMENT BETWEEN MOTOR CARRIER AND OWNER OPERATOR TO PROVIDE WORKERS' COMPENSATION INSURANCE COVERAGE

Notice of Declaration

The undersigned Motor Carrier and the undersigned Owner Operator agree that the Motor Carrier will provide workers' compensation insurance coverage to the Owner Operator and the Owner Operator's employees. The Motor Carrier ☐ will deduct ☐ will not deduct the actual premiums, based on payroll, that are paid or incurred by the Motor Carrier for coverage from the contract price or any other amount owed to the Owner Operator by the Motor Carrier.

TERM (DATES) OF AGREEMENT: FROM: _____

TO: _____

ESTIMATED NUMBER OF WORKERS AFFECTED: _____
Texas Labor Code, Texas Workers' Compensation Act, Section 406.123.

☐ AGREEMENT TO REQUIRE OWNER OPERATOR TO ACT AS EMPLOYER

Notice of Agreement

The undersigned Motor Carrier and the undersigned Owner Operator agree that the Owner Operator assumes the responsibilities of an employer for the performance of work.

TERM (DATES) OF AGREEMENT: FROM: _____

TO: _____

ESTIMATED NUMBER OF WORKERS AFFECTED: _____
Texas Labor Code, Texas Workers' Compensation Act, Section 406.122.

THIS AGREEMENT SHALL TAKE EFFECT NO SOONER THAN THE DATE IT IS SIGNED.

MOTOR CARRIER'S AFFIRMATION

If the Motor Carrier's workers' compensation carrier changes during the effective period of coverage, it is advisable for the Motor Carrier to file this form with the new insurance carrier.

_____
Federal Tax I.D. Number

_____ _____ _____
Signature of Motor Carrier | Date | Address (Street)

_____ _____
Printed Name of Motor Carrier | Address (City, State, Zip)

OWNER OPERATOR'S AFFIRMATION

_____
Federal Tax I.D. Number

_____ _____ _____
Signature of Motor Owner Operator | Date | Address (Street)

_____ _____
Printed Name of Owner Operator | Address (City, State, Zip)

The Motor Carrier should retain the original. Legible copies of this agreement must be filed with the Motor Carrier's workers' compensation insurance carrier and the Division within 10 days of the date of execution. An agreement is not considered filed if it is illegible or incomplete. Filing may be accomplished by mail or facsimile transmission. The Owner Operator must also retain a copy of the agreement.

Division Date Stamp Here

TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION
7551 Metro Center Drive, Suite 100
Austin, Texas 78744

If you are not certain whether all parties meet the requirements for entering into this agreement, you may wish to consult an attorney.

Texas Workers' Compensation Act, Texas Labor Code, Section 406.141(2) defines "independent contractor" as follows: (2) "Independent contractor" means a person who contracts to perform work or provide a service for the benefit of another and who: (A) is paid by the job, not by the hour or some other time-measured basis; (B) is free to hire as many helpers as he desires and to determine what each helper will be paid; and (C) is free to work for other contractors, or to send helpers to work for other contractors, while under contract to the hiring employer.

CHECK ☐ BOX OF STATEMENT THAT APPLIES

☐ JOINT AGREEMENT TO AFFIRM INDEPENDENT RELATIONSHIP FOR CERTAIN BUILDING AND CONSTRUCTION WORKERS

Notice of Declaration

The undersigned Hiring Contractor and the undersigned Independent Contractor hereby declare that the Independent Contractor meets the qualifications of an Independent Contractor under Texas Workers' Compensation Act, Texas Labor Code, Section 406.141, that the Independent Contractor is not an employee of the Hiring Contractor, and that:

(A) the Independent Contractor and the Independent Contractor's employees shall not be entitled to workers' compensation coverage from the Hiring Contractor; and
(B) the Hiring Contractor's workers' compensation insurance carrier shall not require premiums to be paid by the Hiring Contractor for coverage of the Independent Contractor or the Independent Contractor's employees, helpers, or subcontractors.

THIS DECLARATION TAKES EFFECT UPON RECEIPT BY THE TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION. THIS DECLARATION APPLIES TO ALL HIRING AGREEMENTS EXECUTED BY THE HIRING CONTRACTOR AND THE INDEPENDENT CONTRACTOR DURING THE YEAR AFTER THIS DECLARATION IS FILED UNLESS A SUBSEQUENT HIRING AGREEMENT IS MADE TO WHICH THE DECLARATION DOES NOT APPLY. IN THE EVENT THAT A HIRING AGREEMENT TO WHICH THIS DECLARATION DOES NOT APPLY IS MADE, THE HIRING CONTRACTOR AND INDEPENDENT CONTRACTOR SHALL SO NOTIFY THE TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION AND THE HIRING CONTRACTOR'S WORKERS' COMPENSATION INSURANCE CARRIER (IF ANY) IN WRITING WITHIN 10 DAYS AFTER THE NON-APPLYING AGREEMENT IS MADE. ONCE THIS AGREEMENT IS SIGNED, THE SUBCONTRACTOR AND THE SUBCONTRACTOR'S EMPLOYEES SHALL NOT BE ENTITLED TO WORKERS' COMPENSATION COVERAGE FROM THE HIRING CONTRACTOR UNLESS A SUBSEQUENT WRITTEN AGREEMENT IS EXECUTED, AND FILED ACCORDING TO WORKERS' COMPENSATION RULES, EXPRESSLY STATING THAT THIS AGREEMENT DOES NOT APPLY.

Texas Labor Code, Texas Workers' Compensation Act, Section 406.145.

☐ AGREEMENT TO ESTABLISH EMPLOYER-EMPLOYEE RELATIONSHIP FOR CERTAIN BUILDING AND CONSTRUCTION WORKERS

Notice of Agreement

The undersigned Hiring Contractor and the undersigned Independent Contractor hereby agree that the Hiring Contractor ☐ will withhold ☐ will not withhold the cost of workers' compensation insurance coverage from the Independent Contractor's contract price and that the Hiring Contractor will purchase workers' compensation insurance coverage for the Independent Contractor and the Independent Contractor's employees. Once this agreement is signed, for the purpose of providing workers' compensation insurance coverage, the Hiring Contractor will be the employer of the Independent Contractor and the Independent Contractor's employees. This agreement makes the Hiring Contractor the employer of the Independent Contractor and the Independent Contractor's employees only for the purposes of workers' compensation laws of Texas and for no other purpose.

TERM (DATES) OF AGREEMENT: FROM: _____

TO: _____

LOCATION OF EACH AFFECTED JOB SITE (OR STATE WHETHER THIS IS A BLANKET AGREEMENT):

_____

_____

_____

ESTIMATED NUMBER OF EMPLOYEES AFFECTED: _____

THIS AGREEMENT SHALL TAKE EFFECT NO SOONER THAN THE DATE IT IS SIGNED.

Texas Labor Code, Texas Workers' Compensation Act, Section 406.144.

Hiring Contractor's Affirmation

If the Hiring Contractor's workers' compensation carrier change during the effective period of coverage, it is advisable for the Hiring Contractor to file this form with the new insurance carrier.

_____ Federal Tax I.D. Number

_____ Signature of Hiring Contractor

_____ Date

_____ Address (Street)

_____ Printed Name of the Hiring Contractor

_____ Address (City, State, Zip)

Independent Contractor's Affirmation

_____ Federal Tax I.D. Number

_____ Signature of Independent Contractor

_____ Date

_____ Address (Street)

_____ Printed Name of the Independent Contractor

_____ Address (City, State, Zip)

The Hiring Contractor should retain the original. Legible copies of this agreement should be filed with the hiring contractor's workers' compensation insurance carrier and the Division within 10 days of the date of execution. An agreement is not considered filed if it is illegible or incomplete. Filing may be accomplished by mail or facsimile transmission. The Independent Contractor should also retain a copy of the agreement.

Division Date Stamp Here

TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION
7551 Metro Center Drive, Suite 100
Austin, Texas 78744

EXCEPTION TO APPLICATION OF JOINT AGREEMENT TO AFFIRM INDEPENDENT RELATIONSHIP FOR CERTAIN BUILDING AND CONSTRUCTION WORKERS

NOTICE OF DECLARATION

The undersigned Hiring Contractor and the undersigned Independent Contractor declare that the Joint Agreement to Affirm Independent Relationship for Certain Building and Construction Workers (as recorded on DWC FORM-83) does not apply to the subsequent hiring agreement between the Hiring Contractor and Independent Contractor. Nothing in this declaration otherwise nullifies the Joint Agreement to Affirm Independent Relationship for Certain Building and Construction Workers as it applies to other hiring agreements made during the term of the joint agreement.

DATE OF JOINT AGREEMENT TO AFFIRM INDEPENDENT RELATIONSHIP FOR CERTAIN BUILDING AND CONSTRUCTION WORKERS

DATE OF SUBSEQUENT HIRING AGREEMENT TO WHICH THIS FORM APPLIES

LOCATION OF SPECIFIC JOB SITES NOT AFFECTED BY JOINT AGREEMENT: _____

NAME OF HIRING CONTRACTOR

NAME OF INDEPENDENT CONTRACTOR

Texas Labor Code, Texas Workers' Compensation Act, Section 406.145.

Hiring Contractor's Affirmation

If the Hiring Contractor's workers' compensation carrier changes during the effective period of coverage, it is advisable for the Hiring Contractor to file this form with the new insurance carrier.

Federal Tax I.D. Number

Signature of Hiring Contractor

Date

Address (Street)

Printed Name of Hiring Contractor

Address (City, State, Zip)

Independent Contractor's Affirmation

Federal Tax I.D. Number

Signature of Independent Contractor

Date

Address (Street)

Printed Name of Independent Contractor

Address (City, State, Zip)

The Hiring Contractor should retain the original. Legible copies of this agreement should be filed with the hiring contractor's workers' compensation insurance carrier and the Division within 10 days of the date of execution. An agreement is not considered filed if it is illegible or incomplete. Filing may be accomplished by mail or facsimile transmission. The Independent Contractor should also retain a copy of the agreement.

Division Date Stamp Here

TEXAS DEPARTMENT OF INSURANCE, DIVISION OF WORKERS' COMPENSATION
7551 Metro Center Drive, Suite 100
Austin, Texas 78744

If you are not certain whether all parties meet the requirements for entering into this agreement, you may wish to consult an attorney.

Texas Workers' Compensation Act, Texas Labor Code, Section 406.121(2) defines "independent contractor" as follows: (1) "Independent contractor" means a person who contracts to perform work or provide a service for the benefit of another and who ordinarily: (A) acts as the employer of any employee of the contractor by paying wages, directing activities, and performing other similar functions characteristic of an employer-employee relationship; (B) is free to determine the manner in which the work or service is performed, including the hours of labor of or method of payment to any employee; (C) is required to furnish or have his employees, if any, furnish necessary tools, supplies, or materials to perform the work or service; and (D) possesses the skills required for the specific work or service.

AGREEMENT BETWEEN GENERAL CONTRACTOR AND SUBCONTRACTOR TO ESTABLISH INDEPENDENT RELATIONSHIP

Notice of Agreement

The undersigned General Contractor and the undersigned Subcontractor hereby declare that:

(A) the Subcontractor meets the qualifications of an Independent Contractor under Texas Workers' Compensation Act, Texas Labor Code, Section 406.121;
(B) the Subcontractor is operating as an independent contractor as that term is defined under Section 406.121 of the Act;
(C) the Subcontractor assumes the responsibilities of an employer for the performance of work; and
(D) the Subcontractor and the Subcontractor's employees are not employees of the General Contractor for purposes of the Act.

TERM (DATES) OF AGREEMENT: FROM: _____

TO: _____

_____ Name of General Contractor

_____ Name of Subcontractor

LOCATION OF EACH AFFECTED JOB SITE (OR STATE WHETHER THIS IS A BLANKET AGREEMENT):

_____

_____

_____

Estimated number of employees affected: _____

THIS AGREEMENT SHALL TAKE EFFECT NO SOONER THAN THE DATE IT IS SIGNED.

Texas Labor Code, Texas Workers' Compensation Act, Section 406.122 .

General Contractor's Affirmation

If the General Contractor's workers' compensation carrier changes during the effective period of coverage, it is advisable for the General Contractor to file this form with the new insurance carrier.

_____ Federal Tax I. D. Number

_____ Signature of General Contractor _____ Date _____ Address (Street)

_____ Printed Name of General Contractor _____ Address (City, State, Zip)

Subcontractor's Affirmation

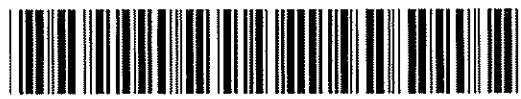
_____ Federal Tax I. D. Number

_____ Signature of Subcontractor _____ Date _____ Address (Street)

_____ Printed Name of Subcontractor _____ Address (City, State, Zip)

The General Contractor should retain the original. The Subcontractor should also retain a copy of the agreement. This form is not required to be filed with the Division, and may be provided to the insurance carrier.

Division Data Stamp Here



TECHNICAL SPECIFICATIONS

DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 03 – CONCRETE

DIVISION 05 – METALS

DIVISION 09 – FINISHES

DIVISION 22 – PLUMBING

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

DIVISION 26 – ELECTRICAL

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DIVISION 40 – PROCESS INTERCONNECTIONS

DIVISION 41 – MATERIAL PROCESSING AND HANDLING EQUIPMENT

DIVISION 43 – LIQUID HANDLING

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Work covered by Contract Documents.
   2. Owner occupancy.
   3. Permits.

B. Related Requirements:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Identification: John T. Hickerson WRF Headworks Barscreen Replacement

B. Location: El Paso, Texas

C. Owner: El Paso Water

D. Work: The project entails the removal and replacement of two (2) existing traveling rake barscreens, screenings and grit handling equipment, mechanical components for two (2) existing vortex grit removal units, associated piping, electrical, and controls; concrete demo and structural modifications necessary for installation of new screening equipment, furnish and installation of two (2)-6 mm perf plate screens, two (2) wash presses, one (1) shaftless horizontal conveyor, two (2) 20 CY Level Lodors, two (2) grit classifiers with integral cyclones, three (3) grit pumps, concrete retaining wall, electrical, controls and instrumentation for new equipment, corrosion protection coating of existing concrete structures, site pavement, grading and drainage improvements, site piping, testing and startup of new equipment, and coordination with plant. Improvements to be completed while plant remains in service.

1.3 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow Owner occupancy.

B. Construction operations limited to areas noted on Drawings.

C. Time restrictions for performing Work:
   1. 7 A.M. to 5 P.M. Monday through Friday.
   2. Other times and days may be necessary as dictated by work and shall be requested by Contractor to Owner for approval.

D. Utility outages and shutdowns.
   1. Coordinate and schedule utility outages/shutdown.
   2. Allowed only at previously agreed-upon times.
   3. Schedule at least one week before outage/shutdown.
   4. Submit outage/shutdown request to Engineer itemizing dates, times, and durations of early requested outage/shutdown.

1.4 OWNER OCCUPANCY

A. Owner will occupy premises during construction to conduct normal operations.

B. Cooperate with Owner to minimize conflict and facilitate Owner operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUBSTANTIAL COMPLETION

A. Substantial completion is the condition upon which, in the opinion of the Engineer, the work is installed so that it is sufficiently complete, in accordance with the Contract Documents, so that the work can be fully utilized for the purposes for which it is intended. To attain substantial completion, all work must have passed all testing associated with the work in accordance with the Contract Documents. The requirements for Initial and Formal Start-up Operations of all electrical, instrumentation and control, mechanical devices, and equipment must have been successfully completed. All roadways, site work, fencing, and site grading must be complete. No significant work can remain to be completed on the Project to attain substantial completion.

B. At the Engineer's discretion, operation by the Owner and the Contractor's written request for Substantial Completion may occur even though items of work, or groups of work items, are not entirely complete. If the Engineer approves of this situation, the incomplete items shall only be items that do not prevent full operation of the new facilities. The incomplete items can only be considered as minor punch list items for Substantial Completion to be declared.

3.2 WARRANTY

A. Contractor shall warrant 100 percent of the project for one (1) year after the date of substantial completion of the work. Special warranty requirements may pertain to specific items of equipment as specified elsewhere in these specification sections.

3.3 FINAL COMPLETION

A. Final Completion shall be obtained once the Contractor has completed all punch-list items to the satisfaction of the Engineer, has submitted red-lined as-built drawings, and has completed all Contract close-out documentation.

3.4 CONTRACTOR'S RESPONSIBILITY FOR COMPLETE FACILITY

A. It is the intent of these specifications that the Project be a complete workable facility, functioning in accordance with the specified requirements. Therefore, it is the direct responsibility of the Contractor to furnish, install and construct the complete facilities required by the plans and specifications for the prices stated in the Contract, and to take account of all subsidiary requirements of the equipment furnished to that end, so that the entire facilities operate as intended.

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Schedule of Values.
   2. Application for Payment.
   3. Change Procedures.
   4. Measurement and payment – unit prices.

B. Related Requirements:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SCHEDULE OF VALUES

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

B. Format: Utilize Bid Items 1 through 15 as defined in Section 01 22 00 “Price and Payment Procedures” of this Project Manual. Identify each line item with bid number and title, separating labor and material for each line item.

C. Include within each line item, a directly proportional amount of Contractor's overhead and profit.

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

1.3 APPLICATIONS FOR PAYMENT

A. Submit application on Owner-Provided Application for Payment.

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

C. Payment Period: As defined in Owner-Contractor agreement.

D. Complete Application for Payment includes Construction progress schedule, and submittal schedule, all required to process Application for Payment.

1.4 CHANGE PROCEDURES

A. Submittals: Submit name of person authorized to receive change documents and responsible for informing others in Contractor’s employ or subcontractors of changes to Work.

B. Carefully study and compare Contract Documents before proceeding with fabricating and installing Work. Promptly advise Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Information (RFI) and Clarifications: Allot time in construction scheduling for liaison with Engineer. Establish procedures for handling queries and clarifications.
   1. Use Contractor’s standard RFI for requesting information.
   2. Engineer may respond with Newforma generated RFI Transmittal Letter.

D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Price or Time by issuing supplemental instructions on Newforma generated SI Transmittal Letter.

E. Engineer may issue "Change Order," including a detailed description of proposed change with supplementary or revised Drawings and Specifications for executing change. Contractor will prepare and submit proposed change in Contractor Price and/or Time within seven days.

F. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change, and its full effect on Work. Include a statement describing reason for change, effect on Contract Price and Time, with full documentation.

G. Stipulated Price Change Order: Based on Contractor's fixed price quotation a recommended by Engineer and accepted by Owner and Contractor.

H. Document each quotation for change in Project Cost or Time with sufficient data to allow evaluation of quotation.

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

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

1.5 UNIT PRICES

A. Authority: Measurement methods delineated in Section 01 22 00 "Unit Prices."

B. Take measurements and compute quantities. Engineer to verify.

C. Unit Quantities: Quantities and measurements indicated in Bid Form are for Contract purposes only. Quantities and measurements supplied or placed in Work determine payment. When actual Work requires more or fewer quantities than those indicated, provide required quantities at contracted unit prices.

D. Payment Includes:
   1. Full compensation for required labor, products, tools, equipment, plant, transportation, services, and incidentals;
   2. Erection, application, or installation of Work item;
   3. Overhead and profit.

E. Final payment for Work governed by unit prices will be made based on actual measurements and quantities accepted by Engineer multiplied by unit price for Work incorporated in or made necessary by Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 22 00 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected products.
B. Related Sections:
   1. Other Division 01 Specification Sections apply to work of this Section.

1.2 AUTHORITY

A. Measurement methods delineated in specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the specific specification section shall govern.
B. The Engineer will take all measurements and compute quantities accordingly.
C. The Contractor shall assist the Engineer by providing necessary equipment, workers, and survey personnel as required by the Engineer.

1.3 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in the Bid Form are for contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Engineer shall determine payment as stated in the General Conditions.
B. If the actual Work requires greater or lesser quantities than those quantities indicated in the Bid Form, the Contractor shall provide the required quantities at the unit prices contracted, except as otherwise stated in the General Conditions, the contract drawings, or other sections within the specifications.

1.4 METHODS OF MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Reinforcing steel, rolled or formed steel or other metal shapes will be measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies will be measured by CRSI or AISC Manual of Steel Construction or by use of scale weights.
B. Measurement by Volume:
   1. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.
   2. Excavation and Embankment Materials: Measured by cubic dimensions using the average end area method.
C. Measurement by Area: Measured as a square dimension using either mean length and width or radius of a circle (or portion of a circle).
D. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
E. Stipulated Price Measurement: Measured by unit designated in the agreement.
F. Other: Includes items measured by weight, volume, area, or lineal means or combinations, as appropriate, as a completed item or unit of the Work.

1.5 NONCONFORMANCE ASSESSMENT

A. The Contractor shall remove and replace the Work, or portion of the Work, not conforming to the Contract Documents at no expense to the Owner.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:
   1. The nonconforming Work will remain as is, but the unit price will be adjusted to a lower price at the discretion of the Engineer.
   2. The nonconforming Work will be modified as authorized by the Engineer, and the unit price will be adjusted to a lower price at the discretion of the Engineer, if the modified Work is deemed to be less suitable than originally specified.

C. Specification sections may modify these options or may identify a percentage or specific equation to be used for a price reduction.

D. The authority of the Engineer to assess the nonconforming Work and identify payment adjustment is final.

1.6 NONPAYMENT FOR REJECTED PRODUCTS

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

1.7 REQUIREMENTS

A. The general scope of work under each bid item includes all labor, equipment and materials required for construction of completely functional and operational facilities as shown on the Drawings and in these Specifications.

B. All estimated quantities for unit price bid items stipulated in the bid proposal are approximate and are to be used only (a) as a basis for estimating the probable cost of the work and (b) for the purpose of comparing the bids submitted for the work. The actual amount of work done, and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for unit price work and materials will be the actual amount of work done and material furnished as measured by the Engineer.

C. All measurements and payments will be based on completed and accepted work performed in strict accordance with the Drawings and Specifications and in accordance with contract unit bid prices. Incidental work and items not listed in the contract-unit bid price schedule will not be paid for separately but will be included in the payment for the listed item or items and shall be full compensation for all labor, equipment, materials, testing and incidentals necessary to perform the work in accordance with these contract documents.

D. Separate payment will not be made for related items of subsidiary work but will be considered as part of the bid items in the proposal. Payment will be made for all work covered in this section at the contract unit price bid items or be included in the lump sum bid item prices for items in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

PART 2 - PRODUCT (Not Used)

PART 3 - EXECUTION

3.0 MEASUREMENT

A. General :

Two general classes of pay items exist consisting of:

1. Unit price Items: Payment for the various unit price items will be made at the particular contract price per unit as shown on the proposal. The unit price for the individual pipeline items shall specifically include all costs associated with the following: construction staking, construction facilities, coordination, site preparation, excavation, thrust restraint, backfilling and compacting for utilities, protection of adjacent utilities and pertinent structures, all pipe bedding, all pipe and accessories, joint bonding and test stations, concrete, and all other items of the project not indicated as being covered under the other specific bid items shown in the Proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.
2. Lump Sum Items: Lump sum items are to be paid for at a lump sum price per job, not in measured increments. Lump sum items shall include all work and materials involved in the installation, construction or performance of work, including incidental and subsidiary items as may be required to complete that item as shown on the drawings and designated in the specifications.
3. The description of work for the individual bid items is a general description of the work, with the items listed as a general guide for the work to be performed. This description is limited and is not meant to be all inclusive. The Contractor is responsible for determining the items necessary to complete the work and include such in his stated bid price for the work.

3.1 MOBILIZATION (BID ITEM 1)

A. Measurement for mobilization and demobilization shall be on a Lump Sum (L.S.) basis for the mobilization and demobilization of equipment, support vehicles, personnel and tools, for the completion of the part of the project for which it pertains.

B. Payment shall include all costs for Contractor’s mobilization and demobilization, insurance and bond, construction permits and fees, Health and Safety Plan, job trailers, site administration expenses, standpipe and temporary meter service, expenses for noise mitigation, utilities to the job trailers including power, telephone and construction water needs. This shall include all costs for contract closeout, site cleanup, and all costs associated with Contractor’s demobilization from site. This bid item shall be limited to a maximum of five (5) percent of the total bid price. A maximum of 60 percent of the mobilization bid amount will be paid for mobilization to the project. The remainder will be paid for demobilization after demobilization of the project occurs.

3.2 VIDEO TAPE PROJECT SITE (BID ITEM 2)

A. Payment for video tape shall be made for on a Lump Sum (L.S.) basis. This price shall be full compensation for videotaping of the project site and surrounding areas prior to any construction. Project shall be videotaped by the Contractor accompanied by the Engineer to show existing conditions of the project area, adjacent properties, structures and utilities that have been located and marked. The video tape shall be converted to DVD format. Two copies of the videotape along with two DVD discs for each segment of the project as determined by the Engineer shall be given to the Engineer.

3.3 FURNISH 6MM PERF PLATE SCREEN (BID ITEM 3)

A. The price for EACH (EA) of the screens shall include equipment, motors, control panel, sensors, transmitters and switches, manufacturers startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.4 FURNISH 105 CF/HR WASH PRESS (BID ITEM 4)

A. The price for EACH (EA) of the wash presses shall include equipment, motors, control panel, interface with the barscreen control panel, sensors, transmitters and switches, manufactures startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.5 FURNISH 210 CF/HR HORIZONTAL SHAFTLESS CONVEYOR (BID ITEM 5)

A. The price for EACH (EA) of the conveyor shall include equipment, motors, control panel, interface with the wash presses, sensors, transmitters and switches, manufactures startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.6 FURNISH 20 CY LEVEL LODOR'S (BID ITEM 6)

A. The price for EACH (EA) Level Lodor shall include equipment, motors, control panel, interface with the horizontal shaftless conveyor, sensors, transmitters and switches, manufactures startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.7 FURNISH GRIT CLASSIFIER WITH INTEGRAL CYCLONE (BID ITEM 7)

A. The price for EACH (EA) of each shall include classifier, integral cyclone, motors, drive, specified appurtenances, manufacturers startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.8 FURNISH GRIT PUMPS (BID ITEM 8)

A. The price for EACH (EA) shall include pump, motor, drive, frame for floor installation, manufacturers startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.9 FURNISH MOTOR, DRIVE, ROTATING SHAFT AND PADDLE ASSEMBLY FOR REPLACEMENT OF SAME ON EXISTING GRIT REMOVAL UNIT (BID ITEM 9)

A. The price for EACH (EA) of the assembly shall include motor, drive, rotating shaft and paddle, manufacturers startup and testing, training, spare parts, and O&Ms.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.10 FURNISH GRIT PIPING, VALVES, AND APPURTENANCES FOR REPLACEMENT OF GRIT PIPING ASSOCIATED WITH ITEMS 7 & 8 (BID ITEM 10)

A. The LUMP SUM (LS) price for this item shall include providing all specified piping, valves, couplings, supports, anchors, sump pumps, and mechanical appurtenances as required for the replacement of existing and installation of new equipment.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.11 FURNISH AND PERFORM BARSCREEN CHANNEL DEMO AND MODIFICATIONS FOR INSTALLATION OF TWO (2) PERF PLATE SCREENS (BID ITEM 11)

A. The LUMP SUM (LS) price for this item is for the removal and disposal of reinforced concrete channel structure and structural modifications as required for installation of two (2) perf plate screens as shown on Drawings.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.12 INSTALL EQUIPMENT, ASSOCIATED PIPING, INCLUDING REMOVAL OF EXISTING AS REQUIRED FOR INSTALLATION, AND PROVIDE TESTING AND STARTUP FOR ITEMS 3-10 (BID ITEM 12)

A. The LUMP SUM (LS) price for this item includes installation labor, tools, contractor's cost for testing and startup, ancillary materials and components necessary for equipment installation but not provided by the manufacturer or covered by another bid item, construction equipment, and supervision for complete and operational piping and equipment systems. Included in this cost shall be removal and disposal of existing piping and equipment shown on the drawings to be replaced.
B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.13 FURNISH AND INSTALL 120 MIL DFT CORROSION PROTECTIVE COATING ON EXISTING CONCRETE SURFACES (BID ITEM 13)

A. The SQUARE FOOT (SF) price for this item includes coating materials, installation labor, tools, supervision, equipment, surface preparation, concrete repairs, existing coating removal, coating testing, and temporary ventilation as necessary for the completing the work.

B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.14 FURNISH AND INSTALL ELECTRICAL, INSTRUMENTATION AND CONTROLS (BID ITEM 14)

A. The LUMP SUM (LS) price for this work shall include removal and disposal of existing conductors, conduits, motor starters, disconnects, and electrical components associated with the equipment replacement; providing electrical materials, instrumentation, components, tools, equipment for installation, labor, testing, supervision, and incidentals, necessary for installation of new equipment, electrical upgrades, and controls as specified.

B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.15 FURNISH AND INSTALL SITE WORK (BID ITEM 15)

A. The LUMP SUM (LS) price for this work includes clearing and grubbing, excavation, leveling, filling and grading, drainage improvements, reinforced concrete box culvert, base course, asphaltic pavement, reinforced concrete retaining wall, reinforced concrete ramp, reinforced concrete support slabs for Level Lodor's, concrete sidewalk, fencing, gates, underground site piping, trenching, trench safety, providing materials, installation labor, tools, construction equipment, supervision, and incidentals necessary for completion of the specified sitework.

B. Included in the cost shall be coordination with the Owner and Engineer for completion of the work and warranties as specified.

3.16 PAYMENT INCLUDES

B. Full compensation for all required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application, or installation of an item of the Work; and Contractor's overhead and profit.

3.18 UNIT PRICE BID

A. Total compensation for required Unit or Lump Sum Price shall be included in the Contractor's Bid Price for the Work.

3.19 STORED MATERIALS

A. Interim payments for stored materials will be made only for materials to be incorporated into the work that are properly stored acceptable to the Engineer. Payment will be made at 95 percent of invoice price.

3.20 PROGRESS PAYMENTS

A. The Contractor shall submit his schedule of values for breakdown of the lump sum bid price to the Engineer for approval prior to the first application of payment.
B. Progress payments will be based on the Engineer's observations and evaluations of quantities incorporated in the Work multiplied by the unit price.

3.21 FINAL PAYMENT

A. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities determined by the Engineer multiplied by the unit price for Work which is incorporated in or made necessary by the Work.

3.22 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal for quantities of work constructed, authorized and accepted. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quality assurance.
   2. Product options.
   3. Product substitution procedures.

B. Related Requirements:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 QUALITY ASSURANCE

A. Contract is based on products and standards established in Contract Documents without consideration of proposed substitutions.

B. Products specified define standard of quality, type, function, dimension, appearance, and performance required.

C. Substitution Proposals: Permitted for specified products except where specified otherwise. Do not substitute products unless Owner accepts substitution and approves in writing.

1.3 PRODUCT OPTIONS

A. See Section 01 60 00 “Product Requirements.”

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Engineer will consider requests for substitutions only within 30 days after date established in Notice to Proceed.

B. Substitutions may be considered when product becomes unavailable through no fault of Contractor.

C. Document each request with complete data, substantiating compliance of proposed substitution with Contract Documents, including:
   1. Manufacturer name and address, product, trade name, model, or catalog number, performance and test data, and reference standards.
   2. Itemized point-by-point comparison of proposed substitution with specified product, listing variations in quality, performance, and other pertinent characteristics.
   3. Reference to Article numbers in Specifications.
   4. Cost data comparing proposed substitution with specified product and amount of net change to Contract Sum.
   5. Changes required in other Work.
   6. Availability of maintenance service and source of replacement parts, as applicable.
   7. Certified test data to show compliance with performance characteristics specified.
   8. Samples when applicable or requested.
   9. Other information as necessary to assist Engineer's evaluation.

D. A request constitutes a representation that Contractor:
   1. Investigated proposed product and determined it meets/exceeds quality level of specified product.
   2. Will provide same warranty for substitution as specified product.
   3. Will coordinate installation and make changes to other Work required for Work to complete with no additional cost to Owner.
   4. Waives claims for additional costs/time extension that subsequently become apparent.
   5. Will coordinate installation of accepted substitute, making required changes for Work to complete in all respects.
   6. Will reimburse Owner for review/redesign services associated with reapproval by authorities having jurisdiction.

E. Substitutions not considered when indicated/implied on Shop Drawing or Product Data submittals without separate written request or acceptance requires revision to Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit requests for substitutions on Contractor-standard or Engineer-provided form.
   2. Submit electronic files to Project website of Request for Substitution for consideration. Limit each request to one proposed substitution.
   3. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on Contractor.
   4. Engineer will notify Contractor in writing of decision to accept/reject request.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project Information Management.
   2. Coordination.
   3. Preconstruction meeting.
   4. Request for information.
   5. Progress meetings.
   6. Preinstallation meetings.

B. Related Requirements:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 PROJECT INFORMATION MANAGEMENT

A. Project Website:
   1. Use Newforma Info Exchange at https://projects.team-psc.com/UserWeb/Login to send and receive Project information.
   2. Contact Engineer to set up username and password information.
   3. If Project is not listed when logged in, contact Engineer to add Project to your account.

B. Project information includes, but is not limited to:
   1. Product Submittals.
   2. Requests for Information (RFI).
   3. Applications for Payment.
   4. Schedules.
   5. Construction Change Requests (CCRs).
   6. Close-out Documents.
   7. Construction Document Files.

1.3 COORDINATION

A. Coordinate scheduling, submittals, and Work to assure efficient and orderly sequence of installation of construction elements.

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

C. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing as closely as practicable. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.

D. In finished building areas, except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements, as applicable.

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

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

1.4 PRECONSTRUCTION MEETING

A. Engineer will schedule a weekly after Notice to Proceed.

B. Attendance Required:
   1. Owner.
   2. Engineer.
   3. Contractor.
   4. Major subcontractors.

C. Agenda:
   1. Distribute Contract Documents.
   2. Submit lists of subcontractors and products, Schedule of Values, submittal schedule, and progress schedule.
   3. Designate personnel representing each party in Contract and Engineer.
   4. Procedures and processing field decisions, submittals, substitutions, Applications for Payments, proposal request, Change Orders, Request for Information (RFI), and Contract closeout procedures.
   5. Review Notice to Proceed and Substantial/Final Completion Dates.
   6. Workmen's identification and background checks.
   7. Stormwater Pollution and Prevention Plan (SWPPP), if necessary.
   8. Scheduling:
      a. Use of premises by Owner and Contractor.
      b. Owner's requirements.
      c. Construction facilities and controls provided by Owner.
      d. Temporary utilities.
      e. Security and housekeeping procedures.
      f. Construction progress meetings.
      g. Procedures for testing.
      h. Procedures for maintaining record documents.
      i. Requirements for start-up of equipment.
      j. Inspection and acceptance of equipment put into service during construction.
   9. Scheduling activities of Construction Material Testing lab.

D. Engineer shall record minutes and distribute copies to participants.

1.5 REQUEST FOR INFORMATION (RFI)

A. RFI requests from subcontractors or material suppliers will not be considered.

B. Information indicated on RFI shall be complete before submission. If Engineer determines request can be answered with information provided, Engineer will assign RFI tracking number. If Engineer determines request is not an RFI, request will be returned to Contractor electronically and deleted from Engineer's electronic tracking software without assigning an RFI tracking number. A transmittal document returning denied RFI request will be provided with a response indicating action to be taken by Contractor.

C. RFIs may contain more than one item when items are related. Otherwise, only one item shall be addressed on each RFI request.

D. Allow seven days for Engineer's response to each RFI.
E. Response to RFI will be issued to Contractor and Owner per Section 01 33 00 "Submittal Procedures."
F. Responses from Engineer are not Changes unless issued with a change per Section 01 20 00 "Price and Payment Procedure."

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout Work progress, at minimum.
B. Engineer will arrange meetings, prepare agenda with copies for participants, preside at meetings.
C. Attendance Required:
   1. Owner.
   2. Job superintendent.
   3. Major subcontractors.
   4. Suppliers.
   5. Engineer.
D. Agenda:
   1. Review minutes of previous meetings.
   2. Review Work progress.
   3. Field observations, problems, and decisions.
   4. Identify problems which impede planned progress.
   5. Review submittal schedule and status of submittals.
   6. Review off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding Work period.
   10. Coordinate projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.
E. Record minutes and distribute copies within five days to Engineer, participants, and those affected by decisions made.

1.7 PREINSTALLATION MEETING

A. When required in individual Specifications, convene a preinstallation meeting at site before installing Work.
B. Require attendance of parties directly affecting, or affected by, Work.
C. Notify Primary Designer seven days in advance of meeting date.
D. Prepare agenda and preside at meeting.
   1. Review conditions of installation, preparation, and installation procedures.
   2. Review coordination with related work.
E. Record minutes and distribute copies within five days after meeting to participants and copy Engineer.

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. Submittals.
   2. Gantt chart schedules.
   3. Review and evaluation.
   4. Updating schedules.
   5. Distribution.

B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Submit initial progress schedule for Engineer review within 15 days after established Notice to Proceed date.

B. Schedule Updates:
   1. Submit with each Application for Payment.
   2. Projected and actual percent of completion.
   3. Completion progress by listed activity and subactivity, to within five working days prior to submittal.
   4. Changes in Work scope and activities modified since submittal.
   5. Delays in submittals or resubmittals, deliveries, or Work.
   6. Adjusted or modified sequences of Work.
   7. Other identifiable changes.
   8. Revised projections of progress and completion.

C. Narrative Progress Report:
   1. Submit with each Application for Payment.
   2. Summary of Work completed during past period between reports.
   3. Work planned during next period.
   4. Explanation of differences between summary of Work completed and Work planned in previously-submitted report.
   5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
   6. Corrective action taken or proposed.

1.3 GANTT CHART SCHEDULES

A. Format Gantt chart Schedule, to include at least:
   1. Identification and listing, in chronological order, activities reasonably required to complete Work, including:
      a. Subcontract Work.
      b. Major equipment design, fabrication, factory testing, and delivery dates including required lead times.
      c. Move-in and other preliminary activities.
      d. Equipment and equipment system test and startup activities.

e. Project closeout and cleanup.
f. Work sequences, constraints, and milestones.
g. Listings identified by Specification Section number.

2. Identification of:
   a. Horizontal time frame by year, month, and week.
   b. Duration, early start, and completion for each activity and subactivity.
   c. Critical activities and Project float.
   d. Sub-schedules to further define critical portions of Work.

1.4 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of schedules with Engineer at each Progress Meeting or Application for Payment submittals.
B. Evaluate Project status to determine Work behind and ahead of schedule.
C. After review, revise schedules incorporating results of review, and resubmit within 10 days.

1.5 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.
B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
C. Update schedules to depict status of Work.
D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
E. Upon approval of Change Order, include change in next schedule submittal.
F. Indicate changes required to maintain Date of Substantial Completion.
G. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and effect.

1.6 DISTRIBUTION

A. Following joint review, distribute copies to subcontractors, suppliers, Engineer, Owner, and other concerned Parties
B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittal procedures.
   2. Resubmittal requirements.
   3. Proposed products list.
   4. Shop Drawings.
   5. Product data.
   6. Samples.
   7. Test reports.
   8. Certificates.
   9. Manufacturers' instructions.
   10. Manufacturer’s Field Reports.

B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTAL PROCEDURES

A. Submit to Engineer for review to check for conformance with information given and design concept expressed in Contract Documents.

B. Produce copies and distribute in accordance with this Article.

C. Use Project website to submit record documents as described in Section 01 70 00 "Execution and Closeout Requirements."

D. Transmit each submittal separately with Contractor's standard transmittal letter including Contractor's name, address, and phone number. Each submittal shall contain only one Specification Section.

E. Sequentially number transmittal forms using Section number or Contractor’s other sequential numbering system.

F. Identify Project, Contractor, subcontractor, or supplier, pertinent Drawing sheet and detail number(s), and Specification Section number appropriate to submittal.

G. Apply Contractor's stamp, signed or initialed certifying review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is per requirements of Work and Contract Documents.

H. Schedule submittals to expedite Project and deliver to Engineer. Coordinate submission of related items.

I. For each submittal for review, allow 10 working days excluding delivery time to and from Contractor.

J. Identify variations from Contract Documents and product or system limitations detrimental to successful performance of completed Work. Information, comments, field verifications, responses, or other notations marked on submittals by Contractor shall be in blue or green colors only.

K. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

L. Unrequested Submittals will not be recognized or processed.
M. Format:
    1. Submit all submittals digitally using PDF file extension. Each submittal shall be a single PDF file including transmittal letter. Multiple files for same submittal will not be accepted.
    2. Submittals in any other format, including ZIP files, will be rejected.
    3. Hard copies not accepted.
    4. To ensure each page is legible, PDF pages of Drawings shall be same size/scale as hard copy. Where applicable, provide scale symbols to indicate scale. Illegible submittals will be rejected.
    5. Upload submittals to Project website.
N. Submittal procedures described herein apply to construction progress schedule, products list, shop Drawings, product data, samples (actual samples and digital files of same), design data, test reports, certificates, manufacturer's instructions and field reports, erection Drawings, RFIs, and other submittals submitted to Engineer.

1.3 RESUBMITTAL REQUIREMENTS

A. Revise submittals as required and resubmit to meet requirements specified and noted on submittal reviews.
B. Mark as *Resubmittal*.
C. Reuse original transmittal number and supplement with sequential alphabetical or numeric suffix for each resubmittal.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 REQUIREMENTS FOR COMPLETE SHOP DRAWINGS

A. Printable Image Size: Minimum 8 1/2 by 11 inches, maximum 30 by 42 inches.
B. Draw details to a noted scale.
C. Draw site plans to same scale indicated on Contract Drawings.
D. Engineer-issued Construction Documents (electronic or paper format) cannot be used in any shape, form, or fashion in creating and developing Shop Drawings, except electronic files containing floor, site plans, or layout plans purchased from Engineer may be used as backgrounds for Contractor, subcontractors, sub-subcontractors, and material suppliers in Shop Drawing process.
E. Electronic Files: Available upon request. See Project Manager.
    1. Electronic AutoCAD drawing files are available for purchase from Engineer upon request. Cost of files plus applicable taxes are:
        a. 1 - 3 sheets: $100.00 per sheet.
        b. 4 - 6 sheets: $400.00 flat fee.
        c. 7 - 9 sheets: $500.00 flat fee.
    2. Contractor, subcontractors, and/or sub-subcontractors may purchase electronic file. Electronic file will be provided in software release currently used by Engineer. File provided via Project website.

3. Before file delivery, purchaser shall sign an Electronic File Transfer Release Form. Payment for an electronic file shall occur upon delivery of file to purchaser.
4. Only use electronic file for production of information required by Project and not any other form (in whole or part).
5. In creation and publication of Shop Drawings, under no circumstances shall Engineer's seal or title block of drawing be reproduced. Shop drawings must be original works from Contractor subcontractors, sub-subcontractors, and material suppliers.

1.6 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to Project.
B. Include recommendations for application and use, and reference to compliance with specified standards of trade associations and testing agencies.
C. After review, distribute per Article 1.2 “Submittal Procedures,” and provide copies for Record Documents described in Section 01 70 00 "Execution and Closeout Requirements."

1.7 TEST REPORTS

A. Submit for Engineer’s knowledge as Contract Administrator.
B. Submit test reports for information to assess conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

A. When specified in individual Specifications, submit certification by manufacturer, installation/application subcontractor, or Contractor, to Engineer.
B. Indicate material or product conforms to/exceeds specified requirements. Submit supporting reference data, affidavits, and certifications, as appropriate.
C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual Specifications, submit manufacturer-printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.
B. Identify conflicts between manufacturers' instructions and Contract Documents.
C. Indicate special procedures, conditions requiring special attention and special environmental criteria required for application or installation.

1.10 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's benefit as contract administrator.
B. Submit report within 30 days of observation to Engineer for information.
C. Submit for information to assess conformance with information given and design concept expressed in Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quality control.
   2. Tolerances.
   3. References.
   4. Mockup requirements.
   5. Testing and inspection services.
   6. Manufacturers' field services.

B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturer’s instructions. If manufacturer’s instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Perform Work using persons qualified to produce required and specified quality.

D. Products, materials, and equipment may be subject to inspection by Engineer at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.

E. Supervise performance of Work to ensure Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or required by applicable codes.

B. Conform to reference standard by date of issue current as of date of Contract Documents except where specific date is established by code.

C. Obtain copies of standards and maintain onsite when required by product Specifications.

D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, or responsibilities of parties in Contract, nor those of Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.5 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent firm acceptable to Owner to perform specified testing.
   1. Before starting Work, submit testing firm name, address, phone number, and name of responsible officer.
B. Independent firm will perform tests, inspections, and other services specified in individual Specifications and as required by Engineer.
C. Testing, inspections, and source quality control may occur on or off Project site. Perform off-site testing as required by Engineer.
D. Submit reports to Engineer, indicating observations and results of tests and compliance or noncompliance with Contract Documents.
E. Cooperate with independent firm. Furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor, as requested.
   1. Notify Engineer and independent firm 24 hours before expected time for operations requiring services.
   2. Pay for additional Samples and tests required for Contractor use.
F. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work per requirements of Contract Documents.
G. Retesting or Re-inspection Required Because of Nonconformance with Specified or Indicated Requirements: Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
H. Independent Firm Responsibilities:
   1. Test Samples of mixes submitted by Contractor.
   2. Provide qualified personnel at Site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform indicated sampling and testing of products per specified standards.
   4. Ascertain compliance of materials and mixes with Contract Document requirements.
   5. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or products.
   6. Perform additional tests required by Engineer.
   7. Attend preconstruction and progress meetings.
I. Independent Firm Reports. After each test, promptly submit report to Engineer and Contractor and provide interpretation of test results. Include:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and Specifications.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Conformance with Contract Documents.

1.6 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specifications, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, equipment startup, testing, adjusting, and balancing equipment, commissioning, and other as applicable, and initiate instructions when necessary.
B. Submit qualifications of observer to Engineer 30 days before required observations. Observer is subject to Engineer approval.
C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.
D. Refer to Section 01 33 00 “Submittal Procedures,” Article 1.11 - Manufacturer's Field Reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 43 26 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing Laboratory Services and Contractor responsibilities related to those services. Where tests of materials or any portions of the Work are required by law/ordinance or public authority, the Contractor shall bear all costs of such tests, shall give timely notice of readiness thereof and shall furnish to the Engineer the required certification of testing or approval. Tests specified in the Technical Specifications shall fall into four categories:
      a. Those required for approval of materials prior to use, which serve the same purpose as shop drawings or samples.
      b. Those required by law.
      c. Those necessary for acceptance of equipment, and/or facilities.
      d. Those made during the progress of the Work to check compliance with the requirements of the Contract Documents.
   2. The Contractor shall bear all the costs of the tests in the first three categories.
   3. The tests made in the fourth category will be made at the discretion of the Engineer and all costs thereof will be borne by the Owner, except that the Contractor shall furnish the materials for the sample and shall cooperate with the Engineer, or Testing Laboratory, in securing such samples. In addition, all failing tests in this category shall be borne by the Contractor.
   4. The tests in the fourth category shall include tests normally performed by a commercial testing laboratory for materials such as: density tests for pipe bedding, trench and/or structural backfill, sub-grade, base course, and hot mix; proctor tests and Atterberg Limits for pipe bedding, trench and/or structural backfill, sub-grade and base course; in place densities for Asphalt pavement, including Marshall stability, Asphalt extraction and gradation tests; cylinders for concrete compressive strength, mortar cubes and prisms for grout strength.
B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing/Inspection of Soil and Rock as Used in Engineering Design and Construction.
B. ASTM E329 - Standard Specification for Minimum Requirements for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.3 SELECTION AND PAYMENT

A. Owner shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work per Contract Document requirements.
C. Contractor shall schedule and monitor testing as required to provide timely results and to avoid delay to the Work.

1.4 LABORATORY REPORTS

A. The Engineer will receive three copies and the Contractor will receive two copies of laboratory reports from the testing laboratory. One of the Contractor's copies shall remain at site field office for the duration of the project. Test results which indicate non-conformance shall be transmitted immediately via fax from the testing laboratory to the Contractor and the Engineer.

1.5 LIMITS ON TESTING LABORATORY AUTHORITY

A. The laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.
B. The laboratory may not approve or accept any portion of the Work.
C. The laboratory may not assume any duties of the Contractor.
D. The laboratory has no authority to stop the Work.

1.6 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall notify the Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. The Contractor shall notify the Engineer if specification section requires the presence of the Engineer.
B. The Contractor shall cooperate with laboratory personnel in collecting samples to be tested or collected on site.
C. The Contractor shall provide access to the Work and to manufacturer's facilities.
D. The Contractor shall provide samples to the laboratory in advance of their intended use to allow thorough examination and testing.
E. The Contractor shall provide incidental labor and facilities for access to the Work to be tested; to obtain and handle samples at the site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.
F. The Contractor shall arrange with the laboratory and pay for:
    1. Retesting required for failed tests
    2. Retesting for nonconforming Work
    3. Additional sampling and tests requested by Contractor beyond specified requirements.
G. PRODUCTS (Not Used)

PART 2 - EXECUTION

2.1 CONDUCTING TESTING

A. Laboratory sampling and testing shall conform to ASTM D3740 and ASTM E329, plus other test standards specified in individual Specification Sections.

2.2 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items shown in the proposal. Either payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SCOPE

A. Contractor shall always supply potable drinking water for his employees.
B. Potable water to be used for construction and testing shall be furnished to the Contractor by the Owner under set conditions and charges contained in the Rules and Regulations adopted by the Public Service Board, specified as Instructions to Contractors Requesting Fire Hydrant Meter. The Contractor shall pay for water at the established rate of $4.42 per CCF for water used at cost, with no mark up.
C. Alternately, water to be used for construction may be obtained by the Contractor. The Contractor is responsible for determining the suitability of the water for his uses.
D. Reclaimed Water for Testing – The construction water to be used for testing NON-POTABLE structures, will be reclaimed water from the plant site. The reclaimed water will be metered by the OWNER and access will be given to the Contractor at a spot to be determined by the Owner on the plant site. Conveyance of the water to the structure or non-potable lines to be tested will be at the Contractors expense. The Contractor will not be charged for the reclaimed water, but if the OWNER determines the water is being wasted the Owner will have the option of charging the Contractor for the water and same rate for potable water described in Item B.

1.3 INSTRUCTIONS TO CONTRACTORS REQUESTING FIRE HYDRANT METER

A. The Contractor must complete a Fire Hydrant Meter Application for a fire hydrant meter with the Engineering Developer Services Section of the El Paso Water Utilities, located on the third floor of the El Paso Water Utilities Building, 1154 Hawkins Blvd. For information, please contact 594-5635 or 594-5539. Billing rate for construction water will be as established in the latest Rules and Regulations.
B. The Engineering Developer Services Section will forward the application form to the Fire Department for approval. The Fire Department will approve within 48-hrs of receipt of the application.
C. Water Distribution Section will have the meter installed within 48 hours after approval by the Fire Department and Engineering Developer Services Section. The Contractor must coordinate with Water Supply Section at 594-5782 to have a Contractor's Representative at the specified fire hydrant for the installation of the meter. The Contractor shall be responsible to secure the valve on the meter to ensure unauthorized use.
D. Readings will be taken monthly from the fire hydrant meter by Utility. Consumption will be billed monthly by the 15th of the month. Payment is due 10 working days later. If not paid, fire hydrant meter will be removed.
E. Immediately after completion of the construction project, the Contractor must complete the Meter Removal Form requesting removal of the meter. The Utility will remove the meter within two working days.

F. A final bill will be consolidated for any damages to the fire hydrant or the fire hydrant meter in addition to any assessments due to violations. Charges will be deducted from the original deposit. Any shortages must be paid before Final Acceptance of the project will be made; any overages will be refunded within 15 days of payment of the final bill.

1.4 NOTES TO CONTRACTORS

A. Additional fire hydrant meters will not be issued for other fire hydrants within a 2000-foot radius of the fire hydrant requested. Deposits and Set-up/Removal fees are due for each meter on a project.

B. The fire hydrant meter shall not be moved for any reason by the Contractor. If the Contractor needs to move the meter to another fire hydrant, the Contractor must contact Engineering Developer Services Section at 594-5635 or 594-5539 to apply for another fire hydrant meter. Fire Department approval for the new meter location is also required.

1. Neither non-metered consumption removal of the meter, nor tampering with the fire hydrant or valve will be allowed under any circumstances. The Contractor agrees that by executing the Fire Hydrant Meter Application any violations of these requirements shall be grounds for immediate removal of the meter and a $500 assessment for water losses for each occurrence.
2. The adapter that is installed for use of the Fire Department on the fire hydrant meter must not be removed. This is considered as tampering and violation fees will be assessed.

1.5 TEMPORARY SERVICE

A. The Contractor shall furnish and install, at his own expense, all temporary electrical facilities and equipment operation required for construction and safety operation. Separate electrical metering shall be provided. Power used shall be paid for by the Contractor, regardless of the source of the power.

1.6 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide adequate toilet facilities for use by his personnel and shall maintain such facilities in a clean and sanitary condition throughout the construction period. Such facilities shall be conveniently located for use by the personnel and the entire area shall be maintained in a clean and sanitary condition. After completion of the work, all temporary toilet facilities shall be removed from the site. No toilet facility shall be located within 150 feet of an existing well or potable water source.

1.7 DUST CONTROL

A. Contractor shall furnish and maintain equipment necessary to always affect the control of dust over the entire working area. The control of dust shall mean that no construction activity shall take place without applying such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.

1.8 CONSTRUCTION STAGING AREA

A. The Contractor shall be responsible for coordinating with the Plant Superintendent a construction staging area for equipment and materials storage, construction offices, etc., that the Contractor feels is necessary for the project.
B. Current approved Laydown Areas are shown on the plans.

1.9 OFFICE FACILITIES

A. No separate office facilities are required to be provided by the Contractor for the use of the Engineer for this project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PAYMENT

A. Payment for all work covered in this section will be included in the Lump Sum Price for mobilization as shown in the contractor's Bid Proposal. Such payment shall be complete compensation for the complete performance of the work including all subsidiary or incidental items necessary to complete the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 01 57 13 TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Obtaining permits, furnishing labor, materials, equipment and incidentals necessary to provide erosion and sediment control during construction.
   2. Furnishing, installing and maintaining erosion and sediment control structures and procedures and proper removal when no longer required.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures,” and shall include:

B. Copies of approved permits.

1.3 NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

A. Anticipated Disturbed area for this project is 0.65 acres, and not part of a larger common plan.

B. One (1) acre or less of disturbed area and not part of a larger common plan
   1. Coverage under the General Permit (TXR150000) is not required.

C. Provide dust control in accordance with the Best Management Practices (BMPs) Controls.

1.4 EROSION AND SEDIMENT CONTROLS

A. Implement structural measures to divert flows from exposed soils, temporarily store flows, or otherwise limit run-off and discharge of pollutants from exposed areas of site. Timely implement structural practices during construction to minimize erosion and sediment run-off, in accordance with Best Management Practices (BMPs).

B. Stabilized Ingress/Egress:
   1. Provide stabilized access to/from construction site as soon as practical per BMP.
   2. Ensure any soil tracked off-site is cleaned from existing roads, alleys, and any adjacent properties as soon as possible. Check for any pollutants (mud, silt, sand, cement, construction materials, etc.) tracked or washed off-site and perform necessary clean-up measures at the end of each work-day.

C. Silt Fences/Diversion Berms: Provide silt fences and/or diversion berms as a temporary structural practice to minimize erosion and sediment runoff, as necessary. Properly install silt fences and/or diversion berms to effectively retain sediment immediately after completing each phase of work where erosion would occur as sheet and rill erosion (clearing and grubbing, excavation, embankment, grading, etc.)

D. Sand/Gravel Bags: Provide sand/gravel bags as a temporary structural practice to minimize erosion and sediment runoff. Properly place bags to effectively retain sediment immediately after completing each phase of work (clearing and grubbing, excavation, embankment, grading, etc.) in each independent runoff area (after clearing and grubbing between ridge and drain, place bags as work progresses, remove/replace/relocate bags as needed for work to progress in drainage area). Replace sand/gravel bags no longer in good condition, as needed.

E. Site Stabilization:
   1. Minimize surface area of base soil material at one time.
   2. Implement necessary stabilization measures including:
      a. Temporary/permanent seeding/sodding.
      b. Mulching.
      c. Geotextiles.
      d. Vegetative buffer strips.
      e. Paving.
      f. Rock riprap; and/or
      g. Rock-filled gabions.
      h. Inlet protection.
   3. Implement stabilization measures per BMPs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PAYMENT

A. Payment for all work covered in this section will be included as part of the unit bid price for the pump station building as shown in the bid proposal.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Products.
   2. Product delivery requirements.
   3. Product storage and handling requirements.

B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products per manufacturer instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products. Prevent soiling, disfigurement, or damage.

D. Owner will not assist in offloading or accepting product deliveries.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products per manufacturer instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products. Prevent soiling, disfigurement, or damage.

H. Arrange product storage to permit access for inspection. Periodically inspect to verify products are undamaged and maintained in acceptable condition.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surveying.
   2. Closeout procedures.
   3. Starting systems.
   4. Demonstration and instructions.
   5. Project record documents.
   6. Operation and maintenance data.
   7. Spare parts and maintenance products.
   8. Product warranties and product bonds.
   9. Examination.
   10. Preparation.
   11. Execution.
   12. Protecting installed construction.
   13. Final cleaning.

B. Related Sections:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SURVEYING

A. Employ land surveyor registered in State of Texas and acceptable to Engineer.

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

C. Control datum for survey is indicated on Drawings.

D. Verify setbacks, easements, and rights of way. Confirm Drawing dimensions and elevations.

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

F. Submit copy of Site Drawing signed by land surveyor certifying elevations and locations of Work are per Contract Documents.

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

H. Protect survey control points before starting Site Work. Preserve permanent reference points during construction.

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

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

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion. Complete following items before requesting Certification of Substantial Completion, either for entire Work or portions of Work:
   1. Submit maintenance manuals, Project record documents, and other similar final record data per this Section.

2. Complete facility startup, testing, adjusting, balancing systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified per this Section.
3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to complete or correct, value of incomplete or nonconforming Work, reason for incompletion, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Change locks and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
8. Perform final cleaning per this Section.

B. Substantial Completion Inspection:
1. When Contractor considers Work substantially complete, submit to Engineer and Owner:
   a. Written certificate that Work, or designated portion, is substantially complete.
   b. List of items to complete or correct (initial punch list).
2. Within seven days after receipt of request for Substantial Completion, Engineer and Owner will inspect to determine if Work or designated portion is substantially complete.
3. If Engineer and Owner determine Work is NOT substantially complete:
   a. Engineer and Owner will promptly notify Contractor in writing, stating reasons for opinion.
   b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer and Owner.
   c. Engineer and Owner will reinspect Work.
   d. Repeat until Work passes inspection.
4. When Engineer and Owner finds Work is substantially complete, they will:
   a. Prepare Certificate of Substantial Completion on EJCDC C-625 - Certificate of Substantial Completion, accompanied by Contractor's list of items to complete or correct as verified and amended by Engineer and Owner (final punch list).
   b. Submit Certificate to Owner and Contractor for written acceptance of responsibilities assigned in Certificate.
5. After Work is substantially complete, Contractor shall:
   a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
   b. Complete Work listed for completion or correction within time stipulated.

C. Prerequisites for Final Completion. Complete following items before requesting final acceptance and final payment.
1. When Contractor considers Work complete, submit written certification that:
   a. Contract Documents were reviewed.
   b. Work was examined for compliance with Contract Documents.

c. Work was completed per Contract Documents.
d. Work is complete and ready for final inspection.

2. Submit:
   a. Final punch list indicating all items are complete or correct.
   b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations, where required.
   c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
   d. Accounting statement for final changes to Contract Sum.
   e. Contractor's affidavit of payment of debts and claims on Contractor's Affidavit of Payment of Debts and Claims form.
   f. Contractor affidavit of release of liens on Contractor's Affidavit of Release of Liens form.
   g. Consent of surety to final payment on Contractor's Consent of Surety to Final Payment form.
3. Perform final cleaning for Contractor-soiled areas per this Section.

D. Final Completion Inspection:
1. Within seven days after receipt of request for final inspection, Engineer and Owner will inspect to determine if Work or designated portion is complete.
2. If Engineer and Owner consider Work incomplete or defective:
   a. Engineer and Owner will promptly notify Contractor in writing, listing incomplete or defective Work.
   b. Contractor shall remedy stated deficiencies and send second written request to Engineer and Owner that Work is complete.
   c. Engineer and Owner will reinspect Work.
   d. Redo and Inspect Deficient Work: Repeated until Work passes inspection.
   e. Engineer and Owner inspection.

1.4 STARTING SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.
B. Notify Engineer seven days before startup of each item.
C. Verify each piece of equipment or system was checked for proper lubrication, drive rotation, belt tension, control sequence, and conditions which may cause damage.
D. Verify tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.
E. Verify wiring and support components for equipment are complete and tested.
F. Execute startup under supervision of manufacturer's representative or Contractors' personnel per manufacturer's instructions.
G. When specified in individual Specifications, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation before startup and supervise placing equipment or system in operation.
H. Submit a written report per Section 01 33 00 "Submittal Procedures," that equipment or system has properly installed and functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance (O&M) of products to Owner's personnel two weeks before date of final inspection.

B. Demonstrate Project equipment by manufacturer's representative who is knowledgeable about Project.
C. Use O&M manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
E. Prepare and insert additional data in O&M manuals when need for additional data is apparent during instruction.
F. Required instruction time for each item of equipment and system is specified in individual Specifications.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain onsite, one set of these record documents and record actual revisions to Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to Contract.
   5. Reviewed Shop Drawings, product data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling future reference by Owner.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress, not less than weekly.
E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including:
   1. Manufacturer's name, product model and number.
   2. Product substitutions or alternates used.
   3. Changes made by Addenda and modifications.
F. Record Drawings and Shop Drawings. Legibly mark each item to record actual construction as:
   1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in Work, and change orders.
   2. Include locations of concealed elements of Work.
   3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components parallel to utilities.
   4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
   5. Identify and locate existing buried or concealed items encountered during Project.
   6. Measured depths of foundations in relation to finish floor datum.
   7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Work.
   9. Field changes of dimension and detail.
   10. Details not on original Drawings.
B. Submit PDF electronic files of marked-up documents to Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.
B. Submit data bound in 8 1/2- x 11-inch text pages, three, D-side-ring binders with durable plastic covers.
C. Prepare binder cover with printed Operation and Maintenance Instructions, title of Project
D. and subject matter of binder when multiple binders required.
E. Internally subdivide binder contents with permanent page dividers, logically organized as described, with tab titling clearly printed under reinforced laminated plastic tabs.
F. Drawings: Provide with reinforced punched binder tab. Bind in with text. Fold larger drawings to size of text pages.
G. Contents: Prepare Table of Contents (TOC) for each volume, with each product or system description identified, typed on white paper, in three parts.

Part 1: Directory listing names, addresses, and phone numbers of Engineer, Contractor, subcontractors, and major equipment suppliers.

Part 2: O&M instructions arranged by Specification Section. For each category, identify names, addresses, and phone numbers of subcontractors and suppliers. Include:

1. Significant design criteria.
2. List of equipment.
3. Parts list for each component.
4. Operating instructions.
5. Maintenance instructions for equipment and systems.
6. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
7. Safety precautions to take when operating and maintaining or working near equipment.

Part 3: Project documents and certificates, including:

1. Shop Drawings and product data.
2. Certificates.
3. Originals of warranties and bonds.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specifications.
B. Deliver to place in location as directed by Owner. Obtain receipt before final payment.

1.9 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers within 10 days after completion of applicable item of Work.
B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
C. Verify documents are in proper form, contain full information, and notarized.
D. Co-execute submittals when required.
E. Include TOC and assemble in three, D-side-ring binder with durable plastic cover.
F. Submit before final Application for Payment.
G. Time of Submittals:
    1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after date of Substantial Completion, before final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within 10 days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing Site conditions and substrate surfaces are acceptable for subsequent Work.
B. Beginning new Work means acceptance of existing conditions.
C. Verify existing substrate can structurally support or attach new Work applied.
D. Examine and verify specific conditions described in individual Specifications.
E. Verify utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces before applying next material or substance per manufacturer instructions.
B. Seal cracks or openings of substrate before applying next material or substance.
C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner before applying new material or substance in contact or bond.

3.3 EXECUTION

A. Comply with manufacturer installation instructions, performing each step, in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.
B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
C. Verify field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
    1. Secure Work true-to-line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
    2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
    3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.
E. Allow for expansion of materials and building movement.
F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
    1. Isolate each unit of Work from incompatible Work necessary to prevent deterioration.
    2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

G. Mounting Heights: Where not indicated, mount individual units of Work at industry-recognized standard mounting heights for application indicated.
   1. Refer questionable mounting heights choices to Engineer for final decision.
   2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.
H. Adjust operating products and equipment to ensure smooth and unhindered operation.
I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction. Lubricate operable components recommended by manufacturer.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified.
B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
F. Prohibit traffic from landscaped areas.

3.5 FINAL CLEANING

A. Execute final cleaning before final Project assessment. Employ experienced personnel or professional cleaning firm.
B. Clean interior and exterior glass and surfaces exposed to view. Remove temporary labels, stains, and foreign substances.
C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
D. Clean filters of operating equipment.
E. Clean debris from roofs, gutters, downspouts, and drainage systems.
F. Clean site. Sweep paved areas and rake landscaped surfaces clean.
G. Remove waste and surplus materials, rubbish, and construction facilities from site.

END OF SECTION

SECTION 03 00 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes for buildings and structures.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
C. References:
   1. ACI 347: Recommended Practice for Concrete Formwork
   2. PS-1: Construction and Industrial Plywood.
   3. ACI 318: Building Code Requirements for Structural Concrete.
   4. ACI 301: Specifications for Structural Concrete.
   5. ACI 117: Specifications for Tolerances for Concrete Construction and Materials.
   6. ACI 315: Details and Detailing of Concrete Reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.
B. W/C Ratio: The ratio by weight of Water to Cementitious Materials.

1.3 SUBMITTALS

A. Qualification Data: For installer, manufacturer, and testing agency.
B. Materials Certificates: For each of the following, signed manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
   8. Bonding agents.
   9. Adhesives.
   10. Vapor retarders.
   11. Semirigid joint filler.
   12. Joint-filler strips.
   13. Repair materials.
C. Design Mixes for each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances that warrant adjustments. Submitted compressive test results must be less than six months old. Indicate amounts of mix water to withhold for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared per ACI 315, *Details and Detailing of Concrete Reinforcement*. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer who completed concrete Work similar in material, design, and extent to that indicated for Project and work resulted in construction with record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products per ASTM C94 requirements for production facilities and equipment.
   1. Manufacturer must be certified per National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: Independent testing agency, acceptable to authorities having jurisdiction, qualified per ASTM C077 and E329 to conduct testing indicated, as documented per ASTM E548. Personnel conducting field tests qualified as ACI Concrete Field testing Technician, Grade 1, per ACI CP-1 or equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of same brand from same manufacturer plant, each aggregate from one source and admixture from same manufacturer.

E. ACI Publications. Comply with the following, unless more stringent provisions indicated:
   1. ACI 301, *Specification for Structural Concrete*.
   2. ACI 117, *Specifications for Tolerances for Concrete Construction and Materials*.

F. Preinstallation Conference: Conduct at Project site to comply with Division 01 requirements. Before placing concrete, hold a preinstallation conference meeting involving Superintendent, Engineer, applicable subcontractors, and testing lab. Meeting includes (at minimum):
   1. Site preparation.
   2. Grades and drainage.
   3. Installation of auxiliary materials (vapor retarders, ducts, etc.)
   4. Type of floor and thickness.
   5. Reinforcement and placement.
   6. Joints.
   7. Concrete materials, production, placement and delivery.
   8. Compaction of soil.
   9. Finishing tools and finishing.
   10. Curing/Sealing/Hardeners: Type and timing/duration of application.
   11. Testing and inspection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.1 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301.
   2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated, and edge sealed.
      c. Structural 1, B-B or better; mill oiled, and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled, and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4- by 3/4-inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties that, when removed, leave holes no larger than one inch in diameter in concrete surface.
   2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
B. Deformed-Steel Wire: ASTM A 1064.
C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1065 flat sheet.
D. Reinforcing Bars to Be Welded: ASTM A 706.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
B. Bar Supports: Bolsters, chairs, and spacers for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from CRSI Manual of Standard Practice, from steel wire, plastic, precast concrete, or fiber-reinforced concrete of greater compressive strength than concrete, and:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Plastic, wood, concrete, clay blocks, and other devices not permissible.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
B. Cementitious Materials:
   1. Portland Cement: ASTM C 150, Type I/II, Type IL, gray.
   2. Fly Ash: ASTM C 618, Class C.
C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Nominal Maximum Aggregate Size: 1-inch, except when clear spacing between reinforcing bars is 2 inches or less, nominal maximum aggregate size shall be 3/4-inch.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
D. Water: ASTM C 94 and potable.

2.6 ADMIXTURES

A. Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material and compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
   1. Air-Entraining Admixture: ASTM C260.
   2. Water-Reducing Admixture: ASTM C494, Type A.
   3. High Range, Water-Reducing Admixture: ASTM C494, Type F.
   4. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
   5. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   6. Articles 2.5 C – 2.5 F are only to be utilized with Engineer approval of mix design admixture.

B. Water: ASTM C 94 and potable.

2.7 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BoMetals Inc.
      b. Paul Murphy Plastics Company.
      c. Sika Greenstreak.
      d. Vinylex Waterstop & Accessories.
   2. Profile: Ribbed without center bulb.
   3. Dimensions: 4 inches by 3/16-inch thick.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Confilm.
      b. ChemMasters; SprayFilm.
      c. Dayton Superior; AquaFilm J74.
      d. L&M Construction Chemicals Inc.; E-CON.
      e. Meadows, W. R. Inc.; EVAPRE.
      f. Sika Corporation; SikaFilm.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; KURE 1315.
      b. ChemMasters Inc.; Polyseal WB.
      c. Dayton Superior Corporation; Cure & Seal 1315 J22WB.
      d. L&M Construction Chemicals Inc.; Lumiseal WB Plus.

e. Meadows, W. R. Inc.; VOCOMP-30.
f. Metalcrete Industries; Metcure 30.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80.
C. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
    1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

A. Repair Underlayment. Cement-based, polymer-modified, self-leveling product applied in thicknesses from 1/8-inch and feathered at edges to match adjacent floor elevations:
    1. Cement Binder: ASTM C150, Portland cement, hydraulic, or blended-hydraulic cement per ASTM C219.
    2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand as recommended by underlayment manufacturer.
    4. Compressive Strength: Not less than 4,100 psi at 28 days when tested per ASTM C 109.
B. Repair Topping. Traffic-bearing, cement-based, polymer-modified, self-leveling product applied in thicknesses from 1/4-inch:
    1. Cement Binder: ASTM C150, Portland cement, hydraulic, or blended-hydraulic cement as defined in ASTM C219.
    2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand as recommended by topping manufacturer.
    4. Compressive Strength: Not less than 5,700 psi at 28 days when tested per ASTM C109/C109M.

2.11 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete shown in the General Notes (Sheet S-106) determined by laboratory trial mix or field test data bases. Proportion normal-weight concrete per ACI 211.1 and 301.
B. Use qualified independent testing agency to prepare and report proposed mix designs for laboratory trial mix basis.
C. Cementitious Materials: Limit percentage by weight of cementitious materials other than Portland Cement in concrete as fly ash at 25 percent.

D. Air Content: Add air-entraining admixture to exterior concrete at manufacturer-prescribed rate to result in concrete at point of placement with air content as follows within a tolerance of ±1.5 percent, unless otherwise indicated:
   1. Air Content: 4.5 percent for 1-inch nominal maximum aggregate size.
   2. Air Content: 5 percent for 3/4-inch nominal maximum aggregate size.

E. Admixtures with chloride-ions prohibited.

F. Admixtures: Use per manufacturer written instructions and only with Engineer approval.
   1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES, GENERAL
(Ref: General Notes for Specific Mix Design Requirements)

A. Prepare design mixtures for each type and strength of concrete, proportioned based on laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 25 percent.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94.
   1. When air temperature is between 85 and 90 degrees Fahrenheit reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, per ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads applied, until concrete structure can support loads.

B. Construct formwork so concrete members and structures are size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual: Class B, 1/4 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, etc., for easy removal. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports, where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in Work. Determine sizes and locations from trades providing items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, per manufacturer-written instructions, before placing reinforcement.

M. Footings may be cast against “earth” forms as long as soil along the side of trenches and/or excavations is stable and will not slough off into the excavation during placing operations. If the soil is not sufficiently stable, forms must be utilized.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items embedded. Install anchor bolts, accurately located, to elevations required.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of Work, not supporting weight of concrete removed after cumulatively curing at not less than 50 degrees F 24 hours after placing concrete provided concrete hard enough to not be damaged by form-removal operations and curing and protection operations maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, supporting weight of concrete in place until concrete achieves at least 70 percent of 28-day design compressive strength:
   1. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens per ACI 301.
   2. Remove forms only if shores arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms reused in Work. Split, frayed, delaminated, or otherwise damaged form-facing material not acceptable for exposed surfaces. Apply new form-release agent.

D. When forms reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless Engineer approves.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete is not impaired at locations indicated or as approved by Engineer.
    1. Place joints perpendicular to main reinforcement. Do not continue reinforcement through sides of strip placements of floors and slabs.
    2. Form keyed joints as indicated.
    3. Space vertical joints in walls; see structural notes.
    4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
C. Contraction Joints in Slab-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construction contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
    1. Sawed Joints: Form contraction joints with early entry dry cut saws. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
    1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
    2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
E. Lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 STEEL REINFORCEMENT

A. Comply with CRSI *Manual of Standard Practice*, for placing reinforcement. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
E. Place all reinforcement before placing concrete. Equipment not allowed to drive over reinforcement.

3.6 WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during Work progress. Field-fabricate joints in waterstops per manufacturer-written instructions.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify installation of formwork, reinforcement, and embedded items are complete and required inspections performed.
B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.

C. Before placing concrete, add water at Project site subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
   2. Do not add water to concrete beyond limit of water withheld from plant.

D. Deposit concrete continuously or in layers of thickness so no new concrete placed on concrete hardened enough to cause seams or planes of weakness. If section not placed continuously, provide construction joints as specified. Avoid segregation.

E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and to avoid inclined construction joints. Place each layer while preceding layer still plastic to avoid cold joints:
   1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
   2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than visible effectiveness of vibrator. Place vibrators to rapidly penetrate placed layer at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete losing plasticity. At each insertion, limit vibration duration necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.
   1. Consolidate concrete during placement operations so concrete thoroughly worked around reinforcement, other embedded items, and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on surface. Do not further disturb slab surfaces before finishing operations.

G. Cold-Weather Placement. Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures:
   1. When air temperature falls to or expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of no less than 50 and no more than 80 degrees F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

H. Hot-Weather Placement. Place concrete per ACI 305R recommendations and:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Use chilled mixing water or chopped ice to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature does not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged orderly and symmetrical with minimum seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch high. Apply to concrete surfaces exposed to public view, covered with coating, or covering material applied directly to concrete, (waterproofing, dampproofing, veneer plaster, painting).

C. Rubbed Finish. Apply the following to smooth-formed finished concrete:

1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout the consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one-and-a-half parts fine sand with 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes. Apply scratch finish to surfaces indicated and to surfaces receiving concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface left with uniform, smooth, granular texture. Apply float finish to surfaces indicated, surfaces receiving trowel finish, and floor and slab surfaces covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that telegraphs through applied coatings or floor coverings.

1. Apply trowel finish to surfaces indicated, floor and slab surfaces exposed to view, or covered with resilient flooring, carpet, ceramic or quarry tile set over cleavage membrane, paint, or another thin film-finish coating system.
2. Finish and measure surface so gap at any point between concrete surface and unleveled freestanding 10-foot-long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4-inch.

E. Trowel and Fine-Broom Finish: Apply partial trowel finish, stopping after second troweling, to surfaces indicated and surfaces where ceramic or quarry tile is installed by thickset or thin-set method. Immediately after second troweling, and when concrete still plastic, slightly scarify surface with fine broom.

F. Broom Finish: Apply broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 4 inches high unless otherwise indicated and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 4,000 psi at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Cast anchor-bolt inserts into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 CONCRETE PROTECTION AND CURING

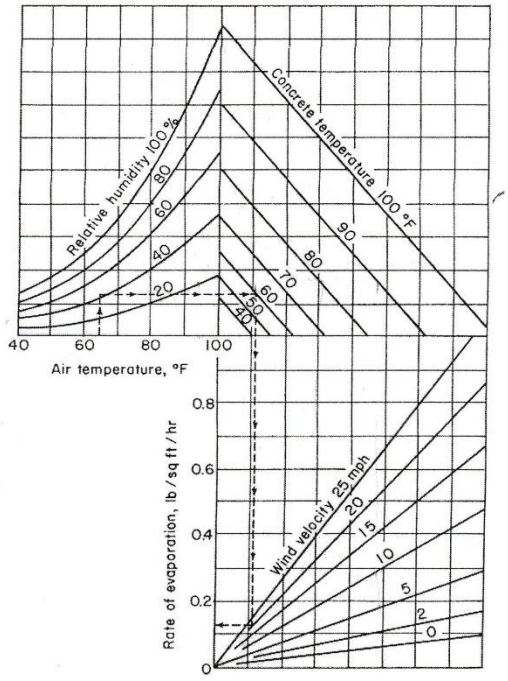
A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds per square foot per hour before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of these methods:

1. Moisture Curing: Keep surfaces continuously moist not less than seven days with these materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.



2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surface to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete not repaired and patched to Engineer approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two-and-a-half parts fine aggregate passing No. 16 Sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other surface projections, stains, and other discolorations not removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension in solid concrete but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent dries. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white and standard Portland cement so, when dry, patching mortar matches surrounding color. Patch test area at inconspicuous locations to verify mixture and color match before patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces affecting concrete durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces (floors and slabs), for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness. Use sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing, and cracks more than 0.01- inch wide, penetrate to reinforcement, or completely through unreinforced sections regardless of width and other objectionable conditions.
2. After concrete cures at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with repair underlayment. Prepare, mix, and apply repair underlayment and primer per manufacturer-written instructions to produce smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas remaining exposed with repair topping. Cut out low areas to ensure minimum repair topping depth of 1/4-inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer per manufacturer-written instructions to produce smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent dries. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified may be used, subject to Engineer approval.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least two inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Inspections:
   1. Steel reinforcement placement.
   2. Headed bolts and studs.
   3. Verification of use of required design mixture.
   4. Concrete placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.

C. Testing Services: Testing composite samples of fresh concrete obtained per ASTM C172 performed per:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cubic yard or fraction thereof of each concrete mix placed each day. When testing frequency provides fewer than five compressive-strength tests for each concrete mix, test from at least five randomly selected batches or each batch if fewer than five used.
   2. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees F and below and 80 degrees F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39; test one laboratory-cured specimen at seven days, two at 28 days, and hold the fourth cylinder for testing as directed by Engineer. Compressive-strength test is average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
7. Take testing specimens after all admixtures and/or field added water is added and incorporated into concrete.

D. Each concrete mix strength is satisfactory if average of any three-consecutive compressive-strength tests equals/exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Report test results in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

F. Nondestructive Testing: Engineer may permit impact hammer, Sono scope, or other nondestructive device but do not use as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency makes additional concrete tests when test results indicate slump, air entrainment, compressive strengths, or other requirements not met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or other methods as directed by Engineer.

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portland cement grout.
   2. Rapid-curing epoxy grout.
   3. Nonshrink cementitious grout.

B. Related Requirements:
   1. Section 03 00 00 “Cast-in-Place Concrete:” Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 01 20 00 “Price and Payment Procedures:” Contract Sum/Price modification procedures.

B. Grout:
   1. Basis of Measurement: By cubic yard.
   2. Basis of Payment: Includes preparation of substrate and grout, placement, consolidation, troweling, and curing.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete for Buildings.
   2. ACI 301M - Specifications for Structural Concrete (Metric).
   3. ACI 318 - Building Code Requirements for Structural Concrete.
   4. ACI 318M - Metric Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
   2. ASTM C40/C40M - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
   3. ASTM C150/C150M - Standard Specification for Portland Cement.
   4. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
   5. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
   6. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic surfacing’s, and Polymer Concretes.
   7. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic surfacing, and Polymer Concretes.
   8. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
   1. CRD-C621 - Non-Shrink Grout.

1.4 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit manufacturer information regarding grout.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statement:
    1. Submit qualifications for manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work according to ACI standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.
D. Protection:
    1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
    2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Section 01 50 00 “Temporary Facilities and Controls:” Requirements for ambient condition control facilities for product storage and installation.
B. Maximum Conditions: Do not perform grouting if temperatures exceed 100 degrees F.
C. Minimum Conditions: Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT GROUT

A. Portland Cement: Comply with ASTM C150/C150M, Type I and II.

B. Water:
   1. Potable.
   2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:
      a. Corrosion of steel.
      b. Volume changes increasing shrinkage cracking.
      c. Efflorescence.
      d. Excess air entraining.

C. Fine Aggregate:
   1. Washed natural sand.
   2. Gradation:
      a. Comply with ASTM C33/C33M.
      b. Represented by smooth granulometric curve within required limits.
   3. Free from injurious amounts of organic impurities according to ASTM C40/C40M.

D. Mix:
   1. Portland cement, sand, and water.
   2. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID-CURING EPOXY GROUT

A. Manufacturers:
   1. Sika Corporation
   2. Laticrete International
   3. W.R. Meadows, Inc.
   4. Substitutions: Not permitted

B. Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

C. Description:
   1. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
   2. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.

D. Performance and Design Criteria:
   1. Compressive Strength:
      a. 12,000 psi at seven days.
      b. Comply with ASTM C579.
   2. Minimum Tensile Strength:
      a. 2,000 psi
      b. Comply with ASTM C307.
   3. Coefficient of Expansion:
      a. 30x10-6 inch per degree F.
      b. Comply with ASTM C531.
   4. Shrinkage:
      a. None.
      b. Comply with ASTM C827/C827M.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Manufacturers:
   1. Sika Corporation
   2. CGM, Incorporated
   3. EUCLID Chemical Company

4. Laticrete International
5. Substitutions: Not permitted.

B. Description:
1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, and no chlorides.

C. Performance and Design Criteria:
1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to CRD-C621 for Type D nonshrink grout:
a. Setting Time:
1) Initial: Approximately two hours.
2) Final: Approximately three hours.
3) Comply with ASTM C191.
b. Maximum Expansion: 0.10 to 0.40 percent.
c. Compressive Strength:
1) One-Day: 4,000 psi.
2) Seven-Day: 7,000 psi +.
3) 28-Day: 10,000 to 10,800 psi.
4) Comply with CRD-C621.

2.4 FORMWORK

A. As specified in Section 03 10 00 “Concrete Forming and Accessories.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify areas to receive grout.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.
C. Roughen concrete lightly, but not to interfere with placement of grout.
D. Remove foreign materials from metal surfaces in contact with grout.
E. Align, level, and maintain final positioning of components to be grouted.
F. Saturate concrete surfaces with clean water, and then remove excess water.

3.3 INSTALLATION

A. Formwork:
1. Construct leakproof forms anchored and shored to withstand grout pressures.
2. Install formwork with clearances to permit proper placement of grout.
3. As specified in Section 03 10 00 - Concrete Forming and Accessories.

B. Mixing:
   1. Portland Cement Grout:
      a. Use proportions of two parts sand and one-part cement, measured by volume.
      b. Prepare grout with water to obtain consistency to permit placing and packing.
      c. Mix water and grout in two steps:
         1) Premix using approximately 2/3 of water.
         2) After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.
      d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
      e. Do not add additional water after grout has been mixed.
      f. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
   2. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.

C. Placing of Grout:
   1. Place grout material quickly and continuously.
   2. Do not use pneumatic-pressure or dry-packing methods.
   3. Apply grout from one side only to avoid entrapping air.
   4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
   5. Thoroughly compact final installation and eliminate air pockets.
   6. Do not remove leveling shims for at least 48 hours after grout has been placed.

D. Curing:
   1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.
   2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
   3. After grout has attained its initial set, keep damp for minimum three days.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.

B. Testing:
   1. Comply with ACI 318.
   2. Submit proposed mix design of each class of grout to Engineer of Record for review prior to commencement of Work.
   3. Tests of grout components may be performed to ensure compliance with specified requirements.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Shop-fabricated metal items.
2. Loose steel lintels.
3. Ledge and shelf angles.
4. Elevator sill angles, hoist beams, and divider beams.
5. Channel door frames.
6. Bollards.
7. Ladders.
8. Structural supports for miscellaneous attachments.
9. Window security grilles.
10. Anchor bolts for sill plates.
11. Fabricated architectural details.

B. Related Requirements:
1. Section 03 0 00 “Cast-in-Place Concrete:” Execution requirements for embedded anchors and attachments for metal fabrications specified by this Section in concrete.
2. Section 04 20 00 “Unit Masonry:” Execution requirements for embedded anchors and attachments for metal fabrications specified by this Section in masonry.

1.2 REFERENCE STANDARDS

A. Aluminum Association:
1. AA DAF-45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American National Standards Institute:
1. ANSI A14.3 - American National Standard (ASC) for Ladders - Fixed - Safety Requirements.

D. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.1M - Structural Welding Code - Steel.
4. AWS D1.6 - Structural Welding Code - Stainless Steel.
5. AWS D1.6M - Structural Welding Code - Stainless Steel.

E. ASTM International:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A36M - Standard Specification for Carbon Structural Steel.
   3. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   4. ASTM A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   6. ASTM A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   7. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   8. ASTM A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   9. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   10. ASTM A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   11. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   12. ASTM A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   13. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   14. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
   15. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
   16. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   17. ASTM A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   18. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   19. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated, 830 mPa Minimum Tensile Strength.
   20. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
   21. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   22. ASTM A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   23. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   24. ASTM A554 - Standard Specification for Welded Stainless-Steel Mechanical Tubing.
   25. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   26. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts.
   27. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

28. ASTM A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
29. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
30. ASTM A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
31. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
32. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
33. ASTM A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
34. ASTM A992 - Standard Specification for Structural Steel Shapes.
35. ASTM A992M - Standard Specification for Structural Steel Shapes.
36. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
37. ASTM B26M - Standard Specification for Aluminum-Alloy Sand Castings.
38. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
39. ASTM B85M - Standard Specification for Aluminum-Alloy Die Castings.
40. ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
41. ASTM B177M - Standard Guide for Engineering Chromium Electroplating.
42. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
43. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
44. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
45. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
46. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
47. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire.
48. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
49. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
50. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
51. ASTM F436 - Standard Specification for Hardened Steel Washers.
52. ASTM F436M - Standard Specification for Hardened Steel Washers.
53. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

F. Builders Hardware Manufacturers Association (BHMA):
1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges and Hasps.

G. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
3. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
4. SSPC SP 1 - Solvent Cleaning.
5. SSPC SP 10 - Near-White Blast Cleaning.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
D. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for canopy structure and wrought iron gate.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statement:
    1. Submit qualifications for licensed professional.

1.4 QUALITY ASSURANCE

A. Finish joints according to NOMMA Guideline 1.
B. Maintain one (1) of each standard affecting the Work of this Section on-site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept metal fabrications on-Site in labeled shipments. Inspect for damage.
C. Protect metal fabrications from damage by exposure to weather or by ground contact.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 LINTELS

A. Description:
    1. Steel sections.
    2. Size and Configuration:
        a. As indicated on Drawings.
        b. Length to allow 8 inch minimum bearing on both sides of opening.
    3. Exterior Location Finish: Prime paint, one coat.
    4. Interior Location Finish: Prime paint, one coat.

2.2 LEDGE AND SHELF ANGLES

A. Ledge and Shelf Angles Channels and Plates Not Attached to Structural Framing:
    1. For support of joists masonry.
    2. Finish: Prime paint, one coat.

2.3 DOOR FRAMES

A. Description:
   1. Steel channel sections.
   2. Size: As indicated on Drawings.
   3. Jamb Anchors:
      a. Suitable for building into masonry.
      b. Minimum four anchors per jamb.
   4. Finish: Prime paint, one coat.

2.4 BOLLARDS

A. Description:
   1. Steel pipe, concrete filled.
   2. Crowned cap.
   3. Size: 6 inch diameter, length as indicated on Drawings.
   4. Finish: Prime paint, one coat.
B. Concrete Fill:
   1. Minimum Compressive Strength: 3,000 psi.
   2. As specified in Section 03 00 00 “Cast-in-Place Concrete.”
C. Anchors: Concealed type as indicated on Drawings.

2.5 LADDERS

A. Roof access ladder:
   1. ANSI A14.3.
   2. Steel-welded construction.
   3. Siderails:
      a. Size: 3/8 by 2 inches.
      b. Spacing: 20 inches.
   4. Rungs:
      a. Solid rod.
      b. Size: 1-inch diameter.
      c. Spacing: 12 inches.
   5. Mounting:
      a. Space rungs 7 inches from wall surface.
      b. Provide steel mounting brackets and attachments.
   6. Finish: Prime paint, one coat finish paint.
B. Ladder Safety Cage:
   1. Steel bar sections, minimum 1/4 by 2 inches.
   2. Bottom Hoop:
      a. Size: 18-inch radius.
      b. Location: Maximum 74 inches above finished floor or roof.
   3. Other Hoops:
      a. Size: 14-inch radius.
      b. Spacing: Maximum 48 inches.
   4. Vertical Bars Spacing: 10 inches.
   5. Finish: Match ladder finish.

C. Ladder Security Enclosure:
   1. Description: Formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.
   2. Sheet steel.
   3. Thickness: Minimum 16 gage/0.058 inch formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.
   4. Provide continuous steel hinge full height of enclosure.
   5. Provide steel hasp for padlocking in closed and open position.
   6. Finish: Match ladder finish.

2.6 MATERIALS

A. Steel:
   1. Structural W Shapes: ASTM A992.
   2. Structural Shapes: ASTM A36.
   3. Channels and Angles: ASTM A36.
   4. Steel Plate: ASTM A36 Grade 50.
   5. Hollow Structural Sections: ASTM A500 Grade B.
B. Bolts, Nuts, and Washers for Equipment and Piping:
   1. Carbon Steel:
      a. Structural Connections: ASTM A307, Grade B, hot-dip galvanized.
      b. Anchor Bolts: ASTM A307, Grade B, hot-dip galvanized.
      c. Pipe and Equipment Flange Bolts: ASTM A193 (193M), Grade B-7.
   2. Stainless Steel: Type 316 stainless steel, Class 2; ASTM A193 (193M) for bolts; ASTM A194 for nuts.

2.7 FABRICATION

A. Fit and shop-assemble items in largest practical sections for delivery to Site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.
E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
F. Fabrication Tolerances:
   1. Squareness: 1/8 inch maximum difference in diagonal measurements.
   2. Maximum Offset between Faces: 1/16 inch.
   3. Maximum Misalignment of Adjacent Members: 1/16 inch.
   4. Maximum Bow: 1/8 inch in 48 inches.
   5. Maximum Deviation from Plane: 1/16 inch in 48 inches.

2.8 FINISHES

A. Steel:
   1. Prepare surfaces to be primed according to SSPC SP 2.
   2. Galvanizing for Fasteners, Connectors, and Anchors:
      a. Hot-Dip Galvanizing: ASTM A153 (A153M).
      b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

3. Sheet Steel: Galvanized with G coating class.
4. Bolts: Unfinished.
5. Nuts: Unfinished.
6. Washers: Unfinished.
7. Shop Primer: SSPC Paint 15, Type 1, red oxide.
8. Touchup Primer: Match shop primer.

B. Stainless Steel:
1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.
2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.

C. Aluminum:
1. Finish Coatings:
a. Conform to AAMA 2603.
b. Comply with AA DAF45.
2. Exterior Aluminum Surfaces:
a. Exterior color, to 7 mil thickness.
3. Interior Aluminum Surfaces:
a. AAMA A41, A42, A43, A44 anodized.
b. Prepared with chemical C pretreatment.
c. Anodized to clear color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for installation examination.
B. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Clean and strip primed steel items to bare metal and aluminum where Site welding is required.
C. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.
B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.
C. Field-weld components indicated on Shop Drawings.
D. Perform field welding according to AWS D1.1 (D1.1M).
E. Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Section 01 40 00 “Quality Requirements:” Requirements for tolerances.
B. Maximum Variation from Plumb: 1/4-inch per story or for every 12 feet in height, whichever is greater, non-cumulative.
C. Maximum Variation from Level: 1/16 inch in 3 feet.
D. Maximum Offset from Alignment:1/4-inch.
E. Maximum Out-of-Position: 1/4-inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
B. Welding: Inspect welds according to AWS D1.1 (D1.1M).
C. Replace damaged or improperly functioning hardware.
D. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.
E. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.6 ADJUSTING

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for starting and adjusting.
B. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field application of paints and other coatings.
B. Related Requirements:
   1. Division 01 Specification Section apply to Work of this Section.
   2. Section 05 50 00 “Metal Fabrications:” Shop-primed items.

1.2 DEFINITIONS

A. Refer to ASTM D16 for definitions of terms used in this Section.

1.3 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
   2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
B. California Department of Public Health:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
C. Green Seal:
   1. GS-03 - Anti-Corrosive Paints.
   2. GS-11 - Paints and Coatings.
D. Master Painters Institute:
   1. MPI - Approved Products List.
   2. MPI - Architectural Painting Manual.
E. South Coast Air Quality Management District: SCAQMD Rule 1113 - Architectural Coatings.

1.4 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.5 SEQUENCING

A. Section 01 10 00 “Summary:” Requirements for sequencing.
B. Do not apply finish coats until paintable sealant is applied.
C. Back prime wood trim before installation of trim.

1.6 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data:
    1. Submit manufacturer data on finishing products.
    2. Include MPI - Approved Products Lists with proposed products highlighted.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statements:
    1. Submit qualifications for manufacturer and applicator.
    2. Submit manufacturer's approval of applicator.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for submittals.
B. Operation and Maintenance Data: Submit information on cleaning, touchup, and repair of painted and coated surfaces.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for maintenance materials.

1.9 QUALITY ASSURANCE

A. MPI Standards:
    1. Comply with indicated MPI standards.
    2. Products: Listed in MPI - Approved Products List.
B. Surface Burning Characteristics:
    1. Fire-Retardant Finishes: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.
C. Maintain one copy of each standard affecting Work of this Section on Site.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Container Labeling: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Inspection:
    1. Accept materials on Site in manufacturer's sealed and labeled containers.
    2. Inspect for damage and to verify acceptability.
D. Store materials in ventilated area and otherwise according to manufacturer instructions.

E. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.12 AMBIENT CONDITIONS

A. Section 01 50 00 “Temporary Facilities and Controls: “Requirements for ambient condition control facilities for product storage and installation.
B. Storage Conditions:
   1. Minimum Ambient Temperature: 45 degrees F.
   2. Maximum Ambient Temperature: 90 degrees F.
C. Application Conditions:
   1. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint manufacturer.
   2. Do not apply exterior coatings during rain or snow, when relative humidity is outside humidity ranges, or when moisture content of surfaces exceeds those required by paint manufacturer.
   3. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors and 50 degrees F for exteriors, unless otherwise indicated by manufacturer instructions.

1.13 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for warranties.

PART 2 - PRODUCT

2.1 PAINTS AND COATINGS

A. Manufacturers:
   1. Sherwin Williams
   2. TNEMEC
   3. Substitutions: As specified in Section 016000 - Product Requirements.
B. Materials:
   1. Coatings:
      a. Ready mixed, except field-catalyzed coatings.
      b. Capable of drying or curing free of streaks or sags.
   2. Accessories:
      a. Grade: Commercial.
      b. Linseed oil.
      c. Shellac.
      d. Turpentine.
      e. Paint thinners.
      f. Other materials not specifically indicated but required to achieve specified finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for application examination.
B. Verify that surfaces are ready to receive Work as recommended by product manufacturer.
C. Examine surfaces scheduled to be finished prior to commencement of Work, and report conditions capable of affecting proper application to Architect/Engineer.
D. Test shop-applied primer for compatibility with subsequent cover materials.
E. Moisture Content:
    1. Measure moisture content of surfaces using electronic moisture meter.
    2. Do not apply finishes unless moisture content of surfaces is below following maximums:
        a. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for application preparation.
B. Prepare coatings as follows:
    1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
    2. For smooth flow and brushing properties.
C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
D. Defects:
    1. Correct defects and clean surfaces capable of affecting Work of this Section.
E. Marks: Seal marks that may bleed through surface finishes with shellac.
F. Impervious Surfaces:
    1. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
    2. Rinse with clean water and allow surface to dry.
G. Aluminum Surfaces Scheduled for Paint Finish:
    1. Remove surface contamination by steam or high-pressure water.
    2. Remove oxidation with acid etch and solvent washing.
    3. Apply etching primer immediately following cleaning.
H. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish:
    1. Remove foreign particles to permit adhesion of finishing materials.
    2. Apply compatible sealer or primer.
I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
J. Concrete Floors:
    1. Remove contamination, acid etch, and rinse floors with clear water.
    2. Verify that required acid-alkali balance is achieved.
    3. Allow to dry.
K. Copper Surfaces Scheduled for Paint Finish:
    1. Remove contamination by steam, high-pressure water, or solvent washing.
    2. Apply vinyl-etch primer immediately following cleaning.

L. Copper Surfaces Scheduled for Natural Oxidized Finish:
   1. Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid.
   2. Rub on repeatedly for required effect, and once attained, rinse surfaces with clear water and allow to dry.
M. Gypsum Board Surfaces:
   1. Fill minor defects with filler compound.
   2. Spot-prime defects after repair.
N. Galvanized Surfaces:
   1. Remove surface contamination and oils, and wash with solvent.
   2. Apply coat of etching primer.
O. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish:
   1. Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.
   2. Remove oil and grease with solution of tri-sodium phosphate, rinse well, and allow to dry.
   3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water and allow to dry.
P. Plaster Surfaces:
   1. Fill hairline cracks, small holes, and imperfections with latex patching plaster.
   2. Make smooth and flush with adjacent surfaces.
   3. Wash and neutralize high-alkali surfaces.
Q. Uncoated Steel and Iron Surfaces:
   1. Remove grease, mill scale, weld splatter, dirt, and rust.
   2. If heavy coatings of scale are evident, remove by power tool wire brushing or by sandblasting.
   3. Clean by washing with solvent.
   4. Apply treatment of phosphoric acid solution, ensuring that weld joints, bolts, and nuts are similarly cleaned.
   5. Spot-prime paint after repairs.
R. Shop-Primed Steel Surfaces:
   1. Sand and scrape to remove loose primer and rust.
   2. Feather edges to make touch-up patches inconspicuous.
   3. Clean surfaces with solvent.
   4. Prime bare steel surfaces.
S. Metal Doors Scheduled for Painting: Prime metal door at top and bottom edge surfaces.
T. Existing Work:
   1. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.3 APPLICATION

A. Comply with MPI - Architectural Painting Manual.
B. Do not apply finishes to surfaces that are not dry.
C. Apply each coat to uniform appearance.
D. Apply each coat of paint slightly darker than preceding coat, unless specified otherwise.
E. Sand metal surfaces lightly between coats to achieve required finish.
F. Cleaning:
   1. Vacuum surfaces to remove loose particles.
   2. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Fillers:
   1. If clear finishes are required, tint fillers to match wood.
   2. Work fillers into grain before set, and wipe excess from surface.

H. Finishing Mechanical and Electrical Equipment:
   1. Schedule of Color-Coding and Identification Banding of Equipment, Ductwork, Piping, and Conduit: As specified in Section 230553 - Identification for HVAC Piping and Equipment.
   2. Paint shop-primed equipment.
   3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components, and paint separately.
   4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where these items are shop finished.
   5. Paint exposed conduit and electrical equipment installed in finished areas.
   6. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
   7. Color-Coding:
      a. Color-code equipment, piping, conduit, and exposed duct work according to indicated requirements.
      b. Color band and identify with flow arrows and names**.**
   8. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.
B. Inspecting and Testing: Comply with MPI - Architectural Painting Manual.

3.5 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for cleaning.
B. Collect waste material that may constitute fire hazards, place in closed metal containers, and remove daily from Site.

END OF SECTION

SECTION 22 05 33 – HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes and describes the requirements for designing, supplying, installing, and testing of an industrial electric heat tracing system for above grade station piping, eyewash station and for domestic water piping in areas subject to freezing temperatures.

B. Contractor shall provide the services of heat trace and pipe insulation system designers to implement requirements of this section. Designers shall be authorized supplier and manufacturer's representative for the heat trace products installed. Acceptable heat tracing systems are:
   1. Thermon
   2. Chromalox, and
   3. Raychem.

C. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 40 42 13 "Process Piping Insulation."
   3. Section 22 07 11 "Plumbing Insulation."

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur on these specifications, the NEC and El Paso Water standard will govern.

B. The Institute of Electrical and Electronic Engineers (IEEE): 515.1-2012 Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications.

C. International Code Council, (ICC): IPC-2018 International Plumbing Code.

D. National Fire Protection Association (NFPA): 70–2020 National Electrical Code (NEC).

E. Underwriters' Laboratories, Inc. (UL): 508-2018 Industrial Control Equipment.

1.3 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00 " Submittal Procedures."

B. Information and material submitted under this section shall be marked "Submitted under Section 22 05 33 "Heat Tracing for Plumbing Piping," with applicable paragraph identification.

C. Manufacturer's Literature and Data including Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Rated capacity.
   2. Length of cable.
   3. Cable spacing.
   4. Electrical power requirements.
   5. Controls.
   6. Enclosures.
   7. Accessories.

D. The shop drawings shall include plans, sections, details, wiring diagrams, and attachments to other work. The wiring diagrams shall include power, signal, and control wiring.
E. Field quality control test reports shall be submitted.
F. Complete operating and maintenance manuals including wiring diagram, technical data sheets, information for ordering replaceable parts, and troubleshoot guide:
    1. Include complete list indicating all components of the systems.
    2. Include complete diagrams of the internal wiring for each item of equipment.
    3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Ten years' experience in design, engineering, manufacture and support of specified system and components.
    1. Factory Mutual approved heating cable that has the same wattage per lineal foot (power output), throughout its entire length.
    2. UL Listed, thermostat and contactor panel.
    3. UL Listed Control/Monitor Panel.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in
C. NFPA 70, by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE HEATING CABLES

A. Self-regulating parallel resistance heating cables shall comply with IEEE 515.1.
B. The heating element shall be a pair of parallel No. 16 AWG tinned stranded copper bus wires embedded in cross linked conductive polymer core, which varies heat output in response to temperature along its length. Cables shall be terminated with waterproof, factory assembled non heating leads with connects at one and seal the opposite end watertight. The cable shall be capable of crossing over itself without overheating.
C. The electrical insulating jacket shall be flame-retardant polyolefin.
D. The cable cover shall be tinned copper and polyolefin outer jacket with UV inhibitor.
E. The maximum power on operating temperature shall be 65 degrees C (150 degrees F).
F. The maximum power off exposure temperature shall be 85 degrees C (185 degrees F).
G. The capacities and characteristics shall be:
    1. Maximum heat output (12.0 W/foot).
    2. Pipe Diameter: 24-inch Max.
    3. Number of parallel cables: 3 Max.

2.2 CONTROLS

A. Pipe mounting thermostats for Freeze protection shall have a remote bulb unit with adjustable temperature range from minus 1 to 10 degrees C (34 to 50 degrees F). The thermostat shall be snap action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable. The thermostat shall be remote bulb on capillary, resistance temperature device, or thermistor for direct sensing of pipe wall temperature.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
B. Warning Labels: Shall comply with NFPA 70.
C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
    1. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, Less Than 6 inches: 3/4-inch minimum.
    2. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, 6 inches or Greater: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspect surfaces and substrates of electric heating cables for compliance with requirements of this specification. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
B. Notify COR if the existing substrate conditions are unsuitable for application of heating cables in accordance with manufacturer's recommendations.
C. If the installation of the heat tracing is unsatisfactory, then the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 INSTALLATION

A. Electric heating cable shall be installed for the following applications:
    1. Freeze protection of water piping: Self-regulating parallel resistance heating cable.
B. Electric heating cable for pipe freeze protection shall be installed according to the following:
    1. Electric heating cables shall be installed after piping has been tested and before insulation is installed.
    2. Electric heat cables shall be installed according to IEEE 515.1
    3. Insulation shall be installed or applied over piping with electric cables. Refer to Section 40 42 13 Process Piping Insulation."
    4. "WARNING" tape shall be installed on pipe insulation where piping is equipped with electric heating cables.
C. Field adjustable switches and circuit breaker trip ranges shall be set.
D. Heating cables including leads shall be protected from damage.
E. Equipment shall be grounded according to Section 26 05 19, "Low Voltage Electrical Power Conductors and Cables."
F. Wiring shall be connected according to Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.3 TESTS

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   2. Test cables for electrical continuity and insulation integrity before energizing.
   3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

D. If deficiency is found, Contractor shall correct all deficiencies at no additional cost or time to the Owner.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4-hours to instruct personnel responsible in operation and maintenance of the system.

END OF SECTION

SECTION 23 05 00 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work covered by this Division shall consist of furnishing all labor, equipment, supplies, and materials and in performing all operations necessary for the installation of complete and operating mechanical systems as required by these Specifications and/or shown on the Drawings, subject to the terms and conditions of the Contract. The Work shall also include the completion of such mechanical and electrical details not mentioned or shown which are necessary for the successful operation of all systems described on the Drawings or required by these Specifications; this includes furnishing all materials for filling the systems to make them operable, including water, refrigerant, oil, and grease. Prove satisfactory operation of all equipment and controls to Engineer on request.
2. Work Not Included: Certain labor, material, and equipment may be furnished and/or installed under other Divisions of these Specifications. This Contractor shall coordinate with other trades and arrange his Work to make the parts fit together. The following items are to be accomplished under other Divisions of these Specifications:
    a. Temporary Heat: Refer to paragraph in this Section.
    b. Temporary Water and Toilet: Refer to General Conditions.
    c. Roof Curbs: Refer to paragraph in this Section.
    d. Electrical Equipment and Wiring: Refer to paragraph in this Section.
    e. Concrete: Refer to paragraph in this Section.
3. Equipment Furnished by Owner: Rough-in services pipes to locations as required by Architectural and Mechanical Drawings and equipment shop drawings. Provide service valves on all pipes except waste and vent pipes. Final Connection to equipment will be made by this Contractor.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.

1.2 BIDDING

A. All mechanical equipment shall be new unless specified otherwise in Specifications or Drawings.

B. All bids must be based only on equipment and materials as scheduled on Drawings and as specified or on equivalent equipment and materials. Any Contractor who assumes equivalence of products and bases his proposal on that assumption, does so at his own risk.

C. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternative to the scheduled items. All fixtures and devices must still be submitted according to the prescribed procedures. In addition, some items that have an important visual affect, (e.g., electric water coolers), may be required to receive Owner or Engineer approval also.

1.3 EXISTING UTILITIES

A. Drawings indicate the locations, type, and sizes of various utilities within the site where known. These utilities are indicated as accurately as possible. If Contractor encounters any utilities during construction which are not shown on Drawings, they shall ask for written instructions from Engineer. Any relocation or remodeling required will then be directed by a change order. Contractor shall assume all responsibility for protection of all utilities, shown or not, and for repair required by this construction.

B. Contractor shall verify location, size, elevation, pressure, and any other pertinent data of existing utilities. Additional costs incurred due to failure to verify such data and coordinate associated Work with respective utility providers, shall not be Owner responsibility but borne by Contractor.

C. All costs associated with providing utilities including, but not limited to, connection fees, boring under roads, etc., shall be included in Contractor's proposal price, whether such costs are incurred by Contractor or charged by the utility company.

D. Submission of a proposal by Contractor shall be considered an acknowledgment by Contractor of his compliance with this Section.

1.4 CODES, PERMITS, AND FEES

A. Contractor shall comply with all local, state, and national codes and shall pay for all applicable costs, fees, permits, licenses, and inspections for this Division.

1.5 TEMPORARY HEAT

A. Temporary heat furnished by General Contractor. Use of permanent heating system will not be allowed without written authorization from Engineer and Owner. In case the permanent heating system is used for temporary heat, General Contractor shall pay all the costs until acceptance by Owner. Warranty of equipment shall not start until acceptance by Owner.

1.6 DRAWINGS

A. Contract Drawings are diagrammatic only and not intended to be scaled for dimensions. All dimensions shall be taken from Architectural Drawings, certified equipment drawings, and the structure itself before fabricating and Work. All space requirements and equipment locations shall be verified and coordinated with other trades, as it is the responsibility of various contractors to install systems complete in space provided without extra charges to Owner.

B. It is intended that anything, whether labor and materials, which is usually furnished as part of any equipment specified and which is necessary for operation, shall be furnished as part of the Contract without additional cost, whether or not shown or described.

C. All piping in finished areas of the building shall be concealed except where otherwise noted on Drawings.

D. All equipment shall be installed in accordance with manufacturer's recommendations unless approval is given in writing by the Consulting Mechanical Engineer for deviation.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

A. Mechanical Work shall be performed in strict accordance with the local and state codes, ordinances, and regulations governing the Work involved. Furnish, without extra charge, any additional material and labor when and where required to comply with these Rules and

Regulations, though the Work is not mentioned in the Specifications or shown on the Drawings. When the Specifications or Drawings call for or describe materials or construction of a better quality or larger sizes than required by the above mentioned; Rules and Regulations, the provisions of these Specifications and accompanying Drawings shall take precedence.

1.8 QUALIFICATIONS

A. All mechanics shall be capable journeymen, skilled in Work assigned to them with licensing required by the inspecting authority. All welders must have been certified within the past three years to perform the Work which they are doing.

1.9 WARRANTY

A. All materials and equipment shall be new unless otherwise specified.
B. Guarantee all workmanship, material, and equipment, and replace any found defective, without cost to Owner, for one year after final acceptance, as defined in General Conditions.
C. Each warrantee for longer than one year as described (that comes with equipment used on job) shall be passed on to Owner in Operation and Maintenance Manual, along with dates of start and end of warranty.
D. Refer to General Conditions for additional information regarding specific warranty requirements.

1.10 PROJECT RECORD DOCUMENTS

A. Before final payment, provide Engineer with one clean set of Drawings and Specifications corrected up-to-date as job progress. These documents shall reflect the as-built conditions. Refer to General Conditions for additional information.

1.11 SUBMITTALS

A. This Section gives general submittal information; refer to specific submittal information in the subsequent Mechanical Sections. Refer to Section 01 33 00 “Submittal Procedures” for further submittal procedure information.
B. Sale of Electronic CADD Files: Refer to Specification Section 01 33 00 "Submittal Procedures" OR call the Parkhill, Smith & Cooper, Inc. office issuing this Project and request the pricing for electronic files.
C. Within 10 days after award of Contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate/provide names of manufacturers, catalog, and model numbers, cut sheets, and such other supplementary information as necessary for evaluation.
D. Requirements for Each Submittal:
    1. Provide all Division 23 submittals for Project in "PDF" format at one time. Refer to Section 01 33 00 “Submittal Procedures.”
    2. Submittals must bear a dated stamp or specific written indication that Contractor has reviewed and approved all submittal prior to submission to Engineer.
    3. Submittals must have all information deleted by Contractor pertaining to means and methods of construction or to fabrication, assembly, installation, or erection (approval by Engineer shall not extend to these areas unless specifically noted by Engineer).

4. SUBMITTALS MUST BE CLEARLY AND SPECIFICALLY MARKED AS TO WHICH SPECIFIC PIECE OF EQUIPMENT IS BEING SUBMITTED, BY USE OF A PERMANENT MARKER, STAMP, ETC., SO AS TO DISTINGUISH IT FROM OTHER PIECES OF EQUIPMENT THAT MAY OCCUR ON THE SAME PAGE.
5. SUBMITTALS MUST BE CLEARLY MARKED AS TO WHICH AVAILABLE OPTIONS ARE SUBMITTED ASSOCIATED WITH A PIECE OF EQUIPMENT, AND SUBMITTALS MUST BE COMPLETE WITH RESPECT TO QUANTITIES, DIMENSIONS, SPECIFIC PERFORMANCE, MATERIALS, AND SIMILAR DATA TO ENABLE ENGINEER TO REVIEW PROPOSED EQUIPMENT.

E. OMISSION BY CONTRACTOR OF ANY REQUIREMENT OR SUBMITTAL WILL SUBJECT SUBMITTAL TO AUTOMATIC REJECTION WITHOUT REVIEW.

F. Any unrequested submittals received by Engineer shall be returned without review of any kind.

G. Installation Instructions: For certain products or systems as identified in subsequent Specification sections or on the Drawings, Contractor shall be required to provide copies of manufacturer's installation instructions with the submittal. When required as such, the installation instructions are considered part of the submittal and their omission may result in automatic rejection of the submittal. Where more than one identical device is scheduled, only one set of installation instructions needs to be submitted; (e.g., if seven 5-ton split systems air conditions are scheduled, only one 5-ton unit installation instruction needs to be submitted). Similarly, if one set of installation instructions is identified by the manufacturer and on the instructions to be applicable to more than one type or size of devices, (e.g., if one set of air conditioner instructions is good for 3-, 4-, 5-ton units, then only one instruction set is required for these devices).

1.12 SUBSTITUTED PRODUCTS

A. Material or equipment specified by manufacturer's name is being used as a basis of standard, unless otherwise noted. Engineer will be the sole judge on the equivalence of substituted equipment and materials.

B. It shall be Contractor's responsibility to verify that submitted substitute equipment will fit in space available. Contractor's submittal for acceptance of the substitute shall include a written statement if such acceptance will or will not require any subsequent or associated changes to the Drawings or Specifications. Any such changes shall be described in writing, briefly but complete.

C. Contractor shall be responsible for the costs of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete; that is, it shall include the cost effect of all other trades.

D. Engineer may request detailed shop drawing or plan layouts of mechanical rooms or systems of the substituted equipment.

1.13 SAFETY

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction," state and federal.

B. According to OSHA, a hazardous chemical is any chemical which is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a contractor produces, uses, or stores hazardous chemicals at the workplace, Contractor shall develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. In projects with multiple tenants in which the building is partially occupied during all or part of the project, Contractor shall inform the building manager or Owner, according to OSHA guidelines, of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified. Contractor shall employ required methods of training, information, handling, ventilation, labeling, storing, disposal, and removal of hazardous chemicals.

1.14 LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Refer to General Conditions for list of such independent testing authorities.

1.15 SITE VISIT REPORTS

A. During the job, Engineer will make site visits to observe Work in progress and will subsequently prepare a written site visit report, which will be sent to Contractor and to whomever else Engineer desires. Contractor shall prepare a written and typed response within seven calendar days of his receiving the site visit report. General Contractor shall include in his response the following information:
   1. Date of site visit by Engineer.
   2. Date of receipt of the site visit report.
   3. Name and title of the preparer of the response.
   4. An item number referenced to the site report.
   5. A brief three- or four-word description of the item.
   6. Contractor or subcontractor affected.
   7. The proposed course of action.
   8. An expected time of completion of the action.

1.16 CUTTING AND PATCHING

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by Contractor without first obtaining written permission and instructions from Engineer.

B. Where it is necessary to cut through any non-structural elements of walls, floors, or ceilings to permit the installation of any Work under this Contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut or to adjacent elements.

C. After the necessary Work has been completed, the damage shall be repaired by the respective Contractor, who shall pay all costs of such cutting, repairs and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the approval of Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new and of specified quality, unless specifically noted otherwise. Materials shall be free from defects. Where manufacturer names are mentioned in the Specifications or on the Drawings, it has been done to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his material to and from the job site; and will be responsible for the storage and protection of his materials and Work until the final acceptance of the job. At the end of each day of work, each Contractor is responsible for covering or protecting his Work/materials that may be susceptible to damage even if such damage is the result of unforeseen causes, (e.g., an overnight thunderstorm). Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced by Contractor at no cost to Owner.

C. Contractor shall verify all pieces of equipment will fit through available openings in the building and all equipment can be installed without modification of building structure.

2.2 EQUIPMENT SCHEDULE

A. All equipment major items are specified in the equipment schedules on Drawings and shall be new and furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory installation.

B. Equipment items so noted will require start-up by factory trained personnel. Equipment items so noted will require factory approved service personnel who shall provide all service, including all parts and all labor, as requested by Owner, during the full period of equipment warranty.

2.3 EQUIPMENT RATINGS

A. Equipment capacities as scheduled on Drawings are at Project site altitude. Capacities of submitted equipment must be corrected for Project site altitude unless otherwise noted.

2.4 WORKMANSHIP

A. Workmanship shall, in all respects, be the highest grade, and all construction done according to best practices of trade. Piping, ducting, and conduit shall be concealed, unless otherwise noted, and installed square to the building lines. Any Work not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

2.5 V-BELT DRIVES

A. Shall be of fabric and rubber construction of approved manufacture. Multiple belts shall be matched; and all belts shall be adjusted to drive the apparatus properly and to prevent slippage and undue wear in starting motor nameplate rating.

2.6 BELTGUARDS

A. Contractor shall provide for each V-belt drive a painted steel belt guard, which shall be constructed around an angle iron frame, securely bolted to the floor or apparatus. Guard shall completely enclose drives and pulleys and constructed to comply with all safety requirements. Hinged access doors not less than 6 x 6 inches shall be provided for access to motors and fan shaft for test purposes.

2.7 ELECTRICAL WIRING AND CONTROL EQUIPMENT

A. All disconnects, motor starters, relays, wiring, etc., shall comply with all requirements of Electrical Specifications.

B. Mechanical Contractor must refer to electrical control equipment and wiring shown on Electrical Drawings. Any changes/additions required by specified or substituted equipment furnished shall be the complete responsibility of Contractor furnishing the equipment.

C. All electrical equipment characteristics (voltage, etc.) must be **VERIFIED** by Mechanical Contractor prior to ordering. It is imperative that voltage and phase characteristics are checked with the Electrical Drawings.

D. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion-proof when located in hazardous atmospheres. Type II weather-protected motors may be used in lieu of TEFC motors on roof fan units and similar equipment. Motors mounted in direct sun shall be provided with a shield to forbid direct radiation from the sun when the sun is 45 degrees or greater above the horizon.

E. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 104 degrees F rise and total temperature rise of 149 degrees F ambient and when powered from system voltage feeding the motor. TEFC motors shall have a service factor of 1.00 with total temperature rise of 149 degrees F in noted conditions. Single-phase motors shall be NEMA Type N split phase induction motors with built-in thermal protectors. Single-phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors.

F. All motors shall be all copper wound, high-power factor, high-efficiency motors. Electric motors shall be an energy efficient type as defined in latest edition of NEMA Document MG1. Motor efficiency shall be made available to Engineer as required.

2.8 EQUIPMENT AND PIPING SUPPORTS

A. All supporting systems for piping, equipment, and materials supported by the building structure shall be submitted to Engineer for approval prior to purchase and installation.

2.9 ACCESSIBILITY

A. Access Panels:
   1. Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, regardless of if they are, or are not shown on the Drawings, and shall be brought to the attention of Engineer for approval of type, color, etc. Where access provided in rated members, access panels shall be a type that maintains integrity of member penetrated.

B. Access to Equipment:
   1. All pipes, tubing, conduit, etc., including but not limited to draining piping of any type, electrical conduit, wiring not in conduit, and pneumatic control tubing, shall be installed in such a way so as not to prevent and/or not to make necessary difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawlspaces), observation ports, measurement or balancing devices, or junction boxes.
   2. If access for these purposes is prevented or made unreasonably difficult in the opinion of Engineer, then Contractor shall make modifications or repairs at no cost to anyone except Contractor. Such modifications or repairs shall be considered neither complete nor adequate until Engineer is satisfied that access for the above purpose is achieved.

2.10 PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partition's penetrations from Drawings. Sealing material and methods shall be per UL recommendations.

2.11 BEDDING COURSE

A. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 STORAGE

A. Provide for proper storage of all materials and equipment and assume responsibility for losses due to any cause. All storage shall be within Contract limits of the building site or in a bonded warehouse. All equipment and materials must be covered and stored out of the elements; any item which has become rusted will not be permitted to be used.

B. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rainproof and lockable as required. Materials or equipment stored on site but not in a lockable rainproof storage facility shall be stored above ground or above slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by Engineer.

3.2 INSTALLATION AND ARRANGEMENT

A. Install all Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts which might require periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit ready access to valves, traps, starters, motors, and control components, and to clear opens of doors and of access panels.
B. Offsets, transitions, and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping pipes whether or not indicated on the Drawings. Furnish and install all traps, air vents, sanitary vents, etc., as required to affect these offsets, transitions, and changes in direction.

3.3 PROTECTION OF WORK AND PROPERTY

A. Where there are existing facilities, be responsible for protection thereof, whether or not such facility is to be removed or relocated or remain as installed. Moving or removing any facility must be done so as not to cause interruption to the Work or Owner’s operation.
B. All pipe and duct openings shall be closed with caps or plugs during installation. All fixtures shall be covered and protected against injury. At final completion, all Work shall be cleaned and delivered in an unblemished condition, or refinished and repainted at Engineer discretion.

3.4 CONCEALED AND EXPOSED WORK

A. Concealed: Within such spaces as pipe chases, pipe trenches, above plaster ceilings, or in walls; buried pipe is inaccessible when building is completed.
B. Exposed: Within equipment rooms, unfinished spaces, above "pushup" ceilings, accessible pipe tunnels, etc., where pipe is accessible.

3.5 CONCRETE

A. Mechanical Contractor shall coordinate all requirements for concrete. All concrete shall be furnished under the Architectural Divisions of these Specifications.

3.6 FIELD MEASUREMENTS

A. Contractor shall verify dimensions and conditions governing Work at Project site. He shall examine adjoining Work on which his Work is dependent, for perfect efficiency, and shall report any Work which must be corrected.

3.7 LUBRICATION

A. Contractor shall provide all oil and grease to operate all equipment until acceptance. Contractor held responsible for all damage to bearings while equipment is operated by him up to the date of acceptance of the equipment. Contractor shall protect all bearings and shafts during installation and shall thoroughly grease the steel shafts to prevent corrosion.

3.8 MANUFACTURER'S DIRECTION

A. Contractor shall install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where directions conflict with the Plans and Specifications, Contractor shall report such conflicts to Engineer who shall make changes deemed necessary and desirable.

3.9 FLUSHING, CLEANING, AND STERILIZING

A. Before final connections are made in the piping systems, all piping shall be blown out with air and then completely washed out with cleaning compounds. The systems shall be flushed for complete removal of all foreign materials. Furnish all temporary connections, valves, etc., required for this purpose.
B. After flushing, sterilize domestic water systems with approved chlorinating agent to provide a dosage of not less than 50 ppm. After minimum contact period of eight hours, the system shall be flushed with clean water until the residual chlorine is no greater than city water.

3.10 TESTS

A. Test all new vent, and waste lines with standing water test of 12 feet of head. Test to be held minimum two hours.
B. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
C. All tests shall be witnessed and approved by Engineer and the local authority having jurisdiction before covering or insulating. Satisfactory operation of blowers, pumps, and other equipment with moving parts shall be demonstrated to Engineer. Equipment without movable parts shall have pressure or other tests performed by Contractor to demonstrate satisfactory operation.
D. Furnish all instruments, pumps, blowers, and equipment required for the testing.
E. Provide written copies of these test reports for inclusion on the Operations and Maintenance Manuals and submit one copy to Engineer.

3.11 PAINTING

A. Surfaces of all equipment and material not provided with a factory finish coat shall be thoroughly cleaned, primed (if not factory primed), and finish coated with a high quality alkyd industrial enamel of a color chosen by Owner.

3.12 SPECIAL OPENINGS

A. Contractor shall attempt to schedule delivery of all large equipment requiring special openings for installation prior to enclosing of area. Where not possible, written notice of required openings which must be provided shall be listed by size and location and submitted to General Contractor before enclosing of areas involved. Work required to

construct openings and the associated cost of enclosing them shall be at no additional cost to Owner.

3.13 PLACING IN OPERATION

A. Clean all ducts, pipes, equipment, controls, etc., of plaster and other foreign debris.
B. Before final acceptance, all strainers shall be thoroughly cleaned or replaced, all bearings shall be oiled or greased, and all drains shall be cleaned out and primed. All permanent filters shall be cleaned; throwaway type filters shall be replaced with new filters.
C. The systems shall be placed in operation.
D. Contractor shall verify that all controls are set to meet operating conditions specified (ie: boiler operating control set at 180 degrees F. Limit control set at 200 degrees F.)
E. Contractor shall verify all pieces of equipment are operable and all sequence of controls met.
F. Contractor to adjust seating through the first year as required by Engineer.

3.14 BALANCING, TESTING, AND ADJUSTING MECHANICAL SYSTEMS

A. Balancing the mechanical systems shall be part of this Contract; refer to subsequent Mechanical Specification Section for details. Contractor is to include in their Proposal the cost of balancing, testing, and adjusting.

3.15 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide four copies of operating and maintenance manuals. Contractor shall deliver four bound sets to Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.
B. Each manual shall contain, but shall not be limited to, the following general sections:
    1. Certificates of acceptance from the inspecting authorities.
    2. Waiver of all liens.
    3. Warranties with starting dates and end dates for each pieces of equipment and/or for each system (warranties shall begin on date of substantial completion and acceptance by Owner).
    4. Names, phone and fax numbers, and addresses of all subcontractors, vendors, manufacturer’s representatives, and warranties providers.
    5. Certification letters from each Contractor that each system furnished and installed by that Contractor and/or subcontractors is started-up, balanced, adjusted, and checked for proper operation in accordance with the intent of the Contract Documents.
    6. Spare parts lists for each piece of equipment.
    7. Lubrication charts showing type of lubrication and application methods and frequencies,
    8. Filter cleaning or replacement schedule (on Contractor’s letterhead stationary).
    9. Preventative maintenance schedule for checking all items such as belt drives, safety controls, oil and refrigerant charges, and seasonal changer over recommendations. Cleaning of all strainers, traps, coils, tower pans, tubes, sprays, etc. (on Contractor’s letterhead stationary).
    10. Water treatment recommendations and instructions for boiler, towers, etc.
    11. Normal operating instructions including a sequence of operations (on Contractor’s letterhead stationary).

12. Instructions as to procedures to be followed for emergency situations, such as alarms or safety items being tripped (on Contractor's letterhead stationary).
13. Instruction on who to call for service during guarantee period (on Contractor's letterhead stationary).
14. Approved copy of the Testing, Adjusting and Balancing Reports.
15. Copies of as-built drawings reproducible photographic process.
16. Copies of all approved shop drawing submittals, including nameplate date, design parameters, name, phone and fax numbers, address of vendor, manufacturer's representative, and warrantee provider.

C. Approval not given for final payment until tests, balancing, and operating instruction portions have been completed.

3.16 INSTRUCTIONS TO OWNER

A. Contractor shall instruct Owner's operating personnel in the operations and maintenance of all mechanical systems and equipment. There shall be minimum four hours of training. Contractor shall furnish any special servicing tools required for maintenance.

B. Contractor shall conduct a demonstration of installation upon completion and final acceptance of Work. There shall be minimum four-hour demonstration. Prior to this, all Work shall have been completed, tested, balanced, and placed in operation. Qualified personnel must be present at demonstration to operate all the systems and prove performance of equipment. The schedule for this demonstration shall be coordinated with Engineer.

3.17 EXCAVATION FOR PIPE AND CONDUIT

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade. Level bottom of all trenches and cover all PVC pipe with processed chat.
   1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
   3. Excavate trenches 4 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Place backfill and fill materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.

E. All piping and conduit trenches across pavement shall be backfilled with two-sack concrete to within 12 inches of finished grade.

F. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
   2. Under walkways, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill material at 92 percent.
   3. Under lawn or unpaved areas, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill material at 85 percent.

G. Install detectable warning tape above conduits and pipe, 12 inches below finished grade, except six inches below subgrade under pavements and slabs.

H. Protection:
   1. Protecting newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
   2. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
   3. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent Work, and eliminate evidence of restoration to the greatest extent possible.

I. Disposal of Surplus and Waste Materials
   1. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property unless otherwise directed by Owner.
   2. Repair: Any damage to shrubs, grass, or structures shall be repaired to previous condition by Contractor at no additional expense to Owner.

J. Bracing and Sheeting: Open cut trenches shall be sheeted and braced as required by OSHA and the requirements of the state of Texas as necessary for the safety of workers or the protection of property.

END OF SECTION

SECTION 23 05 00.20 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic mechanical materials and methods to complement other Division 23 Sections.
      a. Piping materials and installation instructions common to most piping systems.
      b. Concrete equipment base construction requirements.
      c. Equipment nameplate data requirements.
      d. Nonshrink grout for equipment installations.
      e. Field-fabricated metal and wood equipment supports.
      f. Installation requirements common to equipment specification sections.
      g. Cutting and patching.
      h. Touch-up painting and finishing.
   2. Pipe and pipe fitting materials specified in piping system sections.

1.2 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
D. Exposed Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
   1. Product data for Mechanical sleeve seals.
   2. Samples of color, lettering style, and other graphic representation required for each identification material and device.
   3. Coordination drawings for access panel and door locations. Prepare according to Section 01 33 00 "Submittal Procedures" to a 1/4-inch equals 1-foot (1:48) scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to efficient flow of Work. Include:
      a. Proposed locations of piping, ductwork, equipment, and materials. Include:
         1) Planned piping layout, including valve and specialty locations, and valve stem movement.
         2) Planned duct systems layout, including elbow radii and duct accessories.

3) Clearances for installing and maintaining insulation.
4) Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
5) Equipment service connections and support details.
6) Exterior wall and foundation penetrations.
7) Fire-rated wall and floor penetrations.

b. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

c. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

d. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

e. Any costs incurred by Contractor for coordination issues amongst various trades due to the failure to supply coordination drawings will be the sole responsibility of Contractor and will be at no cost to Owner. Any spatial conflicts revealed by the coordination drawings shall have a solution proposed by Contractor and submitted to Engineer for approval. Issues which may arise concerning variations from the original design will be evaluated on a case-by-case basis.

1.4 QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify each welder passed AWS qualification tests for welding processes involved and certification is current.

B. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, equipment must meet design requirements and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
E. Coordinate connection of electrical services.
F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to piping system Specifications for pipe and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to piping system Specifications in Division 23 for special joining materials not listed.
B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
    1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
        a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
        b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
    2. ASME B16.20 for grooved, ring-joint, steel flanges.
    3. AWWA C110, rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.
E. Solder Filler Metal: ASTM B32.
    1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
F. Brazing Filler Metals: AWS A5.8.
    1. BCuP Series: Copper-phosphorus alloys.
    2. BAg1: Silver alloy.
    3. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
G. Solvent Cements: Manufacturer's standard solvents complying with the following:
    1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D2235.
    2. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F493.
    3. Poly (Vinyl Chloride) (PVC): ASTM D2564.
    4. PVC to ABS Transition: Made to ASTM D3138 requirements, color other than orange.

H. Plastic Pipe Seals: ASTM F477, elastomeric gasket.

I. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

J. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
   1. Sleeve: ASTM A126, Class B, gray iron.
   2. Followers: ASTM A47 (ASTM A 47M), Grade 32510 or ASTM A536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.3 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
   1. Inside Diameter: Closely fit around pipe, tube, and insulation.
   2. Outside Diameter: Completely cover opening.
   3. Cast Brass: One-piece, with setscrew.
      a. Finish: Rough brass.
      b. Finish: Polished chrome plate.
   4. Cast Brass: Split casting, with concealed hinge and setscrew.
      a. Finish: Rough brass.
      b. Finish: Polished chrome plate.
   5. Stamped Steel: One-piece, with setscrew and chrome-plated finish.
   6. Stamped Steel: One-piece, with spring clips and chrome-plated finish.
   7. Stamped Steel: Split plate, with concealed hinge, setscrew, and chrome-plated finish.
   8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
   9. Stamped Steel: Split plate, with exposed-rivet hinge, setscrew, and chrome-plated finish.
   10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
   11. Cast-Iron Floor Plate: One-piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
   1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
   2. Insulating Material: Suitable for system fluid, pressure, and temperature.
   3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180 deg. F temperature.
   4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.
   5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
   6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg. F temperature.

7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225 deg. F temperature.

C. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber-sealing elements to expand when tightened.

D. Sleeves. The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 24-gage or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
   4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
      a. Penetrating Pipe Deflection: 5 percent without leakage.
      b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
      c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
      d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer design.
   5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with setscrews.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5,000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.5 ACCESS DOORS

A. Flush mounted steel access doors with 16-gage frame and 14-gage panel. Prime coat finish. Concealed spring hinges, screwdriver cam-lock. Doors in fire rated surfaces shall be UL listed and labeled. Doors to be Milcor or approved equivalent.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping as described, except where system Sections specify otherwise. Individual piping system Specifications in Division 23 specify piping installation requirements unique to piping system.

B. General Locations and Arrangements: Drawings (Plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
C. Install piping at indicated slope.
D. Install components having pressure rating equal to or greater than system operating pressure.
E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited except where indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install fittings for changes in direction and branch connections.
L. Install couplings according to manufacturer's printed instructions.
M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to:
    1. Chrome-Plated Piping: Cast-brass, one-piece, with setscrew, and polished chrome-plated finish. Use split-casting escutcheons, where required, for existing piping.
    2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with setscrew.
    3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
    4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.
    5. Piping in Utility Areas: Cast-brass or stamped-steel, with setscrew or spring clips.
N. Sleeves are required for core drilled holes.
O. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.
P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
    1. Cut sleeves to length for mounting flush with both surfaces.
        a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
    2. Build sleeves into new walls and slabs as Work progresses.
    3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
        a. Steel Pipe Sleeves: For pipes smaller than 6 inches.
        b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger to penetrate gypsum-board partitions.
    4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
Q. Above-Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
    1. Install steel pipe for sleeves smaller than 6 inches.
    2. Install cast-iron wall pipes for sleeves 6 inches and larger.
    3. Assemble and install mechanical seals according to manufacturer's printed instructions.

R. Below-Grade, Exterior Wall, and Pipe Penetrations:
   1. Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
   2. Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

S. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material.

T. Verify final equipment locations for roughing in.

U. Refer to equipment specifications in other Sections for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
   4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
   5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
      a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
      c. Align threads at point of assembly.
      d. Tighten joint with wrench. Apply wrench to valve end into pipe being threaded.
      e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
   6. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
   7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
   8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean clothe or paper towels. Join pipe and fittings according to the following standards:
      a. Comply with ASTM F 402 for safe handling of solvent-cement and primers.
      b. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D2235 and D2661.
      c. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM D2846 and F493.
      d. Poly (Vinyl Chloride) (PVC) Pressure Application: ASTM D2672.
      e. PVC Non-Pressure Application: ASTM D2855.
      f. PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D3138.

9. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.
    a. Plain-End Pipe and Fittings: Butt joining.
    b. Plain-End Pipe and Socket-Type Fittings: Socket joining.

W. Piping Connections. Except as otherwise indicated, make piping connections as:
1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
2. Install flanges in piping 2 1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom where mounting heights not indicated.
B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Engineer.
C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 ACCESS DOORS

A. Furnish an access door for each pipe chase for each floor. This includes both toilets plumbing chases and pipe riser chases. Access doors assembly to be size 16 x 16 inches.
B. Also, furnish access doors in all non-removable ceiling and in partitions and walls where necessary access to plumbing cleanouts, shock absorbers, fire dampers, manual dampers, valves and other mechanical devices requiring access. Size these as required for access with minimum size of 12 x 12 inches.
C. Any access doors furnished for installation in fire rated surfaces or assembly shall carry an approved fire rating for that use.
D. Any access doors furnished for installation in glued on acoustical surfaces or assembly shall have recessed door to allow installation of tiles.
E. Provide all access doors to General Contractor for them to construct into building.

3.4 PAINTING AND FINISHING

A. Refer to Division 09 “Finishes” for field-painting requirements.
B. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
C. Attach to substrates as required to support applied loads.

3.7 DEMOLITION

A. Disconnect, demolish, and remove Work specified under Division 23 and as indicated.
B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.
E. Removal: Remove indicated equipment from the Project site.
F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
B. Clean surfaces that come in contact with grout.
C. Provide forms for placement of grout, as required.
D. Avoid air entrapment when placing grout.
E. Place grout to completely fill equipment bases.
F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes propeller fans.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
C. AMCA 99 - Standards Handbook.
D. AMCA 204 - Balance Quality and Vibration Levels for Fans.
E. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
H. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
I. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
J. NEMA MG 1 - Motors and Generators.
K. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
L. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures.”
B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
D. Manufacturer's Installation Instructions: Submit fan manufacturer instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements.”
B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210
B. Sound Ratings: AMCA 301, tested to AMCA 300
C. UL Compliance: UL listed and labeled, designed, manufactured, and tested per UL 705.
D. Balance Quality: Conform to AMCA 204.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified herein with minimum three years' documented experience.
B. Installer: Company specializing in performing Work herein with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements,” product storage and handling requirements.
B. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements,” product warranties and bonds.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 “Execution and Closeout Requirements,” for maintenance service.
B. Furnish service and maintenance of fans for one year from Date of Substantial Completion.
C. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
D. Perform work without removing fans from service during building normal occupied hours.
E. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.
F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

PART 2 - PRODUCTS

2.1 PROPELLER FANS

A. Construction:
   1. Impeller: Shaped steel or steel reinforced aluminum blade with hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor.
   2. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.
B. Accessories:
   1. Back-draft Damper: Multiple blade with offset hinge pin, blades linked.
   2. Outlet Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.
   3. Safety Screens: Expanded galvanized metal over inlet, motor, and drive; to comply with OSHA regulations.
   4. Hood: Weather shield, to exclude rain and snow.
   5. Fan speed controller.

C. Electrical Characteristics and Components: Refer to Division 26 Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements,” coordination and project conditions.

3.2 INSTALLATION

A. Secure wall fans with cadmium plated steel lag screws to structure.

3.3 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 “Quality Requirements” for manufacturer field services.

3.4 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements” for cleaning.

3.5 DEMONSTRATION

A. Section 01 70 00 “Execution and Closeout Requirements” for demonstration and training.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 “Execution and Closeout Requirements” for protecting finished Work.
B. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been tested-run under observation.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes louvers.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
B. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
C. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures.”
B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements.”

1.5 QUALITY ASSURANCE

A. Test and rate louver performance in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified herein with minimum three years' experience.

1.7 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements,”

1.8 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements,” product warranties and bonds.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Product Description: Combination louver/damper.
B. Type: 4 inch deep with blades on 45 degree slope, heavy channel frame.
C. Fabrication: 16-gage-thick galvanized steel or 12-gage-thick extruded aluminum, welded assembly, with factory prime coat finish color to be selected.
D. Mounting: Furnish with exterior flat flange for installation.
E. Bird Screen: Bird screen with 1/2-inch square mesh for exhaust and 3/4 inch for intake.
F. Insect Screen: Aluminum mesh, set in aluminum frame.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements,” coordination and project conditions.
B. Verify wall systems are ready for installation.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REQUIREMENTS

A. Requirements of General Conditions, Special Conditions, and these Specifications are applicable and part of every section in Division 26 “Electrical.” Contractor shall furnish all labor, material, service, equipment, appliances, and perform all operations in connection with installation and testing of Electrical Work per Contract Drawings and Specifications. Engineer will reject any material found defective and Contractor shall remove defective material from Work site.

B. Contractor is responsible for all material he furnishes and shall replace, at his own expense, all materials found defective in manufacture or damaged after delivery.

C. Interconnections between various items of electrical equipment and control system will likely require coordination and in some cases, interface devices such as but not limited to couplings, flanges, reducers, converters, conduit, relays, terminal blocks, contacts, wiring etc., will be required whether or not these items are shown on Drawings. It is the General Contractor’s responsibility to provide necessary coordination and interface devices at no additional cost to Owner.

1.3 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies. Installation, materials, equipment and workmanship shall conform to the applicable provisions of:
   1. National Electrical Code (NEC).
   2. National Electrical Safety Code (NESC).
   3. Terms and conditions of electrical utility and other authorities having lawful jurisdiction pertaining to work required.
   4. El Paso Water Design Standards Manual for Water, Wastewater, and Reclaimed Water Systems.

B. UL: All materials, appliances, equipment or devices shall conform to applicable standards of UL. Label of, or listing by, UL is required.

C. Standards: Where referenced in these Specifications or Drawings, publications and standards of the following organizations apply:
   1. ASTM, International.
   2. Institute of Electrical and Electronic Engineers (IEEE).
   3. Insulated Power Cable Engineers Association (IPCEA).
   4. National Electrical Manufacturers Association (NEMA).
   5. National Fire Protection Association (NFPA).
   6. American National Standards Institute (ANSI).
   7. Illuminating Engineering Society of North America (IESNA).

D. Should Contractor observe any conflict or variation in Plans and Specifications, notify Engineer in writing no later than 10 days before date of bid opening. Failure to clarify such variations will result in Electrical Contractor bearing all costs arising from electrical work done contrary to Specifications or Drawings.

E. Electrical Contractor shall coordinate all conduit runs, control wiring, and electrical connections to equipment items furnished by Mechanical Contractor, General Contractor, Instrumentation Contractor, Owner, and other contractors under other Specification Sections.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 “Submittal Procedures.”

B. Shop Drawings: Submit Shop Drawings for approval. Show complete outlines, dimensions, control diagrams, electrical characteristics of a special nature or critical to installation and pertinent data required for installation. All descriptive and technical data and shop drawings shall bear signed certification that they were carefully examined and found correct with respect to dimension, space available, non-interference with other trades and that equipment complies with all Specification requirements. Where catalog data submitted, clearly "flag" or otherwise identify proposed items so no confusion exists.

C. Substitutions: Submit proposed substitutions of electrical equipment, control devices, and other equipment with other submittal data. Accompany this request by complete descriptions of substitutes offered, including catalog cuts. Entire burden of proof of equality is placed on Contractor and Engineer decision is final.

D. Test Data: Provide one copy of all data obtained during tests required in Specifications. Organize data in an orderly fashion, type, and indicate each test result. Submit for Engineer review within three days of performing required tests.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. Electrical requirements for equipment specified or indicated on Drawings are based on information available at time of design. If equipment furnished for installation has electrical requirements other than indicated on Electrical Drawings, Contractor shall make any required changes to wire and conduit size, controls, overcurrent protection, and installation as required to accommodate equipment supplied, without additional charge to Owner. Complete responsibility and costs for such adjustments shall be assigned to respective Specification Section where equipment is furnished.

2.2 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer unless specified otherwise. Where no specific material, apparatus, or appliance is mentioned, a accepted industry standard product, with Engineer approval, may be used. Materials and equipment shall be standard products of manufacturers regularly engaged in production of such material and manufacturer's current and standard design. Equipment affected by altitude shall perform satisfactorily for function intended at altitude of Project site. Site elevation can be found on drainage plan of civil drawing sheets.

PART 3 - EXECUTION

3.1 FABRICATION, ERECTION, AND INSTALLATION

A. Fabrication, erection, and installation of complete electrical system shall be per best practice by qualified personnel experienced in such work and proceed in an orderly manner, not impeding Project progress. Electrical Contractor shall check all areas and surfaces where electrical equipment material is installed, removed, or relocated then report any unsatisfactory conditions before starting work. Commencing work signifies Contractor acceptance of existing conditions. In acceptance or rejection of finished installation, no allowance made for lack of skill on the part of workmen.

3.2 TEMPORARY POWER AND LIGHTING

A. Furnish and install temporary electrical facilities, if required, for construction and safety operations. No part of permanent electrical systems or existing electrical system may be used for temporary service unless approved by Engineer. Provide separate electrical service metering for temporary power.

3.3 PERFORMANCE TESTS

A. Thoroughly test all control circuits, fixtures, services and all circuits for proper operating condition and freedom from grounds and short circuits before requesting acceptance. Operate all equipment, appliances, and devices under load conditions. After interior wiring system installation is complete and when Engineer directs, conduct operating tests for approval. When requested, test all wire, cable, devices, and equipment after installation to assure all material possesses all original characteristics required by governing codes and standards listed herein.

B. Perform such tests as required by other Specifications Sections or requested to prove acceptability. Furnish all instruments and labor for testing.

3.4 RECORD DRAWINGS

A. During Work progress, maintain a clean, full set of project plans to record accurate, red-lined changes to system installation. Upon installation completion, submit full set of red-lined Drawings with all record data to Engineer.

3.5 OPERATING INSTRUCTIONS AND MANUALS

A. Without additional charge to Owner, furnish complete instruction to Owner in care, adjustment, and operation of all electrical equipment and system parts. Upon Work completion, prepare and deliver to Owner two sets of complete operating and maintenance manuals for systems and major equipment installed. Include catalog data, Shop Drawings, wiring diagrams, performance curves and rating data, spare parts lists, and manufacturer operating maintenance data. Include a copy of test data collected during field tests in manuals.

B. Requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

3.6 DRAWINGS

A. Electrical Drawings show general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and work of other trades will permit. Structural Drawings shall be considered as a part of work insofar as these Drawings furnish Contractor with information relating to design and construction of building. Because of the small scale of Electrical Drawings, it is impossible to indicate all offsets, fittings, and accessories required. Contractor shall investigate structural and finish conditions affecting work and arrange work accordingly, providing such fittings, elbows, pull boxes, and accessories be required to meet such conditions.

B. Field Measurements: Contractor shall verify dimensions governing electrical work at facility. No extra compensation claimed or allowed on account of differences between actual dimensions and those indicated on Drawings.

3.7 LOCATION OF EQUIPMENT AND OUTLETS

A. Approximate locations of cabinets, conduits, controllers, power outlets, etc., are indicated on Drawings; however, not intended to give complete and detailed information. Determine exact location after thoroughly examining general building plans and actual measurements during construction, subject to the approval of Engineer.

3.8 EXISTING ELECTRICAL

A. Existing electrical system information has been obtained from most up-to-date source and documents, but accuracy not guaranteed. Contractor shall familiarize himself with existing conditions before preparing bid.

B. Only existing electrical affected by this Contract is shown on Drawings. Existing electrical not shown in Drawings is to remain in place and in operation. Repair or replace all existing electrical damaged during construction.

C. Contractor responsible for damage to existing walls/ceilings due to electrical construction. Repairing damage to existing building shall be by proper trades involved.

3.9 PAYMENT

A. Payment made for all Work covered herein at Contract unit price per unit or included in lump sum price per job for items, as shown on proposal. Either such payment shall be complete compensation for complete performance of Work per Drawings and Specification provisions.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes power wire and cable; VFD cable, service entrance cable; control cable; and wiring connectors and connections.

B. Related Sections:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 26 05 53 “Identification for Electrical Systems”: Product requirements for wire identification.
3. Section 26 05 33 “Raceway and Boxes for Electrical Systems.”

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories, Inc.:

1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
2. Stranded conductors for control circuits.
3. Conductor not smaller than 12 AWG for power and lighting circuits.
4. Conductor not smaller than 16 AWG for control circuits.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper.

1.5 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures”: Requirements for submittals.

B. Product Data: Submit for building wire and each cable assembly type.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements”: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread greater than five feet (1.5 m) when tested in accordance with NFPA 262.
B. Perform Work in accordance with El Paso Water standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for coordination.
B. Where wire and cable destination are indicated and routing is not shown, determine routing and lengths required.
C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Wire and Cable: Cable to be manufactured by Southwire, Okonite, PWC, Inc., Capital Wire & Cable Corp, or equal.
B. VFD Cable: BELDEN or equal

2.2 POWER WIRE AND CABLE

A. 600V And Below:
   1. Description: Dry and Wet Locations, multi-conductor, insulated wire.
   2. Conductor: Copper.
   3. Insulation Voltage Rating: 600 volts.
   4. Insulation: ANSI/NFPA 70; Type THHN/THWN-2, 90 degrees C insulation for service entrance, feeders and branch circuits.
   5. For conductor sizes 250 KCM and larger, Type RHH/RHW with XLPE insulation.

2.3 VFD CABLE

A. Description: Shielded motor supply cable for variable frequency drives. Materials used are designed to hold up to the non-linear power distortions associated with VFD drives.
B. Color Code: Three black conductors with white numbers, plus green ground.
Shielded VFD cable shall consist of two spiral copper tape shields. Three symmetrical bare copper grounds Three stranded Class D Tinned Copper (TC) circuit conductors with XLPE Insulation. Black sunlight and oil resistant PVC Jacket with 90 degrees C continuous rating in wet or dry locations.

C. The cable shall have bare stranded copper grounding conductor per ASTM B-8, Class B in accordance with UL 1581.
D. The cable shall be suitable for cable tray use, sunlight resistance, and shall be provided in the sizes and conductor numbers shown on the drawings.
E. Manufacturer: BELDEN - 29532 or approved equal.
F. Nominal voltage: 600/1000 V-UL AWM.

2.4 CONTROL CABLE

A. Analog I/O wiring shall be 16AWG, 600V, tinned copper, twisted pair 100% shielded, Belden 8719 or equal.
B. Discrete I/O wiring shall be 16AWG, 600V, stranded copper, THWN. Use multi-conductor cable when possible.

2.5 WIRING CONNECTORS

A. Split Bolt Connectors:
    1. Manufacturers:
        a. Lisco.
        b. Buchanan.
        c. Burndy.
        d. Or approved equal.
    2. Substitutions: Section 01 60 00 “Product Requirements.”
B. Solderless Pressure Connectors:
    1. Manufacturers:
        a. Lisco.
        b. Buchanan.
        c. Burndy.
        d. Or approved equal.
    2. Substitutions: Section 01 60 00 “Product Requirements.”
C. Spring Wire Connectors:
    1. Manufacturers:
        a. Lisco.
        b. Buchanan.
        c. Burndy.
        d. Or approved equal.
    2. Substitutions: Section 01 60 00 “Product Requirements.”
D. Compression Connectors:
    1. Manufacturers:
        a. Lisco.
        b. Buchanan.
        c. Burndy.
        d. Or approved equal.
    2. Substitutions: Section 01 60 00 “Product Requirements.”

2.6 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.
C. Use anti-seize compound when bolts and screws are used for threaded connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements”: Coordination and project conditions.
B. Verify interior of building has been protected from weather.
C. Verify mechanical work likely to damage wire and cable has been completed.
D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove abandoned wire and cable.
B. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.
C. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.
B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
C. Identify and color code wire and cable under provisions of Section 26 05 53 “Identification for Electrical Systems.” Identify each conductor with its circuit number or other designation indicated.
D. Wire in Raceway:
    1. Pull conductors into raceway at same time.
    2. Install building wire 4 AWG and larger with pulling equipment.
E. Special Techniques - Cable:
    1. Protect exposed cable from damage.
    2. Use suitable cable fittings and connectors.
F. Wiring Connections:
    1. Clean conductor surfaces before installing lugs and connectors.
    2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
    3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
    4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
    5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
    6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
H. Install terminal lugs on ends of 600-volt wires unless lugs are furnished on connected device, such as circuit breakers.
I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.5 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller. Install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three-phase.
      c. Brown, Orange, and yellow for circuits at 277/480 volts single or three-phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape continuously applied for a minimum of 4 inches at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three-phase.
      c. Brown, orange, and yellow for circuits at 277/480 volts single or three-phase.

B. Neutral Conductors: White. When two or more neutrals are in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL AND TESTING

A. Section 01 40 00 “Quality Requirements”: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2., cables, low-voltage, 600 Volt maximum.

D. Verify uniform resistance of parallel conductors.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Wire.
   3. Mechanical connectors.
   4. Exothermic connections.

B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 20 00 “Concrete Reinforcing”: Bonding or welding bars when reinforcing steel is used for electrodes.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 80 – Guide for safety in AC Substation grounding.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5-ohms maximum.

1.5 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures”: Requirements for submittals.
B. Product Data: Submit data on grounding electrodes and connections.
C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements”: Requirements for submittals.
B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 80, and UL labeled.
B. Perform Work in accordance with NEC standards.
C. Maintain one copy each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements”: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for coordination.
B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   1. Burndy.
   2. nVent (Erico).
   3. Harger Lighting & Grounding.
   4. Or approved equal.
   5. Substitutions: Section 01 60 00 “Product Requirements.”

B. Product Description:
   1. Material: Copper Clad.
   2. Diameter: 3/4 inch.
   3. Length: 10 feet.

C. Connector: Connector for exothermic welded connection, or non-reversable Type, Burndy Hy Ground Products listed for the application.

2.2 WIRE

A. Material: Stranded copper.
B. Foundation Electrodes: Bare copper conductor.
C. Grounding Electrode Conductor: Copper conductor insulated.
D. Bonding Conductor: Copper conductor insulated.
E. Ground ring: Bare copper conductor.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:
   1. Burndy.
   2. Vent (Erico).
   3. Harger Lighting & Grounding.
   4. Or approved equal.
   5. Substitutions: Section 01 60 00 “Product Requirements.”

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

C. Exothermic connectors, rod electrodes, and other grounding related equipment shall be supplied by a manufacturer with 10 years’ experience in manufacturing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements”: Verification of existing conditions before starting work.
B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

A. Install Products in accordance with manufacturer’s instructions. Exothermically weld all connections.
B. Install rod electrodes at locations as indicated on Drawings.
C. Install grounding and bonding conductors concealed from view.
D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings.
E. Bond together metal siding not attached to grounded structure bond to ground.
F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements”: Field inspecting, testing, adjusting, and balancing.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13., Grounding Systems.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduit and equipment support.
   2. Anchor and fasteners.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NECA – National Electrical Contractors Association.
   2. ANSI/NFPA 70 – National Electrical Code.
   3. NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriter's Laboratories, Inc. as suitable for purpose specified and shown.

1.4 SUBMITTALS

A. Section 01 33 00 "Submittal Procedures": Requirements for submittals.
B. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
C. Design Data: Indicate load carrying capacity of hangers and supports.
D. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Carlon; a brand of Thomas & Betts Corporation.
   2. Vent (CADDY).
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 "Product Requirements."

2.2 FORMED STEEL CHANNEL

A. Furnish materials in accordance with El Paso Water standards.
B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Furnish materials in accordance with El Paso Water standards.
B. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Sleeves Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
B. Stuffing Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 ANTI-SEIZE COMPOUND

Use anti-seize compound when using bolts and screws to install pre-manufactured equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements”: Verification of existing conditions before starting work.
B. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide expansion anchors, powder actuated anchors and preset inserts.
   2. Steel Structural Elements: Provide beam clamps, spring steel clips, and steel ramset fasteners.
   3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
   4. Sheet Metal: Provide sheet metal screws.
   5. Wood Elements: Provide wood screws.
B. Install conduit and raceway support and spacing in accordance with NEC.
C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
D. Install multiple conduit runs on common hangers.

E. Supports:
   1. Fabricate supports from structural steel. Rigidly weld members or install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.3 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 00 00 “Cast-In-Place Concrete.”
B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
C. Set sleeves in position in forms. Provide reinforcing around sleeves.
D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
G. Install stainless steel escutcheons at finished surfaces.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements”: Field inspecting, testing, adjusting, and balancing.

3.6 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements”: Requirements for cleaning.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for protecting finished Work.
B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 26 “Grounding and Bonding for Electrical Systems.”
   3. Section 26 05 29 “Hangers and Supports for Electrical Systems.”
   4. Section 26 05 36 “Cable Trays for Electrical Systems.”
   5. Section 26 05 53 “Identification for Electrical Systems.”
   6. Section 26 27 16 “Electrical Cabinets and Enclosures.”
   7. Section 26 27 26 “Wiring Devices.”
   8. Section 27 05 36 “Cable Trays for Communications Systems.”

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
C. National Fire Protection Association:
   1. NFPA 70 – National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
B. Underground: Schedule 40 PVC conduit. Provide cast metal boxes or nonmetallic handhole.
C. When transitioning from below grade to above grade, provide PVC coated metal conduit elbows.
D. Outdoor Locations, Above Grade: Provide PVC, coated metal conduit. Provide cast metal with PVC coating outlet, pull, and junction boxes.
E. In Slab Above Grade: Provide thick wall nonmetallic conduit. Provide sheet metal boxes.
F. Wet and Damp Locations: Provide PVC coated metal conduit. Provide cast metal with PVC coating outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide PVC coated metal conduit. Provide sheet-metal with PVC coated boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
H. Exposed Dry Locations: Provide PVC metal coated conduit. Provide sheet-metal with PVC coated boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4-inch unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures”: Submittal procedures.
B. Product Data: Submit for the following:
   1. Rigid metallic conduit.
   2. Liquid tight flexible metal conduit.
   3. Nonmetallic conduit.
   4. Raceway fittings.
   5. Conduit bodies.
   6. Pull and junction boxes.
C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements”: Closeout procedures.
B. Project Record Documents:
   1. Record actual routing of conduits larger than 2-inch.
   2. Record actual locations of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements”: Product storage and handling requirements.
B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Coordination and project conditions.
B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03 “Identification for Electrical Systems.”

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Wheatland.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”
B. Rigid Steel Conduit: ANSI C80.1.
C. Rigid Aluminum Conduit: ANSI C80.5.
D. Intermediate Metal Conduit (IMC): Rigid steel.
E. Fittings and Conduit Bodies: NEMA FB 1; all steel fittings.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers:
   1. Levy.
   2. Robroy Industries.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 thick.
C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Ultatite.
   2. Electri-flex.
   3. Or approved equal.
   4. Substitutions:[Section 01 60 00 “Product Requirements.”
B. Product Description: Interlocked steel construction with PVC jacket.
C. Fittings: NEMA FB 1.

2.4 NONMETALLIC CONDUIT

A. Manufacturers:
   1. Carlon.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: NEMA TC 2; Schedule 40 PVC.
C. Fittings and Conduit Bodies: NEMA TC 3.

2.5 WIREWAY

A. Manufacturers:
   1. Allied Moulded Products, Inc.
   2. Carlon.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: Oiltight and dust-tight type wireway.
C. Knockouts: Bottom only.
D. Size: 6 x 6 inch; length as indicated on Drawings.
E. Cover: Hinged cover with full gaskets.
F. Connector: Slip-in.
G. Fittings: Lay-in type with drip shield.
H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.6 OUTLET BOXES

A. Manufacturers:
   1. Allied Moulded Products, Inc.
   2. Carlon; a brand of Thomas & Betts Corporation.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”
B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.
C. Nonmetallic Outlet Boxes: NEMA OS 2.
D. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Furnish gasketed cover by box manufacturer.
E. Wall Plates for Finished Areas: As specified in Section 26 27 26 “Wiring Devices.
F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.7 PULL AND JUNCTION BOXES

A. Manufacturers:
   1. nVent (Hoffman).
   2. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements”: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26 “Grounding and Bonding for Electrical Systems.”
B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29 “Hangers and Supports for Electrical Systems.
C. Identify raceway and boxes in accordance with Section 26 05 53 “Identification for Electrical Systems.”
D. Arrange raceway and boxes to maintain headroom and present neat appearance.
E. Use anti-seize compound when using bolts and screws to install pre-manufactured equipment.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
B. Arrange raceway supports to prevent misalignment during wiring installation.
C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29 “Hangers and Supports for Electrical Systems:” provide space on each for 25 percent additional raceways.
E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
F. Do not attach raceway to ceiling support wires or other piping systems.
G. Construct wireway supports from steel channel specified in Section 26 05 29 “Hangers and Supports for Electrical Systems.”
H. Route exposed raceway parallel and perpendicular to walls.
I. Maximum Size Conduit in Slab Above Grade: 3/4-inch. Do not cross conduits in slab.
J. Maintain clearance between raceway and piping for maintenance purposes.
K. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F .
L. Cut conduit square using saw de-burr cut ends. Do not use pipe cutter.
M. Bring conduit to shoulder of fittings; fasten securely.
N. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
O. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
P. Install no more than equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 2 inch size.
Q. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
R. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.
S. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
T. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

U. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
V. Close ends and unused openings in wireway.
W. Install sleeves at all locations where conduits penetrate concrete pads and walls.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 “Wiring Devices”.
D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
K. Install adjustable steel channel fasteners for hung ceiling outlet box.
L. Do not fasten boxes to ceiling support wires or other piping systems.
M. Support boxes independently of conduit.
N. Install gang box where more than one device is mounted together. Do not use sectional box.
O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
B. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 70 00 “Execution and Closeout Requirements”: Testing, adjusting, and balancing.
B. Adjust flush-mounting outlets to make front flush with finished wall material.
C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements”: Final cleaning.
B. Clean interior of boxes to remove dust, debris, and other material.
C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Labels.
   3. Wire markers.
   4. Conduit markers.
   5. Stencils.
   6. Underground Warning Tape.
   7. Lockout Devices.

B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures.”

B. Product Data:
   1. Submit manufacturer's catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements”: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with El Paso Water standard.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 “Product Requirements”: Environmental conditions affecting products on site.
B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Brady ID.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.
C. Letter Size:
   1. 1/4-inch high letters for identifying individual equipment and loads.
   2. 1/4-inch high letters for identifying grouped equipment and loads.
   3. 3/8-inch high letters for identifying main disconnect equipment.
D. Minimum nameplate thickness: 1/8-inch.

2.2 LABELS

A. Manufacturers:
   1. Brady ID.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background.

2.3 WIRE MARKERS

A. Manufacturers:
   1. Brady ID.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Description: Cloth tape, split sleeve, or tubing type wire markers.
C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
   2. Control Circuits: Control wire number as indicated on Drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Manufacturers:
   1. Brady ID.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Description: Nameplate fastened with adhesive. Labels fastened with adhesive.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady ID.
   2. Or approved equal.
   3. Substitutions: Section 01 60 00 “Product Requirements.”
B. Description: 4-inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.
B. Nameplate Installation:

   1. Install nameplate parallel to equipment lines.
   2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
   3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
   4. Secure nameplate to equipment front using screws or rivets.
   5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
   6. Install nameplates for the following:
      a. Switchboards.
      b. Panelboards.
      c. Transformers.
      d. Service Disconnects.
C. Label Installation:
   1. Install label parallel to equipment lines.
   2. Install label for identification of individual control device stations.
   3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:
   1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
   2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

E. Underground Warning Tape Installation:
   1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade.

END OF SECTION

SECTION 26 24 19 – MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 26 “Grounding and Bonding for Electrical Systems.”

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
   1. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   2. NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers.
   3. NEMA ICS 3 - Industrial Control and Systems: Factory Built Assemblies.
   4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   5. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
   6. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
   7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. Underwriters Laboratories Inc.:
   1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   2. UL 508 - Industrial Control Panels.
   3. UL 845 - Motor Control Centers.

E. El Paso Water Standards.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures.”

B. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time and current curves of equipment and components.

D. Test and Evaluation Reports: Indicate field test and inspection procedures and test results.
E. Source Quality Control Submittals: Indicate results of factory tests and inspections.
F. Field Quality Control Submittals: Indicated results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Closeout procedures.
B. Operation and Maintenance Data: Submit replacement parts list for controllers.
C. Project Record Documents: Record actual locations, configurations, and ratings of motor control centers and major components.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Product storage and handling requirements.
B. Deliver in 60 inches maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.
C. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
D. Handle in accordance with NEMA ICS 2.3. Lift only with lugs provided. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.7 AMBIENT CONDITIONS

A. Section 01 50 00 “Construction Facilities and Temporary Controls:” Ambient conditions control facilities for product storage and installation.
B. Conform to NEMA ICS 2 service conditions during and after installation of motor control centers.

1.8 EXISTING CONDITIONS:

A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

PART 2 - PRODUCTS

2.1 DISCONNECTS

A. Combine motor controllers with MCP breaker disconnect in common enclosure.
B. The operator handle of all units shall be interlocked with the MCC frame, so that a unit insert cannot be withdrawn or inserted when the operator is in the ON position.
C. Circuit breaker type starter units shall have a short circuit rating greater than the available fault current and shall be motor circuit protectors (MC) with only magnetic trip.
D. Feeder breakers shall be molded case breakers with thermal magnetic trip and have short circuit rating greater than the available fault current.

2.2 FULL-VOLTAGE NON-REVERSING CONTROLLERS

A. Manufacturers:
   1. Allen Bradley
   2. Eaton Cutler Hammer
   3. General Electric
   4. Substitutions: Section 01 60 00 Product Requirements.

B. Description: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

C. Rated for 600V.

D. Provide positive, quick-make, quick-break mechanisms, pad lockable enclosure doors.

E. Control Voltage: 120V, 60 Hertz.

F. Materials:
   1. Overload Relay: NEMA ICS 2; bimetal.
   2. Product Options and Features:
      a. Auxiliary Contacts: NEMA ICS 2, 2 each normally open, field convertible contacts in addition to seal-in contact.
      b. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty, oiltight type.
      c. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A15.
      d. Pushbuttons: Recessed type.
      e. Indicating Lights: LED type.
      f. Selector Switches: Rotary type.
      g. Relays: NEMA ICS 5
      h. Control Power Transformers: 120-volt secondary, 200 VA minimum, in each motor controller. Furnish fused secondary, and bond unfused leg of secondary to enclosure.

2.3 SOLID STATE REDUCED VOLTAGE MOTOR CONTROLLERS

A. Acceptable Manufacturers:
   1. ABB
   2. Allen Bradley
   3. Eaton Cutler Hammer
   4. General Electric
   5. Substitutions: Section 01 6000 “Product Requirements.”

B. Solid State Reduced Voltage Motor Controllers: UL508; integrated, modular unit consisting of power SCRs, microprocessor controls, digital display, programming keypad, output auxiliary contacts, and external communications ports.
   1. Rating: Severe duty.
   2. Power Structure: Modular design for easy replacement, with built in overload protection, integral heat sinks, and two SCRs for each phase with minimum 1,500V peak inverse rating.
   3. Control Structure: Digital microprocessor to control and supervise operation of motor controller with self-tuning power supply, logic control circuitry, SCR firing circuitry.
   4. Overload Protection: Programmable, 3-phase current sensing acting as motor thermal protective device, selectable trip class. Include phase loss, stall, phase reversal, shorted SCR detection.
   5. Built in run bypass contactor.

C. Operation:
   1. Starting: Voltage ramping, with pump control option.
   2. Stopping: Coast to stop and soft stop control.
   3. Slow Speed: User adjustable starting and running current as percentage of full load current rating.
   4. Jog Speed:
      a. High Jog Speed: 100 percent of normal speed; reverse direction.
      b. Low Jog Speed: 50 percent of normal speed; reverse direction.

D. Digital Display: Manufacturer's standard front mounted, LED type, indicating status of motor, controller, and fault conditions.
   1. Motor Indications: 3-phase current, 3-phase voltage, power, power usage, power factor, thermal capacity, and elapsed time.
   2. Controller Indications: Ready, starting, running, and stopping.
   3. Fault Indications: line fault, shorted SCR, power loss, over temperature, under load, overload, under voltage, over voltage, excessive starts, phase reversal, and jam.

E. Programming Keypad: Manufacturer's standard front mounted for setting and adjusting the following controller functions.
   1. Full load amperes.
   2. Starting current limits.
   3. Acceleration ramp.
   4. Initial torque.
   5. Voltage boost.
   6. Starting mode.
   7. Starting time.
   8. Stopping mode.
   9. Thermal overload trip class.

F. Output Auxiliary Contacts: Provide contacts to signal the following operating conditions.
   1. Normal.
   2. Up to speed.
   3. Bypass.
   4. Alarm.

2.4 FEEDER CIRCUIT BREAKER

A. Manufacturers:
   1. EATON
   2. Schneider Electric USA (Square D)
   3. Approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”

B. Description: UL 489, molded-case circuit breaker.

C. Operation:
   1. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 200 instantaneous and ground fault amperes and larger have mechanism for adjusting long time and short time setting for automatic operation. Range of Adjustment: 125 percent.
   2. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have changeable trip units.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 "Quality Requirements: Testing, inspection and analysis requirements.
B. Shop inspect and perform standard productions tests for each controller in accordance with manufacturer's standards.
C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 "Execution and Closeout Requirements:" Requirements for installation examination.
B. Verify surfaces are suitable for motor control center installation.

3.2 INSTALLATION

A. Use anti-seize compound when using bolts and screws to install equipment.
B. Install in accordance with NEMA ICS 2.3. and NEMA 7.1.
C. Select and install heater elements in motor controllers to match installed motor characteristics.
D. Install engraved plastic nameplates in accordance with Section 26 05 53 "Identification for Electrical Systems."
E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage rating, and phase rating. Place label in clear plastic holder. Indicate method of identifying phase conductors.
F. Ground and bond motor control centers in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 "Quality Requirements: for inspecting and testing.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.16.
D. Inspect and test variable frequency controllers according to NEMA ICS 7.1.

3.4 CLEANING

A. Section 01 70 00 "Execution and Closeout Requirements:" Requirements for cleaning.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 33 “Raceway and Boxes for Electrical Systems”: Outlet boxes for wiring devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
B. National Fire Protection Association:
   1. NFPA 70 – National Electrical Code.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures”: Submittal procedures.
B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers; Wall Switch:
   1. General Electric Model 5951-2G.
   2. Hubbell Model 1221-1.
   3. P&S Model 20-AC-1-1.
   4. Or approved equal.
   5. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: NEMA WD 1, specification grade, AC only general-use snap switch.
C. Body and Handle: Ivory plastic with toggle handle.
D. Ratings:
   1. Voltage: 120-277 volts, AC.
   2. Current: 20 amperes.

2.2 RECEPTACLES

A. Manufacturers:
   1. General Electric Model 5362.2.
   2. Hubbell Model 5362.1.
   3. P&S Model 5362.1.
   4. Or approved equal.
   5. Substitutions: Section 01 60 00 “Product Requirements.”
B. Product Description: NEMA WD 1, specification grade general use receptacle.
C. Device Body: Ivory plastic.
D. Configuration: NEMA WD 6, type.
E. Convenience Receptacle: Type 5-20.
F. GFCI Receptacle, 20 amp rated: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
G. Outdoor receptacles shall have an enclosure that is weatherproof regardless of the attachment plug cap is inserted.

2.3 WALL PLATES

A. Manufacturers:
   1. General Electric.
   2. Hubbell.
   3. P&S.
   4. Or approved equal.
   5. Substitutions: Section 01 60 00 “Product Requirements.”
B. General: Provide plates for each switch and receptacle device. Provide plates to match material of box to which it is attached.
C. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. Plates for cast type boxes shall be of the cast, vapor type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 “Administrative Requirements”: Coordination and project conditions.
B. Verify outlet boxes are installed at proper height.
C. Verify wall openings are neatly cut and completely covered by wall plates.
D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Use anti-seize compound when using bolts and screws to install equipment.
B. Install devices plumb and level.
C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
E. Do not share neutral conductor on load side of dimmers.
F. Install receptacles with grounding pole on bottom.
G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
H. Install wall plates on flush mounted switches, receptacles, and blank outlets.
I. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
J. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 “Raceway and Boxes for Electrical Systems” to obtain mounting heights as specified and as indicated on drawings.
B. Install wall switch 48 inches above finished floor.
C. Install convenience receptacle 18 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.
B. Operate each wall switch with circuit energized and verify proper operation.
C. Verify each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Section 01 70 00 “Execution and Closeout Requirements”: Testing, adjusting, and balancing.
B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements:” Final cleaning.
B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fusible and non-fusible switches.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 29 “Hangers and Supports for Electrical Systems.”
   3. Section 26 05 53 “Identification for Electrical Systems.”

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
B. National Fire Protection Association:
   1. NFPA 70 – National Electrical Code.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures”: Submittal procedures.
B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements”: Closeout procedures.
B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Schneider Electric USA (Square D).
   2. Eaton.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”
B. Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Operation:
   1. Switch Ratings
      a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
      b. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes).

D. Materials:
   1. Coordinate selection in the following paragraph with fuses specified for application in enclosed switches.
   2. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
   3. Enclosure: NEMA KS 1, to meet conditions.
      a. Interior Dry Locations: Type 1.
      b. Exterior Locations: Type 3R or 4.
   4. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
   5. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Schneider Electric USA (Square D).
   2. Eaton.
   3. Or approved equal.
   4. Substitutions: Section 01 60 00 “Product Requirements.”

B. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Operation:
   1. Switch Ratings
      a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

D. Materials:
   1. Enclosure: NEMA KS 1, to meet conditions.
      a. Interior Dry Locations: Type 1.
      b. Exterior Locations: Type 3R or 4.
   2. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
   3. Furnish switches with entirely copper current carrying parts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated.

B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29 “Hangers and Supports for Electrical Systems.”

C. Height: 5 feet to operating handle.

D. Install fuses for fusible disconnect switches.

E. Install engraved plastic nameplates in accordance with Section 26 05 53 “Identification for Electrical Systems. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting, testing, adjusting, and balancing.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for cleaning.
B. Clean existing enclosed switches to remain or to be reinstalled.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Site preparation, excavation, grading, trenching and backfilling required for the project. Excavation, of whatever material encountered, for all structures in the project, shall be made as required by Drawings or as directed by Engineer. Material required to be moved during preparation of the site, excess excavated material or any material unsuitable for use in backfilling shall be disposed of by Contractor.
2. Excavation will not be classified, and no additional compensation will be allowed for rock. Bidders shall make such investigations of the nature of material to be encountered in excavations as they deem necessary and shall assume all responsibility for fully informing themselves of the character of such material.
3. Contractor shall furnish all materials, equipment tools, labor, superintendence, and incidentals required to perform the Work as indicated on the drawings, as directed by the Engineer and as specified.

B. Related Sections:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 31 23 16 “Excavation.”
3. Section 40 05 04 “Piping Systems.”

1.2 TRENCH SAFETY

A. Contractor responsible for complying with Texas House Bills 662 and 665 Safety Standards and with applicable OSHA regulations concerning trench excavation, general excavation, and construction safety.

B. Contractor responsible for implementing a trench safety system where trench depth exceeds 5 feet. Contractor shall refer to Section 31 41 10 “Trench Safety,” and to details for approved trench safety methods for pipelines.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CLEARING OF RIGHT-OF-WAY

A. Clearing consists of removal and lawful disposal of vegetation, rubble, trees, tree roots, down timbers, snags, brush, pavements of various types, and rubbish within areas to clear. Protect individual trees, groups of trees, or other vegetation not required to remove and occurring outside earthwork area against unnecessary cutting, breaking/skinning roots, skinning and brushing bark, or smothering trees by stockpiling construction materials or excavated materials within drip lines.

3.2 DISPOSAL

A. Contractor shall lawfully dispose all material removed from job site.

3.3 TRENCHING AND BACKFILLING PIPELINES

A. Excavation for pipe trenches shall be made to lines and grades shown on drawings and established in the field. Trenching and backfilling for pipelines are specified in other Specifications.

3.4 CLEAN UP

A. After completion of all work in connection with project, clean entire work area and any adjacent areas disturbed by construction of all construction debris, rocks and excess materials and remove all such material from site or highway right-of-way and disposed of by Contractor. Replace any sod disturbed by installation of these facilities. Grade entire area to uniform surfaces and present a neat and clean appearance before final acceptance.

END OF SECTION

SECTION 31 20 00.10 – EARTH MOVING FOR FACILITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes preparing subgrades for slabs-on-grade, excavating, and backfilling for buildings, structures, and trenches for utilities and pits for buried utility structures.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 00 00 "Cast-in-Place Concrete."
C. A geotechnical engineering study was completed for the design and construction of the retaining wall for this project. The title of the study is "El Paso Water – John T. Hickerson Wastewater Treatment Plant Retaining Wall Structure, El Paso, El Paso County, Texas, LOI File No. 21-413". This study is included at the end of this section for Contractor's use, and it is referenced in the structural drawings for the retaining wall.

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.
B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
C. Drainage Course: Aggregate layer supporting the slab-on-grade also minimizing upward capillary flow of pore water.
D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as Engineer directs. Authorized additional excavation and replacement material paid for per Contract provisions for changes in Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without Engineer direction. Unauthorized excavation and remedial work directed by Engineer, without additional compensation.
E. Fill: Soil materials used to raise existing grades.
F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4-cubic yard or more in volume exceeding a standard penetration resistance of 100 blows per 2 inches when tested by geotechnical testing agency, per ASTM D1586.
G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
H. Subgrade: Uppermost surface of excavation or top surface of fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
I. Utilities: Onsite underground pipes, conduits, ducts, cables, and underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports for each onsite and borrow soil material proposed for fill and backfill as:
   1. Classification per ASTM D2487.
   2. Laboratory compaction curve per ASTM D1557.

1.4 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthmoving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
B. Utility Locator Service: Notify area where Project is located before beginning earthmoving operations.
C. A geotechnical engineering study was completed for the design and construction of the retaining wall for this project. The title of the study is "El Paso Water – John T. Hickerson Wastewater Treatment Plant Retaining Wall Structure, El Paso, El Paso County, Texas, LOI File No. 21-413". This study is included at the end of this section for Contractor's use, and it is referenced in the structural drawings for the retaining wall.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Provide borrow soil materials when sufficient satisfactory soil materials not available from excavations.
B. Satisfactory Soils: Soil Classification Groups GC, SC, GW, GP, GM, SW, SP, and SM per ASTM D2487, or combination of groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Liquid Limit: 25.
   2. Plasticity Index: 15 max.
   3. Percent Retained on No. 4 Sieve: 25-50.
   4. Percent Retained on No. 40 Sieve: 50-85.
C. Unsatisfactory Soils: Soil Classification Groups CL, ML, OL, CH, MH, OH, and PT per ASTM D2487, or combination of groups. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
D. Engineered Fill: Naturally- or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1 1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
E. Drainage Course: Narrowly graded mixture of washed-crushed stone, crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1 1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
F. Sand: ASTM C33; fine aggregate.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthmoving operations.
B. Protect and maintain erosion and sedimentation controls during earthmoving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface and ground water from entering excavations, ponding on prepared subgrades, and flooding Project site and surrounding area.
B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of surface character and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in Contract Sum or Contract Time authorized for rock excavation or removing obstructions.
    1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
    2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding these dimensions:
        a. 24 inches outside concrete forms other than footings.
        b. 12 inches outside concrete forms at footings.
        c. 6 inches outside minimum required dimensions of concrete cast against grade.
        d. The outside dimensions of concrete walls indicated cast against rock without forms or exterior waterproofing treatments.
        e. 6 inches beneath bottom of concrete slabs-on-grade.
        f. 6 inches beneath pipe in trenches and greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within ±1 inch tolerance . If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within ±1-inch tolerance. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
B. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Excavate trenches to uniform widths to provide 12-inch clearance on each side of pipe or conduit.
C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
   4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

A. Notify Engineer when excavations reach required subgrade.
B. If Engineer determines unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
C. Proof-roll subgrade below building slabs with pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
D. Authorized additional excavation and replacement material paid for per Contract provisions for changes in Work.
E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as Engineer directs, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings with engineered fill material. Lean concrete fill, with 28-day compressive strength of 2,500 psi, used when approved by Engineer. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials, and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing and sheeting.
   7. Installing permanent/temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil. Fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 00 00 “Cast-in-Place Concrete.”

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1-inch in any dimension, to 12 inches over pipe or conduit. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal, so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under building slabs, use satisfactory soils.
   2. Under footings and foundations, use satisfactory soils.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on muddy, frozen, frosty, or icy surfaces.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material exceeding optimum moisture content by two percent and too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along full length of each structure.
C. Compact soil materials under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent percentages of maximum dry unit weight per ASTM D1557.

3.15 GRADING

A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
B. Site Rough Grading: Slope grades to direct water away from buildings and prevent ponding. Finish subgrades to required elevations within the following tolerances: Finish subgrade to a 1/2-inch tolerance when tested with a 10-foot straightedge.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
B. Allow the testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthmoving only after test results for previously completed work comply with requirements.
C. Testing agency will test compaction of soils in place per ASTM D1557, D2167, D2922, and D2937, as applicable. Perform tests at the following locations and frequencies:
   1. Building Slab Areas: At subgrade and each compacted fill and backfill layer, at least one test every 2,000 square feet or less of paved area or building slab, but no fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
D. When testing agency reports subgrades, fills, or backfills not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required. Recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances when completed or partially-completed surfaces become eroded, rutted, settled, or loss of compaction from subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as Engineer directs. Reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSE SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose from Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer. Remove waste materials including unsatisfactory soil, trash, and debris, and legally dispose from Owner's property.

END OF SECTION

Geotechnical Engineering Study

El Paso Water – John T. Hickerson Wastewater Treatment Plant
Retaining Wall Structure
El Paso, El Paso County, Texas
LOI File No. 21-413

Prepared for:
H_2O Terra
2020 East Mills Avenue
El Paso, Texas 79901

Prepared by:
LOI ENGINEERS
2101 E. Missouri Avenue, Suite B
El Paso, Texas 79903

January 10, 2022

ENGINEERS

File No. LOI21-413
January 10, 2022

Mr. Steven T. Morgan, P.E.
H_2O Terra
2020 East Mills Avenue
El Paso, Texas 79901

Re: Geotechnical Engineering Report
El Paso Water – John T. Hickerson Wastewater Treatment Plant
Retaining Wall Structure
El Paso, El Paso County, Texas

Dear Mr. Morgan:

We thank you for the opportunity to present the enclosed geotechnical engineering report for the above referenced project. This engineering report was prepared in accordance with the scope of services as presented in our proposal No. LOIP21-622, dated December 18, 2021, and authorized on December 21, 2021. The information we are presenting herein describes the procedures utilized for field and laboratory investigation, along with the results of our study.

It was a pleasure to work with you on this phase of your project, and we look forward to assist you further during the subsequent construction activities. If you have any questions regarding the information we present herein, please call us.

Respectfully submitted,
LOI ENGINEERS

Diana S. Guerrero, P.E.
Project Engineer

Bernardino Olague, P.E., PMP
Principal Engineer

STATE OF TEXAS
BERNARDINO OLAGUE
LICENSED
PROFESSIONAL ENGINEER
1/10/2022

Copies: Above (1) Via E-mail
Ms. Raquel Alba-Lucker, P.E. (1) Via E-mail (1)
File (1)

ENGINEERS

Table of Contents

APPENDIX B

APPENDIX C

1.0 INTRODUCTION

We have completed the geotechnical engineering study for the proposed retaining wall structures at the El Paso Water (EPW) – John T. Hickerson Wastewater Treatment Plant at 701 Executive Center Boulevard in El Paso, Texas. We were authorized to conduct this study by Ms. Raquel Alba-Lucker, P.E., representing H_2O Terra (Client) on December 21, 2021.

2.0 PROJECT DESCRIPTION AND OBJECTIVE

The project consists of the design and construction of a retaining wall structure. The improvements will be located near the headworks building within the EPW – John T. Hickerson Wastewater Treatment Plant at 701 Executive Center Boulevard in El Paso, Texas, as shown on the General Location Map in Appendix A as Sheet A-1.1.

3.0 FIELD AND LABORATORY INVESTIGATION

3.1 Field Exploration

In our field exploration phase, we drilled a total of three (3) soil borings to depths ranging from 19½ feet to 26½ feet, below ground surface at representative locations within the proposed retaining wall footprint. We encountered auger refusal in the three soil borings due to the presence of large cobbles or boulders. We drilled and sampled the soil borings in general accordance with ASTM D-6151 and D-1586 procedures with a truck-mounted CME-75 drill rig. We located the borings in the field using existing structures included in the project plans provided by Client.

The soil boring locations are shown in the Boring Location Plan included in Appendix A of this report in Sheet A-1.2. We also prepared a log of each soil boring to delineate the soil strata studied at the site. The soil boring logs (B-1 and B-3) are included in Appendix A of this report as Sheets A-2 and A-4. A key to the soil terminology used in the logs is included in Appendix B of this report as Sheets B-1 and B-2.

We conducted Standard Penetration Tests (SPT) at each representative soil strata in the soil borings to determine the relative density or consistency of the resident soils. The SPT is a widely recognized procedure that provides a numerical value of the soil strata being tested, indicating the number of blows that it takes for a standard 140-pound weight hammer with a standard 30-inch free fall drop to penetrate 12 inches into the soil. The SPT values for the soil strata in the soil borings are included in the soil boring logs.

As part of our field exploration, we collected representative soil samples from the soil borings at regular depth intervals using a standard 2-inch diameter split spoon sampler. We identified and labeled the samples according to boring number and depth, visually classified them according to ASTM D-2488, and placed them in moisture-proof containers for transportation to the laboratory for further evaluation and testing.

Unless we receive prompt notification from Client, we will store the samples collected from the field investigation in our laboratory for a period of 90 days from the date of this report, after which time we will discard the samples.

3.2 Geotechnical Laboratory Testing

In the laboratory, we determined the moisture content, particle size analysis, percent passing the No. 200 sieve, and Atterberg Limits of selected samples. We conducted these tests to determine the physical and engineering properties of representative soils at the site. These tests also allowed us to properly classify the resident soils in accordance with the Unified Soil Classification System (USCS). The results of our tests are included in the soil boring logs, adjacent to the depth at which the sample was recovered.

Table 1: Laboratory Testing Program

Type of Test	Number of Tests
Moisture Content (ASTM D-2216)	11
Percent Passing No. 200 Sieve (ASTM D-1140)	9
Atterberg Limits (ASTM D-4318) (including non-plastic samples)	5

4.0 GENERAL SITE CONDITIONS

4.1 Site Geology

The project site is located mainly on or near the interphase between the Rio Grande alluvial deposits and the foot slopes of the Franklin Mountains. According to the Soil Conservation Service of El Paso County, the soils in this area correspond to the Delnorte-Canutillo association, which is described as nearly level to steep soils that are shallow or very shallow over caliche or that are deep and gravely throughout.

4.2 Site Topography and Site Conditions

The project site is relatively level, and slopes gently downward in a southeasterly direction. The proposed site is within an existing and active wastewater treatment plant, on the north and east sides of the headworks building. Existing underground piping is located within the proposed splitter box bypass structure areas.

4.3 Site Vegetation

At the time of our field phase, there was minimal vegetation at the site consisting of weeds, shrubs, trees, and perennial grasses.

4.4 Soil Stratigraphy

The soils we encountered in the borings can be grouped into two (2) generalized soil strata as follows:

Stratum A, consisting of brown fine grained silty sands occasionally intermixed with gravel, was encountered from ground surface elevation, and extended to depths ranging from 19½ to 26½ feet below ground surface (BGS). These soils were

encountered at a medium dense to very dense relative density, with SPT values results ranging from 11 to more than 50 blows per foot of penetration. These soils were encountered at a dry to moist condition, with tested moisture content values ranging from 2 to 22 percent, and percent finer than the No. 200 sieve test results ranging from 6 to 25 percent. Soils in this stratum can be classified as SP, SM or SP-SM in accordance with the USCS.

Stratum B, consisting of mottled-gray poorly graded gravels intermixed with various amounts of sand and silt, was encountered underlying the Stratum A soil in Boring B-1, and extended to the total explored depth of 21-½ feet BGS in the boring. These soils, which are underlain by boulders (rock) and cobbles, were encountered at very dense relative density, with SPT values of over 50 blows per foot of penetration. Soils in this stratum can be classified as GP in accordance with the USCS.

Due to the relatively small diameter of the drilling and sampling tools utilized in our drilling program, we could not establish the maximum size of cobbles in the above strata. However, based on the degree of difficulty in our drilling program at the site, we anticipate that the size of cobbles will exceed 6 inches in diameter. During our drilling operations, auger refusal occurred at depths as shallow as 19 feet. Based on the natural stratigraphy in the vicinity of the project site, large boulders and rock formations may be encountered at depths of about 5 feet in certain locations. However, due to our drilling methodology and localized sampling, we could not verify the type, the presence or the extent of these possible formations.

4.5 Groundwater

Groundwater was encountered in the borings during the time of our field exploration, which took place on December 27, 2021. The groundwater table at the site was encountered at depths ranging from 10 feet to about 20 feet below the ground surface.

It is our opinion that the depth to groundwater at the site may vary considerably after periods of significant rainfall or during irrigation season. Fluctuations in groundwater may also occur as a function of temperature, groundwater withdrawal, and future construction activities that may alter the surface drainage and sub-drainage characteristics of this site.

5.0 ENGINEERING EVALUATION

5.1 Structural Information

Based on the preliminary drawings provided by Client, as well as our experience with similar projects, we have assumed the total load of the splitter box bypass structures will be on the order of 150 tons each and the structures will be supported on mat foundations. If the final loads differ significantly from the assumed values presented herein, LOI ENGINEERS should be notified immediately so that we may conduct further analysis to determine whether our recommendations need to be revised, as appropriate.

5.2 Vertical Movements

We calculated the Potential Vertical Rise (PVR) of the soil profile from our soil borings in accordance with Texas Department of Transportation (TXDOT) method Tex. 124-E.

The soils encountered in the borings exhibited low plasticity characteristics, therefore the calculated PVR value of the dry soil profile is less than ¼-inch.

5.3 Site Preparation

Any vegetation in the construction areas should be removed and disposed of off-site per applicable local regulations prior to grading operations. Soils at their present condition may provide adequate support for foundations and/or slab-on-grade floors, when properly processed, moisture conditions, and compacted as indicated in this report. The upper 24 inches of existing subgrade and/or select fill shall be moisture

conditioned to within ±3% of its optimum moisture content and compacted to at least 95% of its maximum dry density, as determined by ASTM D-1557.

5.4 Foundation Recommendations

The proposed retaining wall structure may be supported on a shallow foundation system. This foundation system should be dimensioned using the parameters shown in the following table:

Table 3: Foundation Recommendations

Type of Foundation	Allowable Soil Bearing Capacity (lb/ft^2)	Minimum Footing Width (in.)	Minimum Footing Bearing Depth (in.)	Minimum Select Fill Below Bottom of Footing Elevation (in.)
Continuous	2,350	42	42	18

The horizontal limits of overexcavation shall extend 18 inches beyond the footing line.

Foundation systems designed and constructed based on the above data and parameters should experience total settlement of less than one inch. It is very important to provide adequate drainage to eliminate water accumulation or infiltration near the proposed building. Based on our settlement calculations using Schmertmann's method total settlements were estimated at 1-inch for a time equal to 1 year (T=1yr.).

Although differential settlement is typically estimated to be about one-half the total settlement (Ds=½-inch), differential movements across foundations may approach the total settlement if loose or soft soil deposits are left within the foundation footprints. The foundation system to be designed in accordance with the above criteria considers a safety factor of 3.

5.5 Trench Guidelines

We recommend adequate protection on the faces of the excavations to prevent hazards from falling material. Adequate sloping on the faces of the excavations should also be implemented to avoid possible soil sloughing.

The Occupational Safety and Health Administration (OSHA) classifies soils for the purpose of defining stable slopes to be used in trenching applications.

The soils found during our field exploration, are considered Type C materials. For temporary slopes in soil trenching for this project, Type C soils can have a maximum slope of 1½:1 (H:V).

The pipeline installation contractor/subcontractor may be required to utilize shielded trench systems during the construction phase whenever excavations deeper than 5 feet are required taking into consideration site constraints such as vehicular traffic, existing underground lines (fuel, natural gas, telecommunication, and water), overhead lines, and existing structures.

We should note that the information included in this report is for design purposes, and is not intended to provide a trench safety plan. The contractor should develop a trench safety plan in accordance with the requirements of OSHA and specifications in the project plans. If trench shields will be used, these should be selected appropriately to retain the lateral loads from the native coarse grained soils.

5.6 Lateral Earth Pressures

We recommend the following values to be used in earth pressure computations, considering the Rankine method for lateral earth pressure computation having cohesionless or granular native materials as follows:

$$\Phi = 32°$$

$$\gamma_w = 125\ lb/ft^3$$

Additionally, the equivalent fluid density, considering the equivalent fluid method with the appropriate k value, may be computed as follows:

$$G_h = k*\gamma_w$$

For concrete or masonry walls, the wall-soil interface friction angle may be computed as follows:

$$\Phi_w = 0.67\Phi$$

Coefficients of active and passive earth pressure are given below, along with the coefficient for the possible at-rest condition:

$$k_a = 0.33$$
$$k_p = 3.00$$
$$k_o = 0.50$$

5.7 Groundwater Control

Relatively shallow groundwater was encountered at the site and may be encountered in excavations at the site. If encountered, we recommend that the groundwater table be lowered and maintained at a depth of at least 2 feet below excavation levels during construction. Adequate control of the groundwater could possibly be accomplished by means of pumping from temporary gravel-lined, cased sumps. However, due to a relatively high permeability of some of the sand layers, cased sumps may not offer enough relief and positive groundwater control such as cased wells or a well point system may be required. The actual system that is to be used can likely best be determined at the time of construction. Whichever system is used, it should offer some flexibility and should operate continuously during the below grade construction process.

Groundwater control should be the responsibility of the contractor. The contractor should be required to submit a dewatering plan. Details of the contractor's design and the contractor's planned approach should be addressed in this plan to assure every effort is being made to effectively lower the groundwater. It may be prudent to actually require the submittal of the dewatering plan as part of the bidding process to help preclude the possibility that the apparent low bidder has inappropriately addressed

any significant items in the construction. It may become difficult to require the contractor to adequately address dewatering as part of the actual construction process after the project has been awarded.

The contractor should be prepared to promptly remove surface water from the general construction area by ditching or other means.

5.8 Site Drainage

Positive surface drainage should be provided during and after construction by sloping the ground surface a minimum of two percent graded away from the structures for a minimum distance of 5 feet. Irrigated planters should not be allowed adjacent to the structures. Underground water and sewer lines should be properly installed underneath the structures to reduce the possibility of moisture infiltration in the event of plumbing leaks.

5.9 Seismic Considerations

Table 4: Seismic Design Parameters (2015 International Building Code)

Parameter	Value
Site Class	D
Site Location (latitude, longitude)	-31.796267, 106.522322
S_{MS} – Spectral Response Acceleration for Short Periods	0.502g
S_{M1} – Spectral Response Acceleration for a 1-Second Period	0.243g
S_{DS} – Design Spectral Response Acceleration for Short Periods	0.335g
S_{D1} – Design Spectral Response Acceleration for a 1-Second Period	0.162g

5.10 Pipe Bedding and Trench Backfill

Pipe bedding and backfill material should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture conditioned to add the amount of moisture required for optimum compaction, and compacted to a minimum of 95 percent of maximum density in accordance with ASTM D-1557 (modified Proctor) procedures. Soil

moisture content should be at plus or minus 3 percent of the optimum moisture content in accordance with the above standard. Refer to Appendix C for El Paso Water Standard Details for bedding and backfill of pressure pipe and gravity pipe in dry and wet conditions. Use the following soil types for the standard details in Appendix C.

Table 5: Pipe Bedding Recommendations

Soil Class	Soil Type ASTM D 2487	Soil Description
Class I	None	Manufactured aggregates, angular, crushed rock, crushed gravel with maximum particle size of 1½ inches per ASTM D-2321
Class II	GW, GP, SW, SP	Coarse grained sands and gravels per ASTM D 2487 with maximum particle size of 1½ inches per ASTM D-2322
Class III	GM, GC, SM, SC	Coarse grained sands with fines per ASTM D 2487 with maximum particle size of 1½ inches per ASTM D-2323

5.11 Select Fill

Select fill material used for site grading should be granular, cohesionless, and free of deleterious material and particles over 4 inches in greatest dimension. Soils proposed for use as fill materials should be classified in accordance with ASTM D-2487. The following soils classified in accordance with the Unified Soil Classification System (USCS) can be considered satisfactory for use as select fill.

> GM, GC, GW-GM, GW-GC, GP, GP-GM and GP-GC, SM, SC, SW-SM, SW-SC, SP-SM, SW-SC and SC-SM.

The following USCS-classified soils are not considered satisfactory for use as select fill.

> CH, CL, MH, ML, OH, OL and PT, or soils that exceed a liquid limit of 40 and a plasticity index of 15.

The soils in our borings are suitable for use as select fill, provided they meet the above criteria for acceptable fill materials.

Select fill should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture-conditioned to add the amount of moisture required for optimum compaction and compacted to a minimum of 95 percent of maximum density in

accordance with ASTM D-1557 (modified Proctor) procedures. The moisture content should be at plus or minus 3 percent of optimum moisture content in accordance with ASTM D-1557.

This compaction requirement also applies to the subgrade soils that will receive select fill. However, if the subgrade soils consist of cohesive soils such as CL or CH, or if the plasticity index exceeds 18, the subgrade soils should be compacted to a minimum of 90 percent of the above standard.

Compaction of the fill material and subgrade soils should be conducted with approved types of pneumatic, power or tamping equipment. Determination of density in the field should be conducted in accordance with ASTM D-2922 or D-1556.

5.12 New Construction near Existing Structures and Utilities

Contractor shall exercise extreme care during footing excavation and site preparation near the existing structures and underground piping, if applicable, to avoid encroaching into the existing foundation systems, hence preventing adversely affecting or undermining the performance and structural integrity of the existing wells and associated appurtenances. We also recommend that before any excavation or earthwork takes place, all underground utilities be located to prevent damages to the existing infrastructure. We also recommend that any underground utilities that may encroach the proposed foundations system be decommissioned, removed and/or relocated, and the voids need to be filled with select fill as recommended in Section 5.11 of this report.

We recommend that ten (10) days prior to commencing any excavation near the existing building, the contractor shall submit a plan describing how they will protect the existing structures during construction activities. Protective measures may include, but may not be limited to temporary shoring and/or phased excavation.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Construction Monitoring

We recommend that Client retain LOI ENGINEERS during the construction phase of this project to verify the findings of our study, and to provide supplemental data to this study in the event that site conditions vary from those described in this report.

The geotechnical engineer should also conduct testing of fill materials used for earthwork operations at the following frequencies:

- At least one (1) moisture-density relationship (ASTM D-1557) and soil classification tests (ASTM D-6913 and ASTM D-4318) for each type of material encountered, or imported material to be used.
- Soil density (compaction) testing in accordance with ASTM D-6938 or D-1556 using the following testing frequencies:
    - Concrete structure area – A minimum of one (1) density test per lift (8-inch compacted) for every 1,000 square feet.
    - Pipe area – A minimum of one (1) density test per lift (8-inch compacted) for every 250 linear feet for pipe bedding and backfill operations, or at least three (3) tests per lift, whichever is greater.

Sampling and testing for quality assurance of concrete materials should be performed at the following frequency:

- A minimum of one (1) set of four specimens should be collected for every 50 cubic yards of concrete placed, or fraction thereof. Concrete field testing shall include temperature, slump, and air content (if applicable).

6.2 Limitations

We have performed our professional services and have obtained the data presented in this report in accordance with generally accepted geotechnical engineering principles

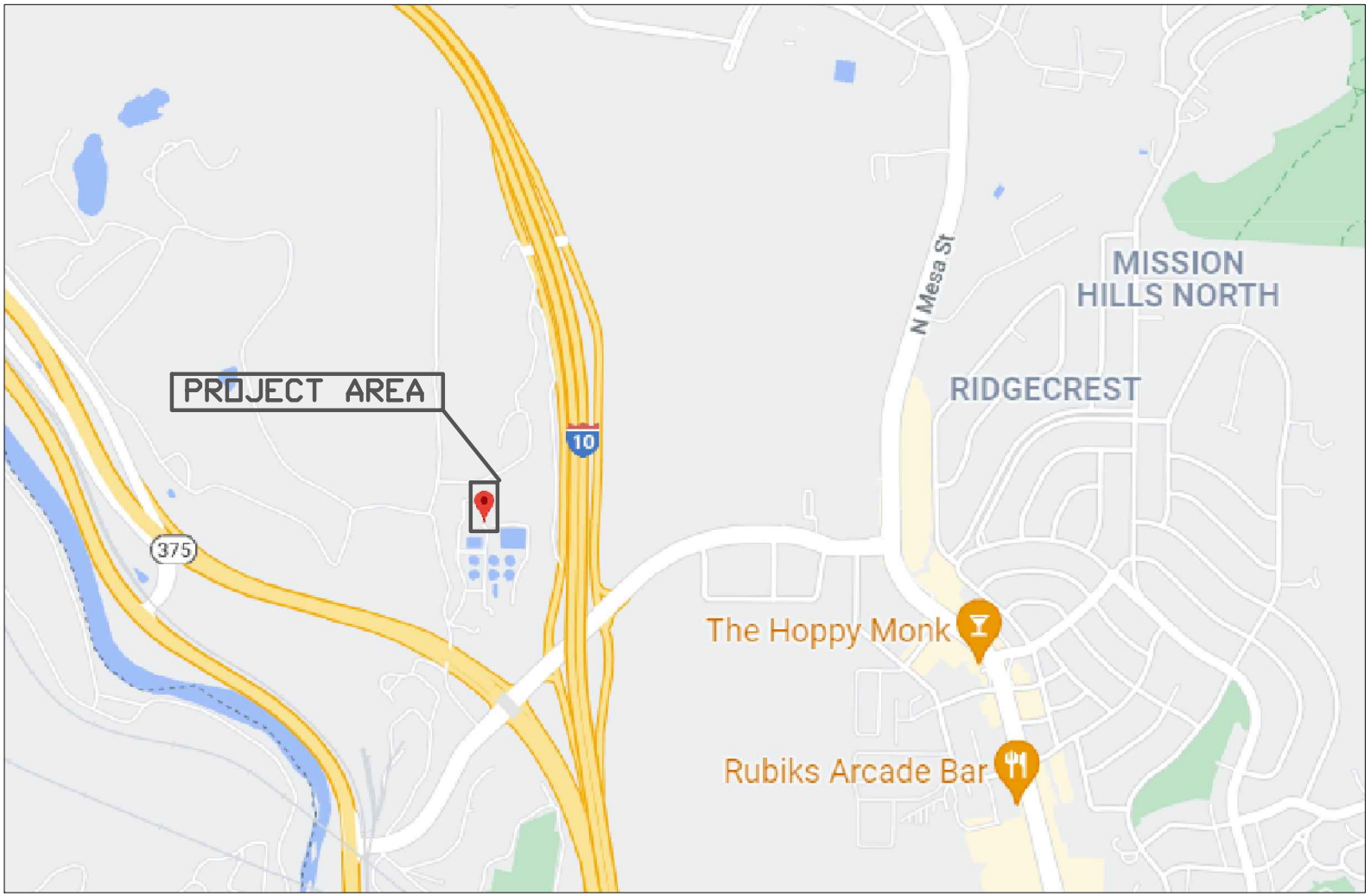
and practices. The information in this report is based on the data obtained from two (2) representative test borings and laboratory testing conducted on representative samples, and on our knowledge of the project conditions at the time of our subsurface soil study.

The data in this report reflects subsurface soil conditions only at the specific sampling location, time of sampling, and to the depths indicated in our report. This report is not intended to identify or address any potential environmental concerns associated with the project site.

We recommend that Client notify LOI ENGINEERS of any changes to the project conditions considered in this report, so that we may provide pertinent modifications to our recommendations if deemed necessary. Additionally, once construction commences, we should be notified of any unusual site conditions that appear to vary from those reported herein, so that we may conduct further investigations and prepare supplemental recommendations if deemed necessary.

We conducted this investigation for the purpose of defining the subsurface soil conditions for the proposed retaining wall structure at the El Paso Water – John T. Hickerson Wastewater Treatment Plant in El Paso, Texas. Use of this information for projects other than the one described herein will not be adequate.

APPENDIX A



LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: GENERAL LOCATION MAP
APPROXIMATE PROJECT LOCATION	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	H20 TERRA 2020 EAST MILLS AVENUE EL PASO, TEXAS 79901	PROJECT NAME: EPW JOHN T. HICKERSON WRF RETAINING WALL EL PASO, TEXAS

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
F.R.	D.G.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
LOI21-413	SITE PLAN	01/05/22	A-1.1

LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: BORING LOCATION PLAN
B-1 APPROXIMATE BORING LOCATION AND NUMBER	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	H20 TERRA 2020 EAST MILLS AVENUE EL PASO, TEXAS 79901	PROJECT NAME: EPW JOHN T. HICKERSON WRF RETAINING WALL EL PASO, TEXAS

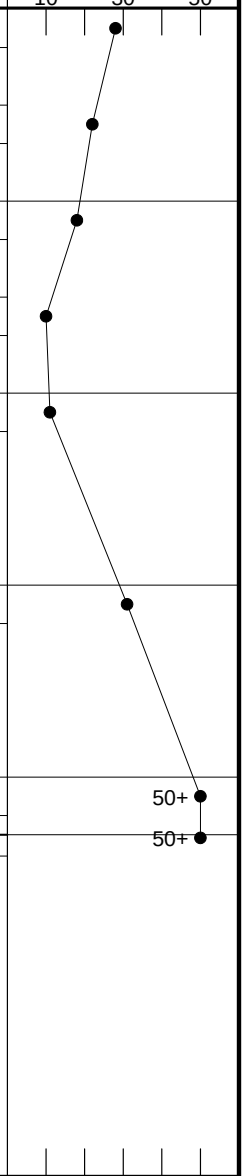
DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
F.R.	D.G.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
LOI21-413	SITE PLAN	01/05/22	A-1.2

LOG OF TEST BORING No. B-1

Project name: EPW John T. Hickerson WRF Retaining Wall
File No.: LOI21-413
Date drilled: 12/27/21
Boring Location: See Sheet A-1.2
Elevation (ft.): N/A North: N/A West: N/A

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)
0			SAND, fine grained, poorly-graded with silt, brown, medium dense, very moist		22	6				28
										22
5			-moist at 5 feet		18	6				18
										10
10				SP-SM						11
15			-dense at 15 feet		7	11				31
20			GRAVEL, poorly-graded, brown, very dense, saturated	GP						50+
			Termination depth at 21.5 feet -Auger Refusal at 21.5 feet due to Heavy Gravels							50+
25										
30										

SPT N-Value CURVE



Groundwater Table Data

Depth	Date	Time
20 feet	12/27/21	10:00 am

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA/SSA
Drilled by: JFL
Logger: JS
Sheet No.: **A-2**

LOG OF TEST BORING No. B-2

Project name: EPW John T. Hickerson WRF Retaining Wall
File No.: LOI21-413
Date drilled: 12-27-21
Boring Location: See Sheet A-1.2
Elevation (ft.): N/A North: N/A West: N/A

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value: CURVE (10 30 50)
0			SAND, fine grained, silty, brown, medium dense, moist	SM						20	
					15	13				22	
5			SAND, fine grained, poorly-graded with silt, brownn, dense, moist with gravel							46	
					14	7					
10											
15				SP-SM	13						
20											
25			SAND, fine grained, silty, brown, dry to moist with gravel	SM	5	25					
			Termination depth at 26.5 feet								
30											

Groundwater Table Data

Depth	Date	Time
20 feet	12/27/21	12:00 am

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA/SSA
Drilled by: JFL
Logger: JS
Sheet No.: **A-3**

LOG OF TEST BORING No. B-3

Project name: EPW John T. Hickerson WRF Retaining Wall
File No.: LOI21-413
Date drilled: 12-27-21
Boring Location: See Sheet A-1.2
Elevation (ft.): N/A North: N/A West: N/A

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value: CURVE (10 30 50)
0			SAND, fine grained, poorly-graded with silt, brown, dense, moist	SP-SM	13	11				30	
			-very dense at 2.5 feet							50+	50+
5					14					50+	50+
			SAND, fine grained, silty, brown, medium dense, dry	SM	2	14				26	
10			-very dense at 10 feet		3	15				50+	50+
15										50+	50+
										50+	50+
20			Termination depth at 19.5 feet -Auger Refusal at 19.5 feet due to Heavy Gravels								
25											
30											

Groundwater Table Data

Depth	Date	Time
10 feet	12/27/21	1:00 pm

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA/SSA
Drilled by: JFL
Logger: JS
Sheet No.: **A-4**

SUMMARY OF RESULTS

Project: EPW John T. Hickerson WRF Retaining Wall

LOI Project No.: LOI21-413

Date: 12/21/21

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
1	0-1½	22			6				Poorly-graded sand with silt (SP-SM)
1	5-6½	18			6				Poorly-graded sand with silt (SP-SM)
1	15-16½	7			11				Poorly-graded sand with silt (SP-SM)
2	2½-4	15	77	48	13				Silty sand with gravel (SM)
2	7½9	14	61	32	7				Poorly-graded sand with silt and gravel (SP-SM)
2	15-16½	13							
2	25-26½	5			25				Silty sand (SM)
3	0-1½	13	77	46	11				Poorly-graded sand with silt and gravel (SP-SM)
3	5-6½	14							
3	7½-9	2	91	44	14				Silty sand (SM)
3	10-11½	3	73	43	15				Silty sand with gravel (SM)

APPENDIX B

SOIL TERMINOLOGY

COARSE GRAINED SOILS: More than 50 percent retained on No. 200 sieve. Includes fine, medium, or coarse grained (depending on grain size) gravel and sand, and silty and/or clayey gravel and sand. Density is described according to relative density measured in the laboratory, or sampler resistance in the field as follows:

Penetration Resistance* (Blows per Foot)	Descriptive Term	Relative Density** (Percent)
0 – 4	Very Loose	0 - 15
5 - 9	Loose	15 – 35
10 - 29	Medium Dense	35 – 65
30 - 49	Dense	65 - 85
More than 50	Very Dense	85 - 100

* From Standard Penetration Test with 140-pound hammer, 30-inch drop.
** From relative density tests on undisturbed sand sample.

FINE GRAINED SOILS: More than 50 percent passing through the No. 200 sieve. Includes organic and inorganic silt and clay, gravelly and/or sandy silt and clay, silty clay, and clayey silt. Consistency is described according to shear strength, from unconfined compression tests in the laboratory, penetrometer tests in the field or laboratory, or sampler resistance in the field as follows:

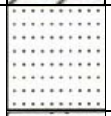
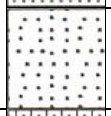
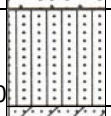
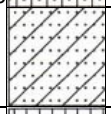
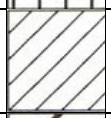
Compressive Strength* (Tons per Square Foot)	Descriptive Term	Penetration Resistance** (Blows per Foot)
Less than 0.25	Very Soft	Less than 2
0.25 - 0.50	Soft	2 - 4
0.50 - 1.00	Firm	5 - 8
1.00 - 2.00	Stiff	9 - 15
2.00 - 4.00	Very Stiff	16 - 50
4.00 and higher	Hard	50 and higher

* From unconfined compression strength test.
** From Standard Penetration Test with 140-pound hammer, 30 inch drop.

Slicken sided: With inclined planes of weakness of slick and glassy appearance.
Fissured: With shrinkage cracks that are frequently filled with fine sand.
Laminated: With thin layers of varying colors and texture.
Interbedded: With alternate layers of different soil types.
Calcareous: With noticeable quantities of calcium carbonate.
Sensitive: Applies to cohesive soils that are subject to loss of strength when remolded.
Well graded: With wide range in grain sizes and good distribution of intermediate particle sizes.
Poorly graded: With one predominant grain size, or a poor distribution with intermediate sizes missing.

SOIL SYMBOLS

Identification of the major soil divisions used to distinguish the change of a different stratum. For their combinations and a more detailed description, see UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487-00)

MAJOR SOIL DIVISIONS			SOIL SYMBOL	USCS SYMBOL	TYPICAL NAME
Coarse-Grained Soils (< 50% pass No. 200 sieve)	GRAVELS (<50% pass No. 4 sieve)	Clean Gravels (< 5% pass No. 200 sieve)		**GW**	Well-Graded Gravels
				**GP**	Poorly-Graded Gravels
		Gravels with fines (> 12% pass No. 200 sieve)		**GM**	Silty Gravels
				**GC**	Clayey Gravels
	SANDS (> 50% pass No. 4 sieve)	Clean Sands (< 5% pass No. 200 sieve)		**SW**	Well-Graded Sands
				**SP**	Poorly-Graded Sands
		Sands with fines (> 12% pass No. 200 sieve)		**SM**	Silty Sands
				**SC**	Clayey Sands
Fine-Grained Soils (> 50% pass No. 200 sieve)	SILTS	Silts of Low Plasticity (*LL < 50)		**ML**	Inorganic Silts (slightly plastic)
		Silts of High Plasticity (*LL > 50)		**MH**	Inorganic Silts (elastic)
	CLAYS	Clays of Low Plasticity (*LL < 50)		**CL**	Inorganic Clays (lean clays)
		Clays of High Plasticity (*LL > 50)		**CH**	Inorganic Clays (Fat clays)

*Liquid Limit of the soil
NV: No value obtained; NP: Non-plastic

SECTION 31 23 16 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil densification.
   2. Excavating for building foundations.
   3. Excavating for paving and parking areas.
   4. Excavating for slabs on grade.
   5. Excavating for Site structures.
   6. Excavating for landscaping.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 31 20 00 “Earth Moving.”
   3. Section 31 23 16 “Excavation:” Excavating as required for building foundations and utilities within building perimeter.
   4. Section 31 23 23 “Backfill:” Backfilling at building perimeter and Site structures, and fill under slabs on grade, pavement, and landscaped areas.

1.2 REFERENCE STANDARDS

A. Local utility standards when working within 36 inches of utility lines.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Shop Drawings:
C. Indicate soil densification grid for each size and configuration footing requiring soil densification.
   1. Excavation Protection Plan:
      a. Describe sheeting, shoring, and bracing materials and installation, as required, to protect excavations and adjacent structures and property.
      b. Submit signed and sealed Shop Drawings with design calculations and assumptions to support plan.
D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
E. Qualifications Statement:
   1. Submit qualifications for licensed professional.

1.4 QUALITY ASSURANCE

A. Perform Work according to OSHA standards.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Utility Service Locator:
   1. Call local utility service-line information at 811 not less than three working days before performing Work.
   2. Request that underground utilities be located and marked within and immediately surrounding the Site.
   3. Identify required lines, levels, contours, and data.
C. Existing Utilities:
   1. Notify utility company to remove or relocate utilities.
   2. Protect from damage utilities indicated to remain.
D. Protect plant life and other features designated to remain as portion of final landscaping.
E. Protect benchmarks, survey control points**,** existing structures, fences, paving, and curbs from excavating equipment and vehicular traffic.
F. Do not close or obstruct roadway or hydrants without permits.
G. Erect and maintain temporary barriers and security devices, including warning signs, warning lights, and similar measures, for protection of public and existing improvements indicated to remain.

3.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation Work.
B. Excavate subsoil to accommodate building foundations, slabs on grade, paving, Site structures and construction operations.
C. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity, as specified in Section 31 23 23 “Fill.”
D. Slope banks with machine to angle of repose or less until shored.
E. Do not interfere with 45-degree bearing splay of foundations.
F. Grade top perimeter of excavation to prevent surface water from draining into excavation.
G. Trim excavation and remove loose matter.
H. Removal of Deleterious Materials:
   1. Remove lumped subsoil, boulders, and rock.
   2. Remove excess and unsuitable material from Site.
I. Notify Architect/Engineer of unexpected subsurface conditions.
J. Correct over-excavated areas as specified in Section 31 23 23 “Fill.”
K. Remove excavated material from Site.
L. Stockpile subsoil in area designated on Site to depth not exceeding six feet and protect from erosion.
M. Repair or replace items indicated to remain that have been damaged by excavation.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for testing, adjusting, and balancing.
B. Inspecting: Request visual inspection of bearing surfaces by Engineer before installing subsequent Work.

3.4 PROTECTION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for protecting finished Work.
B. Prevent displacement or loose soil from falling into excavation and maintain soil stability.
C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
D. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that may be created by earth operations.

END OF SECTION

SECTION 31 23 23 – BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Examination, preparation, backfilling, and tolerances.
   2. Field quality control and protection of finished work.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify fill materials to reuse are acceptable by testing and analysis (Article 3.5).

3.2 PREPARATION

A. Generally compact subgrade to density requirements for subsequent backfill materials.
B. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type B fill and compact to density equal to or greater than requirements for subsequent backfill material.
C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 98 percent of its maximum dry density in accordance with ANSI/ASTM D1557 Modified.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.
B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
C. Place and compact materials in continuous layers not exceeding 8 inches compacted depth.
D. Employ a placement method that does not disturb or damage utilities in trenches.
E. Maintain optimum moisture content of backfill materials to attain required compaction density.
F. Make grade changes gradual. Blend slope into level areas.
G. Spread surplus backfill materials in designated areas.
H. Leave fill material stockpile areas completely free of excess fill materials.

3.4 TOLERANCES

A. Top Surface of Backfill shall match existing grades or existing crown conditions.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.
B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557, Modified.
C. Compaction testing will be performed in accordance with ANSI/ASTM D1557, Modified.
D. If material does not meet specified requirements, remove Work, replace, and retest at no cost to Owner.
E. Frequency of Tests: One test for every lift every 500 linear feet.
F. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.6 PROTECTION OF FINISHED WORK

A. Recompact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 41 10 – TRENCH SAFETY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Trench safety systems for trench excavations greater than 5 feet in depth. All work performed herein shall also comply with OSHA Part 1926, Subpart P and all state and local codes.
   2. Contractor responsible for complying with requirements of Specifications, Drawings, and all applicable codes. Contractor shall immediately notify Engineer of any unforeseen field conditions which might affect trench safety system integrity.

B. Scope of Work:
   1. Trench and excavation safety systems by cut-back or braced-excavation method for all trenches 5 feet and deeper whether indicated on Drawings or required by actual field conditions. Protect trenches not exceeding five feet in depth as required by OSHA, state, and local standards.
   2. Submit alternative methods of trench safety for approval to Engineer; however, alternative methods will not be reviewed or approved before bid opening.
   3. Contractor holds responsibility to adhere to the latest version from OSHA.

C. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. OSHA Part 1926, Subpart P attached at the end of this Section.

1.2 SUBMITTALS

A. Provide detailed drawings for proposed trench safety systems. Clearly identify where each system is proposed for use and type of system to use. Trench excavations cannot start until trench safety systems are submitted and approved by Engineer.

B. Trench Boxes: Submit manufacturer's standard data sheet and certificate of compliance signed by a registered engineer stating maximum allowable depth for given design pressure for each type of trench box proposed for use.

C. Alternative Systems: If alternative systems composed of steel, aluminum, wood, or a combination of materials are proposed, submit design calculations signed by a registered engineer showing all member properties, design strengths, and any stress increases used with justification for use.

1.3 QUALITY ASSURANCE

A. Design trench safety systems based on actual field conditions. Contractor shall review and determine field conditions for Project.

B. Work shall be performed by forces having at least two years’ experience with similar types of trench safety systems. All prefabricated items used in trench safety systems shall be manufactured by a company with at least two years’ experience in fabricating the items.

C. Contractor responsible for complying with all trench safety requirements and for safety of trenches and excavations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide suitable materials able to withstand imposed loads without excessive deflections. Materials shall be clean, free of rust, holes, knots, and other defects.
   1. Steel shall be type and thickness required by design with minimum yield stress of F_y = 36,000 psi.
   2. Aluminum: Type 6061-T6, thickness as required by design.
   3. Wood in Contact with Earth: Pressure-treated soft woods or untreated hardwoods.
   4. Wood not in Contact with Earth: Soft or hardwood as required by design.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Before trench excavations, examine all site conditions and note any conditions in existing pavements, structures, and other items which may be adversely affected by trenching operations. Prepare a written list of all such conditions and submit list to Engineer. During trenching operations, note any changes which occur to existing pavements or structures and submit a written report to the Engineer of all such changes.

3.2 EXISTING UTILITIES

A. Before trench excavations, chart and field locate all existing utilities. Notify owners of all utilities of work to perform. Protect all existing utilities from damage. Provide additional support for utility lines which cannot span trench width. Do not interrupt existing services without written approval by Engineer and utility owner.

3.3 TRENCHING PROCEDURES

A. Provide shoring systems per submitted design to adequately resist earth pressures indicated on Drawings.
B. Proceed with work in an orderly fashion. Install trench bracing systems as soon as possible after opening trenches. Do not allow workers in trench before installing trench bracing systems.
C. Backfill trenches as soon as possible after completion of work.
D. Stockpile excavated materials at a minimum of 5 feet away from edge of trench.
E. Maintain barricades/signage as required by state and local codes to protect open excavations.
F. Do not allow surface water to enter excavations. Properly grade areas adjacent to trench excavations to control surface drainage away from excavations. Cover excavations remaining open during periods of rainfall with suitable material to prevent accumulations of water in excavation.
G. If employing cut-back method, maintain a clear 3-foot distance from edge of cut to avoid allowing loose material to enter trench.
H. Do not operate heavy equipment except for trench-digging equipment within 20 feet of edge of excavation.

END OF SECTION

· OSHA REGULATIONS ·

- REGARDING TRENCH SAFETY (FROM FEDERAL REGISTER)

(2) The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

(3) Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

(e) *Commercial diving operations.* Commercial diving operations shall be subject to subpart T of part 1910, §§ 1910.401-1910.441, of this chapter.

[39 FR 22801, June 24, 1974, as amended at 42 FR 37674, July 22, 1977]

§ 1926.606 Definitions applicable to this subpart.

(a) *Apron*—The area along the waterfront edge of the pier or wharf.

(b) *Bulwark*—The side of a ship above the upper deck.

(c) *Coaming*—The raised frame, as around a hatchway in the deck, to keep out water.

(d) *Jacob's ladder*—A marine ladder of rope or chain with wooden or metal rungs.

(e) *Rail*, for the purpose of § 1926.605, means a light structure serving as a guard at the outer edge of a ship's deck.

Subpart P—Excavations

AUTHORITY: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), or 9-83 (48 FR 35736), as applicable, and 29 CFR part 1911.

SOURCE: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with § 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or

interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.* (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps.* (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with § 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50–1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficently removed from the excavation so as to be

unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with § 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

§ 1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping

and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from

the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

APPENDIX A TO SUBPART P—SOIL CLASSIFICATION

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653–85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS–121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a miminum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

APPENDIX B TO SUBPART P—SLOPING AND BENCHING

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B–1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B–1.

TABLE B–1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)[1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK TYPE A [2] TYPE B TYPE C	VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½: 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

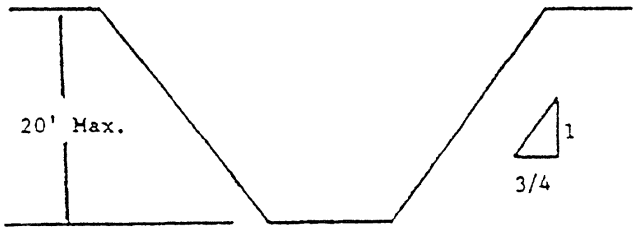
Figure B–1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

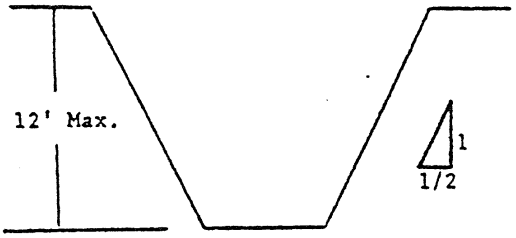
B–1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



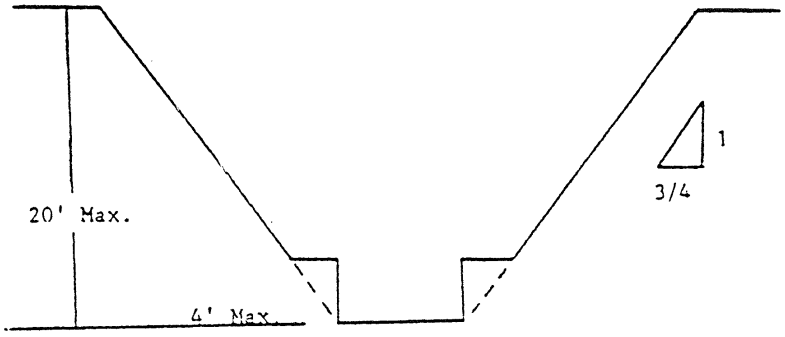
SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

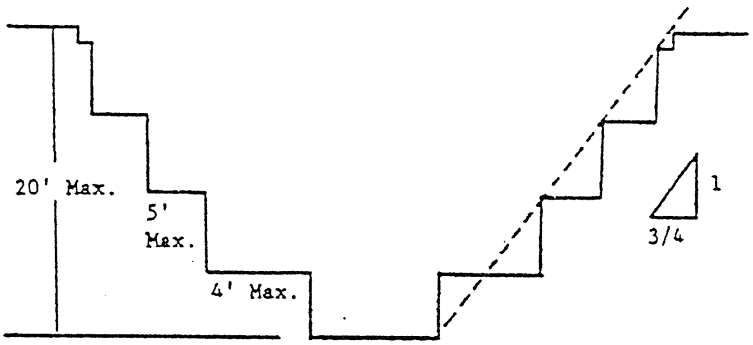


SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

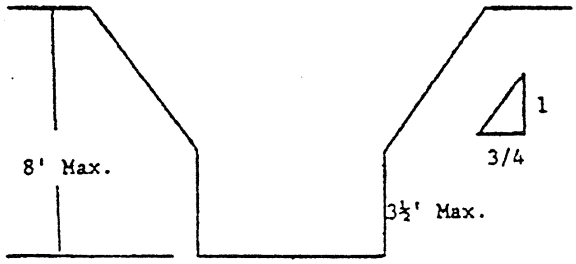


SIMPLE BENCH



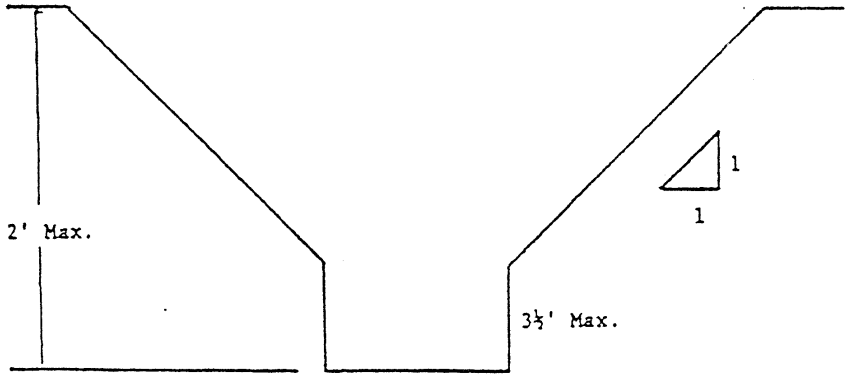
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



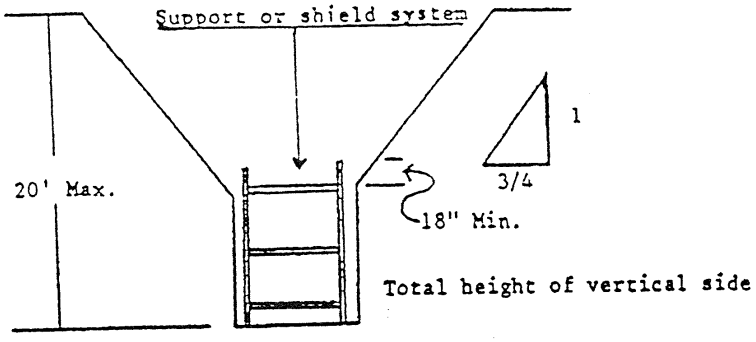
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

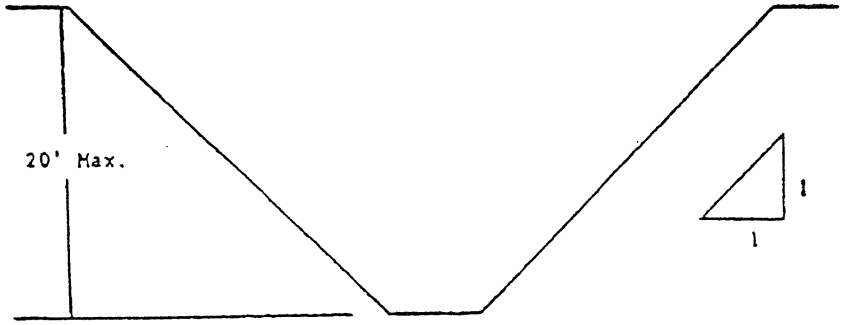


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

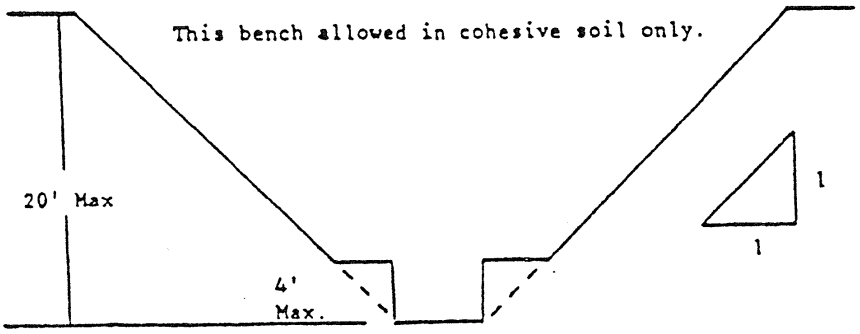
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

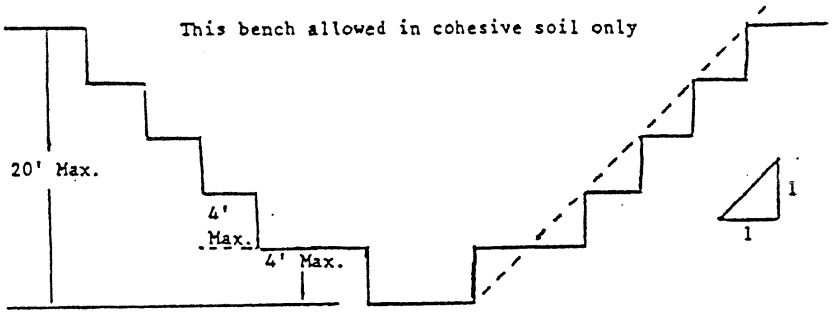


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

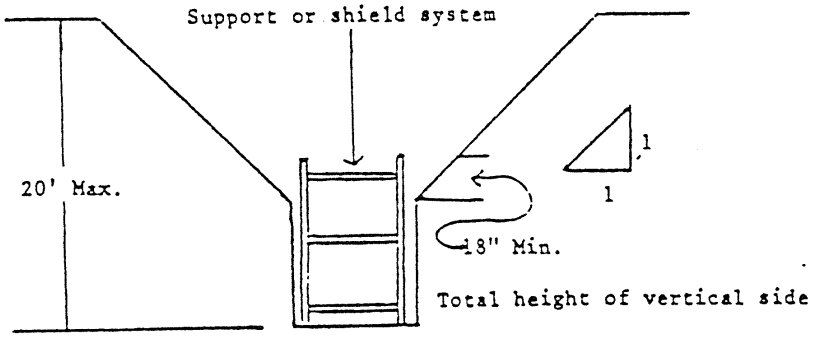


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

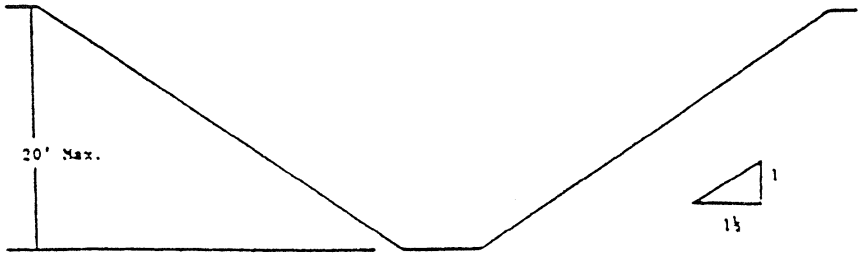


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

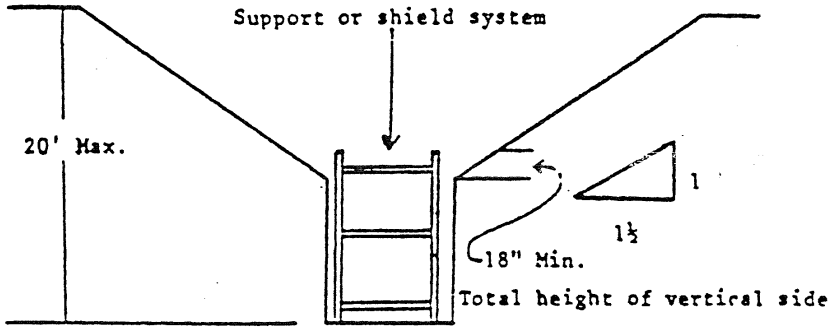
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

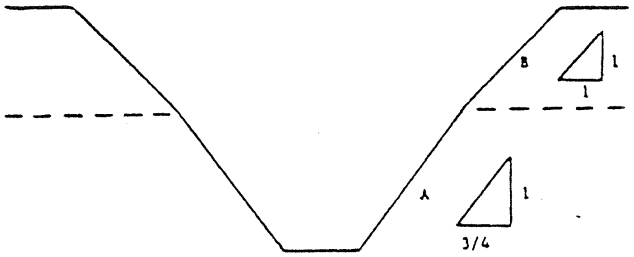


VERTICAL SIDED LOWER PORTION

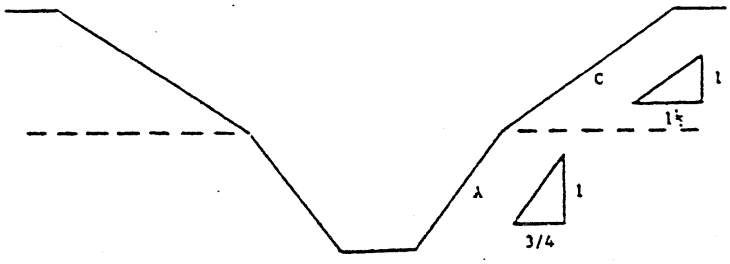
3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B-1.4 Excavations Made in Layered Soils

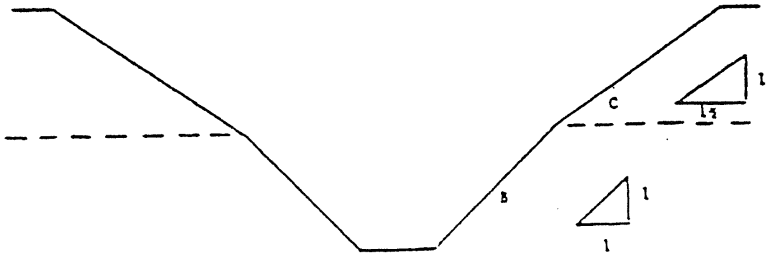
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



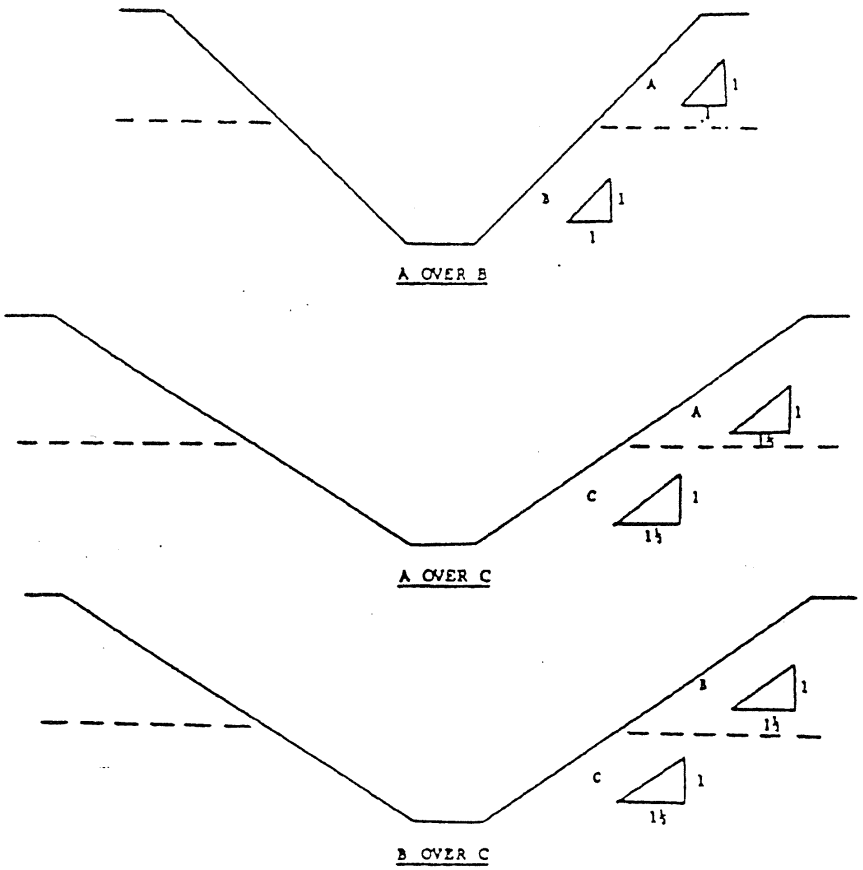
B OVER A



C OVER A



C OVER B



2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

APPENDIX C TO SUBPART P—TIMBER SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from caveins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil

type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C-1.1 through C-1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C-1.1 through C-1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C-1.1*, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4x4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3x8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4x6 crossbraces at eight feet horizontally and four feet vertically.

Space 8x8 wales at four feet vertically.
Space 2x6 uprights at four feet horizontally.

Arrangement #3

Space 6x6 crossbraces at 10 feet horizontally and four feet vertically.
Space 8x10 wales at four feet vertically.
Space 2x6 uprights at five feet horizontally.

Arrangement #4

Space 6x6 crossbraces at 12 feet horizontally and four feet vertically.
Space 10x10 wales at four feet vertically.
Spaces 3x8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement #1

Space 6x6 crossbraces at six feet horizontally and five feet vertically.
Space 8x8 wales at five feet vertically.
Space 2x6 uprights at two feet horizontally.

Arrangement #2

Space 6x8 crossbraces at eight feet horizontally and five feet vertically.
Space 10x10 wales at five feet vertically.
Space 2x6 uprights at two feet horizontally.

Arrangement #3

Space 8x8 crossbraces at 10 feet horizontally and five feet vertically.
Space 10x12 wales at five feet vertically.
Space 2x6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8x8 crossbraces at six feet horizontally and five feet vertically.
Space 10x12 wales at five feet vertically.
Position 2x6 uprights as closely together as possible.
If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8x10 crossbraces at eight feet horizontally and five feet vertically.
Space 12x12 wales at five feet vertically.
Position 2x6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8x10 crossbraces at six feet horizontally and five feet vertically.
Space 12x12 wales at five feet vertically.
Use 3x6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X5	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**														
	CROSS BRACES								UPRIGHTS						
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed Oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *
SOIL TYPE A P_a = 25 X H ± 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **														
	CROSS BRACES							WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)					
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE					
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6					
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6					
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6					
	See Note 1														
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6					
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6					
	See Note 1														
	See Note 1														
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6					
	See Note 1														
	See Note 1														
	See Note 1														
OVER 20	SEE NOTE 1														

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

APPENDIX D TO SUBPART P—ALUMINUM HYDRAULIC SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufaturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D–1.1, D–1.2, D–1.3 and D–1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil. 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to §1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to §1926.652(c)(2) and §1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5x3.5x0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1

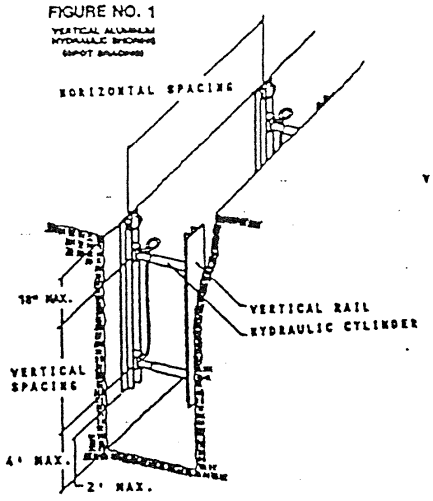


FIGURE NO. 2

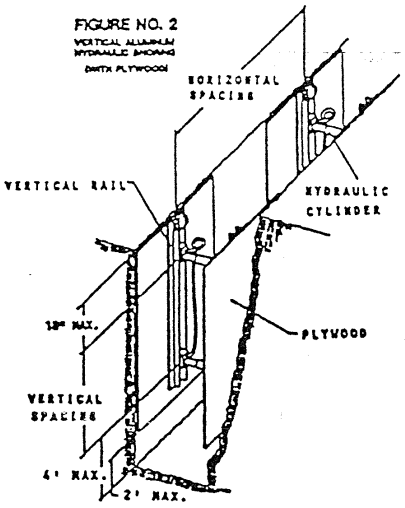


FIGURE NO. 3

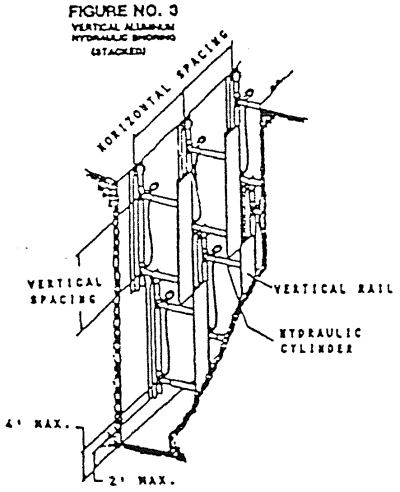


FIGURE NO. 4

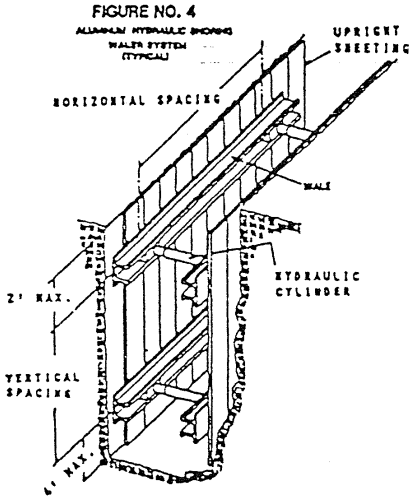


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS * (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN³) *	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

APPENDIX E TO SUBPART P—ALTERNATIVES TO TIMBER SHORING

Figure 1. Aluminum Hydraulic Shoring

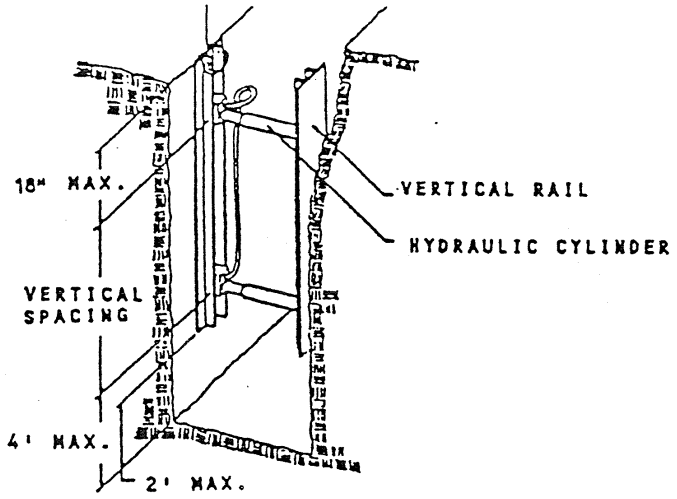


Figure 2. Pneumatic/hydraulic Shoring

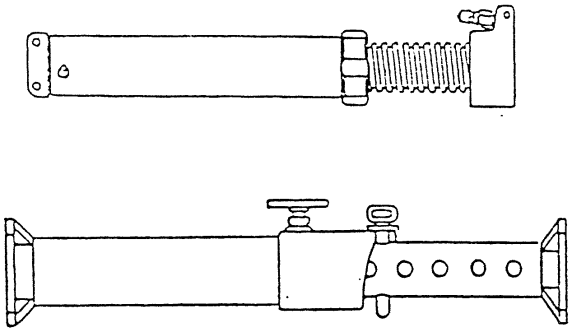


Figure 3. Trench Jacks (Screw Jacks)

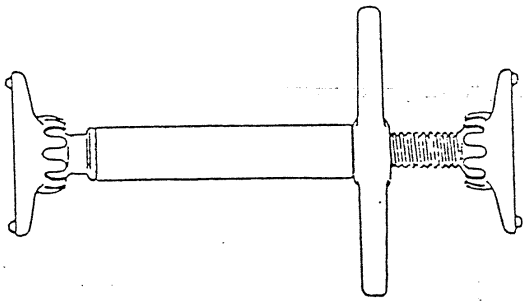
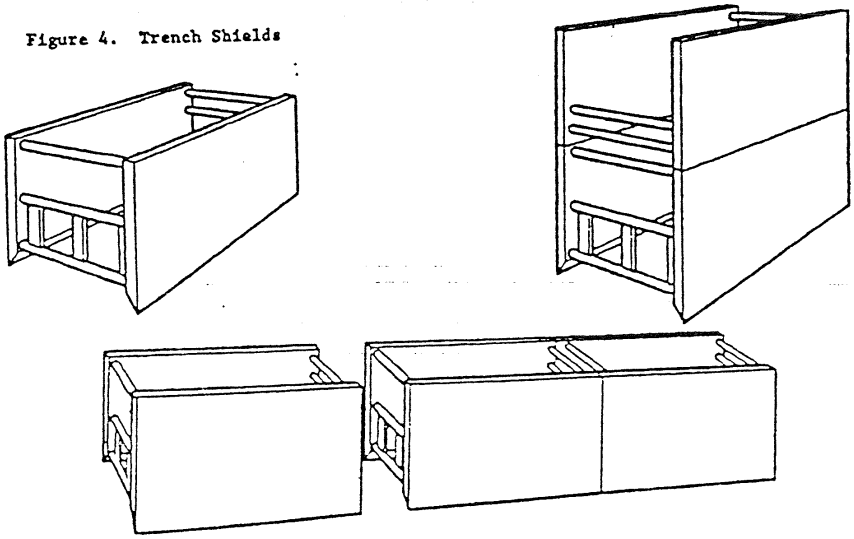


Figure 4. Trench Shields



APPENDIX F TO SUBPART P—SELECTION OF PROTECTIVE SYSTEMS

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

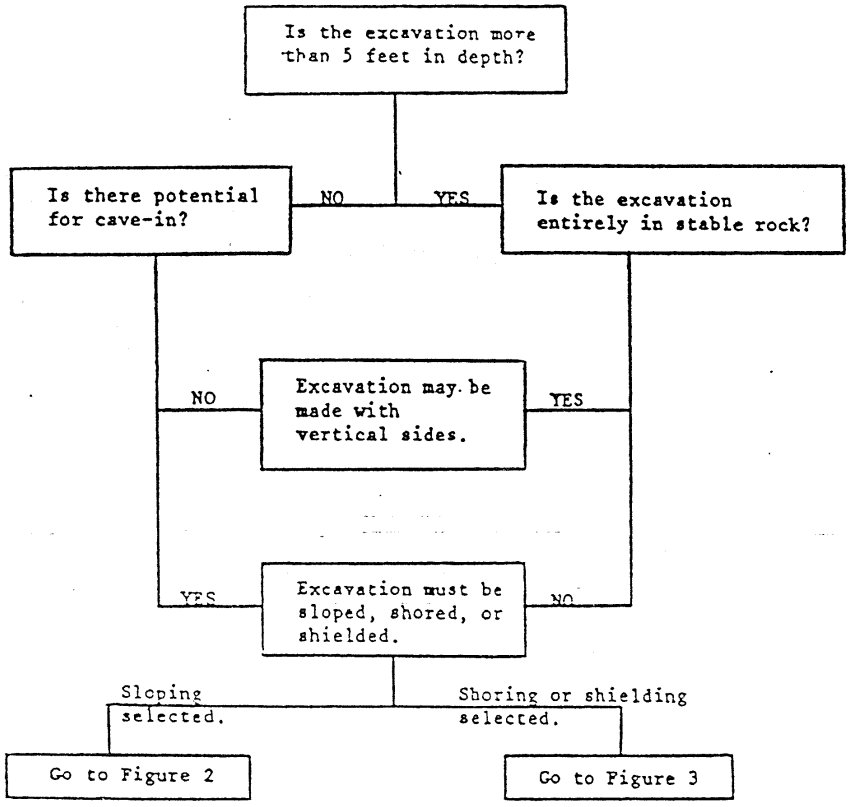


FIGURE 1 - PRELIMINARY DECISIONS

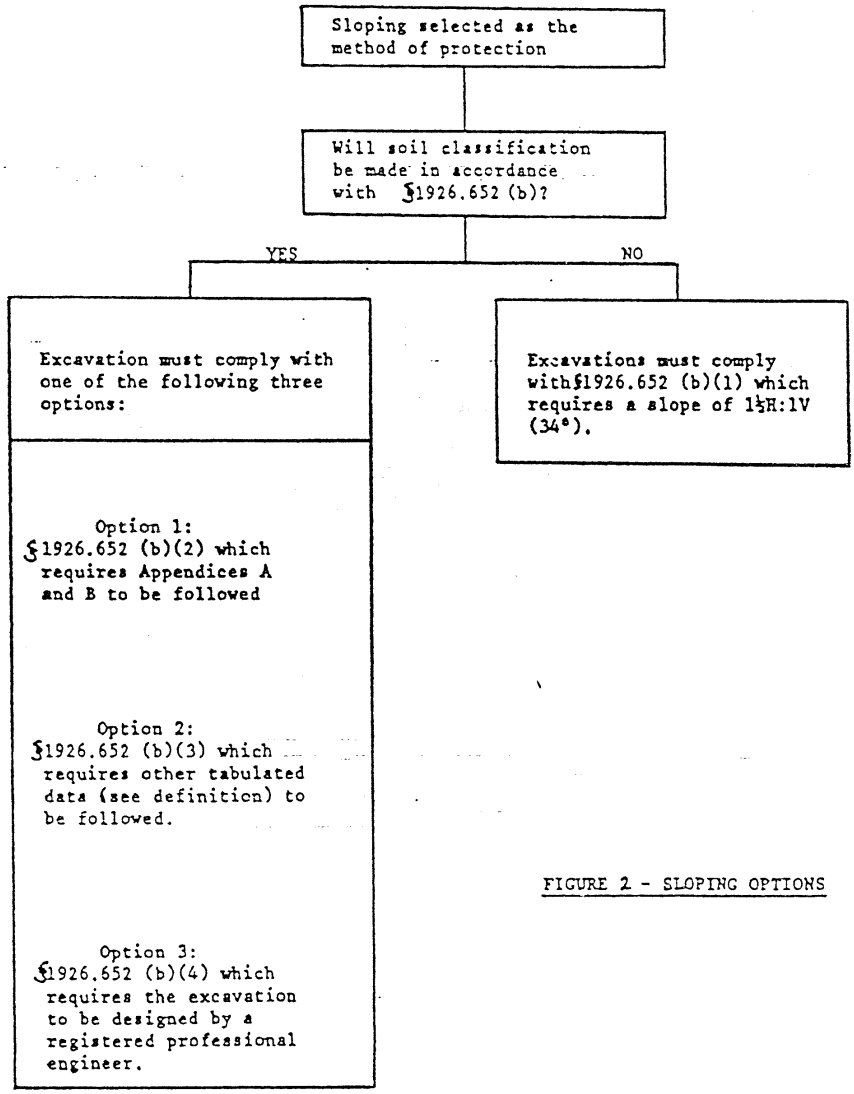


FIGURE 2 - SLOPING OPTIONS

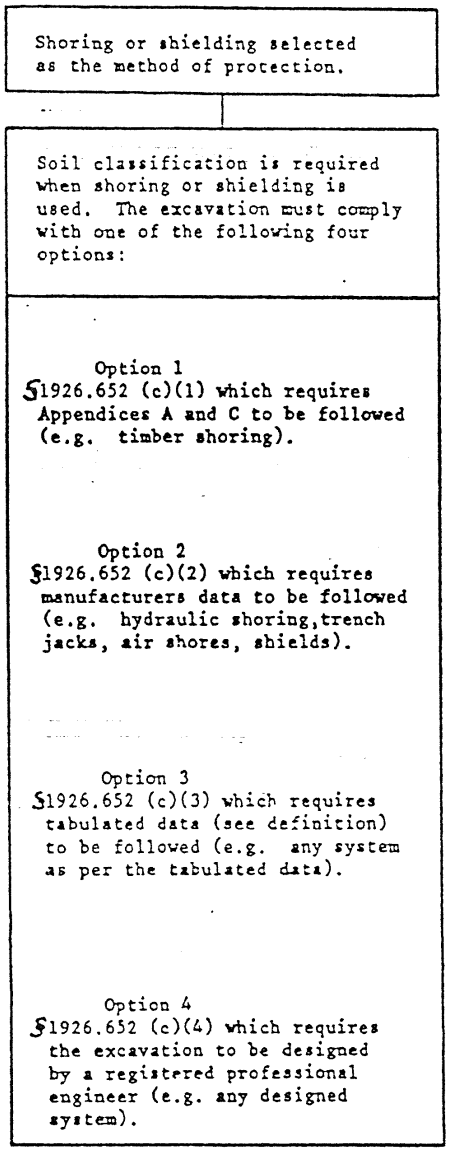


FIGURE 3 - SHORING AND SHIELDING OPTIONS

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMAY

A. Section Includes:
   1. Aggregate subbase.
   2. Aggregate base course.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 32 12 16 “Asphalt Paving.”

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
B. ASTM International:
   1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   2. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   4. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
C. Texas Department of Transportation (TxDOT)
   1. TxDOT Standard Construction Specifications, 2014.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Materials Source: Submit name of aggregate materials suppliers.
C. Manufacturer’s Certificate: Certify all products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.
B. Perform Work according to City of El Paso standards.
C. Perform work according to all requirements specified in the Construction Drawings and pertinent Specifications.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSES

A. TxDOT – Type A, Grade 2, Item 247, 2014 Standard Construction Specifications.
   1. Type A Material: Crushed and consist of durable particles of stone mixed with approved binding material, or as approved by Engineer.
   2. Grade 2: When properly slaked and tested by TxDOT Standard Laboratory Methods, flexible base material shall meet the following retainage requirements:
      a. 2 1/2-inch sieve: 0%
      b. 1 3/4-inch sieve: 0-10%
      c. 7/8-inch sieve: 10-35%
      d. 3/8-inch sieve: 30-65%
      e. No. 4 sieve: 45-75%
      f. No. 40 sieve: 60-90%
   3. Material passing No. 40 sieve shall be known as "Soil Binder" and meet the following requirements when prepared per Test Method TxDOT 101-E procedure:
      a. Liquid limit shall not exceed 40, or as allowed by Engineer.
      b. Plasticity index shall not exceed 10, or as allowed by Engineer.
      c. Wet ball mill value shall not exceed 40, or as allowed by Engineer.
      d. Percent increase on No. 40 sieve shall not exceed 20, or as allowed by Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 "Administrative Requirements:" Verification of existing conditions before starting work.
B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate in minimum two perpendicular passes to identify soft spots.
   2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 "Backfill."
C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Spread Base Course over prepared substrate to total compacted thickness as indicated on Drawings.
B. Compact Base Course to 98 percent maximum density per ASTM D1557 and within ±2 percentage points of optimum moisture.
C. Level and contour surfaces to elevations, profiles, and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.
E. Maintain optimum moisture content of fill materials to attain specified compaction density.
F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 “Quality Requirements:” Tolerances.
B. Maximum Variation from Flat Surface: 1/2 inch measured with 10 foot straight edge.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Field inspecting, testing, adjusting, and balancing.
B. Compaction testing will be performed according to ASTM D1557**.**
C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
D. Frequency of Tests: One test for every 500 square yards of compacted aggregate.
E. Owner will retain an independent engineering testing firm with specific testing equipment required to provide timely test results per Specifications. Coordinate and schedule all tests as required by Construction Drawings and Specifications. Coordinate with Engineer for any required visual inspections.
F. Do not allow finished aggregate base courses to lose moisture beyond 3 percentage points of optimum, prior to asphaltic prime application. Should aggregate base course, due to any reason or cause, lose required moisture, stability, density, or finish before final surfacing is placed, rework, recompact, and refinish without additional compensation.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.
6. Surface slurry.

B. Related Requirement:
1. Section 31 23 23 “Fill:” Compacted subbase for paving.
2. Section 32 11 23 “Aggregate Base Courses:” Compacted subbase for paving.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:
1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.

7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results supporting design.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to City of El Paso Public Works standard.

1.5 AMBIENT CONDITIONS

A. Section 01 50 00 “Temporary Facilities and Controls:” Ambient conditions control facilities for product storage and installation.
B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F or surface is wet or frozen.
C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Performance / Design Criteria:
   1. Paving: Design for movement of trucks up to 30,000 lbs.
B. Asphalt Materials:
   1. Asphalt Cement: ASTM D3381; viscosity grade AC-10
C. Aggregate Materials:
   1. Coarse Aggregate: ASTM D692; crushed stone, gravel, or blast furnace slag.
   2. HMAC to be Type “C”, “B”, “D” as dictated by thickness shown on plans.

2.2 MIXES

A. Use dry material to avoid foaming. Mix uniformly.
B. Asphalt Paving Mixtures: ASTM D3515; designed in accordance with AI MS2.
   1. Base Course: Dense Mixture.
   2. Binder Course: Open Mixture.
   3. Wearing Course: Open Graded Friction Course Mixture.
C. Paving Surfaces: Minimum solar reflectance index (SRI) of 29, calculated in accordance with ASTM E1980.
   1. Reflectance: Measured in accordance with ASTM E903, ASTM E1918, or ASTM C1549.
   2. Emittance: Measured in accordance with ASTM E408 or ASTM C1371.

2.3 ACCESSORIES

A. Sealant: ASTM D6690 Type I; hot applied type.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Testing, inspection and analysis requirements.
B. Submit proposed mix design for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
C. Verify compacted subgrade and base course is dry and ready to support paving placement loads.
   1. Proof roll subbase with a minimum two perpendicular passes to identify soft spots.
   2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23 “Backfill.”
D. Verify gradients and elevations of base are correct.
E. Verify manhole frames and valve boxes are installed in correct position and elevation.

3.2 PREPARATION

A. Prepare subbase in accordance with City of El Paso standards

3.3 DEMOLITION

A. Saw cut and notch existing paving as indicated on the drawings.
B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 INSTALLATION

A. Subbase:
   1. Aggregate Subbase: Install as specified in Section 32 11 23.
B. Primer:
   1. Apply primer in accordance with AI MS-2 standards.
C. Tack Coat:
   1. Apply tack coat in accordance with AI MS-19 standards.
   2. Apply tack coat to contact surfaces of curbs, and gutters.
   3. Coat surfaces of manhole and valve box frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.
D. Single Course Asphalt Paving:
   1. Install Work in accordance with City of El Paso standards
   2. Place asphalt within 24 hours of applying primer or tack coat.
   3. Place asphalt wearing course to 2 inch compacted thickness indicated on Drawings.
   4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
   5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 TOLERANCES

A. Section 01 40 00 “Quality Requirements:” Tolerances.
B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
C. Scheduled Compacted Thickness: Within +1/4 inch
D. Variation from Indicated Elevation: Within 1/2 inch.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.

3.7 PROTECTION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for protecting finished Work.
B. Immediately after placement, protect paving from mechanical injury for 72 hours or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 16 23 - SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete paving for sidewalks.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 00 00 “Cast-in-Place Concrete:” Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M182 - Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
B. American Concrete Institute:
   1. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
C. ASTM International:
   1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   4. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   5. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   6. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   7. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   8. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   9. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   10. ASTM C33 - Standard Specification for Concrete Aggregates.
   11. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   12. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
   13. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
   14. ASTM C150 - Standard Specification for Portland Cement.
   15. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
   16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   17. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
24. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
25. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
26. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
27. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
28. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
29. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
30. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
31. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
32. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
33. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
34. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
35. ASTM D5893 - Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
36. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
37. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
38. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
39. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
40. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data:
    1. Submit required information regarding concrete materials, joint filler, admixtures and curing compounds.
    2. Mix Design:
        a. Submit concrete mix design for each concrete strength prior to commencement of Work.
        b. Submit separate mix designs if admixtures are required for hot- and cold-weather concrete Work.
        c. Identify mix ingredients and proportions, including admixtures.
    3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statement:
    1. Submit qualifications for manufacturer and installer.

1.5 QUALITY ASSURANCE

A. Perform Work according to Section 03 00 00 “Cast-in-Place Concrete.”
B. Obtain cementitious materials from same source throughout.
C. Perform Work according to ACI standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.
D. Protection:
    1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
    2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Section 01 50 00 “Temporary Facilities and Controls:” Requirements for ambient condition control facilities for product storage and installation.
B. Minimum Conditions: Do not place concrete if base surface temperature is less than 40 deg. F or if surface is wet or frozen.

C. Subsequent Conditions: Maintain minimum 50 degrees F, for not less than 72 hours after placing, and at a temperature above freezing for remainder of curing period.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms:
   1. Height: Equal to full depth of finished sidewalk.
B. Concrete:
   1. Concrete Materials:
      a. As specified in Section 03 00 00 “Cast-in-Place Concrete.”
   2. Cement:
      a. Comply with ASTM C150.
      b. Type: I/II Portland.
      c. Color: Gray.
   3. Water:
      a. Description: Potable.
      b. Comply with ASTM C94.
      c. Without deleterious amounts of chloride ions.
   4. Air Entrainment: Comply with ASTM C260.
   5. Chemical Admixtures:
      a. Comply with ASTM C494.
      b. Type A - Water Reducing**.**

2.2 FABRICATION

A. Reinforcing: Comply with CRSI Manual of Practice.
B. Hooks: As indicated on Drawings.
   1. Type: Standard 90-degree bends.

2.3 MIXES

A. Concrete:
   1. Comply with ASTM C94, Option A.

2.4 ACCESSORIES

A. Curing Compound:
   1. Comply with ASTM C309.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for testing, inspection, and analysis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
C. Verify that gradients and elevations of subgrade are as indicated on Drawings.
D. Verify reinforcing placement for proper size, spacing, location, and support.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Moisten substrate to minimize absorption of water from fresh concrete.
C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

A. Forms:
    1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
    2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
    3. Clean forms and coat with form oil each time before concrete is placed.
B. Reinforcement:
    1. Place reinforcing at mid-height of sidewalk.
C. Placing Concrete:
    1. As specified in Section 03 00 00 “Cast-in-Place Concrete.”
D. Curing:
    1. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
    2. Mats:
        a. Cover exposed surface with two or more layers of wetted burlap, overlapping each other minimum six inches.
        b. Maintain burlap continuously saturated and in contact with concrete for minimum seven days.
E. Backfilling: After curing, backfill, grade, and compact adjacent disturbed area as indicated.

3.4 TOLERANCES

A. Section 01 40 00 “Quality Requirements:” Requirements for tolerances.
B. Maximum Variation of Surface Flatness: 1/4-inch in 10 feet .
C. Line and Grade for Forms: 1/8-inch in any 10-foot long section.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.

3.6 PROTECTION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for protecting finished Work.
B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.
C. Do not permit traffic over paving until 70 percent design strength of concrete has been achieved.
D. Damaged Concrete:
    1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
    2. Refinishing damaged portion is not acceptable.
    3. Dispose of damaged portions.

END OF SECTION

SECTION 33 01 10.58 - DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Disinfection of potable water distribution and transmission system.
   2. Testing and reporting of results.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B302 - Ammonium Sulfate.
   3. AWWA B303 - Sodium Chlorite.
   4. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Disinfection Procedure:
   1. Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.
C. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Certify that final water complies with disinfectant quality standards of TCEQ.
F. Test and Evaluation Reports: Indicate testing results comparative to specified requirements.
G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
H. Qualifications Statements:
   1. Submit qualifications for manufacturer and applicator.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for submittals.
B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

1.5 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:
   1. Hypochlorite: Comply with AWWA B300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that piping system has been cleaned, inspected, and pressure tested.
C. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide required equipment to perform Work of this Section.
B. Introduce treatment into piping system.
C. Maintain disinfectant in system for 24 hours.
D. Flush, circulate, and clean until required disinfectant quality standard has been achieved using domestic water.
E. Replace permanent system devices that were removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.
B. Disinfection, Flushing, and Sampling:
   1. Disinfect pipeline installation according to AWWA C651.
   2. Use of liquid chlorine is not permitted.
   3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
   4. Disposal:
      a. Legally dispose of chlorinated water.
      b. If chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
C. After final flushing and before pipeline is connected to existing system or placed in service, certify that disinfectant level meets quality standards of TCEQ.

END OF SECTION

SECTION 33 05 05.31 - HYDROSTATIC TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hydrostatic testing of pressure piping.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Submit following items prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gage calibration.
C. Test and Evaluation Reports: Indicate results of piping tests.
D. Qualifications Statement:
   1. Submit qualifications for applicator.

1.4 QUALITY ASSURANCE

A. Perform Work according to AWWA standards.

PART 2 - PRODUCTS

2.1 HYDROSTATIC TESTING

A. Equipment:
   1. Pressure pump.
   2. Pressure hose.
   3. Water meter.
   4. Test connections.
   5. Pressure relief valve.
   6. Pressure Gage: Calibrated to 0.1 psi (0.69 kPa).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that piping is ready for testing.
C. Verify that trenches are backfilled.
D. Verify that pressure piping thrust restraints have been installed.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for inspecting and testing.
B. Testing of Pressure Piping:
    1. Test system according to AWWA C600 and following:
        a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
        b. Conduct hydrostatic testing for at least two hours.
        c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
        d. Install corporation cocks at high points.
        e. Close air vents and corporation cocks after air is expelled.
        f. Raise pressure to specified test pressure.
        g. Observe joints, fittings, and valves undergoing testing.
        h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
        i. Retest.
        j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
        k. Maintain pressure within plus or minus 5.0 psi of test pressure.
        l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
        m. Compute maximum allowable leakage using following formula:
            1) L = SD x sqrt(P)/C.
            2) L = testing leakage allowance, gph
            3) S = length of pipe tested, feet
            4) D = nominal diameter of pipe, inches
            5) P = average test pressure during hydrostatic testing, psig
            6) C = 148,000
            7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.
    2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
    3. Correct visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 33 05 09.33 - THRUST RESTRAINT FOR UTILITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tied joint restraint system.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 31 41 10 “Trench Safety:” Trenching and backfilling requirements for Site utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 01 20 00 “Price and Payment Procedures:” Contract Sum/Price modification procedures.
B. Tied Joint Restraint System:
   1. Unless otherwise indicated price for materials and installation is subsidiary to the pipe cost.

1.3 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
B. ASME International:
   1. ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form.
C. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
   5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   6. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   7. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.
   8. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   9. ASTM F436 - Standard Specification for Hardened Steel Washers.

1.4 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for coordination.
B. Coordinate Work of this Section with installation of fittings and joints that require restraint.

1.5 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.6 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit manufacturer catalog information for restrained joint details and installation instructions.
C. Shop Drawings:
    1. Indicate restrained joint details and materials being used.
    2. Submit layout drawings showing piece numbers and locations.
    3. Indicate restrained joint locations.
D. Samples: Submit one samples of joint restraint parts.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Delegated Design Submittals:
    1. Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained lengths.
    2. Submit joint restraint details.
    3. Use joint restraint devices specifically designed for applications described in manufacturer information.
G. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
    1. Qualifications Statement: Submit qualifications for manufacturer, fabricator, and licensed professional.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for submittals.
B. Project Record Documents: Record actual locations of joint restraints.

1.8 QUALITY ASSURANCE

A. Perform Work according to AWWA standards.
B. Maintain one (1) copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.
B. Restrained lengths of pipe shall be as indicated on the drawings.

2.2 MATERIALS

A. Steel:
   1. High-Strength Low-Alloy Steel: Comply with ASTM A588/A588M, heat treated.
   2. High-Strength Low-Alloy Steel: Comply with ASTM A588/A588M.
   3. Carbon Steel: Comply with ASTM A36/A36M.

2.3 FINISHES

A. Zinc Plating:
   1. Factory applied.
   2. Comply with ASTM B633.
B. Galvanizing:
   1. Factory applied.
   2. Comply with ASTM A153/A153M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that pipe and fittings are ready to receive Work.
C. Field measure and verify conditions for installation of Work.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Clean surfaces of pipe and fittings that are to receive tied joint restraint systems.

3.3 INSTALLATION

A. According to AWWA C600.
B. Install joint restraint system such that joints are mechanically locked together to prevent joint separation.

3.4 TOLERANCES

A. Section 01 40 00 “Quality Requirements:” Requirements for tolerances.
B. Torque 5/8-inch nuts on mating threaded fasteners to manufacturer recommended specifications.
C. Torque 3/4-inch nuts on mating threaded fasteners to manufacturer recommended specifications.
D. Torque 1-inch nuts on mating threaded fasteners to manufacturer recommended specifications.

END OF SECTION

SECTION 33 14 00 - WATER UTILITY TRANSMISSION AND DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Constructing exterior (not inside building) underground site piping and pipe accessories required for water lines on this project. Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals required for complete construction of the work as shown on Contract Drawings and specified herein.
2. All materials used in potable water line construction shall be new and size, type, and class shown on Contract Drawings and specified herein for various items of construction.

B. Related Sections:
1. Division 01 Specification Sections apply to Work of this Section.
2. Division 03 Specification Sections apply to Work of this Section.
3. Division 31 Specification Sections apply to Work of this Section.
4. Division 33 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. Potable Water Process Piping and associated components shall conform to:
1. AASHTO – LRFD Bridge Design Construction Specifications
2. ASTM A536 – Standard Specification for Ductile Iron Castings
3. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
4. ASTM D2774 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
5. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
6. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
7. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
8. AWWA B300 – Hypochlorites
9. AWWA B301 – Liquid Chlorine
10. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
11. AWWA C110 – Ductile Iron and Gray Iron Fittings
12. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
13. AWWA C153 – Ductile Iron Compact Fittings
14. AWWA C502 – Dry-Barrel Fire Hydrants
15. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
16. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
17. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
18. AWWA C651 – Disinfecting Water Mains
19. AWWA C655 – Field Dechlorination
20. AWWA C800 – Underground Service Line Valves and Fittings
21. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in.
22. AWWA M23 – PVC Pipe – Design and Installation

23. NSF/ANSI 61 – Drinking Water System Components – Health Effects
24. Uni-Bell PVC Pipe Association – Handbook of PVC Pipe Design and Construction

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Submit manufacturer data on all pipe, fittings, specials, service tape, valves, meters, and other materials specified herein to use on Project. Include pipe thickness class calculations, special coatings, lining information, and special embedment requirements differing from that indicated in Contract Documents.
C. Laboratory analysis for rock embedment including sieve analysis, fracture faces, abrasion tests, and soundness tests.
D. Trench Safety Program.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for piping and component requirements.
B. Strictly adhere to all applicable TCEQ regulations.

1.5 TRENCH SAFETY

A. Comply with all federal, state, and local trench safety requirements, as well as the safety of trenches and excavations.

1.6 CERTIFICATION

A. Furnish Engineer certifications properly executed by manufacturer showing compliance to specification requirements and standards sighted herein. Test data from tests performed shall be provided as requested by Engineer.

1.7 INSPECTION

A. Engineer and representatives shall have access to all phases of work. Manufacturer and Contractor shall provide proper facilities for access and inspection. Material, fabricated parts, and pipes discovered defective, or do not conform to Specification requirements, will be subject to rejection any time before final acceptance of pipe.

1.8 SCHEDULE OF PIPE

A. Pipe considered for use on Project are those specified herein. Only use each specified type of pipe on pipelines designated.

Size and Use	Type and Class
4-inch Open Trench Waterline	PVC, C900 DR18
8-inch Open-Trench Waterline	PVC, C900 DR18
10-Inch Open Trench Waterline	PVC, C900 DR18

PART 2 - PRODUCTS

2.1 GENERAL

A. Select type of pipe to install on a particular water line if that pipe is specified herein for use on that water line. All pipe of like size and use, however, shall be same type and class. Only use approved pipe in construction of all pipelines and piping.
B. All pipe and fittings used shall comply with all applicable requirements of NSF/ANSI 61

2.2 POTABLE WATER PIPE

A. PVC Pressure Pipe
   1. 4- to 24-inch AWWA C900 PVC Pipe, DR 18
      a. Meet requirements of AWWA C900; elastomeric gasket shall meet ASTM F477 requirements of, solid wall, virgin PVC resin, cell class 12454 per ASTM D1784, blue in color, 20-foot lay length.
      b. Qualify for minimum 4,000-psi HDB per ASTM D2837.Bell section shall be designed to be at least as hydrostatically strong as pipe. Joint shall follow ASTM D3139 requirements.
      c. Marked with AWWA standards including size, dimension ratio, pressure class, manufacture name and code, and seal of testing agency who verified suitability of pipe material for potable water service.
      d. Pressure test each length of pipe (standard and random), including integral bell, to four times the rated pressure for minimum 5 seconds. Pipe shall meet all additional test requirements defined in AWWA C900.
      e. As manufactured by Napco, Diamond Plastics, or approved equal.
   2. 4- to 24-inch AWWA C900 Restrained Joint PVC Pipe, DR 18
      a. Pipe provided herein shall meet all AWWA C900 requirements and Article 2.2A except as modified herein.
      b. Pipe shall be restrained joint by utilizing precision-machined grooves on pipe spigot and inside bell. When assembled, insert a nylon spline through an entry hole in pipe bell, resulting in a continuous circumferential restrained joint.
      c. Pipe shall be Certa-Lok as manufactured by Napco or approved equal.

2.3 PIPE FITTINGS

A. Pipe fittings used with PVC water lines shall be ductile or cast iron, mechanical joint (MJ), cement-mortar lined, asphaltic coated fittings per AWWA C110 requirements and suitable for use with specified PVC pipe used.
B. Unless otherwise specified, use joint restraints for all buried fittings as indicated on Contract Drawings. Mechanical joint restraints may be used in lieu of concrete thrust-blocking unless indicated otherwise. Restraining glands shall have a pressure rating equal to pipe used. MJ restraints shall be EBAA Series 2000PV, Romac PVC Romagrip, or approved equal.
C. As required in Contract Drawings, utilize a restraint harness for restraining pipe joints when MJ restraints utilized at pipe bends.
D. Restraint harness shall be an EBAA Series 1900 or approved equal.

2.4 VALVES

A. Gate Valves
   1. Furnish and install gate valves of size, type, and configuration indicated, where shown on Contract Drawings. Gate valves shall be flanged, mechanical joint, or hub end as shown on Contract Drawings or required by type of joint used in piping. All valves shall open by turning left and unless otherwise specified, have a non-rising stem and furnished with a 2-inch operating nut when valves are buried, with hand wheels when above ground. When operating nut is more than 3 feet below ground, valves supplied with an operator extension to position operating nut within 3 feet of finished ground surface.
   2. Gate valves shall meet all requirements specified in AWWA C515.
   3. Gate valves shall be designed for a 250-psi working pressure and as manufactured by Mueller Co. or approved equal.
   4. Buried gate valves shall be MJ restrained per Article 2.3.
   5. A concrete foundation with compacted base provided for all gate valve installations per specifications and Contract Drawings.

B. Valve Boxes and Extension Stems.
   1. Extension stems furnished on buried valves where top of operating nut is more than 36 inches below finished grade. Top of extension stem shall not be more than 9 inches below top of valve box.
   2. Buried gate valves provided with cast iron valve boxes. Valve boxes to be screw type, asphaltic bituminous coated, placed at depth required in the field. Install valve boxes with reinforced concrete collar as indicated in Contract Drawings.
   3. Valve boxes to be Tyler Union, model 6860 screw-type valve box or approved equal.

2.5 TAPPING VALVES

A. Furnish and install tapping gate valves of size, type, and configuration indicated, where shown on Contract Drawings. Tapping gate valves shall be mechanical joint by flanged joint unless otherwise specified. All tapping gates valves shall open by turning left and unless otherwise specified, have a non-rising stem and furnished with a 2-inch operating nut when valves are buried. When operating nut is more than 3 feet below ground, supply valves with an operator extension to position operating nut within 3 feet of finished ground surface.

B. Tapping gate valves shall meet all requirements specified in AWWA C509.

C. Tapping gate valves shall be designed for a 250-psi working pressure and as manufactured by Mueller Co. or approved equal.

D. Buried tapping gate valves shall be MJ restrained per Article 2.3.

E. Provide a concrete foundation with compacted base for all gate valve installations per specifications herein and Contract Drawings.

F. Valve Boxes and Extension Stems.
   1. Extension stems furnished on buried valves where top of operating nut is more than 36 inches below finished grade. Top of extension stem shall not be more than 9 inches below top of valve box.
   2. Buried tapping gate valves provided with cast iron valve boxes. Valve boxes to be screw-type, asphaltic bituminous coated, placed at depth required in the field. Install valve boxes with a reinforced concrete collar as indicated in Contract Drawings.
   3. Valve boxes to be Tyler Union, model 6860 screw-type valve box or approved equal.

2.6 TAPPING SLEEVES

A. Furnish and install tapping sleeves of size, type, and configuration indicated, where shown on Contract Drawings. Tapping sleeves shall be full, wraparound type, 200-psi rated, stainless steel, ductile iron, or approved equal. All bolts and various other hardware shall be stainless steel.
B. Tapping sleeves to be Mueller T-28 or approved equal.

2.7 COMBINATION AIR VALVES

A. Combination air valves shall be single-housing style combining operating features of both air/vacuum and air release valves. Air/vacuum portion shall automatically exhaust large quantities of air during line filling and allow air to re-enter when internal pressure of pipeline nears a vacuum. Air-release mechanism shall automatically release small quantities of air from pipeline when line is in service. Valves shall be rated for a 150-psi working pressure with 100 psi surge allowance. Install valves based on size and locations shown on Drawings. Valve inlets and outlets shall have ANSI Class 125 flanged connections. Valves shall be by APCO or approved equal.
B. Materials: Body cover and baffle shall be cast iron. Float and all other wetted trim shall be stainless steel with seat being BUNA-N and adjustable orifice button constructed of Viton.
C. Vault shall have a fiberglass body with a concrete foundation. Please refer to Sheet C-112 within Drawings for variations of vaults according to the specific location.

2.8 PIPE REPAIR

A. As necessary furnish and install pipe repair clamps.
B. Pipe repair clamps shall be stainless steel, full seal clamps.
C. Repair clamps to be Mueller 500/510 Series or approved equal.

2.9 ACCESSORIES

A. Warning Tape: Provide traceable tape made of plastic, blue in color, minimum 4 inches wide, with lettering stating a water line is buried below.

PART 3 - EXECUTION

3.1 MEASUREMENT AND PAYMENT

A. Potable Water Lines
    1. Payment for installation of potable water lines will be on a linear foot basis. Gravel embedment, excavation, trenching, backfill, and other items necessary to completely install pipe are included in unit price.
    2. Measurement will be from natural ground to flow line of pipe. Owner representative will perform measurement.
B. Pipe Fittings
    1. Payment for installation of pipe fittings will be included in the cost of the pipe. All necessary items to completely install fitting is included in unit price.
    2. Measurement provided by Contractor and verified by Owner representative.

C. Valves, Tapping Sleeves, Tapping Valves, Fire Hydrants, and Pipe Repair
   1. Payment for installation of valves, tapping sleeves, tapping valves, fire hydrants, and pipe repair will be on an (each basis), or included with the price of the pipe. All necessary items to facilitate a complete install are included in unit price.
   2. Measurement provided by Contractor and verified by Owner representative.

D. Warning Tape
   1. Payment for installation of warning tape will be included in the price of the pipe. All necessary items to facilitate a complete install are included in unit price.
   2. Measurement provided by Contractor and verified by Owner representative.

3.2 POTABLE WATER LINE INSTALLATION

A. General
   1. All pipe and accessories for work specified herein shall be unloaded, handled, laid, jointed, tested for defects and for leakage as herein specified.
   2. Coordinate delivery storage, and delivery schedule with Owner representative.
   3. Pipe Bending and Joint Angular Deflection shall meet requirements of AWWA C605 and manufacture specifications. Whichever is more stringent shall apply to Project.
   4. Connections to Existing Lines: Connect new work and existing work, where required, using proper transition sleeves and fittings to suit actual conditions. Additional bends may also be necessary to provide minimum pipe separations as required by TCEQ. These fittings, special sleeves, and bends provided after verification from Engineer. When necessary to interrupt service to existing facilities to make connection to an existing line, Contractor may be required to make connections as designated by Owner at no additional cost to Owner.

B. Responsibility for Materials: Contractor is responsible for all material he furnishes and shall replace, at own expense, all material found to be defective in manufacture or became damaged in handling after delivery.

C. Storage, Handling Pipe and Accessories
   1. All pipe, fittings, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at site of the work by Contractor. In loading and unloading, lift by hoists or slid or roll on skidways to avoid shock or damage to materials. DO NOT drop. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
   2. Place pipe, fittings and accessories along site to keep as free as possible from dirt, sand, mud, and other foreign matter.
   3. When prolonged exposure to direct sunlight anticipated, cover PVC pipe and accessories with an opaque material while still permitting adequate air circulation above and around pipe.

D. Trench Safety
   1. Scope of work includes but not limited to trench and excavation safety systems by cut-back or braced excavation method for all trenches 5 feet and deeper whether indicated on drawings or required by actual field conditions. Trenches exceeding or not exceeding 5 feet in depth shall be protected as required by OSHA, state and local standard and as specified in Section 31 41 10 “Trench Safety.”
   2. Comply with all applicable State of Texas safety standards and applicable OSHA regulations concerning trench excavation, general excavation, and construction safety.
   3. Contractor is responsible for implementing a trench shoring system where trench depth exceeds 5 feet.

E. Trench Excavation

1. Provide construction-staking services and notify Owner representative of any concerns with construction staking.
2. Excavate to alignment and elevations indicated on Contract Drawings or as staked in the field. Any deviations shall be approved by Engineer.
3. No classification of or extra payment for excavated materials. Excavate all materials encountered as required. Protect adjacent structures and property from damage by construction equipment.
4. Stockpile excavated materials to not endanger workers or the public and causes least obstruction to roadways.
5. Note the trench bottom, as shown on Contract Drawings, is approximately 4-6 inches below bottom of pipe grade so bedding material can be placed beneath pipe per trench cross-section details and specifications. Minimum depth of cover for piping shall be 48 inches unless otherwise specifically shown on Contract Drawings.
6. Install trench safety systems as specified where required. Make trench walls vertical to a point at least 1 foot above top of pipe. Vertical trench walls above this point not required; however, in areas of limited right-of-way or when necessary to protect existing facilities or private property, limit slope of trench wall. Where necessary to stay within maximum width limits at top of pipe or maintain a relatively straight trench wall to remain within available right-of-way, adequately support trench walls as required by specifications and OSHA regulations. Contractor is fully responsible for any damage to private property or existing facilities due to inadequate support.
7. Excavate trench only as necessary to install pipe. Excavation limits are as follows:
   a. Pipe less than 18 inches in diameter: Pipe O.D. +12 inches.
   b. Pipe 18-36 inches in diameter: Pipe O.D. +18 inches.
8. Maintain trenching equipment on a sufficiently level roadbed to provide substantially vertical trench walls.
9. To obtain a true even grade, fine grade and shape trench per details shown on Contract Drawings. Correct any part of the trench excavated below grade by filling with approved material and thoroughly compacting. If clay, rock or other unyielding material encountered in trench bottom, remove to 4-6 inches below grade, refill with approved material, and thoroughly compact to grade.
10. Trench digging machinery may be used to make trench excavations except where operations would cause damage to existing structures above or below ground. Employ hand methods in such instances.
11. Locate all existing utility lines, whether or not shown on Contract Drawings, including consumer service lines, far enough in advance of trenching to make proper provisions for protecting lines and allow for any deviations required from established lines and grades. Notify operators of all oil or gas pipelines before excavation around such lines so these operators may be present during excavation.
12. DO NOT disrupt service on any utility lines except consumer service lines, which may be taken out of service for short periods of time, if obtained permission from Owner representative.
13. Immediately notify proper utility company of any damage to utility lines so service may be established with least possible delay. Repair/replace any damage to existing lines and repair of consumer lines authorized to be cut or temporarily taken out of service at Contractor expense, and as directed by an official representative of the owner of the damaged line.
14. Properly support all new and existing lines to prevent settlement or damage to line both during and after construction.
15. Where necessary to prevent caving, adequately support trench.

F. For trenchless installations of utility piping, refer to Section 33 05 07 “Trenchless Installation of Utility Piping.

G. Dewatering: Where running or standing water occurs in trench bottom, remove water by pumps and other suitable means to prevent pipe flotation, until pipe is installed and backfill placed and compacted.

H. Trench Methods
   1. Trench Boxes: Submit manufacturer-standard data sheet and certificate of compliance signed by a registered professional engineer stating maximum allowable depth for given design pressure for each type of trench box proposed for use.
   2. Alternative Systems: If composed of steel, aluminum, wood, or combination of materials proposed, submit design calculations signed by a registered professional engineer showing all member properties, design strengths, and any stress increases used with justification for their use.

I. Laying Pipe
   1. Place pipe and fittings into trench with ropes and skids, slings on a backhoe bucket, or by hand. DO NOT throw pipe or fittings into trench nor any part of pipe be allowed to take an unrestrained fall onto trench bottom.
   2. When not laying pipe, close the open ends of installed pipe to prevent trench water, dirt, and foreign matter from entering line.
   3. Lay pipe to elevations shown in Contract Drawings.

J. Joint Assembly, Field-Cutting, Chamfering, and Curvature: Perform joint assembly, field cutting, chamfering, and curvature per Uni-Bell PVC Pipe Association PVC Pipe Design and Construction handbook and/or manufacturer-recommended procedures. The more stringent shall apply.

K. Backfill
   1. Foundation
      a. Foundation only required when trench bottom is unstable. In such cases, over-excavate bottom of trench and bring back to grade. Utilize Class I, II, or III for foundation, if necessary, as follows:

Soil Class	Placement
Class I	Install in 12-inch-thick lifts
Class II	
Class III	Install in 6-inch thick-lifts

      b. Moisten material, place in lifts as indicated, and compact by tamping to a density not less than 98-percent ASTM D1557 Modified Proctor with a ±2-percent optimum moisture content.
   2. Bedding
      a. Required to bring trench bottom up to grade, place to provide uniform and adequate support under pipe and place by hand. Provide holes for pipe bells at each joint to ensure uniform support for pipe.
      b. Bedding layer shall be 4-6 inches thick. Only use fine grain materials such as sand in bedding layer. Trenches with natural materials of fine grains may be utilized for bedding layer. No particles larger than 3/4 inch diameter allowed in bedding layer.
   3. Haunching
      a. Haunching is backfill from bottom to springline of pipe. Place and consolidate material under pipe haunch so adequate side support provided to pipe without causing displacement from proper alignment.

b. Moisten material and place in lifts not exceeding 6 inches thick and compact by tamping to a density not less than 98-percent ASTM D1557 Modified Proctor with a ±2-percent optimum moisture content.

c. Place material by hand or approved mechanical methods. Use Class IB, II, or III soil that meets the following criteria for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</=50%	<5%	n/a	n/a
II	100%	</=50%	<5%	n/a	n/a
III	100%	>50%	>12 - <50%	n/a	GM <4 GC <7 SM >4 SC >7

d. Material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.

e. Water jetting not allowed.

4. Initial Backfill

a. Initial backfill is backfill from springline of pipe to 1 foot above pipe. Moisten material and place in lifts not exceeding 6 inches thick and compact to density not less than 98-percent ASTM D1557 Modified Proctor with a ± 2-percent optimum moisture content. Take care not to damage pipe during compaction.

b. Place material by hand or approved mechanical methods. Use Class IB, II, or III soil that meets the following criteria for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</=50%	<5%	n/a	n/a
II	100%	</=50%	<5%	n/a	n/a
III	100%	>50%	>12 - <50%	n/a	GM <4 GC <7 SM >4 SC >7

c. Material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.

d. Water jetting not allowed.

5. Final Backfill

a. Final backfill is backfill from 1 foot above pipe to bottom of subgrade for paved areas or to existing grade for unpaved areas. Moisten material, place in lifts not exceeding 6 inches thick, and compact to density not less than 98-percent ASTM D1557 Modified Proctor with a ±2-percent optimum moisture content.

b. Take care to not damage pipe during compaction.

c. Place material by hand or approved mechanical methods. Use Class IB, II, or III soil that meets the following criteria:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</=50%	<5%	n/a	n/a
II	100%	</=50%	<5%	n/a	n/a
III	100%	>50%	>12 - <50%	n/a	GM <4 GC <7 SM >4 SC >7

d. Material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.

e. Water jetting not allowed.

f. At Contractor expense/option, utilize flowfill in place of soil for final backfill zone.

g. If Contractor elects to use flowfill in final backfill zone, it should be composed of a mixture of Portland cement and pea gravel and sand with a of 1 1/2 sacks per cubic yard cement content of flowfill.

h. Install tracible warning tape in Final Backfill zone 18 inches below finished grade of trench directly above potable water line.

L. Cleanup

1. DO NOT round backfill up over trenches. Compact and blade surface of trench backfill to final grading contours.
2. Maintain trench surfaces in a satisfactory manner until final completion and acceptance of work. Maintenance shall include blading as necessary, filling depressions caused by settlement, and other work required to keep all areas presentable.
3. Correct any trench settlement which occurs within one-year warranty period at no expense to Owner.

3.3 POTABLE WATER LINE FITTING INSTALLATION

A. Connect fittings, meters, and valves with flanged or mechanical joints as indicated on Contract Drawings. Each joint shall include flanged ends or gland retainer, gasket, and bolts required to complete connection. Contractor shall perform all work necessary to make connections and be responsible for quality and proper operation of those joints.

B. Procedures

1. Before making connections, properly support pipe, fittings, or valves, free to move as bolted. Set flange faces so bolt holes are properly aligned, flange faces bear uniformly on gaskets, and flanges will not be under strain after joint completion.
2. To avoid strains upon flanges, gradually tighten bolts at uniform rates sequentially on opposite sides of flanges. To assure flanges are not under strain, Engineer may request bolts loosened in any joint. Install mechanical joint fittings and valves similar to flanged.
3. Buried fittings will require polyethylene wrap with a minimum 10-mil thickness.

C. All underground water line fittings shall be mechanical joint with a pressure rating equal to or greater than water line pipe material.

D. Restrain joints by concrete blocking/MJ restraints as specified on Contract Drawings.

a. Concrete Blocking: Concrete blocks provided bearing solidly against undisturbed trench bank, at all changes in direction/elevation. Concrete for blocking shall contain not less than three sacks of cement per cubic yard with a 28-day, 3,000-psi compressive strength.

2. MJ Restraints

a. Provided at all changes in direction/elevation. If MJ restraints alone used at bends, pipe joints for a distance specified in Contract Drawings, restrain with a restraint harness.

b. Install per manufacturer recommendations.

3.4 VALVE, TAPPING VALVE, TAPPING SLEEVE, FIRE HYDRANT, AND PIPE REPAIR INSTALLATION

A. Install in configuration indicated on Contract Drawings per manufacturer specifications and specifications herein.

3.5 HYDROSTATIC TESTING

A. Test water lines per AWWA C605 and specifications herein.

B. Provide all materials, equipment, tools, labor, superintendence, and incidentals required to achieve a completed and approved hydrostatic test.

C. Procedure

1. Slowly fill each section of pipe with water at point of lowest elevation. Apply pressure and maintain by pump connected to pipe in a satisfactory manner.

2. As line is filled and before applying test pressure, expel all air from pipe. To accomplish this, make taps, if necessary, at points of highest elevation. After test, tightly plug taps per specifications herein.

3. Do not begin test until after water line is properly filled, flushed, and purged of air. Pressurize water line to 1.50 times system working pressure or minimum 150 psi, whichever is greater, at highest point on section of line tested. Duration of each pressure test shall be as directed by Engineer but not exceed 2 hours.

4. When test pressure is on pipe, carefully check line at regular intervals for breaks or leaks. Repair any joints showing appreciable leaks and remove/replace any cracked or defective pipes or fittings with sound materials as provided. Repeat test until satisfactory results obtained.

5. After all defects in line are satisfactorily repaired and visible leaks stopped, make a leakage test on each valved section of line to determine quantity of water lost by leakage. Furnish all labor, material, and equipment required for making test. Leakage determined by measuring quantity of water supplied to each valved section of line, during test period, when various sections of line are under pressure.

6. Maximum allowable leakage for pressure drop in potable water line is calculated as:

$$Q = \frac{L\,D\,\sqrt{P}}{148{,}000}$$

Where:

Q = Quantity makes up water in gallons per hour

L = Length of pipe section being tested, in feet

D = Nominal diameter of the pipe in inches

P = Test pressure in psi ± 5 psi of specified

7. If sections show excessive leakage, locate and repair defective joints until leakage is within specified allowance.

3.6 DISINFECTION

A. Disinfect water lines per 30 TAC §290.46(g) and AWWA C651 and specifications herein. Before acceptance for operation, disinfect all portions of water lines installed as specified. Before putting lines in service and after pressure tests made, thoroughly flush unit to disinfect with water until all entrained dirt and mud removed before introducing chlorinating material.

B. Forms of Chlorine for Disinfection
   1. Liquid chlorine (gas): Per AWWA B301, containing 100-percent available chlorine.
   2. Sodium hypochlorite: Per AWWA B300, containing 5- to 15-percent available chlorine.
   3. Calcium hypochlorite: Per AWWA B300, containing 65-percent available chlorine.

C. Chlorination Methods for Disinfection
   1. Tablet/Granule Method: If elected, perform per AWWA C651, Section 4.3.
   2. Continuous-Feed Method: If elected, perform per AWWA C651, Section 4.4.
   3. Slug Method: If elected, perform per AWWA C651, Section 4.5.
   4. Spray Disinfection: If elected (only to be used for large transmission lines), perform per AWWA C651, Section 4.6.

D. Verification of Bacteriological Tests
   1. Perform per AWWA C651, Section 5.
   2. Submit test samples to a TCEQ-approved laboratory and indicate facility is free from microbiological contamination before placing into service.

E. Arrange for satisfactory disposal of water flushed from lines, using pipe, dikes, or channels to an adequate drain so no nuisance is created.

F. Include costs for disinfection in unit cost for installing pipe.

3.7 CLEAN UP

A. After construction work is complete, remove all rubbish, excess materials from excavations, and other debris from site of work. Replace/repair all affected items (surfacing, landscaping, etc.) to equal or better condition than preconstruction conditions. Cost of cleanup included in bid prices for various units of work.

END OF SECTION

SECTION 40 05 04 – PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies systems of process piping and general requirements for piping systems. Detailed specifications for the components listed on the Piping System Specification Sheets are found in other sections of Division 40. This section shall be used in conjunction with those sections.

B. DEFINITIONS: Pressure terms used in Section 40 05 04 “Piping Systems” and elsewhere in Division 40 – Process Interconnections, are defined as follows:
   1. Maximum: The greatest continuous pressure at which the piping system operates.
   2. Test: The hydrostatic pressure used to determine system acceptance.

1.2 QUALITY ASSURANCE

A. REFERENCES: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   1. AASHTOM36/N36M - Metallic (Zinc or Aluminum) Coated CorrugatedSteel Culverts and Under- drains
   2. ANSI A13.1 - Scheme for the Identification of Piping Systems
   3. ANSI BI.20. 1- Pipe Threads, General Purpose (Inch)
   4. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
   5. ANSI B16.3 - Malleable Iron Threaded FittingsClass 150 and 300
      ANSI B16.5 - Pipe Flanges and Flanged Fittings
   6. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings
   7. ANSI B16.11 - Forged Steel Fittings, Socket Welding and Threaded
   8. ANSI B16.12 - Cast Iron Threaded Drainage Fittings
   9. ANSI B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
   10. ANSI B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes
   11. ANSI B31.1 - Power Piping
   12. ANSI B31.3 - Chemical Plant and Petroleum Refinery Piping
   13. ASME Section IX - Boiler and Pressure Vessel Code; Welding and Brazing Qualifications
   14. ASTM A47 - Malleable Iron Castings
   15. ASTM A53 - Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless
   16. ASTM A74 - Cast Iron Soil Pipe and Fittings
   17. ASTM A105/A105M - Forgings, Carbon Steel, for Piping Components
   18. ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service
   19. ASTM A197 - Cupola Malleable Iron
   20. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
   21. ASTM A312/A312M - Seamless and Welded Austenitic Stainless Steel Pipe
   22. ASTM A403/A403M - Wrought Austenitic Stainless Steel Piping Fittings
   23. ASTM A536 - Ductile Iron Casting

24. ASTM A570/A570M - Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
25. ASTM A774/A774M - As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
26. ASTM A778 REVA - Welded Unannealed Stainless Steel Tubular Products
27. ASTM B88 - Seamless Copper Water Tube
28. ASTM C769 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
29. ASTM C296 - Asbestos-Cement Pressure Pipe
30. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fitting
31. ASTM D1248 - Polyethylene Plastics Molding and Extrusion Materials
32. ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
33. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
34. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
35. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
36. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
37. ASTM D2996 - Filament-Wound reinforced Thermosetting Resin Pipe
38. ASTM D3261 - Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
39. ASTM D4174 - Cleaning, flushing, and Purification of Petroleum Fluid Hydraulic Systems
40. ASTM D4101 - Propylene Plastic Injection and Extrusion Materials
41. ASTM F441 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
42. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
43. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 Inch Through 48 Inch, for water and other liquids
44. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
45. AWWA C115 - Flanged Ductile-Iron and Gray-Iron Pipe and Threaded Flanges
46. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other Liquids
47. AWWA C200 - Steel Water Pipe 6 Inches and Larger
48. AWWA C203 - Coal-Tar Protective Coating and Linings for Steel Water Pipelines – Enamel and Tape-Hot Applied
49. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 Inches and Larger-Shop Applied
50. AWWA C206 - Field Welding of Steel Water Pipe
51. AWWA C207 - Steel Pipe Flanges for Waterworks Services-Sizes 4 inches through 144 inches
52. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings
53. AWWA C209 - Cold-Applied Take Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
54. AWWA C2l0 - Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
55. AWWA C2l4 - Tape Coating Systems for the Exterior of Steel Water Pipelines

56. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids
57. AWWA C303 - Reinforced Concrete Pressure Pipe-Steel Cylinder Type, Pretensioned, for Water and Other Liquids
58. A WWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances
59. AWWA C65l - Disinfecting Water Mains
60. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water Steel Pipe-A Guide for Design and Installation
61. AWWA M11 - Steel Pipe-A Guide for Design and Installation
62. CISPI 301 - Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings
63. FEDSPEC L-C-530B(1) - Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy.
64. MIL-H-13528B - Hydrochloric Acid, Inhibited, Rust Removing
65. MIL-STD-810C - Environmental Test Methods
66. SAE J1227 - Assessing Cleanliness of Hydraulic Fluid Power Components and Systems
67. SPC (1988) - Standard Plumbing Code

B. FITTINGS AND COUPLING COMPATIBILITY: To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturers.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the piping system specification sheets. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenances specified in other sections of Division 40.

2.2 PIPING IDENTIFICATION

A. PLASTIC CODING MARKERS: Plastic markers for coding pipe shall conform to ANSI Al3.1 and shall be as manufactured by W. H. Brady Company, Seton Name Plate Corporation, Marking Services Inc., or equal. Markers shall be the mechanically attached type that are easily removable, they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-8l0C. Markers shall withstand a continuous operating temperature range of -40 degrees F to 180 degrees F. Plastic coding markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic.

B. Markers bearing the legends (symbols) on the background colors specified inthePIPESPEC shallbeprovidedinthefollowingletter heights:

Outside pipe diameter inches	Letter height, inches
Less than 1-1/2	1/2
1-1/2 through 3	1-1/8
Greater than 3	2-1/4

Outside pipe diameter shall include insulation and jacketing.

In addition, pipe markers shall include uni- and bi-directional arrows in the same sizes as the legend. Legends and arrows shall be white on blue or red backgrounds and black on other specified backgrounds .

C. PLASTIC TRACER TAPE: Tracer tape shall be 6 inches wide, colored the same as the background colors as specified in Table A, Section 40 05 04 paragraph 3.06, and made of inert plastic material suitable for direct burial. Tape shall be capable of stretching to twice its original length and shall be as manufactured by Allen Systems, W. H. Brady' Co., Seton Name Plate Corporation, Marking Services Inc., or equal.

Two messages shall be printed on the tape. The first message shall ***read "CAUTION CAUTION CAUTION PIPE BURIED BELOW"*** with bold letters approximately 2 inches high. The blank shall be filled with the system fluid such as chlorine, air, or wastewater. The second message shall read **"*CALL EL PASO WATER UTILITY*"** with letters approximately 3/4 inch high. Both messages shall be printed at maximum intervals of 2 feet.

D. MAGNETIC TRACER TAPE: Polyethylene magnetic tracer tape shall be as manufactured by Allen Systems, W.H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal. Tape shall be acid and alkali- resistant, 3 inches wide, 0.005 inch thick, and have 1500 psi strength and 140 percent elongation value. The tape shall be colored the same as the background colors as specified in Section 40 05 04 "Piping Systems," paragraph 3.06 and shall be inscribed with the word 'CAUTION--PIPE BURIED BELOW' and the name of the piping system.

2.3 VALVES

A. Valves of the same size and service shall be provided bx a single valve manufacturer. Packing shall be non-asbestos material. Actual length of valves shall be within 1/16 inch (plus or minus) of the manufacturer's specified length. Flanges shall meet the requirement of ANSI B16.5. Push-on and mechanical joints shall meet the requirements of AWWA C111 Valve operators are specified in Section 40 05 51.

2.4 PRODUCT DATA

A. Product data on piping materials shall be provided in accordance with Section 01 33 00 "Submittal Procedures" where specified.

B. Piping layout drawings shall be transmitted to the Engineer a minimum of 2 weeks prior to construction. Drawings shall be original layouts by the Contractor; photocopies of contract drawings are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. LOCATION: Piping shall be provided as specified except for adjustments to avoid architectural and structural features and shall be coordinated with electrical construction.

B. PIPING SIZES: Where the size of piping is not specified, the Contractor shall provide piping of the sizes required by Uniform Plumbing Code (UPC). Unless specified otherwise, small piping (less than 1-inch in diameter) required for services not described by Uniform Plumbing Code (UPC) shall be 1/2-inch.

C. PIPE SUPPORT, ANCHORAGE SEISMIC BRACING: Piping shall be supported by anchor brackets, guides, saddles or hangers. Acceptable types of supports, guides, saddles, hangers and structure attachments for general pipe support, expansion/ contraction and for seismic bracing, as well as anchorage details, are shown on the drawings. Minimum spacing shall be as specified for supports and for seismic bracing. Where a specific type of support or anchorage is indicated on the drawings, then only that type shall be used there. Piping shall be vertically supported by anchor brackets, guides, saddles or hangers and shall be seismically braced where indicated to resist lateral load. Supports shall be provided on each run at each change of direction. Pipe supports shall be hot-dip or mechanically galvanized. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.

D. ANCHORACE FOR BURIED PIPING: All plugs, caps, tees and bends in buried pressure piping systems shall be anchored by means of reaction backing or restrained joints as specified Bedding and backfill for buried piping shall be as specified.

E. Bedding and Backfill: Bedding and backfill for buried piping shall be as specified.

3.2 PIPING IDENTIFICATION

A. PIPE CODING: After application of the specified coating and insulation systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with plastic markers as specified in Section 40 05 04 “Piping Systems,” paragraph 2.2 A. Legend markers and directional arrows shall be located at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, and at approximately 50-foot centers.

B. PLASTIC TRACER TAPE: A single line of tape as specified in Section 40 05 04 “Piping Systems,” paragraph 2.2 B shall be provided 2.5 feet above the centerline and parallel to each buried pipe. Tape shall be spread flat with message side up before backfilling.

C. MAGNETIC TRACER TAPE: Polyethylene magnetic tracer tape shall be buried 12 to 18 inches below ground and shall be above and parallel to buried nonferrous, plastic and reinforced thermosetting resin pipelines. For pipelines buried 8 feet or greater below final grade, the Contractor shall provide a second line of tape 2.5 feet above and parallel to the buried pipe.

3.3 VALVE IDENTIFICATION

A. Stainless steel tags bearing the specified valve number stamped in 1/4-inch high letters shall be installed on valve flanges in a position visible from floor level. Flangeless valves 8 inches in diameter and larger shall have tags attached to the valve body by self-tapping corrosion resistant metal screws. Flangeless valves 6 inches in diameter and smaller shall have tags attached to the valve stem by stainless steel wire. Wire shall be 0.063 inch minimum.

3.4 TESTING

A. GENERAL: Upon completion of piping, but prior to application of insulation on exposed piping, the Contractor shall test the piping systems. Pressures, media and test durations shall be as specified in the PIPESPEC. Equipment which may be damaged by the specified test conditions shall be isolated. Testing shall be performed using calibrated test gages and calibrated volumetric measuring equipment to determine leakage rates. Each test gage shall be selected so that the specified test pressure falls within the upper half of the gage's range. Unless otherwise specified, the Contractor shall notify the Engineer 24 hours prior to each test.

Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new pipe systems. Existing pipe shall be tested to the nearest existing valve. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.

Where testing existing chlorine systems to the nearest isolation valve, Contractor shall provide a tee in the line adjacent to the valve. The branch outlet on the tee shall be valved and used for cleaning, pressure testing, draining, and drying the line. Unless otherwise indicated, the existing chlorine system shall not be shut down during testing or connecting the tee and valve. Prior to placing the line in service, the valve on the branch outlet shall be plugged or sealed with a blind flange or threaded plug. Contractor shall be responsible for all damage to the existing system because of this work.

B. GAS, AIR, AND VAPOR SYSTEMS: Testing medium and procedures for chlorine systems are specified in Section 40 05 04 paragraph 3.04 D.

Unless otherwise specified, the testing medium for other gas, air and vapor systems shall be as follows:

Pipeline Size	Specified Test Pressure	Testing Medium
2 inch and smaller	75 psi or less	Air or Water
2 inch and smaller	Greater than 75 psi	Water
Greater than 2 inches	3 psi or less	Air or Water
Greater than 2 inches	Greater than 3 psi	Water

The allowable leakage rate for hazardous gas systems, insulated systems, and systems tested with water shall be zero at the specified test pressure throughout the specified test Period. Hazardous gas systems shall include chlorine and natural gas systems.

The allowable leakage rate for other systems tested with air shall be based on a maximum pressure drop of 5 percent of the specified test pressure for the duration of the period. Prior to starting a test interval using air, the air shall be at ambient temperature and specified test pressure.

C. LIQUID SYSTEMS: Leakage shall be zero at the specified test pressure throughout the specified duration of the following systems: exposed piping, buried insulated piping, and buried or exposed piping carrying liquid chemicals. Testing procedures for chlorine systems are specified in Section 40 05 04 paragraph 3.4 D. Testing procedures for hydraulic and lube oil systems are specified in Section 40 05 04 paragraph 3.4 E. Unless otherwise specified,

leakage from other buried liquid piping systems shall be less than 0.02 gallon per hour per inch diameter per 100 feet of buried piping.

D. CHLORINE SYSTEMS:

1. GENERAL: Chlorine systems comprise chlorine, in gaseous and liquid phase, under positive and negative pressure. After cleaning, as specified in Section 40 05 04 "Piping Systems," paragraph 3.5 E, the system shall be pressure tested. Pressure gages, relief valves, automatic control valves, and other components which may be damaged or exceeded by test pressures shall be removed and openings shall be blocked off prior to testing. Contractor shall not attempt to repair leaks until all pressure has dissipated from the system. The system shall be repaired and retested as necessary until a successful test (zero leakage) is achieved.

   For evaporator-supplied systems, Contractor shall disconnect the vent from the discharge side of the pressure relief valve of each evaporator, plug the resultant opening, inspect and secure all joints, close all valves which discharge to atmosphere, and open all in-line valves. Contractor shall open the valve in the bypass line around the pressure reducing valve on the downstream side of each evaporator to provide a through path around this valve. System piping shall then be tested to 150 psig. After testing, Contractor shall replace all equipment previously removed and close all in-line valves. Contractor shall reconnect the vent line to the downstream side of the pressure relief valve of each evaporator and close the valve in the bypass line around the pressure reducing valve on the downstream side of each evaporator.

   Steel pipelines shall be hydrostatically tested. However, if drying after hydrostatic testing is impractical or cannot be accomplished, the Contractor may test steel lines with nitrogen gas or dry air providing he takes the necessary safety precautions to safeguard personnel and minimize the risk incurred when performing such a test at high pressures. All PVC pipelines shall be hydro- statically tested. Testing PVC lines with nitrogen or air is not permitted.

2. HYDROSTATIC TESTING: Steel piping lines and PVC solution lines hydrostatically tested shall be tested to 150 psig. PVC vacuum lines shall be hydrostatically tested to 50 psig. After testing, all moisture absorbing gaskets and valve packing shall be replaced.

3. DRYING: Chlorine piping systems shall be dried prior to placing in service. Even if water has not been purposely introduced into the system for hydrostatic testing or cleaning, drying is still required because moisture may enter the system from the atmosphere or other sources.

   For steel pipe, drying shall be accomplished by passing steam through the lines from the high end of the system until the lines are thoroughly heated. While steaming, the Contractor shall allow condensate and foreign matter to drain out. The steam supply shall then be disconnected and all pockets and low spots in the line drained. While the line is still warm, dry oil-free air having a dew point of -40 degrees F, or below, shall be blown through the line until the exiting air dew point is the same as the supply air. Valves shall be fixed in the half-open position during drying. Valves removed temporarily from the system during drying operations must be free of moisture before being recoupled to the system piping.

Drying of PVC pipe applies solely to vacuum lines and consists of draining and removing all water and moisture from the system. After draining the line, the Contractor shall first pig the pipe to remove excess water. The Contractor shall then air dry the system in accordance with the requirements for steel pipe. PVC pipe shall not be steamed.

4. NITROGEN OR AIR PRESSURE TESTING: The Contractor may use nitrogen gas or oil-free dry air to test steel lines. Testing consists of gradually introducing nitrogen gas or dry air up to 50 psig and maintaining this pressure while testing the line for leaks with soapy water. When the system is free from leaks at this pressure, the test pressure shall then be increased in increments of 50 psig up to a maximum of 150 psig. At each stepped increase in pressure, the Contractor shall check for leaks and take corrective action as necessary. When the system is free from leaks at the final test pressure, the system shall then be depressurized, the test source disconnected, and the system capped to prevent the entrance of water.

   For testing with nitrogen gas, the Contractor shall use cylinders of dry high purity nitrogen gas, nitrogen handling cylinder mounted pressure regulator 0 to 300 psig, and necessary fittings and adapters to complete connection between the source and system header. Pressure regulator shall be self-relieving type which vents to the atmosphere and include a throttling valve.

   For testing with air, the Contractor shall provide oil-free air with a relative humidity of zero. All fittings, adapters, and accessories, pressure regulator and throttling valve shall be suitable for pressure testing with air and rated for 300 psig service.

5. SERVICE GAS TESTING: Immediately after the chlorine system has been dried and pressure tested, the service gas shall be gradually introduced, and the entire system tested for leaks. Time shall be allowed for the complete replacement of air from the piping with service gas.

   The Contractor shall use a liquid ammonia solution or chlorine gas detector to detect for chlorine leaks. The Contractor shall spray the solution at the pipe connections and shall not squirt the liquid on the pipe or fittings. In the event leaks are detected in the piping or the equipment, they shall not be repaired until all gas has been purged from the line. The reaction of the two substances produces a dense white cloud. Upon completion of repairs, the Contractor shall repeat the cleaning and drying process described in Section 40 05 04 “Piping Systems,” paragraphs 3.4 D and 3.5 E and retest the lines with service gas.

E. HYDRAULIC LUBE OIL SYSTEMS: Upon completion of cleaning, all field connections shall he completed, and the system tested at the specified pressure. Pressure loss shall be zero for the specified test period. For fluid power systems, the manufacturer shall supervise the installation and testing of all system components including all field piping.

F. DRAINS: Drain systems, other than pumped drain systems, shall be tested in accordance with SPC.

3.5 CLEANING AND FLUSHING

A. GENERAL: Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, regulating or instrumentation equipment. The Contractor may, at his option, clean and test sections of buried or exposed piping systems. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab.

B. TEMPORARY SCREENS: Upon completion of the cleaning, the Contractor shall connect the piping systems to related process equipment. Temporary screens, provided which locator tabs which remain visible from the outside when the screens are in place, shall be inserted in pipelines at the suction of pumps and compressors in accordance with the following table:

Equipment suction or piping size, inches	Maximum screen opening, inches
0-1	1/16
1-1/4 - 3	1/4
3-1/2 - 6	1/2
Over 6	1

The Contractor shall maintain the screens during testing, initial start-up, and initial operating phases of the commissioning process. In special cases, screens may be removed as required for performance tests. The Contractor shall remove the temporary screens and make the final piping connections after the screens have remained clean for at least 24 consecutive hours of operation. Systems handling solids are exempted.

C. GAS AND AIR SYSTEMS: Unless otherwise specified, gas and air system piping 6 inches in diameter and smaller shall be blown out, using air or the testing medium specified. Piping larger than 6 inches shall be cleaned by having a swab or ”pig’ drawn through the separate reaches of pipe. After connection to the equipment, it shall then be blown out using the equipment. Upon completion of cleaning, the piping shall be drained and dried with an air stream. Natural gas 3.05 C. systemsshallbepurgedwithnitrogenandanitrogenpadmaintained at10 psiuntilputinservice. Chlorinesystemsshallbecleaned in accordance with Section 40 05 04 “Piping Systems,” paragraph 3.5E.

D. LIQUID SYSTEMS: After completion of cleaning, liquid systems, unless otherwise specified, shall be flushed with clean water. With temporary screens in place, the liquid shall be circulated through the piping system using connected equipment for a minimum period of 15 minutes and until no debris is collected on the screens. Liquid chlorine lines shall be cleaned in accordance with Section 40 05 04 “Piping Systems,” paragraph 3.5 E.

E. CHLORINE SYSTEMS:
   1. GENERAL: All portions of the system shall be cleaned free of oil and grease.
   2. STEEL PIPE: All pipe threads shall be washed clean and free from cutting oil. The inside of all pipe sections and fittings shall be cleaned of any pipe dope, oil and grease by drawing a cloth wetted with solvent through each assembly. Valves shall be dismantled, thoroughly cleaned with solvents, and repacked, if necessary. Contractor shall cap or plug all open ends at the end of each workday. Contractor shall use carbon tetrachloride or trichloroethylene. The Contractor shall always exercise caution to

minimize solvent exposure and shall be responsible for its proper handling and disposal. Solvents containing hydrocarbons or alcohols are unacceptable.

3. PVC PIPE: All solution lines shall be cleaned using water only. Vacuum lines shall be cleaned with a detergent and water and thoroughly rinsed to remove all vestiges of detergent. All lines shall be further purged of water by passing a cleaning ball or swab through the lines as specified in Section 40 05 04 “Piping Systems”, paragraph 3.5A.

F. STEAM SYSTEMS: Before the steam system is put into service, cleaning shall be performed to remove such contaminants as mill scale, weld scale, corrosion products, oil, grease, dust and dirt. Cleaning shall include a water flush performed at a velocity not less than 2 feet per second, steam blowdown, and an alkaline flush boilout of the boiler.

After flushing as indicated above, the boiler shall be treated with a caustic compound such as sodium triphosphate, soda ash, sodium tripolyphosphate, or caustic soda. The cleaning process shall be in accordance with steam system cleaning schemes developed by Dowell, the Mogul Division of Dexter Corp., Bentz Entec, or equal.

After cleaning and flushing, and prior to continuous operation of the steam system, adequate corrosion protection shall be provided by maintaining the system full of steam or potable water. If continuous operation does not occur within 60 days after cleaning and flushing, the steam or potable water shall be treated with an acceptable corrosion inhibiting chemical to assure adequate corrosion protection of the steam system.

G. HYDRAULIC AND FLUID POWER OIL SYSTEMS: Upon completion of all field piping, but before connection to any control components, hydraulic and fluid power oil systems shall be flushed and cleaned by circulating special flushing oil through the system. Flushing oil and procedures shall comply with ASTM D4l74.system shall be cleaned such that internal contamination of system, when tested using procedures specified in SAE J1227, Section 2.3, shall not exceed the Allowable Cleanliness Level (ACL).Unless otherwise specified, the ACL values shall be established by the manufacturer of the major hydraulic system components in accordance with SAE J1227, Section 9.1.System supplier shall provide Certificate of Compliance as product data (Section 40 05 04 “Piping Systems”, paragraph 2.4) that the ACL has been met.

H. POTABLE WATER SYSTEMS: Potable water piping systems shall be flushed and disinfected in accordance with AWWA C65l.

3.6 PIPING SPECIFICATION SHEETS (PIPESPEC)

A. Piping and valves for groupings of similar plant processes or types of service lines are specified on individual piping specification sheets (PIPESPECS) on page 11. Piping services are grouped according to the chemical and physical properties of the fluid conveyed and/or by the temperature or pressure requirements. Each grouping of services (PIPESPEC) is identified by a piping system number. Piping services specified in the PIPESPECS and on the drawings are alphabetically arranged by designated service symbols as shown in Table A. Table A also indicates the system number, fluid category, and pipe marker background color of each service.

PIPING SPECIFICATION SHEETS (PIPE SPECS)

TABLE A PIPING SERVICES				
Symbol	**Service**	**System**	**Fluid Category**	**Pipe Marker Background Color**
A	Aeration Air	1A	Air	Orange
AA	Agitation Air	1,1A,5A	Air	Orange
AFE	Air Flotation Effluent	13	Wastewater	Green
AR	Air Release	29	Sludge	Green
BW	Backwash Water	12	Wastewater	Green
CD	Chemical Drain	25	Drain/Vent	Yellow
CHS	Chemical Solution	19	Chemical	Yellow
CLG	Chlorine Gas	20	Chemical	Yellow
CLL	Chlorine Liquid	20	Chemical	Yellow
CLS	Chlorine Solution	19	Chemical	Yellow
CLV	Chlorine Vacuum	21	Chemical	Yellow
CSO	Caustic Soda	19	Chemical	Yellow
D	Drain	24	Drain/Vent	Green
EE	Engine Exhaust	31	Air	Red
FA	Foul Air	FRP Duct See Spec 40 05 36		Yellow
FE	Final Effluent	9	Water	Green
FLT	Filtrate	15	Sludge	Green
GR	Grit	17	Grit Slurry	Green
HOCL	Sodium Hypochlorite	19	Chemical	Yellow
HW	Potable Hot Water	7	Water	Blue
IA	Instrument Air	2	Air	Orange
LF	Lime Feed	1	Chemical	Yellow
LOR	Lube Oil Return	18	Petroleum	White
LOS	Lube Oil Supply	18	Petroleum	White
LOW	Lube Oil Waste	18	Petroleum	White
ML	Mixed Liquor	14	Sludge	Green
MS	Mixed Sludge	16	Sludge/Scum	Green
NG	Natural Gas	5	Gas	Yellow
OF	Overflow	13	Wastewater	Green
PD	Pumped Drainage	12	Wastewater	Green
POL	Polyelectrolyte	19	Chemical	Yellow
RAS	Returned Activated Sludge	14	Sludge	Green
RS	Raw Sewage	12	Wastewater	Green
RWP	Rainwater Pipe	24	Drain/Vent	Green
SA	Service Air	2	Air	Orange
SCN	Screenings	32	Semi-Solid	Green
SD	Sanitary Drain	24	Drain/Vent	Green
SE	Secondary Effluent	13	Wastewater	Green
SSC	Secondary Scum	16	Sludge/Scum	Green
STA	Starting Air	3	Air	Orange
STD	Storm Drain	24	Drain/Vent	Green
TD	Tank Drain	12	Wastewater	Green

THS	Thickened Sludge	14	Sludge	Green
TWAS	Thickened Waste Activated Sludge	14	Sludge	Green
V	Vent	24	Drain/Vent	Yellow
VC	Chemical Vent	24	Drain/Vent	Yellow
WAS	Waste Activated sludge	14	Sludge	Green
1W	Potable Water (City water)	7	Water	Blue
2W	Nonpotable City Water	11	Water	Green
2WL	Landscape Irrigation	29	Water	Green
2WS	Softened Nonpotable City Water	10	Water	Green
3W	No. 3 Water (secondary effluent)	11,19	Water	Green
3WS	No. 3 Spray Water	10	Water	Green

PIPING SYMBOL/SERVICE	**AA – AGITATION AIR SYSTEM -1**
Test Requirements:	
Medium	Air; ref. Section 40 05 04, paragraph 3.4B.
Pressure:	20 psig
Duration:	120 minutes
Gasket Requirements:	
Flange:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Push-on/Mech Cpl:	EPDM

EXPOSED PIPE AND VALVES: (See drawings for pipe size and valve type:)

(2-inch and smaller)	
Pipe:	Steel: ASTM A53, galvanized. Ref. spec Section 40 05 24.
	Conn: taper threaded, ANSI B1.20.1.
	Ftgs: malleable iron, ASTM A197, ANSI B16.3, Class 150, galvanized.
Valves:	Ball: Jamesbury Fig. 351, Nibco T-580, or equal.
	Globe: Crane 7TF or 17TF, Lunkenheimer; 123 or 214, or equal.
	Lift check; Crane 27TF, Lunkenheimer 231, or equal.
(2 1/2-inch thru 8-inch)	
Pipe:	Steel; ASTM A53, ERW, Grade B, black, no lining, Ref. Spec Section 40 05 24.
	Conn; butt weld, grooved mechanical pipe coupling or flanged.
	Ftgs: malleable iron, ductile iron, or steel per Spec Section 40 05 24 ends to match pipe.
Valves:	Butterfly: ref Spec Section 40 05 64.
	Double-disc Check; ref. Spec Section 40 05 65.29
(10-inch thru 24-inch)	
Pipe:	Steel: same as 8-inch or AWWA C200, 7-gage, no lining. Ref Spec Section 40 05 24
Valves:	Butterfly; ref Spec Section 40 05 64.
	Double-disc check: ref. spec Section 40 05 65.29

BURIED AND ENCASED PIPE AND VALVES:
(See Drawings for pipe size and valve type. Omit coating on encased pipe.)

(8-inch and smaller)	
Pipe:	Steel: same as exposed with polyethylene tape coating. Field application of coating to all couplings. Ref Spec Section 40 05 24.
	Conn; same as exposed with coating.
	Ftgs; same as exposed with coating.
Valves:	Ball; same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

(2 ½-inch thru 8-inch)

Valves:	Butterfly: same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

(10-inch and larger)

Pipe:	Steel; same exposed with coating. Con: same as exposed with coating. Ftgs: same as exposed with coating.
Valves:	Butterfly: same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

REMARKS:

1. Water Bearing Channels/Tanks Pipe and Valves;

Pipe	CPVC; ASTM D1784, Class 23447-B, ASTM F441, Schedule 80. Pipe and fittings exposed to sunlight shall be painted. See Spec Section 40 05 31. Conn; plain end solvent weld with flanged adapters for valves 3 inches and larger. Ftgs; material same as pipe. Solvent weld, socket type, ASTM F439.
Valves: (2-inch and smaller)	Ball: CPVC, socket type with Teflon seats and Viton O-ring seals; Chemtrol Tru Bloc TU Series, Asahi/America Duo Bloc TU Series, GSR TU Series, or equal.
(3-inch thru 6-inch)	Butterfly; ref. Spec Section 40 05 64.

REMARKS:

1. Channel coarse bubble diffuser agitation air piping shall be piping system 1A. Ultraviolet agitation air piping shall be piping system 5A.
2. All air piping shall be insulated on discharge piping where human contact may be encountered. Areas include Blower Building, Sludge Thickening Building and U.V. Building. Refer to Spec Section 40 42 13.
3. Buried AA piping shall be the same as exposed. Provide a polyethylene tape wrap as specified in Section 40 05 24, paragraph 2.6B.

PIPING SYMBOL/SERVICE	**A-AERATION AIR SYSTEM – 1A** **AA-AGITATION AIR**
Test Requirements:	
Medium:	Air; ref/ Spec Section 40 05 04, paragraph 3.4B.
Pressure:	20 psig
Duration:	120 minutes
Gasket Requirements:	
Flange:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Mech Cpl:	EPDM

EXPOSED PIPE AND VALVES: (See drawings for pipe size and valve type)

(2-inch and smaller)

Pipe:	Stainless steel: ASTM A312, Schedule 40S. Ref Spec Section 40 05 23. Conn: threaded, ANSI B1.20.1. Ftgs: ASTM A403, material, ends and wall thickness to match pipe.
Valves:	Ball: Jamesbury Fig. 351, Nibco T-580, or equal. Globe: Crane 75F or 17TF, Lunkenheimer 123 or 214, or equal. Life check: Crane 27TFE, Lunkenheimer 231, or equal.

(3-inch and larger)

Pipe	Stainless steel: ASTM A778. Ref Spec Section 40 05 23. Conn: butt weld or flanged, couplings where specified. Ftgs: ASTM A774, material, ends and wall thickness to match pipe.
Valves:	Butterfly: ref. Spec Section 15103. Line with 10 mils of epoxy per Spec Section 40 05 24. Double-disc check; Ref Spec. Section 40 05 65.29. Line with 10 mils of epoxy per Spec Section 40 05 24.

REMARKS:

1. System 1A used for coarse bubble channel agitation air as shown.
2. All air piping shall be insulated on discharge piping where human contact may be encountered. Areas include sludge thickening building, U.V. building, and blower building. Ref. Spec Section 40 42 13. Paragraph 3.2.

PIPING SYMBOL/SERVICE:	**SA-SERVICE AIR, SYSTEM-2** **IA-INSTRUMENT AIR**
Test Requirements:	
Medium	Water; Ref Spec Section 40 23 19 paragraph 3.4B.
Pressure:	200 psig
Duration:	120 minutes
Gasket Requirements:	
Flange	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder.
Push-on/Mech Cpl:	N/A

EXPOSED PIPE AND VALVES: (See Drawings and pipe size and valve type)

(1/2-inch and smaller)	
Pipe:	Copper tube: ASTM B88, Type L, drawn. Conn: brass compression type. Ftgs: brass compression type, Swagelok, Gyrolok, or equal. See note 4.
(3/4-inch thru 2-inch)	
Pipe:	Copper tube: ASTM B88, Type L, drawn. Conn; solder type with threaded adapters for valves Ftgs: wrought copper or bronze, ANSI B16.22.
(2-inch and smaller)	
Valves:	Ball: Jamesbury Fig. 351, Nibco T-580, or equal. Globe; Crane 7TF or 17TF, Lunkenheimer 123 or 214, or equal. Lift Check: Lunkenheimer 1616, Crane 366E or equal.
(2 1/2-inch thru 6-inch)	
Pipe:	Steel: ASTM A53, ERW,Grade B, black no lining. Ref. Spec Section 40 05 24. Conn: butt weld, flanged for valves. Ftgs: steel, ASTM A234, ANSI B16.9; ends to match pipe.
Valves	Ball; Jamesbury 5150-31-2200TT, Nibco F-510, or equal. Check; Pennsylvania Airchek, Hoerbiger, or equal.

BURIED AND ENCSED PIPE AND VALVES: (See drawings for pipe size and valve type. Omit coatings on encased pipe.)

(2-inch and smaller)	Copper tube; ASTM B88, Type K, annealed or drawn. Conn; solder type. Ftgs; wrought copper or bronze, ANSI B16.22.

Valves:	Ball; same as exposed with extension stem and valve box.
(2 1/2-inch thru 6-inch)	Steel;same as exposed with polyethylene tape coating. Field application of coating to all couplings Ref. Spec Section 40 05 24. Conn; same as exposed with coating. Ftgs; same as exposed with coating.
Valves:	Ball; same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

REMARKS:

1. Piping between compressors and aftercoolers shall be insulated per spec. Section 40 42 13. Service air piping between compressor and aftercooler shall be galvanized steel as follows:

Pipe:	Steel; ASTM A53, Sch 40, galvanized. Ref. Spec Section 40 05 24. Conn; taper threaded, ANSI B1.20.1. Ftgs; Class 150, galvanized; ends to match pipe. Coating; buried – same as 2-1/2 inch thru 6-inch.

2. Utility station risers for service air piping shall be galvanized steel as specified in Note 1. Isolate from copper piping. Ref spec Section 40 05 06.
3. Lateral connections shall be made in the top half of the main line. Provide drip legs with valves at low points in the piping system and slope pipe to drip legs.
4. Instrument air to and from bubbler panels shall be 1/2-inch Type 316 stainless steel.

PIPING SYMBOL/SERVICE	**HW- POTABLE HOT WATER SYSTEM-7** **1W- POTABLE WATER**
Test Requirements	
Medium	Water; ref. Spec Section 40 05 04, paragraph 3.4C.
Duration:	60 minutes
Gasket Requirements:	
Flange:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Push-on/Mech Cpl:	EPDM

Exposed Pipe and Valves: (See drawings for pipe size and valve type. See Remarks for insulation requirements.)

(3-inch and smaller)	
Pipe:	Copper tube: ASTM B88, Type L, drawn. Ref. Spec Section 40 05 17. Conn: solder type with threaded or flanged adapters for valves. Ftgs; wrought copper or bronze, ANSI B16.22.
(2-inch and smaller)	
Valves:	Ball; Jamesbury Fig. 351, Nibco T-580, or equal. Globe; Crane 7TF or 17TF, Lunkenheimer 123 or 214, or equal. Swing check; Crane 137, Lunkenheimer 230, or equal.
(4-inch and larger)	
Pipe:	Steel; ASTM A53, seamless, Grade B, black with cement mortar lining. Ref. Spec Section 40 05 24. Conn; grooved mechanical pipe coupling or flanged. Ftgs; malleable iron, ductile iron, or steel per Spec Section 40 05 24; ends and lining to match pipe.
(2 1/2-inch and larger)	
Valves:	Butterfly; Ref. Spec Section 40 05 64. Substitute Type B on 2 1/2-inch lines. Swing check: spring loaded per Spec Section 40 05 65.23

Buried and Encased Pipe and Valves: (See drawings for pipe size and valve type. Omit coating on encased pipe. See Remarks for insulation requirements.)

(3-inch and smaller)	
Pipe:	Copper tube: ASTM B88, Type K, annealed or drawn. Conn; solder type, with threaded or flanged adapters for valves. Ftgs; wrought copper or bronze, ANSI B16.2

Valves:	Gate: ref. Spec Section 40 05 61, with extension stem and valve box. Coating M-1 per spec Section 09 90 00.
(4-inch and larger)	Ductile iron; AWWA C151 with cement mortar lining. Ref. Spec Section 40 05 19. Conn; grooved end or restrained push-on rubber gasket joint. Flanged adapters for valves. Ftgs; ductile iron per spec Section 40 05 19, coating, lining, and ends to match pipe.
Valves:	Butterfly; same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

REMARKS:

1. Manual air vents shall be provided at the high points and drains provided at the low points of each reach of pipeline as specified in Section 40 05 78.11 paragraph 3.3.
2. Exposed piping for potable hot water (HW) shall be insulated per spec Section 40 42 13. Buried HW lines shall be placed in insulated conduits per Spec Section 40 42 13.
3. Water lines installed over suspended or other type ceilings shall be insulated for condensation control.

PIPING SYMBOL/SERVICE:	**2W-NONPOTABLE CITY WATER SYSTEM-11** **3W-NO. 3 WATER**
Test Requirements:	
Medium:	Water; Ref. Spec Section 40 05 04, paragraph 3.4C.
Pressure:	200 psig
Duration:	120 minutes
Gasket Requirements:	
Flange:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Push-on/Mech Cpl:	Nitrile or Neoprene
(2-inch and smaller)	
Pipe:	Steel: ASTM A53, galvanized. Ref. Spec Section 40 05 24. Conn; taper threaded, ANSI B1.20.1. Ftgs: Class 150, galvanized.
Valves:	Ball: Jamesbury Fig. 351, Nibco T-580, or equal. Globe; Crane 7TF or 17TF, Lunkenheimer 123 or 214, or equal. Swing check: Crane 137, Lunkenheimer 230, or equal.
(2 1/2-inch thru 8-inch)	
Pipe:	Steel; ASTM A53, ERW, Grade B, black, no lining. Ref Spec Section 40 05 24 Conn; butt weld, grooved mech pipe coupling or flanged. Ftgs; malleable iron, ductile iron, or steel per Spec Section 40 05 24; ends to match pipe.
(2 1/2-inch thru 8-inch)	
Valves:	Butterfly; Ref. Spec Section 40 05 64. Substitute Type B on 2 1/2-inch lines. Swing check: spring loaded per spec Section 40 05 65.23
(10-inch and larger)	
Pipe:	Steel; same as 8-inch or AWWA C200, 1/4-inch thick, w/lining. Ref. Spec Section 40 05 24. Conn; butt weld, mech pipe coupling, or flanged. See Remarks. Ftgs; steel, ASTM A234, or fabricated steel, AWWA C208; lining and ends to match pipe.
Valves:	Butterfly; Ref. Spec Section 40 05 64. Swing check; spring loaded per Spec Section 40 05 65.23

Buried and Encased Pipe and Valves: (See drawings for pipe size and valve type. Omit coating on encased pipe.)

(3-inch and smaller)

Pipe:	Steel; same as exposed with polyethylene tape coating. Field application of coating to all couplings. Ref. Spec Section 40 05 24. Conn; taper threaded, ANSI B1.20.1 with coating. Flanged adapters for 2 1/2-inch, 3-inch valves. Ftgs: malleable iron, ASTM A197, ANSI B16.3, Class 150, galvanized with coating.
Valves:	Gate; Ref. Spec Section 15101, with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

(4-inch thru 12-inch)

Pipe	Ductile iron; AWWA C151. Ref. Spec Section 40 05 19. Conn; grooved end or restrained push-on rubber gasket joint. Flanged adapters for valves. Ftgs; ductile iron per Spec Section 40 05 19; lining and ends to match pipe.
Valves:	Butterfly; same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

(14-inch and larger)

Pipe	Ductile iron; same as 12-inch for pipe and ftgs or Concrete cylinder; ref. Spec Section 40 05 39.13. Conn; restrained bell and spigot with O-ring rubber gasket joint. Flanged adapters for valves. Ftgs; fabricated steel, mortar lined and coated. Ref. Spec Section 40 05 39.13
Valves:	Butterfly; same as exposed with extension stem and valve box. Coating M-1 per Spec Section 09 90 00.

REMARKS:

1. Manual air vents shall be provided at the high points and drains provided at the low points of each reach of pipeline as specified in Section 40 05 78.11 paragraph 3.3.
2. Grooved mechanical pipe couplings, 10 to 24 inch size, may be used with standard weight or heavier pipe; grooved or shouldered mechanical pipe couplings are permitted with fabricated pipe if the rated working pressure of the coupling exceeds the specified test pressure. Butt weld connections are not permitted with lined pipe.
3. System 11 piping installed in areas and locations subject to freezing (including ceiling areas which are not heated) shall be insulated per Spec Section 40 42 13.
4. 3W piping within sludge storage tanks shall be PVC per system 19.

PIPING SYMBOL/SERVICE	**GR-GRIT SYSTEM-17**

Test Requirements:

Medium	Water; Ref. Spec Section 40 05 04, paragraph 3.4C.
Pressure:	120 psi
Duration:	120 minutes

Gasket Requirements:

Flange:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Push-on/Mech Cpl:	Nitrile or Neoprene

Exposed Pipe and Valves: (See drawings for pipe size and valve type)

2 1/2-inch and larger)

Pipe:	Steel: ASTM A53, ERW, Grade B, black, Sch. 40, no lining. Ref. Spec Section 40 05 24. Conn; mechanical pipe coupling; flanged for valves. Ftgs: malleable iron, ASTM A47; ductile iron ASTM A536; or steel, ASTM A53, long tangent, seg. Weld for wyes, crosses, and laterals; ends and wall thickness to match pipe.
Valves	Lubricated plug: cast iron, flanged, Teflon or moly disulfide coated plug, Rockwell Fig. 143, Walworth Fig. 1797F, or equal, thru 5 inches; worm gear operator Rockwell Fig. 149, Walworth Fig. 1727F, or equal, 6 to 8 inch. Ball check; Ref. Spec Section 40 05 65.22

Buried and Encased Pipe and Valves: (See drawings for pipe size and valve type)

(3-inch and larger)

Pipe:	Ductile iron: AWWA C151, Class 56, standard coating, no lining. Ref. Spec Section 40 05 19. Conn: flanged, grooved or shoulder mechanical type. Ftgs: high alloy white cast iron, 650 BHN as fr by GIW Industries; ductile iron Abresist lined as mfr by Abresist Corp., or equal. Long radius, ends to match pipe.
Valves:	Lubricated plug; same as exposed with extension stem and valve box.

REMARKS:

1. Manual air vents shall be provided at the high points and drains provided at the low points of each reach of pipeline as specified in Section 40 05 78.23 paragraph 3.3.
2. Provide mechanical couplings at fittings and at 10-foot centers along straight pipe runs.

Piping Symbol/Service:	**D-Drain System-24** **RWP-Rainwater Pipe** **SD-Sanitary Drain** **V-Vent** **STD-Storm Drain**

Test Requirements:

Medium:	In accordance with Section 318, Uniform Plumbing Code.
Pressure:	In accordance with Section 318, Uniform Plumbing Code.
Duration:	In accordance with Section 318, Uniform Plumbing Code.

Gasket Requirements:

Flange	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder.
Push-on/Mech Cpl:	Nitrile or neoprene

Exposed Pipe and Valves: (See drawings for pipe size.)

(3-inch and smaller)

Pipe:	Steel; ASTM A53, galvanized. Ref. Spec Section 40 05 24. Conn; taper threaded, ANSI B1.20.1. Ftgs; cast iron, threaded drainage fittings, ASTM A126, ANSI B16.12, galvanized.
Valves:	None

(4-inch thru 12-inch)

Pipe:	Cast iron soil pipe (CISP); ASTM A74. Conn; service hub and spigot compression type or hubless cast iron sanitary system per CISPI 301. Ftgs; CISP, ASTM A74, joint options to match pipe.
Valves:	None

(14-inch and larger)

Pipe:	Ductile iron; AWWA C151. Ref Spec Section 40 05 19. Conn; flanged or mechanical. Ftgs; ductile iron, per Spec Section 40 05 19; ends to match pipe.

Valves:	None

Buried and Encased Pipe and Valves Under and Five Feet Outside Building: (See Drawings for pipe size)

(12-inch and smaller)

Pipe:	Cast iron soil pipe (CISP); same as exposed.
Valves:	None

(14-inch and larger)

Pipe:	Ductile iron; same as exposed.
Valves:	None

Buried and Encased Pipe and Valves Beyond Five Feet Outside Building
(See drawings for pipe size)

(8-inch and smaller)

Pipe	PVC; ASTM D1784, Class 12454-B, ASTM D2665, Sch. 40. Ref. Spec Section 40 05 31. Provide magnetic tracer tape. Conn; plain end, solvent weld. Ftgs; PVC, socket type, DWV, ASTM D2665.
Valves:	None

(10-inch and 12-inch)

Pipe:	PVC, ASTM D3034, SDR 35. Provide magnetic tracer tape. Conn; Push-on with nitrile gasket. Ftgs; PVC or IPS cast iron; ends to match pipe.
Valves:	None

(14-inch and larger)	Reinforced concrete pipe (RCP); Ref. Spec Section 33 42 13. Conn; ASTM C443, rubber gasket type. Ftgs; concrete manhole as specified on the drawings.
Valves:	None

REMARKS:

1. HVAC equipment condensate drains shall be copper tube; ASTM B88, Type M, drawn. Fittings shall be wrought copper or bronze, ANSI B16.22. Connections shall be solder type with threaded adapters for equipment connections where required. Products and fabrication shall be as specified in Section 40 05 17.

END OF SECTION

SECTION 40 05 05 – JOINT GASKETS

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies rubber gaskets for push-on compression type joints used with fabricated steel pipe, steel pipe, reinforced concrete pipe, concrete cylinder pipe, and cement mortar lined and coated steel pipe.

1.2 QUALITY ASSURANCE

A. REFERENCES: Section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   1. ASTM D395 - Rubber Property – Compression Set, Test for
   2. ASTM D4112 - Rubber for Properties in Tension, Test for
   3. ASTM D471 - Rubber Property-Effect of Liquids, Test for
   4. ASTM D573 - Rubber-Deterioration in an Air Oven, Test for
   5. ASTM D1149 - Rubber Deterioration-Surface Ozone Cracking in a Chamber (Flat Specimens), Test for
   6. ASTM D2240 - Rubber Property-Durometer Hardness, Test for

B. TESTING: Certified copies of test reports indicating that the gasket material has been tested and that the results of the tests comply with the requirements specified in Section 40 05 05, paragraph 2.2 shall be provided as product data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gasket stock shall be a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain no less than 50 percent by volume neoprene and shall be free from factice, reclaimed rubber and other deleterious substances.

2.2 PHYSICAL REQUIREMENTS

A. The compound shall meet the following physical requirements when tested in accordance with the specified ASTM standards.

B. TENSILE (ASTM D4l2): The tensile strength shall be 1,500 psi minimum and the ultimate

C. elongation shall be 350 percent minimum.

D. HARDNESS (ASTM D2240, TYPE A DUROMETER): The compound shall have a hardness in the range of 3S to 50 for concrete spigots and 50 to 65 for steel spigots.

E. COMPRESSION SET (ASTM D395): The compression set shall not exceed 20 percent when compressed for 22 hours at 70 degrees C.

F. The test specimens shall be circular discs cut from the gaskets. Test specimens shall be 0.500 (± 0.005 - 0.025) inches in height. The diameter of the test specimen shall be that of the gasket but not to exceed 1.129 ±0.010 inches in diameter.

G. AGING (ASTM D573): The test specimen deterioration shall be less than 20 percent reduction in tensile strength, 40 percent reduction in ultimate elongation, and 15 points increase in hardness.

H. EFFECT OF LIQUIDS (ASTM D471): The maximum volume change in oil and in water shall be as follows:

1. Oil: 100 percent in ASTM Oil No.3.
2. Water: 15 percent.

I. The test specimens shall have a thickness of 0.080 +0.005 inches and shall be circular discs cut from the gasket.

J. OZONE CRACKING (ASTM D1149):

K. The test specimen shall be a gasket loop mounted to give at least 20 percent elongation. There shall be no cracking visible at two times magnification of the gasket after 100 hours exposure to 1 mg/1 ozone at 40 degrees C.

2.3 PRODUCT DATA

A. In accordance with Section 01 33 00 “Submittal Procedures,” the Contractor shall provide certified copies of test reports specified in Section 40 05 05, paragraph 1.2 B.

PART 3 - EXECUTION

3.1 GASKETS

A. The gaskets shall be installed in accordance with the manufacturer’s recommendations.

END OF SECTION

SECTION 40 05 06 – COUPLINGS, ADAPTORS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies the following methods of connecting metallic piping: flanges, threading, mechanical couplings, dielectric unions, and welding.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.
   1. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)
   2. ANSI B1.20.1 - Pipe Threads, General Purpose (Inch)
   3. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
   4. ANSI B16.5 - Pipe Flanges and Flanged Fittings
   5. ANSI B18.2.1 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws
   6. ANSI B18.2.2 - Square and Hex Nuts
   7. ANSI B31.1 - Power Piping
   8. ANSI B31.3 - Chemical Plant and Petroleum Refinery Piping
   9. ASME Section IX - Boiler and Pressure Vessel Code; Welding and Brazing Qualifications
   10. ASTM F37 - Standard Test Methods for Seal ability of Gasket Materials
   11. ASTM F104 - Standard Classification System for Nonmetallic Gasket Materials
   12. ASTM F152 - Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials
   13. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
   14. AWWA C206 - Field Welding of Steel Water Pipe
   15. AWWA C207 - Steel Pipe Flanges for Waterworks Service—Size 4- to 144-inch.
   16. AWWA C606 - Grooved and Shouldered Type Joints
   17. AWWA M11 - Steel Pipe—A Guide for Design and Installation

PART 2 - PRODUCTS

2.1 FLANGE ASSEMBLIES

A. FLANGES: Cast iron flanges shall be faced in accordance with ANSI B16.1. Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face. Class 150 and Class 300 forged steel flanges shall be raised face conforming to ANSI B16.5. Lightweight slip-on flanges shall be plain face conforming to AWWA C207, Class B and ANSI B16.5. Unless otherwise specified, steel flanges shall be ANSI B16.5, Class 150 or AWWA C207, Class D. Class E AWWA flanges shall be provided where test pressure exceeds 175 psi. Plain faced flanges shall not be bolted to raised face flanges.

B. GASKETS: material shall be as specified in Section 40 05 06, paragraph 2.3. Gaskets for plain faced flanges shall be the full face type. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter. Unless otherwise specified, gaskets for raised face flanges shall match the raised face and shall be 1/16 inch thick for pipe 3-1/2 inches and less in diameter and 1/8 inch thick for pipe 4 inches and larger.

C. BOLTS: Flange assembly bolts shall be ANSI B18.2.1 standard square of hexagon head carbon steel machine bolts with ANSI B18.2.2 standard hot pressed hexagon nuts. Threads shall be ANSI B1.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5. Flange assembly bolts and nuts for submerged or buried service shall be made of noncorrosive high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.

2.2 MECHANICAL COUPLINGS

A. SLEEVE-TYPE COUPLINGS: Unless otherwise specified, sleeve-type mechanical pipe couplings shall be Rockwell Type 411, Dresser Style 38, or equal, with the stop removed from the middle ring. Reducing couplings shall be Rockwell Type 415, Dresser Style 62, or equal. Sleeve-type flanged coupling adapters shall be Rockwell Type 913, Dresser Style 128, or equal. Insulating couplings shall be Rockwell Type 416, Dresser Style 39, or equal. Bolts and nuts shall be made of high-strength, low-allow steel as specified in ANSI/AWWA C111/A21.11. Gaskets shall be as specified in Section 40 05 06, paragraph 2.03 and AWWA C111.

B. PLAIN END COUPLINGS: Plain end pipe couplings for pipe sizes 6 inches and smaller shall be Gustin-Bacon 200, Victaulic Style 99, or equal for Schedule 80 pipe and Gustin-Bacon 205, Victaulic Style 90, or equal for lighter weight pipe. Plain end couplings for pipe sizes 8 inches and larger shall be Gustin-Bacon 200, Victaulic Style 99, or equal. Unless otherwise specified, bolts and nuts shall comply with AWWA C606. Gaskets shall be as specified in Section 40 05 06, paragraph 2.03 and AWWA C606.

C. GROOVED END COUPLINGS: Grooved end flexible-type couplings shall be Gustin-Bacon 100, Victaulic Style 77, or equal. Grooved end rigid-type couplings shall be Gustin-Bacon 120 Rigi-Grip, Victaulic Style 07 Zero-Flex, or equal. Flexible-type couplings shall be used for all piping greater than 12 inches in diameter; for pipe 12 inches in diameter and less in rack-mounted tunnel piping applications; and for grooved joints adjacent to pump or blower suction and discharge where grooved couplings are used for noise and vibration control. All other applications for piping 12 inches in diameter and less shall utilize rigid-type couplings. Grooved end flanged coupling adapters shall be either Gustin-Bacon 154, Victaulic Style 741, or equal. Snap-joint grooved end couplings shall be Gustin-Bacon 115, Victaulic Style 78, or equal. Cut grooves are not permitted on fabricated or lightwall pipe. Unless otherwise specified, bolts and nuts shall comply with AWWA C606. Bolts and nuts for submerged or buried service shall be high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11. Gaskets shall be as specified in Section 40 23 19, paragraph 2.3 and AWWA C606.

2.3 GASKETS

A. Gaskets are designated in Section 40 23 19 shall be as follows:
   1. EPDM: ethylene-propylene-diene-terpolymer.
   2. Neoprene : neoprene.
   3. Nitrile : nitrile (Buna N).

4. Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder; ASTM F104 (F712400), 2500 psi (ASM F152), 0.2 ML/HR LEAKAGE FUEL A (ASTM F37).
5. Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder; ASTM F104 (F712400), 2500 PSI (ASM F152), 0.1ml/hr leakage Fuel A (ASTM F37).
6. Gylon gasketing, Garlock Style 3500, 2000 psi (ASTM F152), 0.22 ml/hr Fuel A (ASTM F37).
7. Gylon gasketing, Garlock Style 3510, 2000 psi (ASTM F152), 0.04 ml/hr Fuel A (ASTM F37)
8. Gylon gasketing, Garlock Style 3504, 2000 psi (ASTM F152), 0.12 ml/hr Fuel A (ASTM F37).
9. TFE: non creeping tetrafluoroethylene (TFE) with insert filler.
10. TFE bonded EPDM: TFE bonded to EPDM in full-face gasket having concentric-convex molded rings.

2.4 THREAD

A. Pipe thread dimensions and size limits shall conform to ANSI B1.20.1.

2.5 DIELECTRIC UNIONS

A. Dielectric unions shall be EPCO, Capital, or equal.

2.6 COATINGS

A. Unless otherwise specified, flange assemblies and mechanical type couplings for buried installation shall be field coated with System M-1 as specified in Section 09 90 00.

2.7 PRODUCT DATA

A. In accordance with Section 01 33 00 “Submittal Procedures,” the Contractor shall provide for each welder, a welder qualification certificate indicating the welder is certified for pipe welding in accordance with ASME Boiler and Pressure Vessel, Section IX. Each welder’s certificate shall be provided to the Engineer prior to that welder working on the job.

PART 3 - EXECUTION

3.1 PIPE CUTTING, THREADING AND JOINTING

A. Pipe cutting, threading and jointing shall conform to the requirements of ANSI B31.1

3.2 PIPE WELDING

A. Pipe shall be welded by ASME-certified welders using shielded metal arc, gas shielded arc or submerged arc welding methods. Welds shall be made in accordance with the requirements of ANSI B31.1 for piping Systems 8, 26, and 28 specified in Section 40 23 19. Welds shall be made in accordance with the requirements of ANSI B31.3 for piping System 20 specified in Section 40 23 19. Welds for piping systems not specified above shall be made in accordance with AWWA C206.

3.3 TAKEDOWN COUPLINGS

A. Takedown couplings shall be screw unions, flanged or grooved end mechanical coupling type joints and shall be provided as specified. Flanged or grooved end joints shall be employed on pipelines 2-1/2 inches in diameter and larger. Where piping passes through walls, takedown couplings shall be provided within 3 feet of the wall, unless specified otherwise. A union or flanged connection shall be provided within 2 feet of each threaded end valve.

3.4 FLEXIBILITY

A. Unless otherwise specified, piping 2 inches in diameter and larger passing from concrete to earth shall be provided with two pipe couplings or flexible joints as specified within 2 feet or one pipe diameter of the structure, whichever is greater. Where required for resistance to pressure, mechanical couplings shall be restrained in accordance with AWWA M11, paragraph 13.10, Tables 13-6 and 13-7, and Figure 13-17.

3.5 DIELECTRIC CONNECTIONS

A. Where a copper pipe is connected to steel or cast iron pipe, an insulating section of rubber or plastic pipe shall be provided. The insulating section shall have a minimum length of 12 pipe diameters. Dielectric unions as specified in Section 40 05 06; paragraph 2.5 may be used instead of the specified insulating sections. Where copper pipe is supported from hangers, it shall be insulated from the hangers, or copper-plated hangers shall be used.

END OF SECTION

SECTION 40 05 07 - HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Structural attachments.
   4. Pipe guides.
   5. Formed-steel channel.

B. Related Requirements:
   1. Section 03 00 00 “Cast-in-Place Concrete:” Execution requirements for placement of concrete housekeeping pads specified by this Section.
   2. Section 09 90 00 “Painting and Coating:” Product and execution requirements for painting specified by this Section.
   3. Section 40 05 19 “Ductile Iron Process Pipe:” Execution requirements for placement of hangers and supports as specified by this Section.
   4. Section 40 05 51 “Common Requirements for Process Valves:” Common product requirements for valves for placement by this Section.
   5. Section 40 42 13 “Process Piping Insulation:” Insulation requirements for pipe, fittings, and appurtenances.

1.2 REFERENCE STANDARDS

A. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

B. ASME International:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.9 - Building Services Piping.

C. ASTM International:
   1. ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacturer, Selection, Application, and Installation.

1.3 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for coordination.
B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and as indicated on Drawings.

1.4 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit manufacturer information, including load capacity.
C. Shop Drawings: Indicate system layout with location, including critical dimensions, sizes, hanger and support locations, and details of trapeze hangers, anchors, and guides.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
F. Delegated Design Submittals:
    1. Submit signed and sealed Shop Drawings with design calculations and assumptions for load carrying capacity of trapeze, multiple pipe, and riser support hangers.
    2. Indicate sizing methods used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.
G. Manufacturer Instructions: Submit special procedures and assembly of components.
H. Qualifications Statements:
    1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.
    2. Submit manufacturer's approval of installer.

1.6 QUALITY ASSURANCE

A. Perform Work according to AWS D1.1 for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.
D. Protection:
    1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
    2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:
    1. Verify field measurements prior to fabrication.
    2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for warranties.
B. Furnish one-year manufacturer's warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Globe Pipe Hanger Products
   2. Hilti, Inc.
   3. NIBCO
   4. Substitutions: As specified in Section 01 60 00 “Product Requirements.”
B. Description:
   1. Comply with ASME B31.1.
   2. Provide means of vertical adjustment after erection.
   3. Pipe Sizes 1/2 to 1-1/2 Inches:
      a. Material: Steel; ASTM A36
      b. Configuration: Split ring.
      c. Swivel: Adjustable.
   4. Pipe Sizes 2 Inches and Larger:
      a. Material: Steel; ASTM A36
      b. Configuration: Clevis.
      c. Swivel: Adjustable.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast-iron J-hook.
   7. Wall Support for Pipe Sizes 4 Inches and Larger: Welded steel bracket
   8. Vertical Support: Riser clamp.
   9. Floor Supports: Cast-iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
C. Performance and Design Criteria:
   1. Pipe Hangers:
      a. Design for pipe movement without disengagement of supported pipe.
      b. Allow for expansion and contraction of piping while eliminating undue stress on piping appurtenances and equipment.
      c. Provide linkage to permit lateral or axial movement where anticipated.
      d. If horizontal pipe movement is greater than 1/2-inch, or if hanger rod deflection from the vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger rod and structural attachment to maintain rod vertical in hot position.
   2. Heat Transmission: Design supports, hangers, anchors, and guides to prevent excessive heat from being transmitted to building structure, equipment, or piping appurtenances.
   3. Riser Supports: Support risers on each floor with riser clamps and lugs, independent of connected horizontal piping.
   4. Point Loads:
      a. Support plastic piping containing meters, valves, appurtenances, and other point loads on both sides.

b. Avoid point loads on plastic piping by providing extra-wide pipe saddles or galvanized-steel shields.

5. Noise Reduction: Wrap copper tubes located within buildings in a 2-inch wide strip of neoprene at each pipe support, bracket, clip, and hanger.

2.2 HANGER RODS

A. Material: Steel; ASTM A576.
B. End Connections: All thread.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify that field dimensions as indicated on Shop Drawings.

3.2 INSTALLATION

A. Obtain permission from Engineer before using powder-actuated anchors.
B. Obtain permission from Engineer before drilling or cutting structural members.
C. Inserts:
   1. Placement:
      a. Concrete forms.
      b. Reinforced concrete slabs and sides of reinforced concrete beams.
   2. Piping 4 Inches and Larger: Provide hooked rod to concrete reinforcement section.
   3. Concrete Slabs Forming Finished Ceiling: Locate inserts flush with slab surface.
D. Pipe Hangers and Supports:
   1. Comply with ASME B31.1.
   2. Support horizontal piping as indicated on Drawings.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Minimum Vertical Adjustment: 1-1/2 inches.
   5. Supports:
      a. Independently of equipment.
      b. Horizontal Ductile-Iron Piping: Adjacent to each hub, with maximum 5-foot spacing between supports.
      c. Riser Piping: Independent of connected horizontal piping.
   6. Piping in Parallel at Same Elevation: Provide multiple pipe or trapeze hangers.
   7. Clamps and Brackets:
      a. Provide welded steel brackets if piping is to be run adjacent to building walls or columns.
      b. Use beam clamps if piping is to be suspended from building steel.
      c. Insulated Piping: Provide two bolted clamps designed to accommodate insulated piping.
      d. Use offset clamps if pipes are indicated as offset from wall surfaces.
E. Insulation:
   1. Provide clearance in hangers and from structure and other equipment for installation of insulation.

F. Equipment Bases and Supports:

1. Housekeeping Pads:
    a. Material: Concrete, as specified in Section 03 00 00 - Cast-in-Place Concrete.
    b. Minimum Thickness: As indicated on Drawings.
    c. Plan Area: Extend 6 inches beyond supported equipment.

G. Finishes:
1. Prime coat exposed steel hangers and supports as specified in Section 09 90 00 “Painting and Coating.”
2. Hangers and supports" located in crawlspaces, pipe shafts, and suspended ceiling spaces are not considered as exposed.

3.3 ATTACHMENTS

A. Pipe Hanger Spacing:
1. Pipe Material: CPVC.
    a. Size: 1-inch and smaller.
    b. Maximum Hanger Spacing: 3-feet.
    c. Hanger Rod Diameter: 1/2-inch .
2. Pipe Material: PVC.
    a. Maximum Hanger Spacing: 4-feet.
    b. Hanger Rod Diameter: 3/8-inch.

END OF SECTION

SECTION 40 05 19 – DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies ductile iron pipe, ductile fittings and gaskets.

B. DEFINITION: Where cast iron pipe is specified, the term and symbol shall mean ductile iron pipe.

C. RELATED REQUIREMENTS: Section contains references to the following documents. References are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. ANSI A21.14 - Ductile-Iron Fittings 3 In. Through 24 In., for Gas
2. ANSI A21.52 - Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand Lined Molds for Gas
3. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
4. ANSI B16.5 - Pipe Flanges and Flanged Fittings
5. ASTM A716 - Ductile-Iron Culvert Pipe
6. ASTM C150 - Portland Cement
7. AWWA C104 (ANSI A21.4) - Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water
8. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
9. AWWA C110 (ANSI A21.10) - Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
10. AWWA C111 (ANSI A21.11) - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
11. AWWA C115 (ANSI A21.15) - Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
12. AWWA C150 (ANSI A21.50) - Thickness Design of Ductile-Iron Pipe
13. AWWA C151 (ANSI A21.51) - Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
14. AWWA C153 (ANSI A21.53) - Ductile-Iron Compact Fittings, 3 In. Through 12 In. for Water and Other Liquids
15. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances
16. AWWA C606 – Grooved and Shouldered Type Joints

PART 2 - PRODUCTS

2.1 GENERAL

A. PIPE DESIGN: Materials and manufacture shall comply with the following documents:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	AWWA C151
Water or other liquid Gas ANSI A21.52	
Gravity service pipe	ASTM A716
Joints	
Rubber gasket	AWWA C111
Threaded flange	AWWA C115
Fittings	AWWA C110/AWWA C153
Water or other liquid Gas ANSI A21.14	
Cement mortar lining	AWWA C104

2.2 PIPE

A. Unless otherwise specified, ductile iron pipe shall be Class 50 and have nominal laying lengths of 18 or 20 feet. For grooved end and flanged pipe, wall thickness shall be minimum Class 53 except where the specified pressure requires heavier pipe.

2.3 GASKETS

A. Unless otherwise specified, gasket stock shall be a synthetic rubber compound in which the elastomer is nitrile or neoprene. The compound shall contain not less than 50 percent by volume nitrile or neoprene and shall be free from factice, reclaimed rubber and other deleterious substances. Gaskets shall, in addition, comply with AWWA C111 for push-on and mechanical joints and with AWWA C606 for grooved end joints.

2.4 FITTINGS

A. Unless otherwise specified, fittings shall conform to AWWA C110. Ends shall be flanged, restrained mechanical joint, restrained push-on, or grooved to suit the conditions specified. The AWWA C153 compact ductile iron fittings in sizes 3 through 12 inches are an acceptable substitute for standard fittings unless otherwise specified. Long-radius elbows shall be provided where specified. Grooved end fittings and couplings shall be provided by the same manufacturers.

2.5 JOINTS

A. UNRESTRAINED JOINTS

1. PUSH-ON JOINTS: Unrestrained joints, where specified, shall be the rubber ring compression, push-on type joint suitable for buried service. Unrestrained joints shall be the Fastite Joint as manufactured by American Cast Iron Pipe Company, the Tyton Joint as manufactured by U.S. Pipe, or equal. This joint is not permitted on fittings or specials, unless otherwise specified. Unless otherwise specified, joints shall have an allowable deflection up to 5 degrees at specified pressures. Joint assembly and field cut joints shall be made in strict conformance with AWWA C600 and manufacturer's recommendations.
2. MECHANICAL JOINTS: Where specified, mechanical joints for above or below ground service shall meet the requirements of ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111. Gaskets and bolts and nuts shall comply with Section 40 05 19 paragraph, 2.3 and 2.5 D, respectively.

B. RESTRAINED JOINTS

1. GENERAL: Unless otherwise specified, restrained joints are required for all exposed and buried piping. Unless otherwise specified, restrained joints shall be flanged or grooved end for exposed service and push-on or grooved end for buried service.
2. PUSH-ON JOINTS: Restrained push-on joints shall be as specified in Section
3. 40 05 19, paragraph A.1., modified for restraint. Joints shall be the Flex-Ring or Lok-Ring Joint as manufactured by American Cast Iron Pipe Company, TR Flex Joint as manufactured by US Pipe, or equal. Restrained joints shall be capable of being deflected after full assembly. Joint assembly shall be in strict conformance with AWWA C600 and manufacturer's recommendations. No field cuts of restrained pipe are permitted without prior approval of the Engineer.
4. FLANGE ASSEMBLIES: Unless otherwise specified, flanges shall be ductile iron and shall be threaded-on flanges conforming to ANSI/AWWA A21.15/C115 or cast-on flanges conforming to ANSI/AWWA A21.10/C110. Flanges shall be adequate for 250 psi working pressure. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges. Where specified, flanges shall be threaded-on or cast-on flanges conforming to ANSI B16.1, Class 250. Unless otherwise specified, bolts and nuts for flange assemblies shall conform with Section 40 05 06, paragraph 2.1 C. Gaskets shall be specified in Section 40 05 06, paragraph 2.1 B.
5. GROOVED END JOINTS: Grooved end couplings shall conform to AWWA C606 and shall be Gustin-Bacon 500 Series, Victaulic Style 31, or equal with flush seal type gasket designed for ductile iron pipe. Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service. Unless otherwise specified, bolts and nuts shall comply with Section 40 05 19, paragraph 2.5 D.
6. MECHANICAL JOINTS: Where specified, restrained mechanical joints shall be the positive restraint type. Mechanical joints with retainer glands are not acceptable. Locked mechanical hydrant tees, bends and adapters are an acceptable substitute for anchoring fire hydrants and valves to the pipe main.

C. BALL AND SOCKET FLEXIBLE JOINT PIPE: Ball and socket flexible joint pipe shall be the boltless type and shall allow a maximum joint deflection of 15 degrees. Each joint shall be provided with a retainer lock to prevent rotation after assembly. Joints shall be the Flex-Lock Joint as manufactured by American Cast Iron Pipe Company, USIflex as manufactured by U.S. Pipe, or equal.

D. BOLTS AND NUTS: Corrosion-resistant bolts and nuts for use with ductile iron joints shall be high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11.

2.6 PIPE COATING – Refer to Drawings.

2.7 PIPE LINING

A. ASPHALTIC LINING: Unless otherwise specified, pipe and fittings shall be lined with asphaltic material as specified in AWWA C151.
B. CEMENT MORTAR LINING: Where specified interior surfaces of pipe and fittings, cement shall be mortar lined in accordance with AWWA C104. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkali's.
C. GLASS LINING: Where specified, pipe and fittings shall be glass lined with a dual layer coating system of vitreous material to a minimum thickness of 10 mils. Glass lining shall provide continuous coverage as tested by a low voltage holiday detector with only isolated voids permitted due to casting anomalies. Voids, other than isolated pinholes, shall be cause for rejection.
D. Ductile or cast iron pipe shall be bored, machined, or grit blasted to remove any voids, protrusions or surface irregularities to obtain a smooth continuous surface for glass lining. Pipe shall be at least Class 53 on diameters of 6 inches or greater except for pipe to be bored or machined which shall be of a suitable wall thickness to assure boring or machining will not impair minimum wall thickness required for Class 53. 4-inch pipe shall be Class 56. Fittings shall be ground, or grit blasted to remove any voids, protrusions or surface irregularities. Glass lining shall be Ferrock MEH-32, Ervite SG-14, or equal.

2.8 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 "Submittal Procedures:"
   1. Shop drawings.
   2. Alignment drawings.
   3. Certifications specified in the following documents:
      ANSI A21.14, paragraph 14-4.2
      ANSI A21.52, paragraph 52-4.2
      ASTM A716, paragraph 4.2
      AWWA C110, paragraph 10-5.3
      AWWA C111, paragraph 11-6.1
      AWWA C115, paragraph 15-4.2
      AWWA C151, paragraph 51-5.2
      AWWA C153, paragraph 53-6.3
      AWWA C606, paragraph 4.1.1.1

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Piping runs specified on the drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01 33 00 "Submittal Procedures." Pipe shall be installed in accordance with AWWA C600. Connections to existing structures and manholes shall be made so that the finished work will conform as nearly as practicable to the requirements specified for the new manholes, including necessary

concrete work, cutting and shaping. Concrete mortar shaping within any structure and manhole shall be as specified.

B. INSULATING SECTIONS: Where a metallic nonferrous pipe or appurtenance is connected to ferrous pipe or appurtenance, an insulating section shall be provided as specified in Section 40 05 06, paragraph 3.1 E.

C. ANCHORAGE: Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted in accordance with Section 01 33 00 "Submittal Procedures."

3.2 ACCEPTANCE TESTING

A. Hydrostatic pressure tests shall be conducted in accordance with Section 4 of AWWA C600 except that test pressures and allowable leakage shall be as listed in Section 33 05 05.31. The contractor shall conduct the tests in the presence of the Engineer.

3.3 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall be provided for all buried pipe and and fittings. Installation of polyethylene shall be as specified in ANSI A21.5, Section 5-4.2.1 and these specifications. Pipe, fittings, vales and couplings shall be wrapped. Fittings that require concrete backing shall be wrapped prior to placing the concrete. The polyethylene tube seams and overlaps shall be wrapped and held in place by means of a 2-inch wide plastic backed adhesive tape. The tape shall be Polyken No. 900 (polyethylene), scotch wrap adhesive shall bond securely to both metal surfaces and polyethylene film. Bedding and initial backfill for polyethylene wrapped pipe shall be a well-graded granular material which will not cut or damage the polyethylene tube during placement and backfilling. Sharp angular material over 0.5 inch shall not be used with polyethylene encasement.

END OF SECTION

SECTION 40 05 23 – STAINLESS STEEL PROCESS PIPE AND TUBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies stainless steel pipe and fittings.

B. TYPES OF SERVICE: Stainless steel piping specified in this Section shall be used for the following service applications:

Application	Location
Agitation Air	Raw Sewage Distribution Channel; Distribution, and Equalization Channels.
Grit Piping	Grit Pumps-suction and discharge piping.

1.2 QUALITY ASSURANCE

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

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, 250, and 800
2. ANSI B16.11 - Forged Steel Fittings, Socket Welding and Threaded
3. ANSI B31.1 - Power Piping
4. ANSI B36.19M - Stainless Steel Pipe
5. ASME Section IX - Boiler and Pressure Vessel Code; Welding and Brazing Qualifications
6. ASTM A182/A182M - Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
7. ASTM A193/A193M - Alloy-Steel and Stainless Steel Bolding Materials for High-Temperature Service
8. ASTM A194/A194M - Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service
9. ASTM A240 - Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
10. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes
11. ASTM A312/A312M - Seamless and Welded Austenitic Stainless Steel Pipes
12. ASTM A403/A403M - Wrought Austenitic Stainless Steel Piping Fittings
13. ASTM A409/A409M - Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service
14. ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
15. ASTM A774/A774M - As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

B. QUALIFICATIONS: All shop fabricated stainless steel pipe and fittings shall be furnished by a single manufacturer who is experienced and qualified in the manufacture and fabrication of the items to be furnished. The pipe and fittings shall be shop-fabricated and field-installed in accordance with common industrywide practices and methods and shall comply with these specifications. Only weld procedures which have been qualified under ASME Section IX and only welders who have successfully completed performance qualification tests per ASME Section IX on these qualified procedures shall be utilized.

C. TESTING: Factory testing shall conform to the requirements of ASTM A312, ASTM A409 HT-0, or ASTM A778, depending on the size and type of stainless steel pipe provided.

1.3 SUBMITALS

A. The following information shall be provided in accordance with Section 01 33 00 "Submittal Procedures:"
   1. Shop fabrication drawings showing details of materials, piping, fittings, couplings, dielectric connections, joint locations, and details, types and locations of supports.
   2. Other data necessary to show conformance of the complete piping system to these specifications.
   3. A copy of this specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviations.

PART 2 - PRODUCTS

2.1 PIPE

A. Stainless steel pipe 2 1/2-inches and smaller shall be Type 304L, seamless, threaded joints conforming to ASTM A312. The minimum wall thickness shall be Schedule 40S.

B. Unless otherwise specified, stainless steel piping 3 inches and larger shall be manufactured from ASTM A240 annealed and pickled sheets and plates, Type 304L, in accordance with ASTM A778 or ASTM A409 HT-0. Only extra-low carbon (ELC) materials with .03 percent maximum carbon shall be used. Pipe shall be manufactured to nominal pipe sizes as listed in ANSI B36.19, Table 2, and shall have the following nominal wall thickness:

Air Piping Nominal pipe size, inches	Schedule gage/plate	Wall thickness inches
3-8	Schedule 5S	
10-12	12-gage sheet	0.105
14-18	11-gage sheet	0.120
20	10-gage	0.135
24-36	3/16-gage	0.188
42-48	1/4-gage	0.250
Grit Pumps-Suction and Discharge Piping		
3-8	Schedule 40 S	

2.2 FITTINGS

A. Stainless steel fittings, 2- 1/2-inch and smaller, shall be ASTM A403, of the same material and pressure rating as the pipe, threaded long radius with dimensions conforming to ANSI B16.11.

B. Unless otherwise specified, stainless steel fittings, 3-inch and larger, shall be butt-weld type manufactured in accordance with ASTM A774 of the same material and in the same thicknesses as the pipe. Long radius elbows up to 24 inches in diameter shall be smooth flow. All short radius, special radius, and reducing elbows, and long radius elbows greater than 24 inches in diameter shall be of mitered connection. Tees, crosses, laterals, and wyes shall be shop-fabricated from pipe.

2.3 JOINTS

A. Stainless steel pipe fabricated into spool pieces shall have shop-welded circumferential butt-weld joints or flanges. Unless otherwise specified, flanged joints shall be Van Stone joints made up of stainless steel slip-on type rolled-angle face rings and ductile iron back-up flanges drilled to ANSI 16.1, Class 125 standard. The angle face ring thickness shall be equal to or greater than the wall of the pipe or fitting to which it is welded, and it shall be continuously welded on both sides to the pipe or fitting. The angle leg shall not interfere with the flange bolt holes. For submerged joints, back-up flanges shall be stainless steel pipe flanges. The back-up flanges shall be supplied with the following nominal thicknesses.

Nominal pipe size, inches	Flange thickness, inches
3	1/2
4	9/16
6-10	5/8
12-16	3/4
18-20	7/8
24-30	1
36	1 1/8
42	1 1/4

2.4 COUPLINGS

A. GENERAL: Fabricated stainless steel piping shall be shop-prepared for pipe couplings where specified. Unless otherwise specified, couplings shall be arched-band or grooved type. Only stainless steel couplings shall be used with stainless steel pipe for buried or submerged service.

B. SLEEVE TYPE: Not included.

C. ARCHED-BAND TYPE: Arched-band type couplings shall be stainless steel of the same material and wall thickness as the pipe and shall be Depend-O-Lok type as manufactured by Brico or equal. Couplings shall be Fixed—FxF, Expansion—ExE, or Fixed by Expansions—FxE as specified or as required. The pipe shall be plain-end with external weld beads ground smooth and with S.S. restraining rings shop-welded to the piping for fixed type couplings.

D. GROOVED-END TYPE: Grooved-end or split type couplings shall be malleable iron or ductile iron as specified in Section 40 05 06 paragraph 2.2 C except that submerged couplings shall be the same material as the pipe. The pipe ends shall be roll-grooved to the coupling manufacturer’s specifications. Where roll grooving is impractical, the pipe shall have heavy-wall machine-grooved pipe nipples or machined ring collars fully welded to the

pipe or fitting. Nipples shall be taper-bored to the I.D. of the adjoining pipe to allow full-weld penetration. Collars shall be welded on both sides to the piping. Nipples and collars shall be of the same alloy as the piping.

E. EXPANSION TYPE: Unless otherwise specified, expansion couplings shall be the flanged rubber arch type as specified in Section 40 05 06. Pipe flanges shall be provided for these couplings.

2.5 THREADED CONNECTIONS

A. Threaded pipe, gage, or instrument connections shall be made using stainless steel, 150-pound, threaded half-couplings conforming to ASTM A182 or ASTM A276, shop welded to the pipe at the locations specified.

2.6 GASKETS

A. Unless otherwise specified, gaskets shall be as specified in Section 40 05 04 and in Section 40 05 06, paragraph 2.3. For air lines, gaskets shall be neoprene or EPDM suitable for use at temperatures to 240 degrees F.

2.7 BOLTS

A. Bolts, nuts, and washers for stainless steel flange assemblies and stainless steel couplings shall be the same material, conforming to ASTM A320 for low-temperature service and ASTM A193 and ASTM A194 for high-temperature service. Bolts, nuts, and washers for other couplings shall be as specified in referenced paragraphs for the couplings.

2.8 PIPE SUPPORT SYSTEMS

A. Unless otherwise specified, all hangers, rods, structural attachments, and other components of support systems for stainless steel pipe shall be of the same materials as the pipe and conform to Section 40 05 07 “Hangers and Supports for Process Piping.”

2.9 FINISH

A. After all shop operations have been completed, pipe and fittings shall be pickled and passivated in manufacturer’s plant and scrubbed and washed until discoloration and possible iron picked up from manufacturing process are removed. The standard finish for 16-gage through 8-gage material shall be No. 1 or 2B per ASTM A480; 3/16-inch and heavier plate material shall be No. 1 mill finish or better per ASTM A480.

2.10 PRODUCT DATA

A. The following information and data shall be provided in accordance with Section 01 33 00 “Submittal Procedures.”

1. Certifications specified in the following documents:
   ASTM A403, paragraph 14.1
   ASTM A774, paragraph 14.1
   ASTM A778, paragraph 14.1
   ASTM A409, paragraph 17.1
2. Test results specified in Section 40 05 05, paragraph 1.02 C.
3. Names and qualification records of proposed welders.

PART 3 - EXECUTION

3.1 PIPE CUTTING, THREADING, AND JOINTING

A. Pipe cutting, threading, and jointing shall conform to the requirements of ANSI B31.1. All pipe threads shall be lubricated with Teflon tape.

3.2 WELDING

A. GENERAL: Piping with wall thickness up to 11-gage (0.120-inch) shall be welded with the TIG (GTAW process). Unless otherwise specified, heavier walls shall be properly beveled and have a root pass with the TIG (GTAW) process followed by subsequent passes with the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process. Filler wire of ELC grades only shall be added to all welds to provide a cross section at the weld equal to or greater than the parent metal. Weld deposit shall be smooth and evenly distributed and have a crown of no more than 1/16-inch on the I.D. and 3/32-inch on the O.D. of the piping. Concavity, undercut, cracks, or crevices shall not be allowed. Butt welds shall have full penetration to the interior surface, and inert gas shielding shall be provided to the interior and exterior of the joint. Excessive weld deposits, slag, spatter, and projections shall be removed by grinding. Welds on gasket surfaces shall be smooth ground.

B. FIELD WELDING: Field welding shall be minimized to the greatest extent possible by use of couplings and prefabrication of pipe systems at the factory. Pipe butt welds may be performed at the job site, providing the butt welds are performed only with an inert gas shielded process and that other applicable specified welding requirements are rigidly adhered to. All residue, oxide, and heat stain are to be removed from any type of field weld and the affected areas adjacent using stainless steel wire brushes, followed by cleaning with an agent such as Eutectic Company's "Eucleen" or equal, followed by complete removal of the agent.

C. PREPARATION OF SURFACES TO BE WELDED: Surfaces of joints to be welded shall be free from mill scale, slag, grease, oil, paint, rust, and other foreign material. Joints to be welded shall be wire-brushed with stainless steel wire brushes and precisely fitted before welding.

D. WEATHER CONDITIONS: Welding shall be done only when the surfaces are completely free of any moisture. Welding of the pipe shall not be done during periods of high winds or rain unless the areas being welded are properly shielded.

E. TACK WELDS, CLIPS, AND OTHER ATTACHMENTS: Nicks, gouges, notches, and depressions in the base metal in the joint shall be repaired before the joint weld is made. Tack welds, clips, and other attachments shall be removed, and defects repaired, except where the tack welds occur within the weld area and these tack welds do not exceed the size of the completed weld. Cracked tack welds shall be removed. Areas to be repaired shall be ground to clean metal and then repaired by building up with weld metal. The required areas shall be ground smooth to form a plane surface with the base metal.

F. DEFECTS AND REPAIRS: Welds with cracks, slag inclusions, porosity, undercutting, incomplete penetration, or which are otherwise deficient in quality or made contrary to any provisions of these specifications shall be removed by chipping or grinding throughout their depth to clean base metal. Calking or peening of welds to correct defects shall not be done. Welds found deficient in dimension but not in quality shall be enlarged by additional welding after thoroughly cleaning the surface of previously deposited metal and the adjoining plate. Weld deposits, slag, weld spatter, and projections into the interior of the pipe shall be removed by grinding.

3.3 MARKING, SHIPPING, AND STORAGE

A. All pipe, fittings, and fabrications shall be properly marked with type, gage, and heat number. All fabricated piping shall have openings plugged and flanges secured for storage transport with identifying numbers or codes which correspond to the contractor's layout and installation drawings. The marks will be located on the spools at opposite ends and 180 degrees apart. Pipe spools shall be loaded and blocked and lagged as necessary to ensure protection from damage during shipping. Stainless steel pipe and fittings shall be stored per manufacturer's recommendation. Dents, gouges, and scratches in stainless steel pipe and fittings are not acceptable and are reason for rejecting pipe and fittings.

3.4 FABRICATION/INSTALLATION REQUIREMENTS

A. The piping supplier during manufacturing, fabricating, and handling stags, and the contractor during handling and installation stages, shall use extreme care to avoid the contact of any ferrous materials with the stainless steel piping. All saws, drills, files, wire brushes, etc. shall be used for stainless steel piping only. Pipe storage and fabrication racks shall be non-ferrous or stainless steel or rubber-lined. Nylon slings or straps shall be used for handling stainless steel piping. Contact with ferrous items may cause rusting of iron particles embedded in the piping walls. After installation, the contractor shall wash and rise all foreign matter from the piping surface. All welded joints shall be treated with a pickling solution, brushed with stainless steel wire brushes and rinsed clean. If rusting of embedded iron occurs, the contractor shall pickle the affected surface with Oakite Deoxidizer SS or equal, scrub with stainless steel brushes, and rinse clean.

3.5 COATINGS

A. After installation, the contractor shall paint all steel or iron flanges, couplings, and appurtenances in accordance with Section 09 90 00. Painting of the stainless steel pipe is not required. However, the contractor shall be responsible for supplying and installing the stainless steel piping with a consistently clean surface. Identifying spool piece marks shall be removed with paint thinner or solvents and the entire stainless steel surface shall be washed with detergent and hot water and rinsed clean.

END OF SECTION

SECTION 40 05 24 – STEEL PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes steel pipe and fittings.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 QUALITY ASSURANCE

A. REFERENCES: Section contains references to the following documents. They are part of section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   1. ANSI B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
   2. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings
   3. ANSI B16.11 - Forged Steel Fittings, Socket-Welding and Threaded
   4. ASTM A36/A36M -Structural Steel
   5. ASTM A47 - Ferritic Malleable Iron Castings
   6. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   7. ASTM A105/A105M-a - Forgings, Carbon Steel, for Piping Components
   8. ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service
   9. ASTM A197 - Cupola Malleable Iron
   10. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
   11. ASTM A283/A283M - Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
   12. ASTM A536 - Ductile Iron Castings
   13. ASTM A570/A570M - Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
   14. ASTM A572/A572M - High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
   15. AWWA C200 - Steel Water Pipe 6 Inches and Larger
   16. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied
   17. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe—4 In. and Larger—Shop Applied
   18. AWWA C206 - Field Welding of Steel Water Pipe
   19. AWWA C207 - Steel Pipe Flanges for Waterworks Services—Sizes 4 In. Through 144 In.
   20. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings
   21. AWWA C209 - Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
   22. AWWA C210 -
   23. Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
   24. AWWA C214 -
   25. Tape Coating Systems for the Exterior of Steel Water Pipelines
   26. AWWA C600 -
   27. Installation of Ductile-Iron Water Mains and Their Appurtenances
   28. AWWA M11 - Steel Pipe—A Guide for Design and Installation
   29. SSPC-SP10 - Near-White Blast Cleaning

B. TESTING: Factory testing shall conform to the requirements of ASTM A53, ASTM A106, OR AWWA C200 as applicable.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Steel pipe and fittings shall be provided in accordance with ASTM A53, ASTM A106, OR AWWA C200 as specified in Section 40 05 04 " Piping Systems."
B. Steel for pipe fabricated to meet requirements of AWWA C200 shall conform to the requirements of ASTM A36, ASTM A572, Grade 42, ASTM A570, Grades 33 and 36, or ASTM A283, Grade D. Steel for ASTM A53 and ASTM A106 pipe shall be Grade B.

2.2 PIPE MANUFACTURE

A. Unless otherwise specified, ASTM A53 pipe shall be Type E, electric resistance welded or Type S, seamless pipe as specified in Section 40 05 04.

The minimum wall thickness for ASTM A53 or ASTM A106 pipe shall be Schedule 40 for pipe 10 inch diameter and less and 3/8 inch for pipe 12 inch through 24 inch diameter. Increased shell thickness shall be provided where specified. AWWA C200 pipe shall be straight or spiral seam.

B. The minimum wall thickness shall be 7-gage for pipe 6-inch through 24-inch diameter and 1/4-inch for pipe 26-inch diameter and larger. Increased shell thickness shall be provided where specified.

Unless otherwise specified inside pipe diameter, including lining, shall not be less than nominal pipe diameter.

2.3 CONNECTIONS

A. Connections shall be as specified in Section 40 05 04 and shall conform to Section 40 05 06. Coating for buried connections shall be as specified in Section 40 05 06 "Couplings, Adaptors, Specials for Process Piping," paragraph 2.06.

2.4 FITTINGS AND appurtenances

A. Malleable iron threaded fittings and appurtenances shall conform to the requirements of ASTM A47 or ASTM A197, ANSI B16.3.
B. Unless otherwise specified, steel fittings and appurtenances shall conform to the requirements of ASTM A234, ASTM A105, or ANSI B16.11; and fabricated steel fittings and appurtenances shall conform to AWWA C208.
C. Fittings for grooved end piping systems shall be full flow cast fittings, steel fittings, or segmentally welded fittings with grooves or shoulders designed to accept grooved end couplings. Cast fittings shall be cast of ductile iron conforming to ASTM A536 or malleable iron conforming to ASTM A47. Standard steel fittings, including large size elbows, shall be forged steel conforming to ASTM A106. Standard segmentally welded fittings shall be fabricated of Schedule 40 carbon steel pipe.

D. Unless otherwise specified, all fittings shall be rated for pressure and loadings equal to the pipe.

2.5 PIPE LINING

A. COAL TAR EPOXY: Unless otherwise specified, pipe and fittings shall be lined with coal tar epoxy as specified in AWWA C210 to a minimum thickness of 20 mils in not less than two coats.
B. COAL TAR ENAMEL: Where specified, pipe and fittings shall be lined with coal tar enamel as specified in AWWA C203.
C. CEMENT MORTAR: Where specified, pipe and fittings shall be lined with cement mortar as specified in AWWA C205. Fittings and specials larger than 24 inches, not fabricated from centrifugally lined straight sections, shall require 2-inch by 4-inch by 13-gage self-furring wire mesh reinforcement for hand-applied lining.
D. EPOXY: Where specified, steel pipe and fittings shall be epoxy lined with not less than 10 mils of epoxy suitable for temperatures of 225 degrees F. Epoxy lining shall be 3M Scotchkote 306, Porter MCR 65 High Solids Epoxy, or equal. Surfaces shall be prepared in accordance with SSPC-SP 10 Near White Blast Cleaning, and the lining applied as recommended by the manufacturer.
E. GLASS LINING: Where specified, pipe and fittings shall be glass lined with a dual-layer coating system of vitreous material toa minimum thickness of 10 mils. Glass lining shall provide continuous coverage as tested by a low voltage holiday detector with only isolated voids permitted due to casting anomalies. Voids, other than isolated pinholes, shall be cause for rejection. Pipe and fittings shall have all internal welds ground smooth, and any voids or slag holes ground out, rewelded and ground smooth. Glass lining shall be Ferrock MEH-32, Ervite SG-14, or equal.

2.6 PIPE COATING

A. COAL TAR EPOXY: NOT USED
B. POLYETHYLENE TAPE: Unless otherwise specified, pipe and fittings for buried service shall be coated and wrapped with prefabricated multilayer cold applied polyethylene tape coating in accordance with AWWA C214. The coating application shall be a continuous step operation in conformance with AWWA C214, Section 3. The total coating thickness shall be not less than 50 mils for pipe 24 inches and smaller and not less than 80 mils for pipe 26 inches and larger.

2.7 FUSION EPOXY COATING AND LINING

A. Where specified, steel pipe and fittings shall be fusion epoxy coated and lined. The fusion epoxy coating shall be 3M Scotchkote 203, or equal. Surface preparation shall be in accordance with SSPC-SP 10 Near White Blast Cleaning. The application method shall be by the fluidized bed method and shall attain 12 mils minimum dry film thickness.
B. Field welds, connections and otherwise damaged areas shall be coated and patched according to the manufacturer’s instructions with 3M Scotchkote 306.

2.8 JOINT GASKETS

A. Joint gaskets shall be as specified in Section 40 05 05.

2.9 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 “Submittal Procedures:”
   1. Affidavits of Compliance with AWWA C200, ASTM A53, or ASTM A106 as applicable.
   2. Contractor’s layout drawings as specified in Section 40 05 04 , paragraph 2.4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Pipe shall be installed in accordance with AWWA M11, Chapter 16. Welded joints shall be in accordance with AWWA C206 and Section 40 05 06. Sleeve-type mechanical pipe couplings shall be provided in accordance with AWWA M11 and Section 40 05 05, paragraph 2.2A. Pipe lining and coatings at field joints shall be applied as specified in Section 40 05 24, paragraphs 2.5 and 2.6. Unless otherwise specified, buried mechanical couplings shall be field coated as specified in Section 40 05 06 “Couplings, Adaptors, Specials for Process Piping” paragraph 2.06.

B. ANCHORAGE: Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted in accordance with Section 01 33 00 “Submittal Procedures.”

3.2 TESTING

A. Hydrostatic testing shall be in accordance with Section 4 of AWWA C600 except that test pressures and allowable leakage shall be as listed in Section 40 05 04.

END OF SECTION

SECTION 40 05 31 – PLASTIC PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. SCOPE: This section specifies polyvinylchloride, chlorinated polyvinylchloride, polyethylene, and polypropylene pipe and fittings

B. PIPE DESIGNATIONS: For use in the Piping System Specification Sheets (PIPESPEC) in Section 40 05 04 and in this section, the following plastic pipe designations are defined:

Reference	Title
PVC	Polyvinylchloride
CPVC	Chlorinated polyvinylchloride
PE	Polyethylene
PP	Polypropylene

1.02 QUALITY ASSURANCE

A. REFERENCES: This section contains references to the following documents. They are a part of this section as specified and modified. In case of I conf1ict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

	Reference	Title
1.	ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
2.	ASTM D2464	Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
3.	ASTM D2466	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
4.	ASTM D2467	Socket-Type (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
5.	ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
6.	ASTM D2657	Heat-Joining Polyolefin Pipe and Fittings
7.	ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
8.	ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
9.	ASTM D4101	Propylene Plastic Injection and Extrusion Materials
10.	ASTM F402	Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
11.	ASTM F437	Thread Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
12.	ASTM F438	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
13.	ASTM F439	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
14.	ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
15.	ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
16.	ASTM F493	Solvent Cements for Chlorinated Poly (Vinyl Chlorinated) (CPVC) Plastic Pipe and Fittings

PART 2 - PRODUCTS

2.01 PVC PIPE

A. PRESSURE PIPE: PVC material for pipe and fittings shall conform to ASTM D1784, Class 12454-B. Pipe and fittings shall either be in accordance with ASTM D1785 or shall conform to ASTM D2241 for standard dimensions ratios: 160 psi pipe—SDR 26; 200 PSI pipe—SDR 21; 250 psi—SDR17. Pressure rating for pipe shall be in excess of test pressure specified in Section 40 05 04. Neoprene gaskets with push-on joints shall conform to ASTM F477.

Schedule 80 PVC socket type fittings shall conform to ASTM D2467. Schedule 40 PVC fittings shall conform to ASTM D2466. PVC solvent weld cement for socket connections shall meet the requirements of ASTM D2564. Schedule 80 PVC threaded fittings shall conform to ASTM D2464. Fittings for gasketed pipe shall be ductile iron or steel push -on IPS-sized pressure fittings rated for use with the specified class of PVC pipe. Unless otherwise specified, fittings shall be lined and coated in accordance with Section 40 05 19 or Section 40 05 24 as applicable.

B. NONPRESSURE PIPE:
   1. GRAVITY SEWER PIPE: PVC material for sewer pipe and fittings shall meet the requirements of ASTM D3034 for SDR 35. Neoprene gaskets with push-on joints shall conform to ASTM F477.
   2. DRAIN, WASTE AND VENT PIPE: PVC material for drain waste and vent (DWV) pipe and fittings shall conform to Class 12454-B, ASTM D1784. Pipe and fittings shall conform to ASTM D2665. Unless otherwise specified, connections shall be solvent shall be with approved adapter type fittings designed for intended use. Solvent weld cement for socket connections shall meet requirements of ASTM D2564.

2.02 CPVC PIPE

A. CPVC material for pipe and fittings shall conform to ASTM D1784, Class 23447-B. Pipe and fittings shall be in accordance with ASTM F441. Neoprene gaskets with push-on joints shall conform to ASTM F477.

Schedule 80 CPVC socket type fittings shall conform to ASTM F439. Schedule 40 CPVC socket type fittings shall conform to ASTM F439. Schedule 40 CPVC socket type fittings shall conform to ASTM F438. CPVC solvent weld cement for socket connections shall meet the requirements of ASTM F493. Schedule 80 PVC threaded type fittings shall conform to ASTM F437.

2.03 PE PIPE

A. PE pipe shall meet the requirements of ASTM D1248, Type III, Grade P 34, Class C, 100 psi or as specified in sections 45 05 04, whichever is higher. Fittings shall be of the same material, molded socket fusion for size 4 inch diameter and smaller and molded or fabricated butt fusion for sizes 6 inch and larger. Fittings shall be 125 psi or as specified in Section 45 05 04, whichever is higher. Heat fusion welding shall be in conformance with ASTM D2657.

2.04 PP PIPE

A. PRESSURE PIPE: PP pipe and fittings shall be formulated of polypropylene conforming to ASTM D4101, SDR 11, butt fusion type. Pipe shall be 150 psi rated in all sizes. Heat fusion welding shall be in conformance with manufacturer's recommendation.

B. DRAIN, WASTE AND VENT PIPE: PP drain, waste and vent (DWV) pipe and fittings shall be made from flame retardant, Schedule 40, polypropylene (PPFR) plastic as defined in ASTM D4101. Pipe and fittings used for buried piping and in concealed locations shall be joined by electrical fusion coils energized by a variable low-voltage power supply to completely fuse the interface between the pipe and socket and form a completely homogenous structure. Unless otherwise specified, mechanical joint fittings may be used under bench or in exposed locations where future disassembly is desired. The mechanical method shall be in conformance with the manufacturer's recommendation.

2.05 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00:
   1. Manufacturer's certificates of compliance with the specified standards and Contractor's layout drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PVC pipe three inches in diameter and smaller shall be joined by means of socket fittings and solvent welding in conformance with ASTM F402. Solvent -cemented joints shall be made in strict compliance with the manufacturer's/supplier's instructions and recommended procedures. Unless otherwise specified, PVC pipe four inches in diameter and greater shall be joined by means of gasketed push-on joints and steel or ductile iron push-on or mechanical joint fittings. Fittings shall be lined and coated as specified in sections 15061 or 15062. Unless otherwise specified, PVC and CPVC piping exposed to sunlight shall be painted with coating system L-2 as specified in Section 09900.

Connections to different types of pipe shall be by means of flanges, specified adapters or transition fittings. Where sleeve type couplings are used, both shall be uniformly torqued in accordance with pipe manufacturer's recommendation. Foreign material shall be removed from the pipe interior prior to assembly.

Unless otherwise specified, PE pipe and fittings 4 inch diameter and smaller shall be joined by means of thermal socket fusion and pipe 6 inch and larger by thermal butt fusion. Butt fusion joining of the pipes and fittings shall be performed with special joining equipment in accordance with procedures recommended by pipe manufacturer. Tensile strength at yield of butt-fusion joints shall not be less than pipe. Flanged adapters shall be provided for connection to valves and where specified.

3.02 TESTING

A. Leakage testing of plastic piping shall be as specified in Section 40 05 04 “Piping Systems.”

B. Deflection tests shall be performed on all flexible and semi rigid pipes 4 inches or greater in diameter. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5.0 percent. If the deflection test is to be run using a rigid ball or mandrel, such test devices shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices. The design engineer should recognize that this is a maximum deflection criterion for all pipes. A reduced percent deflection may be more appropriate for specific types and sizes of pipe.

END OF SECTION

SECTION 40 05 36 – FIBERGLASS DUCTWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. SCOPE: This section specifies fiberglass reinforced plastic (FRP) ductwork for nonflammable corrosive vapor exhaust systems.

B. TYPE: The FRP duct shall be listed by Factory Mutual for use as a smoke removal system, and for use without the necessity for a fire protection sprinkler system or any dampering devices installed within the duct.

C. DESIGN CRITERIA AND CONSIDERATIONS: All FRP ductwork shall be designed in accordance with the following:

1. All ducts shall be designed for not less than 10 inches water column pressure and 10 inches water column vacuum.
2. The following contaminants will be anticipated in the airstream being handled by the duct system:

Airstream contaminants	Sustained Peak concentration, ppm
Hydrogen sulfide	20

1.02 QUALITY ASSURANCE

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

1. ASTM D2996 - Filament–Wound Fiberglass (Glass Fiber – Reinforced Thermosetting Resin) Pipe
2. ASTM D4097 - Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks
3. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
4. FM 4922 - Test Standard for Evaluating Fume Exhaust Ductwork
5. PS 15 - U.S. Department of Commerce. Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment
6. SMC - Standard Mechanical Code

B. STANDARDS: Duct work fabricated for this project shall meet all requirements of ASTM D 2996 for filament wound pipe, ASTM D4097 for hand layed-up shapes, and PS-15 for internal liners.

C. FACTORY INSPECTION: The Engineer or his representative shall maintain the right to tour the FRP duct manufacturer's plant anytime that fabrication is being performed on ductwork intended for this project. The manufacturer shall notify the Construction Manager when production has been completed on the first 50 lineal feet of fabricated ductwork. Anytime after that date, the Construction Manager may exercise the option, without any advance notice, to tour the plant and inspect all stages of fabrication to ensure that quality control is being maintained. The visitation and inspection option shall remain in effect throughout the entire cycle of production for material used on this project.

D. FACTORY SUPPLIED TEST SAMPLES: The duct fabricator shall provide a minimum of six sample specimens for mechanical property tests and 1amination lay-up analysis. Test specimens shall be submitted to an independent, qualified laboratory skilled in the art of analysis and properly equipped to perform tests listed in paragraph 40 05 36 – 1.02 E.

E. ACCEPTANCE OF FRABRICATED DUCTWORK: Acceptance of factory fabricated ductwork shall be based on laboratory analysis of the factory-supplied and field supplied test sample specimens and inspection of the ductwork during fabrication. No ductwork shall be installed on the project until the Engineer approves all test results to very the fabricated product complies with the technical requirements specified herein.

The Contractor shall include all cost required for performing duct sample tests indicated herein. All factory and field test sample specimens shall be analyzed at the independent laboratory to determine:

1. Tensile and flexural strength
2. Barcol hardness
3. Glass content
4. Visual quality of laminate
5. Thickness measurements of construction layers

If the duct samples fail to meet the requirements of the technical data, or meet the fabrication steps of these specifications, the ductwork manufacturer shall contract with the laboratory for services for the same test procedures described above on six new sample specimens removed from ductwork stockpiled on the construction site. Written acceptance by the Construction Manager or his representative will provide necessary clearance of stockpiled material to be installed by the Contractor. Written rejection by the Construction Manager or his representative of any or all of the ductwork shall constitute noncompliance. The manufacturer shall remove all nonconforming material from the construction site and replace with new material fabricated to conform to these requirements. Test sample specimens shall be taken from all ductwork fabricated as replacement for nonconforming material, and the tests specified above shall be repeated.

F. CERTIFICATIONS: Certifications from applicable agencies shall be provided as specified below:

1. Current listing and test report by Factory Mutual Research as approved without the necessity for internal sprinkles or dampers.
2. Current listing and test report by Factory Mutual Research as approved for smoke removal service.
3. Test reports from nationally recognized laboratory on broth pressure and vacuum capabilities of the duct.

1.03 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00:

1. Complete specifications, descriptive literature which shall include data on the dust material, hanging weight, fabrication techniques, and resins and fillers proposed for the finished duct material.
2. Complete shop drawings of the duct layout at the same scale as the building drawings or a minimum of 1/8-inch scale. showing location and dimensions of all main and branch runs, fittings, offsets, takeoffs, and accessories.
3. Published, illustrated installation and maintenance instructions and field joint installation instructions.

4. Information and qualifications o€ the independent laboratory selected for testing factory and field sample specimens.
5. Copies of test and evaluation reports specified in paragraph 40 05 36 -1.02 E.

1.04 ENVIRONMENT CONDITIONS

A. Equipment shall be installed in locations specified.

PART 2 - PRODUCTS

2.01 FRP DUCTWORK

A. GENERAL: Fiberglass reinforced plastic (FRP) ductwork shall be constructed in full accordance with the specifications herein. No spray-up technique shall be used for duct, fittings or bonds.
B. INTERNAL CORROSION-RESISTANCE SURFACE: The internal liner in contact with the contaminated exhaust airstream shall be constructed of material resistant to the chemicals stated. Thickness of this corrosion liner shall be 100 mil minimum, specifically hand layed-up as a corrosion barrier, and formed separately from the materials and procedures of the intermediate structural layer. The internal liner shall be formed with a resin-rich surface reinforced with organic veil and with 35 percent glass by weight in the form of chopped strand mat to achieve the thickness of the liner. Resins used for this internal corrosion-resistant liner shall be compatible with the chemical stream being exhausted.
C. INTERMEDIATE STRUCTURAL LAYER: The intermediate layer of duct wall thickness shall be fabricated by either filament wound or hand layed-up techniques to the dimensional thickness and strength required by the ASTM and NBS Standards. The outer surface shall be relatively smooth with no exposed glass fiber ends. Resins used for this intermediate structural layer shall be the same as that used for the internal surface.
D. EXTERNAL LAYER--INDOOR DUCTWORK: The external layer shall be fabricated by either filament wound, or hand layed-up glass saturated with resins of a thickness necessary to provide the wall thickness required. Exterior surface shall have a fine mesh glass cloth and surfacing veil.
   Both external and internal surfaces of all FRP ductwork installed inside the building shall provide for fire protection. Both inside and outside surface of the duct shall have been tested and have demonstrated flame spread rating of 15 or less, and a smoke development rating of 5 or less when tested to ASTM E-84. These ratings shall be certified and listed by a nationally recognized test laboratory such as FM or UL. The external surfaces of all indoor ductwork shall be painted at the job site with system E-7 as specified in Section 09 90 00.
E. EXTERNAL LAYER--OUTDOOR DUCTWORK: The external surface of all FRP ductwork installed outdoors shall provide protections against ultraviolet degradation and weather erosion. The ducts shall have a flame spread rating of 15 or less and a smoke developed rating of 5 or less on both inside and outside surfaces. These ratings shall be certified by and listed with a nationally recognized laboratory such as FM or UL. All outdoor ductwork shall be painted at job site with System U as specified in Section 09 90 00.

2.02 DAMPERS

A. Bodies of process equipment isolation dampers, header separation manifold dampers, and exhaust branch duct balancing dampers shall be manufactured of the same material as the ductwork. Damper blades shall be of the drop-out type; in the event of fire or high heat, the

damper shall fail open to permit continuing exhaust. Round dampers shall be single butterfly blade locking-quadrant type with nonmetallic shaft with external shaft bearing mounts. All dampers shall be suitable for

B. 10-inches W.C. pressure differential. Dampers shall contain indicators to show open and closed positions.

2.03 DRAINS

A. Duct drains shall be provided in the bottom of all main and branch ducts which are P-trapped and/or as specified to allow removal of condensate liquids. Drains shall be located at every rise in duct; they shall also be located at the heel of all drops. Drains shall be clear PVC pipe 1-inch minimum, with PVC ball valve and 1-inch long tail piece. Drain lines shall be installed as specified.

2.04 HANGERS AND SUPPORTS

A. Hangers and supports shall comply with Section 308 and Chapter 5 of the Standard Mechanical Code and shal1 be designed in accordance with the Standard Building Code for seismic Zone 1. Unless otherwise specified, all hangers and supports shall be fabricated from mild steel rods, bars, angles, and straps hot-dip galvanized after fabrication. Abrasion resistant shields shall be provided between the lower half of the duct and the duct hanger to allow expansion and contraction of the duct freely in its supports. Anti-abrasion shields shall be sized as follows:

Duct diameter, inches	Thickness, inches
10 and smaller	2
12 to 16	4
18 to 30	4
32 to 48	8
54 to 60	12

2.05 JOINTS

A. Duct joints and connections shall be made in accordance with the manufacturer's published illustrated procedures. Joint materials shall be approved and/or listed for use by FM and SBCCI. Heat shrink or glass and resin joints may be used on indoor duct; glass and resin joints only shall be used on outdoor ducts.

2.06 FABRICATION

A. FRP DUCT: Duct sizes as specified represent the nominal inside diameters or its equivalent net free area required for that service. All FRP ductwork shall be fabricated installed in accordance with PS-15 and duct manufacturer's instructions.

B. Fittings shall be factory fabricated duct transitions, elbows, and branch connections such as tees and lateral. All branch connections and takeoffs shall be made on the 90-degree horizontal axis of the duct, except for duct drains. Branch connections 6-in diameter end above shall be bonded both on the inside and outside of the joint, shall be sanded prior to bonding, and shall be made by hand lay-up; no spray-up technique shall be used. The junction between main and branch shall provide for smooth flow and low pressure drop; no projections into the main will be allowed. Branch duct connections shall be made with 45-degree lateral wyes, or 90-degree

(conical) tees. Branch taps shall be located after transitions. Duct inspection doors for a 12 x 12 opening shall be provided at all manifold dampers or main branch duct dampers except for branch ducts to individual pieces of process equipment. Doors shall be of the same material as the duct or Type 316 stainless steel, bolted and gasketed for airtight seal.

Transitions shall have tapers whose length is minimum of 4 times the difference in diameters. All ducts and fittings shall be of seamless construction longitudinally; material shall not be cut from mold and rebounded.

C. Elbows shall not be shipped to the job with their throats slit, which would require subsequent field bonding. All round elbows from 2 to 54 inches in diameter shall be smooth sweep elbows for low pressure drop unless space does not permit their use. Sweep elbows shall have a centerline radius of 1.5 times the diameter. Short radius elbows shall be used only where sweep elbows will not fit; elbows larger than 54 inches in diameter shall have a centerline radius of 1.5 times the diameter space permits. When space constraints are such that two-piece mitered elbows must be used, all elbows 10-inches in diameter and larger shall contain solid airfoil shaped turning vanes on no greater than 6-inch c.c. along the miter for low pressure drop . Vanes shall be bonded securely to the miter. Mitered elbows 30 inches in diameter and larger shall have a reinforcing panel at midpoint perpendicular to miter and shall be bonded to vanes and e1bow walls.

Diameter, inches	Thickness, inches
2 – 12	1/8
14 – 26	3/16
30 – 38	1/4
42 – 50	5/16
54 – 84	3/8

D. LABELS: Duct and fittings shall bear labels on no more than 10-foot centers which contain the following information:
   1. The identity of the manufacturer and their location.
   2. The product identity or brand name.
   3. The listed file numbers for the agencies specified in paragraph 40 05 36 – 1.02F
   4. The ASTM E-84 ratings for both inside and outside surfaces of the duct in thicknesses to 3/8 inch.
   5. Whether the product may be used without the necessity of internal sprinklers or dampers.
   6. Whether the product may be used for smoke removal.

2.07 PRODUCT DATA

A. Certifications specified in paragraph 40 05 36 provided in accordance with Section 01 33 00.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All material and equipment shall be installed as required by the applicable state and local codec. All ductwork indicated on the drawings is schematic. Therefore, changes in duct size, duct configuration, and location may be necessary to conform to field conditions.
B. FRP ductwork shall be installed and supported in accordance with Section 1004 and Chapter 11 of the Standard Mechanical Code. Ductwork shall be supported at intervals no greater than on l0-foot centers. Large elbows and terminal ends of ducts shall be supported independently. For all horizontally mounted outdoor ducts and other locations where specified, anti-abrasion shields, sized as specified, shall be provided at all hangers and supports to allow expansion and contraction. Flexible connections consisting of EPDM gasketing materials and stainless steel clamps shall be provided between fans and ductwork.

3.02 FIELD QUALITY CONTROL

A. TESTING: All ductwork shall be 1eak-tested using a small high-pressure blower with a calibrated orifice and manometer. The blower shall maintain at least 6 inches static pressure during the test. Leakage in the entire system shall be no more than 1 percent of the design total scfm for that part of the system. All audible leaks shall be sealed. All tests shall be scheduled with the Engineer.
B. FIELD SUPPLIED TEST SAMPLES: The Contractor shall provide a minimum of six samples specimens for mechanical property tests and lamination lay-up analysis. Test specimens shall be submitted to the laboratory selected by the Engineer. All sample specimens shall be taken as directed by the Engineer or his representative, at random locations from standard production ductwork available on the job site. Acceptance of ductwork shall be as specified in paragraph 40 05 36 1.02 E.
C. MANUFACTURERS' SERVICES: The FRP duct manufacturer shall have a representative on site at the start of the installation t train the Contractor in the correct procedures in installation of the FRP duct system. The representative shall remain on site to witness the initial installation of the ductwork to ensure the Contractor is employing the proper procedures. The manufacturer's representative shall make two additional visits to the site during the installation to inspect the FRP duct installation and witness the installation procedures of the Contractor.

   The manufacturer's representative shall instruct the Contractor on the proper installation procedures at anytime the representative and/or the Engineer witnesses improper installations practices. The manufacturer's representative shall assist the Contractor in the final inspection, testing, and startup of the systems.

END OF SECTION

SECTION 40 05 51 – MANUAL VALVE AND GATE OPERATORS AND OPERATOR APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies manual operators for valves and gates, and operator appurtenances.

1.02 REFERENCES

A. This section contains references to the following document. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.
   1. AWWA C500 - Gate Valves 3 through 48 inch NPS, for Water and Sewage Systems

PART 2 - PRODUCTS

2.01 GENERAL

A. Except as specified in valve and gate specification sections, manual operators shall be as specified herein. Operators shall be mounted on the valve or gate and provided as a unit. Each valve body or operator shall have cast thereon the word "OPEN," an arrow indicating the direction to open, and flow direction arrows.

2.02 OPERATORS

A. GENERAL: Manual operators shall have operated torques less than 80 foot-pounds. Unless specified otherwise, each manual operator shall be provided with an operating wheel. Unless specified otherwise, the direction of rotation of the operator shall be counterclockwise for opening.
B. WRENCH NUTS: Wrench nuts shall comply with Section 3.16 of AWWA C500. A minimum of two operating keys, but no less than one key per every ten valves, shall be provided for operation of the wrench nut operated valves.
C. CHAIN WHEELS: Chain wheels shall be ductile iron. Operating chains shall be galvanized.

2.03 OPERATOR APPURTENANCES

A. VALVE BOXES: Valve boxes shall be cast iron and shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers. Covers shall be hot-dip galvanized.
B. FLOOR BOXES: Floor boxes shall be hot-dip galvanized. Where the operating nut is in the concrete slab, the floor box shall be bronze brushed. Where the operating nut is below slab, the opening in the bottom of the box shall be sufficient for passage of the operating key.
C. ADJUSTABLE SHAFT VALVE BOXES: Adjustable shaft valve boxes shall be concrete or cast iron Brooks No. 3RT, Christie G5, Empire 7 1/2 valve extension box, or equal. Box covers on water lines shall be impressed with the letter "W". Gas line covers shall be impressed with the letter "G."

2.04 PRODUCT DATA

A. Manufacturer's catalog information and other data confirming conformance to design, and material requirements shall be provided in accordance with Section 01 33 00.

PART 3—EXECUTION

3.01 GENERAL

B. Installation shall be as specified herein. Valve operators shall be located so that they are readily accessible for operation and maintenance. Valve operators shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Valve operators shall not be mounted where shock or vibration will impair their operation. Support systems shall not be attached to handrails, process piping, or mechanical equipment.

3.02 OPERATORS

A. GENERAL: Valves and gates shall be provided with manual operators, unless specified otherwise. Where possible, manual operators shall be located between 48 inches and 60 inches above the floor or a permanent work platform.

B. WRENCH NUTS: Wrench nuts shall be provided on buried valves, on valves which are to be operated through floor boxes, and where specified. Extended wrench nuts shall be provided if necessary, so that the nut will be within 6 inches of the valve box cover.

C. CHAIN WHEELS: Unless otherwise specified, valves with centerlines more than 7 feet, 6 inches above the specified operating level shall be provided with chain wheels and operating chains. Chain wheel operated valves shall be provided with a chain guide. Operating chains shall be looped to extend within 4 feet of the specified operating level below the valve. For plug-type valves 8 inches and larger, the operator shall be provided with a hammer blow wheel. Hooks shall be provided for chain storage where the chain may hang in a walkway.

3.03 OPERATOR APPURTENANCES

A. VALVE BOXES: Valve boxes extending to finished surfaces shall be provided for buried valves.

B. FLOOR BOXES: Floor boxes shall be provided for wrench operation of valves located below concrete slabs. Each floor box and cover shall be of the depth required for installation in the slab.

END OF SECTION

SECTION 40 05 61 – GATE VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies bronze and iron-body, solid-wedge gate valves. Iron body valves shall be bronze mounted.

1.2 QUALTY ASSURANCE

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

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
AWWA C500	Gate Valves for Water and Sewage Systems

B. DESIGN CRITERIA: Gate valves 3 inches through 48 inches in size shall comply with AWWA C500, including applicable hydrostatic testing. Gate valves smaller than 3 inches shall be subject to hydrostatic testing at the specified test pressure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials of construction shall be as follows:

Component	Material
Body:	
3 inches and smaller	Bronze
Larger than 3 inches	Cast iron, ASTM A126, Class B
Wedge:	
3 inches and smaller	Bronze
Larger than 3 inches	Cast iron, ASTM A126, Class B
Mounting	Bronze
Stem	Bronze, AWWA C500, Section 3.12
Seat rings	Bronze, Grade A, AWWA C500, Section 3.8

2.2 MANUFACTURE

A. GENERAL: Unless otherwise specified, bronze gate valves shall be provided with integral seats. Iron body valves shall be provided with screwed-on seat rings. Exposed gate valves shall be rising stem type. Buried or submerged gate valves shall be of the nonrising stem type. Rising stem valves and brass nonrising stem valves shall be provided with a Teflon braid packing. Iron body nonrising stem valves shall be provided with O-ring stem seals.

B. END CONNECTIONS: Gate valve end connections shall be flanged or threaded as specified. Threaded ends shall not be provided on gate valves with end connections larger than 4 inches. End flanges shall be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1 for 125-pound flanges.

C. MANUAL OPERATORS: Unless specified otherwise, valves less than 12 inch size shall be provided with handwheels, and valves 12 inches and larger shall be provided with geared operators.

D. BYPASS: Unless otherwise specified, gate valves 16 inches and larger, shall be provided with a bypass valve sized in accordance with AWWA C500.

2.3 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 “Submittal Procedures:”
   1. Affidavits of compliance, as required by AWWA C500.
   2. Hydrostatic test results.

PART 3 - EXECUTION

3.1 GENERAL

A. Gate valves shall be installed in the closed position.

END OF SECTION

SECTION 40 05 62 – ECCENTRIC PLUG VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies eccentric plug valves.

1.2 QUALITY ASSURANCE

A. REFERENCES: This section contains references to the following documents. They are a part of this section insofar as specified and modified herein. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.
   1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
   2. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   3. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes
   4. ASTM A436 - Austenitic Gray Iron Castings
   5. A536 - Ductile Iron Castings
   6. AWWA C504 - Rubber Seated Butterfly Valves

B. PROOF OF DESIGN TESTS: The Contractor shall furnish the Engineer three certified copies of a report from an independent testing laboratory certifying successful completion of proof-of-design testing conducted in accordance with AWWA C504, Section 5.5, except that where the word “disc” appears in the standard, it is understood to mean “plug.” In lieu of testing the values at an independent testing laboratory, proof-of-design testing may be performed at the valve manufacturer’s laboratory but must be witnessed by a representative of a qualified independent testing laboratory, and all test reports must be certified by the laboratory representative. Proof-of-design testing shall have been performed on not less than three 6-inch diameter valves, with all three test units demonstrating full compliance with the test standards. Failure to satisfactorily complete the test shall be deemed sufficient evidence to reject all valves of the proposed make or manufacturer’s model number.

PART 2 - PRODUCTS

2.1 MATERIALS: MATERIALS OF CONSTRUCTION SHALL BE AS FOLLOWS:

Component	Material
Body	Cast iron, ASTM A126, Class B
Plug	Cast iron, ASTM A126, Class B, or cast iron ASTM A436 (Ni-Resist), or ductile iron, ASTM A536
Plug facing	Neoprene or Buna-N
Body seats	
Less than 3 inches	Cast iron, ASTM A126, Class B
3 inches and larger	Stainless steel, ASTM A276, Type 304 or nickel
Packing	Buna V-flex or TFE

2.2 MANUFACTURE

A. GENERAL: Valves shall be straight flow nonlubricated resilient plug type suitable for drip tight, bi-directional shutoff at the specified valve design pressure. Port areas for the valve shall be at least 80 percent of the adjacent full pipe area for valves up to 20-inches in diameter, and 70 percent for valves 24-inches and larger. Valve body seats consisting of nickel for valves 3 inches and larger shall be constructed of a welded-in overlay of not less than 90 percent pure nickel. Upper and lower journal bearings shall be replaceable, sleeve-type, corrosion resistant, and permanently lubricated. Packing shall be self-adjusting chevron type replaceable without disassembling the valve.

B. Unless otherwise specified, valves shall, as a minimum, conform to the follow pressure ratings:

Size, inches	Design pressure, psig
12 and smaller	175
14 through 36	150
42 through 54	125

C. END CONNECTIONS: Valves 3 inches and smaller shall have threaded ends. Valve flange drilling for valves larger than 3 inches shall be per ANSI B16.1, Class 125. Grooved-end valves may be provided with grooved-end piping systems.

D. MANUAL OPERATORS: Unless otherwise specified, valves 4 inches and smaller shall be provided with a lever type manual operator. Valves larger than 4 inches shall be provided with totally enclosed worm gear operators. Where specified, manual operators shall have an adjustable stop. All operator components shall be sized for the valve design pressure in accordance with AWWA C504, Section 3.8. Operators shall comply with applicable portions of Section 40 05 51.

E. POSITION LIMIT SWITCHES: Provide position indicating limit switches as indicated on the Drawings. Position limit switches shall be rated 15A, SPDT and provided with a NEMA 4X enclosure. Position limit switches shall be Automax UltraSwitch XL, or equal.

2.3 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 “Submittal Procedures.”
   1. Manufacturer’s product data.
   2. Proof-of-design test reports specified in Section 40 05 62, paragraph 1.2B.

PART 3 - EXECUTION

3.1 GENERAL

A. Unless otherwise specified, valves shall be provided with the seat downstream away from flow. Valves at tank connections shall be installed with seat away from tank. Valves on pump discharge lines shall be installed with seat adjacent to the pump. Valves on grit piping shall be installed with seat upstream against flow.

END OF SECTION

SECTION 40 05 65.23 – SPRING-LOADED SWING CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies spring-loaded swing check valves.

1.2 QUALITY ASSURANCE

A. REFERENCES: Section contains references to the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   1. ASTM A126-Gray Iron Castings for Valves, Flanges, and Pipe Fitting
   2. ASTM A276-stainless and Heat-Resisting Steel Bars and Shapes
   3. AWWA C508-Swing-check Valves for Waterworks Service, 2- to 24-inch NPS

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Check valves shall be Golden Anderson Fig. 250-D with outside lever and spring, APCO series 6000 CLS, or equal.

2.2 MATERIALS

A. Materials of construction shall be as follows:

Component	Material
Body, cover	Cast iron, ASTM A126, Class B
Disc	Cast iron, ASTM A126, Class B
Seat rings	Bronze, AWWA C508
Hinge shafts and hinge pins	Stainless steel, ASTM 276, type 304
Shaft bushings	Bronze, AWWA C508

2.3 MANUFACTURE

A. Disc, disc arm, shaft, keyways, lever and spring shall be capable of closing within.05 seconds of pump stoppage and fluid moving at velocity of 8 feet per second. Spring tension shall be adjustable. The valve design shall permit mounting levers and springs on either side of the valve body. Valves shall be provided with a clear opening equal to or greater than the connecting piping, with no raised seating surface. Seats shall be threaded onto the body or fitted with an O-ring seal and locked in place with stainless steel screws or pins and shall be replaceable. Shafts shall be provided with stuffing box and packing or O-ring seals at each end which are externally replaceable.

B. Unless otherwise specified, valves shall, as a minimum, conform to the following ratings:

Size, inches	Working pressure, psig	Hydrostatic test pressure, psig
2 - 12	175	350
14 - 40	150	300

2.4 PRODUCT DATA

A. Manufacturer's catalog information including dimensions, cross-sectional views, details of construction and materials list shall be provided in accordance with Section 01 33 00 "Submittal Procedures."

PART 3 - EXECUTION

3.1 GENERAL

A. Spring loaded swing check valves shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 40 05 78.11 - AIR RELEASE VALVES FOR WATER SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Air release valves for water service piping.
B. Related Requirements:
   1. Division 01 Specification Section apply to Work of this Section.
   2. Section 09 90 00 “Painting and Coating:” Preparing, priming, and painting surfaces, including field-applied and equipment finishing.
   3. Section 40 42 13 “Process Piping Insulation:” Insulation applied to process piping systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
B. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 01 30 00 “Administrative Requirements:” Requirements for coordination.
B. Coordinate Work of this Section with installation of process piping.

1.4 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit manufacturer catalog information.
C. Shop Drawings: Submit assembly drawings indicating materials, dimensions, weights, and end connections.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer Instructions: Submit special procedures and setting dimensions.
F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

I. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.
   2. Submit manufacturer's approval of installer.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for submittals.
B. Project Record Documents: Record actual locations of air release valves.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.
B. Perform Work according to AWWA standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.
D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
   3. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for warranties.
B. Furnish five-year manufacturer's warranty for air release valves.

PART 2 - PRODUCTS

2.1 AIR RELEASE VALVES FOR WATER SERVICE

A. Manufacturers:
   1. Valmatic
   2. DeZURIK
B. Substitutions: Not permitted.
C. Description:
   1. Comply with AWWA C512.
D. Materials:
   1. Body and Cover: Ductile iron
   2. Float, Seat, and Trim: Type 316 stainless steel.
E. Working Pressure: 150 psig.
F. Size: As indicated on Drawings.
G. End Connections:
   1. Size 1/2 to 3 Inches: Threaded.
   2. Size 4 Inches and Larger: Flanged.

2.2 INSULATION

A. As specified in Section 40 42 13 “Process Piping Insulation.”

2.3 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09 90 00 “Painting and Coating.”

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements:” Requirements for testing, inspection, and analysis.
B. Provide shop inspection and testing of completed assembly.
C. Owner Inspection:
   1. Make completed air release valve assembly available for inspection at manufacturer's factory prior to packaging for shipment.
   2. Notify Owner at least seven days before inspection is allowed.
D. Owner Witnessing:
   1. Allow witnessing of factory inspections and test at manufacturer's test facility.
   2. Notify Owner at least seven days before inspections and tests are scheduled.
E. Certificate of Compliance:
   1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
   2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that field dimensions are as indicated on Drawings.
C. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flanges mate properly.

3.2 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Thoroughly clean end connections before installation.
C. Close pipe and equipment openings with caps/plugs during installation.
D. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions.
B. Provide access for operation, removal, and maintenance, and to avoid discharge to occupied areas or other equipment.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for testing, adjusting, and balancing.
B. Inspect for interferences and proper supports.
C. Testing:
    1. As specified in Section 40 05 51 “Common Requirements for Process Valves.”
    2. Demonstrate operation without undue noise or vibration.
D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.
E. Equipment Acceptance:
    1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
    2. Make final adjustments to equipment under direction of manufacturer's representative.
    3. Repair damaged coatings with material equal to original coating.
F. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.5 CLEANING

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for cleaning.
B. Keep interior of air release valves clean as installation progresses.

3.6 DEMONSTRATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION

SECTION 40 42 13 - PROCESS PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Process piping insulation.
2. Jacketing.
3. Accessories.

B. Related Requirements:
1. Section 09 90 00 “Painting and Coating:” Execution requirements for painting insulation jackets and coverings as specified by this Section.

1.2 REFERENCE STANDARDS

A. ASTM International:
1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
10. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
11. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
12. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
13. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
14. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
15. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
16. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
17. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
18. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

1.3 PREINSTALLATION MEETINGS

A. Section 01 30 00 “Administrative Requirements:” Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit product description, thermal characteristics, list of materials, and thickness for each service and location.
C. Samples: Submit two samples of representative size, illustrating each insulation type.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Instructions: Submit manufacturer's published literature indicating recommended installation procedures.
F. Qualifications Statements:
   1. Submit qualifications for manufacturer and applicator.
   2. Submit manufacturer's approval of applicator.

1.5 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame-spread index of 25 and maximum smoke-developed index not exceeding 50, according to ASTM E84.
B. Comply with ASTM C585 for inner and outer diameters of pipe insulation.
C. Factory-fabricated fitting covers according to ASTM C450.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
B. Accept materials on-Site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
C. Inspection: Accept insulation on-Site in manufacturer's packaging. Inspect for damage.
D. Store insulation according to manufacturer's instructions.
E. Protect insulation from weather and construction traffic, dirt, water, chemicals, and damage by storing in original wrapping.

1.8 AMBIENT CONDITIONS

A. Section 01 50 00 “Temporary Facilities and Controls:” Requirements for ambient condition control facilities for product storage and installation.
B. Install insulation only when ambient temperature and humidity conditions are within ranges as recommended by manufacturer.
C. Maintain recommended temperature and humidity before, during, and after installation for minimum of 24 hours.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for warranties.
B. Furnish one-year manufacturer's warranty for human-made fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Furnish materials according to ASTM standards.

2.2 PIPE INSULATION

A. Type P-1:
   1. Description: Molded glass fiber.
   2. Comply with ASTM C547.
   3. Thermal Conductivity: 0.23 Btu-in./h-ft.-deg. F at 75 degrees F
   4. Operating Temperature Range: Zero to 850 degrees F.
   5. Vapor Barrier Jacket:
      a. Description: Factory-applied, reinforced foil kraft with self-sealing adhesive joints.
      b. Comply with ASTM C1136, Type I.
   6. Jacket Temperature Limits: Minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor-Retarder Jacket:
   1. Description: White Kraft paper with glass-fiber yarn, bonded to aluminized film.
   2. Comply with ASTM C921.
   3. Water Vapor Permeance:
      a. ASTM E96.
      b. 0.02 perms.
B. Aluminum Pipe Jacket:
   1. Comply with ASTM B209
   2. Sheet Thickness: 0.025 inch.
   3. Finish: Embossed

4. Joining: Longitudinal slip joints with 2-inch.
5. Fitting Covers:
    a. Description: Die-shaped, with factory-attached protective liner.
    b. Thickness: 0.016 inch.
6. Metal Jacket Bands:
    a. Width: 1/2 inch.
    b. Thickness and Material: 0.015 inch, aluminum.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor-Retarder Lap Adhesive: Compatible with insulation.
B. Covering Adhesive Mastic: Compatible with insulation.
C. Piping 1-1/2-Inch Diameter and Smaller:
    1. Description: Galvanized-steel insulation protection shield.
    2. Comply with MSS SP-69, Type 40.
    3. Length: Based on pipe size and insulation thickness.
D. Piping 2-inch diameter and larger:
    1. Description: Wood insulation saddle, hard maple.
    2. Inserts Length: Not less than 6 inches.
    3. Thickness and Contour: Match adjoining insulation.
E. Closed-Cell Elastomeric Insulation Pipe Hangers:
    1. Description: Polyurethane insert with aluminum single-piece construction and self-adhesive closure.
    2. Thickness: Match pipe insulation.
F. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: Comply with ASTM C449.
H. Insulating Cement:
    1. Comply with ASTM C195.
    2. Hydraulic setting on mineral wool.
I. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation examination.
B. Verify that piping and equipment has been tested before applying insulation materials.
C. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
B. Fire-Rated Penetrations:
    1. Continue insulation through penetrations of building assemblies or portions of assemblies having fire-resistance rating of one hour or less.
    2. Provide intumescent firestopping when continuing insulation through assembly.
    3. Finish at supports, protrusions, and interruptions.

C. Piping Systems conveying fluids below ambient temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   2. Jacketing:
      a. Furnish factory-applied or field-applied vapor-retarder jackets.
      b. Secure factory-applied jackets with pressure-sensitive adhesive with self-sealing longitudinal laps and butt strips.
      c. Secure field-applied jackets with outward-clinch expanding staples, and seal stapled penetrations with vapor-retarder mastic.
   3. Fittings, Joints, and Valves:
      a. Insulate with molded insulation of like material and thickness as adjacent pipe.
      b. Finish with glass cloth and vapor-retarder adhesive or PVC fitting covers.

D. Glass-Fiber Board Insulation:
   1. Apply insulation close to equipment by grooving, scoring, and beveling insulation.
   2. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
   3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface; on cold equipment, use vapor-retarder cement.
   4. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Piping Exterior to Building:
   1. Provide vapor-retarder jacket.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced, vapor-retarder cement.
   3. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping, with overlap facing down to shed water, or on bottom side of horizontal piping.

F. Heat-Traced Piping Exterior to Building:
   1. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe.
   2. Size insulation large enough to enclose pipe and heat tracing.
   3. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping, with overlap facing down to shed water.

G. Prepare pipe insulation for finish painting as specified in Section 09 90 00 “Painting and Coating.”

END OF SECTION

SECTION 40 77 00 – CONTROL SYSTEM UPGRADES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work:
   1. Furnish and install all instrumentation and control upgrades, including cabling and terminations needed to monitor the perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor on the existing plant SCADA network, and to send control commands, required process data and setpoint changes from the plant PLC to the perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor.
   2. Create HMI screens for the plant SCADA system to monitor perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor status equivalent to the perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor local control Panel.
   3. Connect existing I/O from existing plant PLC to new perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor local control panel as indicated on Project Drawings.

B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 GENERAL REQUIREMENTS

A. Contractor provides services of system integrators to implement requirements of this section. System integrators shall have minimum five years of experience in controls, automation, and/or system integration.

B. Contractor examines site, Drawings, Specifications, and control strategy to determine actual locations, processes, programming strategies, and configurations.

C. Contractor provides Human Machine Interface (HMI), PLC, and SCADA programming as part of Project. Owner and Engineer perform acceptance test of SCADA system as a whole. Test includes visual inspection for conformance with Specifications, functionality of programmed system, program documentation, and system ability to be easily modified. Contractor makes any corrections necessary to fully monitor and control the perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor.

1.3 CONTROL STRATEGY

A. Contractor coordinates all programming efforts with Owner. Control strategy for programming station PLC, represents Owner's minimum requirements.

B. Program Structure and Logic Criteria:
   1. Programming languages other than ladder-logic type, (structured text, function block, etc.) to be kept at minimum if need arises for languages to be utilized, (I/O mapping, analog scaling, etc.).
   2. Do not utilize PLC programming aliasing for tag creation/connection to module I/O.
   3. PLC programming shall not utilize consumer or produced tags within PLC-to-PLC communication as well as PLC-to-HMI communication.
      a. PLC-to-PLC communication utilizes message commands over Ethernet/IP.
      b. PLC-to-HMI communication shall utilize OPC/DDE over Ethernet/IP.
   4. All physical I/O mapped to memory locations outside of those created by PLC.

5. All memory location tag names shall utilize ISA symbols and mnemonic-type naming for PLC memory tags like those utilized within Owner's current programming schemes.
6. HMI creation utilizes a dedicated tag database derived from PLC tag databases directed through compatible communication software.
7. All control and monitoring algorithms programmed within PLCs.
8. HMI development limited to on-screen monitoring, trending, alarming, setpoint alteration, control mode alteration, and minor calculations.
9. HMI calculations shall not supersede or affect PLC programming.
10. All alarms created within PLC shall be visible and alerted on HMI.

C. Control Requirements. Program Station PLC and HMI:
1. In the existing plant Allen Bradley Compact Logix PLC 1769-L32# is the current controller series in use. Contractor to implement communications and connections between new equipment and newly replaced equipment considering the current version, firmware and software in-use at the plant. New automation equipment as supplied by OEM will be required to establish communications with plant PLCs regardless of OEM automation equipment supplied.
2. Transmit plant data necessary for the proper operation of the new equipment via an existing 4-20ma output channel and new data connection as shown on project drawings.
3. Monitor, control, alarm, and trend new equipment on an existing HMI screen, to be chosen by plant personnel.
4. Create/import new screens from local control panels (OIT/HMI) into existing plant HMI system.
5. Monitor perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor System on the existing plant network. Utilize ethernet communications from perforated plate belt screen(s), wash press(es), conveyor, and Level Lodor System to plant network.

1.4 OWNER RESPONSIBILITY

A. Owner and Engineer responsible for providing guidance to PLC programming and HMI configuration.
B. Contractor provides, assistance of system integrator during SCADA startup and commissioning.

1.5 CONTRACTOR RESPONSIBILITY

A. Contractor to provide qualified systems integrator during new equipment installation and replaced equipment installation specific to electrical and control wiring. Systems integrators shall have a minimum of 10 years' experience with industrial control systems utilizing PLC based automation controllers and plant wide operator interface software with emphasis on municipal wastewater treatment systems. Systems integrator shall have at minimum 10 years' experience with Rockwell Software and Allen Bradley based automation controllers. System integrator to coordinate communication requirements as shown on project drawings between newly installed equipment and existing plant control system. System integrator to successfully integrate all new equipment into existing plant control system to include PLC code modifications and HMI screen modifications/additions as required to create a fully functional system with the newly installed equipment. System integrator to successfully integrate replaced equipment with that of existing control loops, PLC code, and HMI screens.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PAYMENT

A. Payment made for all work covered in this section at contract unit price per unit or included in lump sum price per job for items, as shown on proposal. Either such payment shall be complete compensation for complete performance of work per Drawings and Specification provisions.

END OF SECTION

41 12 13.36 – SCREW BULK MATERIAL CONVEYORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing one (1) screenings shaftless conveyor and associated controls. Equipment shall be installed as shown on the Contract Drawings as specified herein, and in compliance with all local, state and federal codes and regulations.
   2. Each conveyor shall consist of a shaftless spiral screw, trough, inlet chute(s) drive system, support legs, covers, and electrical controls, and all other appurtenances required and as shown on the drawings.

1.2 MANUFACTURER

A. The shaftless conveyor equipment specified in this section shall be the SAVÉCO® North America, Inc. WAM Shaftless Conveyor Model SSC400.
B. The conveyor is part of an engineered fully integrated screenings system, and as such the conveyor as identified herein shall be provided by the same manufacturer as that of the barscreens and wash/presses. See Section 46 21 14 Perforated Rotating Plate Screens and Section 46 21 73 Screenings Washing and Compacting Equipment. No other conveyor equipment and/or manufacturer is acceptable. All screenings equipment shall be provided by the same supplier.

1.3 REFERENCES

A. The Shaftless Conveyor shall, as applicable meet the requirements of the following industry standards:

- AISI (American Iron and Steel Institute)
- ANSI (American National Standards Institute)
- ABMA (American Bearing Manufacturers Association)
- AGMA (American Gear Manufacturers Association)
- NEMA (National Electrical Manufacturer's Association)
- NFPA (National Fire Protection Association)
- ASTM (American Society for Testing and Materials)
- WSC (American Welding Society Code)
- ASME (American Society of Mechanical Engineers)
- NEC (National Electrical Code)
- UL (Underwriters Laboratory Standards)

1.4 EXPERIENCE

A. To establish a quality standard for the manufacture and production of the equipment, all manufacturers shall meet the requirements listed in this section.
B. Manufacturers shall have a minimum twenty-five (25) years history of engineering and fabricating shaftless conveyors. Documentation of at least ten (10) installations having been installed for a minimum of five (5) years shall be provided.

C. The minimum acceptable standards for the equipment shall conform to the project contract documents as outlined in the respective sections of the Specifications and Drawings.

1.5 SUBMITTALS

A. The Manufacturer shall furnish the required number of submittals (and an electronic version) within 4-6 weeks of receipt of the order to verify compliance with the specification. The submittals shall include:
   1. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
   2. A list of all deviations from drawings and specifications.
   3. Descriptive literature, bulletins and/or catalogs of the equipment.
   4. Complete data on motors and gear reducers.
   5. Wiring diagrams and electrical schematics for all control equipment to be furnished.

1.6 WARRANTY

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of 1-Year from date of start-up. Items specifically not covered by the warranty are consumable wear parts as identified in the O&M manual.

PART 2 - PRODUCTS

2.1 ACCETABLE MANUFACTURERS

A. Shaftless Spiral Conveyor Model shall be as supplied by SAVÉCO North America, Inc. – WAM Shaftless Conveyor Model SSC400..
B. Substitute equipment must be modified as necessary to provide the specified features and to meet the specified requirements.

2.2 QUALITY ASSURANCE

A. Equipment manufacturer shall be ISO 9001 certified.
B. The Shaftless Conveyor shall be shipped to the site fully assembled, if possible, and dependent upon the length of the conveyor. Some ancillary components may be removed to prevent damage during shipment.

2.3 PERFORMANCE REQUIREMENTS

Conditions	**Unit**
Number of Shaftless Conveyors	One (1)
Transport Capacity	210 ft^3/hr.
Angle of Inclination	Horizontal
Nominal Screw Diameter	16 inches
Overall Trough Length	~48.7 ft.
Configuration	Push
Number of Inlets	Two (2)
Number of Outlets	Two (2)

2.4 UTILITY REQUIREMENTS/ENVIRONMENTAL CONDITIONS

Requirements/Locations	**Unit**
Motor HP	5.0
Power Supply (V/P/Hz)	480/3/60
Conveyor Installation Location (indoor/outdoor)	Indoor
Conveyor NFPA Classification Requirement	Class I, Div. 2
Control Panel Location (indoor/outdoor)	Indoor
Control Panel NFPA Classification Requirement	Non-hazardous

2.5 DESIGN REQUIREMENTS

A. Materials: The materials used in the fabrication of the spiral conveyor furnished under this section shall conform to the following:

Trough	304 stainless steel
Spiral	Micro Alloy steel: Minimum thickness of 3/4 inch and depth of 2.5 inch.
Wear liners	1/4-inch-thick UHMWPE
Covers	304 stainless steel with neoprene gasketing.
Inlet Hoppers and Discharge Chutes	304 stainless steel
Support Legs	304 stainless steel
Bolts, nuts, and washers	304 stainless steel
Anchors	304 stainless steel

B. General
   1. Functional Description: The conveyor will accept solids with a dry weight not less than 8 percent solids at the screening's inlet as shown on the drawings. The shaftless spiral screw will convey the solids to the discharge point as shown on the drawings.
   2. Refer to and comply with the design performance requirements list in Paragraph 2.3.
   3. Shop Surface Preparation/Coating: All welds shall be cleaned and passivated to remove weld spatter, slag and discoloration using glass bead blasting process. Bearings, electrical devices, motor, and gear reducer shall be provided with the manufacturer's standard coating system.

C. Trough Assembly
   1. The trough assembly shall consist of a U-trough, wear liner, inlet area, and trough cover.
   2. The U-trough shall be constructed from material per Paragraph 2.5A.
   3. The wear liner will support the spiral throughout the trough length and be constructed of 1/4-inch thick UHMW. Wear liners shall be provided in 4-foot maximum lengths and held in place by clips for ease of replacement.
   4. Hold down angles from 304 stainless steel shall be provided on both sides of the trough assembly to control excessive vertical movement of the spiral flights. Hold downs shall not interrupt material transportation.
   5. Inlet hopper to mate up with screen discharge chute. Inlet hopper shall have a minimum incline of 60 degrees from horizontal.
   6. Except for the inlet area, the trough will be supplied with covers. Trough covers will be provided with neoprene gaskets and constructed from minimum 14ga thick type 304 stainless steel and bolted to the flanges of the U-trough.

D. Shaftless Spiral Screw
   1. The spiral screw shall be single stage formed in sections from one continuous flat bar. The minimum thickness and height for the spiral shall be 3/4-inch x 2.5 inches.
   2. Spiral flights shall have full penetration welds at all splice connections. Spiral flights shall be welded to a 4-inch pipe with flanged disc end for connection to the end drive shaft.

E. Inlet Hopper
   1. The inlet hopper shall be designed to accept discharge screenings from the screen wash press discharge chute. The hopper shall directly interface with the screen wash press discharge with no solids or water bypass.
   2. The inlet hopper shall be fabricated from minimum 12-gauge type 304 stainless steel.

F. Slide Gate
   1. One (1) 16-inch by 16-inch Slide Gate, square flange design. Materials of Construction: Seal-SINT polyurethane; Blade – 304 Stainless Stee; Gate Body – Cast Aluminum; Gate Enclosure – 304 Stainless Steel. Gate includes:
      a. One (1) Electromechanical drive, 230-460V/60HZ/0.5 HP motor (Class I, Division 2).
      b. Two (2) Micro Limit Switches (Class I, Division 2).

G. Drive Assembly
   1. Gear reducer shall be a helical gear type with hollow input shaft. The unit will be provided with a cast iron frame and be designed in accordance with AGMA recommendations for Class II service based on the horsepower required to operate the conveyor.
   2. The motor shall be TEFC (Class I, Division 2), 5.0 HP, 460 Volt, 3 phase, 60 Hz. The motor shall be NEMA design code B and be direct coupled to the reducer.

2.6 ELECTRICAL CONTROLS AND DEVICES

A. In addition to the drive motor and slide gate actuator, the equipment supplier shall furnish all electrical items specifically called for in this specification section. The contractor shall supply all other electrical items, and interconnecting wiring of proper size, including all conduit and supports required to place the equipment into service.
   1. The following components will be included in the associated screw conveyor control panel to provide proper operation of the equipment:
      a. NEMA 4X Type 304 Stainless Steel Enclosure suitable for wall mounting.
      b. Main disconnect with through door interlock handle.
      c. Step down control transformer.
      d. Branch circuit protection.
      e. Drive motor starter.
      f. Slide gate actuator starter.
      g. Emergency stop pushbutton.
      h. HOA switch.
      i. Hour meter for motor.
      j. Run and off indicating lights.
      k. Position sensors for Gate Operator.
      l. Alarm light indicating over current, and starter overload.
      m. Alarm reset pushbutton.
      n. Timers and relays to provide necessary control logic and monitor equipment mounted electrical devices.

o. Run and alarm auxiliary contacts for use by the customer.
p. UL Label.
q. Remote Open and Close commands for slide gate actuator.
r. Slide Gate Open Status for use by the customer.

B. Emergency Stop pull cord.
1. An emergency stop system consisting of a pull cord switch actuated by a cable system running the full length of the conveyor or by activating e-stop directly at the controller.
2. Cable shall be orange colored, plastic covered stainless steel aircraft cable.
3. Support eyes shall be fitted as need along length of conveyor from 304 stainless steel.
4. The switch shall be manually set after actuation and shall provide visual indication of operation. Switch shall be single-pole, double-throw output contact. Switch shall be normally closed and shall open when pull cord switch is actuated.
5. Emergency stop system shall be rated for area classification.

2.7 OPERATING, MONITORING, AND CONTROL

A. Sequence of Operation
1. Hand Operation: When the shaftless conveyor selector switch is in the Hand position, the conveyor spiral will run continuously. Turning the shaftless conveyor selector switch to Off will stop the unit.
2. Automatic Operation: When the shaftless conveyor selector switch is in the Auto position, the spiral will cycle on and off on demand from a remote contact closure from the wash press control panel system. An off-delay timer shall control the end of the conveyor operational sequence. The screw conveyor shall be interlocked with the wash press and shall operate anytime either of the two (2) wash presses are in operation.
3. Emergency Stop: The unit can be deactivated at any time by pressing either the control panel mounted emergency stop push button or unit mounted emergency pull cord.
4. Fault Conditions: Motor overload condition will stop the motor and illuminate the fault light.
5. Slide Gate: When in Auto, Slide Gate shall open and close on demand from remote contact closures from the Level Lodor Control Panel.

2.8 ANCHORAGE AND FASTENERS

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2-inch diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.
B. Fasteners: All fasteners shall be Type 304 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.9 SPARE PARTS

A. The following minimum spare parts shall be provided for the shaftless conveyor:
   1. Two (2) ULTMW wear liners.
B. Manufacturer shall recommend any additional spare parts deemed necessary based on experience with the screen in similar applications.

PART 3 - EXECUTION

3.1 PREPARATION

A. The mounting points TOC shall be level and parallel and of proper size.
B. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings, prior to fabrication. Indicate field measurements on Shop Drawings.

3.2 LIFTING AND MOVING EQUIPMENT

A. Lifting points shall be identified on all equipment. A crane of sufficient capacity must be on site for unloading the equipment from the truck and placement in the channel for installation.

3.3 INSTALLATION

A. The installation is the responsibility of the Contractor. Complete installation procedures to be included in the O&M manual shipped with the unit.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Contractor and Manufacturer shall provide O&M Manual (s) as described in Section 01 70 00 “Execution and Closeout Requirements” and Section 23 05 00 “General Mechanical Requirements.”

3.5 START UP/TRAINING/FIELD QUALITY CONTROL

A. The initial start-up of equipment will be performed by an authorized manufacturer representative. The authorized representative shall verify the proper operation and installation and provide training to the equipment operators which shall be included with the barscreen start-up and training.

3.6 ADJUSTING AND CLEANING

A. Information on minor periodic adjustments and cleaning is contained in the Operating and Maintenance Manual.

END OF SECTION

SECTION 41 52 13 – SCREENINGS BIN – LEVEL LODOR

PART 1 – GENERAL

1.1 SUMMARY

A. Section covers furnishing two (2) LEVEL LODOR™ self-contained leveling covers to evenly distribute and cover a nominal 20-yard waste container.

1.2 QUALITY ASSURANCE

A. Equipment furnished in this specification shall be fabricated and assembled in full conformity with this specification and as shown in the contract drawings. Each unit shall be furnished complete with all supports; all mechanical equipment required for proper operation, including complete drive units; all steel, iron, and other metal construction specified herein; and all additional materials or fabrication as required by the supplier's design.

B. All equipment included in this section shall be furnished by a single supplier who shall be responsible for the design, coordination, and the satisfactory operation of the system. The patented LEVEL LODOR™ system shall be the Shaftless type as manufactured by JDV Equipment, Dover, New Jersey including all equipment, materials and appurtenances necessary and as specified herein. No other screening bins equipment and/or manufacturer is acceptable. The supplier of this equipment shall be the same supplier providing barscreens, wash/presses, and horizontal conveyor for the project.

C. The LEVEL LODOR™ equipment shall include, but not be limited to the following:
   1. Container Cover
   2. Spiral flighting
   3. Troughs and Liners
   4. Chutes
   5. Covers.
   6. End Shaft
   7. End Seals
   8. Motor Reducer
   9. Mounting and Support Structure with automated tilting
   10. Level Indication
   11. Guide rails and stops
   12. Electrical Controls
   13. Safety Accessories

1.3 SUBMITTALS

A. General
   1. Data Sheet with description of the proposed equipment, size, length, type, capacity, arrangement, materials of construction, motor size, motor type, motor power requirements and equipment weights.
   2. List of components and accessories to be furnished with catalog information.
   3. Significant dimensional differences between the equipment and specified herein, indicated on the drawings and the proposed equipment.

B. Design Calculations
   1. Submit capacity and power requirements of the screw conveyor.
   2. Submit bearing life calculations for the gear reducer bearing and or drive end bearings.
   3. Design loadings to be transmitted to foundations or supports.

C. Shop Drawings
   1. Drawings and specifications for components of the equipment, showing principal dimensions and parts, materials of construction, material thicknesses (where applicable).
   2. Screw diameter, pitch, and rotational speed(s).
   3. Equipment performance specifications.
   4. Drive details, including service factor of gear reducer based on absorbed horsepower and installed motor horsepower.
   5. Size and location of anchor bolts or attachments to the foundations or supports.

D. Quality and Control Submittals
   1. Operation and Maintenance manuals
   2. Special shipping, storage, protection and handling instructions where applicable
   3. Manufacturer's installation instructions

1.4 MANUFACTURER

A. All equipment included in this section shall be furnished by a single supplier who shall be responsible for the design, coordination, and the satisfactory operation of the system. The patented Level LODORTM system shall be manufactured by JDV Equipment, Dover, New Jersey including all equipment, materials and appurtenances necessary and as specified herein.
   1. The shaftless screw conveyors shall be manufactured by a supplier with not less than twenty (20) operating installations with the Level LODOR in North America.
   2. The Supplier shall acknowledge that he is familiar with all the requirement of the contract documents relevant to the equipment supplied herein and agrees to perform and observe all obligations under the contract documents which relates to the portion of the work covered by this section and related sections.
   3. The Supplier of the material and/or products included in this section undertakes and agrees to defend, at Supplier's own expense, all suits, action or proceeding brought against the municipality or it's Contractor(s) for actual or alleged infringement on any United States patent or foreign letters patent because or on account of the employment of sales of such material or products, and further agrees to pay and discharge any and all judgments or decrees which may be rendered in any such suit, action or proceeding against the defendants herein.

1.5 WARRANTY

A. The manufacturer shall provide a twelve (12) month warranty from the date of start-up or beneficial use.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT

A. All products supplied shall meet the following as a minimum intent of supply.

1. Power supply - Power supply to the equipment will be 480 volts, 60 Hz, 3 phase. Power supply for controls shall be 120 volts, 60 Hz, single phase.
2. Electrical Equipment - All electrical equipment shall conform to applicable standard of the National Electrical Manufactures Association (NEMA) and the National Electrical Code (NEC). Both power and control equipment shall be insulated for not less than 600 volts even though operating voltages may be lower. All motors shall be totally enclosed, fan cooled (TEFC). Control panels shall be NEMA 4X, stainless steel.
3. Fabrication - All welds shall be continuous unless otherwise specified. Facing surfaces of bolted joints shall be shop primed. Facing surfaces of field welded components shall be beveled and match marked.
4. Edge Grinding - Sharp corners of all cut and sheared edges shall be made smooth by a power grinder.
5. Fasteners - All bolts, nuts, washers, and other fasteners shall be AISI 316 stainless steel.
6. Surface Preparation - All iron and mild steel surfaces to be painted shall be dry abrasive grit blasted to "near white metal" in accordance with SSPC-SP6 or SSPC-SP10, and in accordance with the painting section of these specifications. Grit blasted surfaces shall be painted within 24 hours to prevent rusting and surface discoloration.
7. Painting - After surface preparation, metal surfaces except for the spiral flighting shall receive a minimum of one coat of Tnemec "66-1211 Epoxoline primer" or equal, and one coat of "46H-413 Hi-Build Tnemec-tar" coal tar epoxy or equal, to provide a total minimum dry film thickness of 15 mils prior to shipment to jobsite. Stainless steel components shall be furnished unpainted.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. The Level LODOR system shall be designed to meet the following minimum performance and design requirements. The standards for conveyor selection shall be based on the operational experience of the manufacturer with shaftless screw conveyors, and not standards developed for shafted screw conveyors.

B. Schedule of Leveling System(s):

POSITION	Level LODOR NO. 1	Level LODOR NO. 2
	SSC - 1	SSC-2
Cubic ft per Hour	210	210
Material	Screenings	Screenings
Material Density (lb/ft$^{3)}$	60-65	60-65
Max Solids (in)	3	3
Container Size, CY	20	20
Max Screw Speed RPM	25	25
Max Trough Fill	50%	50%
Min Flight OD	11.2”	11.2”
Min Spiral Weight per ft	27	27
Minimum Trough Width	12.5”	12.5”
Minimum HP	3	3
Drive Location	Inlet End	Inlet End
Motor Type	TEFC	TEFC
Reversing Screw	None	None

C. The Equipment Manufacturer shall provide "Performance Bond" in the amount of 100% of the cost of the equipment to be in effect for a minimum period of 3 years from the anticipated date of final acceptance by the Owner.

2.3 MATERIALS

A. Unless otherwise specified or permitted, the materials used in the fabrication of the equipment under this section shall conform to the following:

Chutes	AISI 304, ASTM A167, 18-8
Troughs, End Plates, Covers	AISI 304, ASTM A167, 18-8
Container Supports	A36 Galvanized Carbon Steel
Hoppers	AISI 304, ASTM A167, 18-8
Spiral Flighting	Cold formed, High Strength Micro Alloy Carbon Steel with a minimum hardness of 220 Brinell (+/-)
Wear Liner	Ultra-High Molecular Weight Polyethylene (UHMW)
Bolts, Nuts, and Washers for Conveyor Supports	AISI 316, ASTM A167, 18-8
Conveyor Trough	AISI 304, ASTM A167, 18-8
Container Guide Rails	A36 Galvanized Carbon Steel

2.4 CONTAINER COVER

A. Components of the cover shall include truss/support assemblies, cover plates, purlins and conveyor designed to allow water to drain off top. Cover plates to be a minimum of 3/16". Cover to be designed to allow pivoting without excessive deflection. The cover shall include at a minimum, the following:
   One (1) flanged odor control connection, 8-inch
   One (1) flanged connection for radar sensor, 8-inch
   One (1) radar sensor
   One (1) inspection hatch

2.5 SHAFTLESS SCREW CONVEYOR

A. Spiral flighting for the shaftless screw conveyors shall be designed to convey material without a center shaft. The minimum overall spiral weight and surface pressure shall be as specified herein. The conveyor will include an inner flight to increase axial strength and capacity of the conveyor. The minimum spiral weight shall be specified herein.

B. Spiral flights shall be cold-formed high strength micro alloy steel with a minimum hardness of 220 Brinell. The spiral flights shall be designed with the stability to prevent distortion and jumping in the trough. The torsional rating of the auger flighting shall be reached at 30 percent of the Fy value in the extreme fiber of the flight material. Supplier shall demonstrate that, at 250 percent of the motor nameplate horsepower, the drive unit cannot produce more torque than the torsional rating of the flighting, and that the "spring effect" of the spiral shall not exceed + 0.8 mm per meter of length at maximum load conditions.

C. Spiral flight material, fabrication technique, strength, hardness, and overall quality are critical to the proper operation of the conveying system as herein designed. Spiral flights that do not meet the characteristics specified herein are not acceptable. Supplier shall provide certified written documentation that the spiral flights conform to the following:

Material:	Micro Alloy Steel
Hardness:	220 Brinell Minimum +/-
Concentricity:	2.0 mm +/-

1. Supplier shall maintain a certified factory quality control program which shall include certification of spiral flighting as described herein.
2. The spiral flighting shall be formed in sections from one continuous flat bar and shall be concentric to within 2mm +/-. Sectional flighting formed from plate shall not be permitted.
3. Spiral flighting shall have full penetration welds at all splice connections. The flights shall be aligned to assure true alignment when assembled in the field and shall be made in accordance with the supplier's requirements. The spiral flights shall be coupled to the end shaft by a flanged, bolted connection.
4. The connection of the spiral to the drive system shall be through a flanged connection plate that is welded to the spiral forming a smooth and continuous transformation from the flange plate to the spiral. The drive shaft shall have a mating flange and shall be bolted to the spiral connection plate.

2.6 HORIZONTAL TROUGHS

A. Troughs shall be like the dimensional standards of CEMA 300 and enclosure classification IIE. Each conveyor trough shall be U-shaped, fabricated from a minimum 1/8 inch stainless steel plate.
   1. Stiffeners shall be placed across the top of the trough and fastened to both sides of the trough to maintain trough shape and act as a face seal for the covers; apply a continuous gasket, one half inch width, to the entire top face of the trough top flange and stiffeners.
   2. Each trough shall be equipped with filling and/or discharge openings as required by the contract drawings. If required, each filling and discharge opening shall be flanged suitable for interconnection to other devices. Any interconnecting devices such as chutes and hoppers shall be fabricated from the same material as the troughs.
      a. A flanged covered drain outlet shall be provided with each conveyor to facilitate cleaning.
      b. The portion of each trough that is not covered by the filling chute shall be covered by a bolted cover of a material identical to the trough. The covers shall be manufactured in maximum four foot length section to allow for access to the conveyors. To prevent unsafe access to the conveyors, quick opening covers will not be allowed.

2.7 WEAR LINER

A. The wear liner for each conveyor shall be fabricated of ultra-high molecular weight polyethylene (UHMW) sintered with an anti-wear filler to reduce wear and synthetic lubricant to reduce friction.
   1. The wear liner shall be furnished in maximum four foot sections, 3/8” minimum thickness, to provide ease of replacement.
   2. The liner shall be held in place with clips; no fasteners will be allowed.

2.8 INLET AND DISCHARGE CHUTES

A. Inlet and discharge chutes shall be provided by the conveyor supplier as shown on the drawings. All chutes shall be fabricated from the same material as the conveyor trough.

2.9 SUPPORTS

A. Each LEVEL LODOR™ shall be furnished complete with supports suitable for mounting as shown on the contract drawings and as required to allow unit to tilt up so dumpster can be removed and replaced. The supports shall be shop fabricated from structural steel shapes and plates, and shall be assembled and fitted to the conveyor prior to its delivery to the jobsite. Supports and conveyor segments shall be match marked and shipped to the jobsite for assembly by the contraction others.
   1. Supports shall be fabricated of AR 36 steel, galvanized or equal.
   2. All shop welding shall conform to the latest standards of the American Welding Society (AWS). The supports shall be designed to avoid interference with other equipment or equipment supports.

2.10 GUIDE RAILS

A. The container rollers shall be guided into position with floor guide rails, one on each side. The guide rails shall be constructed from 3/8" thick carbon steel angle with coped ends to aid with the container alignment.
   1. A 1/2" carbon steel stop plate shall be supplied by the LEVEL LODOR™ manufacture and anchored to the floor as per the manufacturer's recommendations.
   2. The 2" high side guides rails shall be anchored to the concrete pad.
   3. All carbon steel shall be factory galvanized.
   4. Anchor bolts shall be spaced on 24-inch centers minimum.

2.11 ELECTRIC HOIST

A. A 1.5 ton electric hoist shall be mounted on front end support. Hoist shall be mounted to support and installed as part of the LEVEL LODOR™. General components of the hoist shall meet the following conditions.
   1. Arrange all working parts for convenient inspection, lubrication, adjustment, repair, or replacement. Assemble paint, test, and adjust the equipment, in the shop as far as practicable before shipment.
   2. House the operating machinery and other exposed parts suitably, fabricate the exterior of the unit to have smooth surfaces or pleasing appearance.
   3. Design the hoist with an overload limit device to prevent damage to the equipment or structure if loads more than the specified capacity of the hoist are applied.
   4. Place a label, easily readable from the operating floor on each monorail beam showing the rated capacity of the equipment. Provide all appurtenances, caution markers, and appliances necessary to comply with applicable safety laws and codes.
   5. Unless otherwise shown or specified, provide all hoisting equipment suitable for normal indoor and outdoor service as shown.
   6. Design all gearing to meet requirements of CMMA Specification No. 74 and AGMA Standards and of helical or spur type constructed of heat treated steel. Provide worm gears of bronze and with precision machined cut teeth. Provide all pinions of heat treated alloy steel. Enclose or guard gearing and provide either oil bath or splash lubrication.
   7. Design the gear reducer or gear motor specifically for crane service with minimum classification of moderate shock service and with minimum service factor 1.0.

2.12 STRUCTURAL DESIGN

A. All structural supporting members shall be designed such that the ratio of the unbraced length to least radius of gyration (slenderness ratio) shall not exceed 120 for any compression member and shall not exceed 240 for any tension member (of angles about Z-Z axis). In addition, all structural members and connections shall be designed so that the unit stresses will not exceed the American Institute of Steel Construction allowable stresses by more than 1/3 when subject to loading of twice the maximum design operating torque of the spiral conveyor drive motors.

B. Design shall be signed and sealed by Texas Registered professional Structural Engineer.

2.13 DRIVE UNITS

A. Each spiral conveyor shall be driven by a constant-speed integral gear reducer/motor drive unit mounted to an adapter flange mounted to the end plate of the conveyor. The adapter flange shall allow the leakage of any material from the conveyor trough to atmosphere rather than into the gear reducer/ motor drive unit. Direct coupling of the gear reducer/motor drive unit to the end flange of the conveyor will not be acceptable.

B. The drive unit shall be rigidly supported so there is no visible "wobble" movement under any operating condition. In the event of a prolonged power failure or emergency system shutdown the drive system shall be designed, at a minimum, to start the conveyor from a dead stop with the trough filled throughout its entire cross sectional area and length with partially dried and hardened dewatered material.

C. Each motor shall be 460 volt, 60 Hz, 3 phase conforming to the General Equipment specifications, except as modified herein. Each motor shall be high efficiency, 40C ambient rated, 1.15 service factor and shall have Class F insulation. Motor shall have a TEFC enclosure with Design B speed/torque characteristics.

2.14 GEAR REDUCERS

A. All gears shall be AGMA Class II, single or double reduction, helical gear units with high capacity roller bearings.
   1. Bearings shall be designed for the thrust loads from the fully loaded startup condition and shall have an AFBMA B10 life of 30,000 hours.
   2. The reducer will be the standard air cooled unit with no auxiliary cooling.
   3. The gear reducer shall be sized with a torque service factor of 1.5 times the absorbed power or 1.1 times the motor nameplate, at the driven shaft speed, whichever is greater.

2.15 PACKING

A. An adjustable greased gland packing ring consisting of two Teflon coated packing rings shall seal the drive shaft at its penetration through the end plate.

2.16 CONTROL SAFETY DEVICES

A. Motion Failure Alarm Unit - Each conveyor drive unit shall be equipped with a motion failure alarm unit. The location and mounting details shall be as recommended by the conveyor manufacturer. Motion sensors shall be the non-contacting type using a probe with a pre-amplifier and main electronic assembly. The main electronic unit shall operate on 120 volt, single phase, 60 Hz power supply, and shall be housed in a NEMA 4X enclosure. A 0 to 60 second time delay shall be provided for startup of the conveyor.

B. Emergency Shutdown - Each conveyor shall be furnished with an emergency trip cord and safety switch. The cord shall run the full length of each conveyor. The trip switch shall immediately stop all conveyors when the switch is actuated.

2.17 CONTROLS

A. The main control panel shall be NEMA 4X supplied by equipment manufacture for wall mounting by the contractor. Power supply shall be 480VAC, 3 phase, 60 Hertz. Panel shall have the following components as a minimum:
   1. Main Circuit Breaker
   2. Disconnect Switch
   3. Motor Starters
   4. Control Transformer
   5. H-O-A Switch
   6. Conveyor Run Light
   7. Alarm Light
   8. Dumpster Full Light
   9. Alarm Horn
   10. Silence Button
      a. On/Off Switch for Electric Hoist Controls
      b. E-Stop
   11. Allen Bradley PLC Control
   12. Ethernet Communications with PLC

B. In addition, controls shall include relays and timers to form a complete operational system.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

A. Conveyors shall be inspected and operated in the shop with the actual drive unit for this project in its entire length. Conveyor longer than the required shipping lengths will have the screws tack welded together and tested in their entire length.
   1. Conveyors should be operated for a minimum of 15 minutes and observed for alignment and abnormal operation. Conveyors shall be corrected as necessary.
   2. Prior to shipment the tack welds will be broken apart and conveyors suitably prepared for shipment.
   3. A video of the test should be supplied on disk to the contractor to be forwarded on to the engineer for record purposes. Video must be received to get paid.

3.2 OPERATION AND MAINTENANCE MANUALS

A. Contractor and Manufacturer shall provide O&M Manual(s) as described in Section 01 70 00 “Execution and Closeout Requirements” and Section 23 05 00 General Mechanical Requirements.”

3.3 MANUFACTURER'S FIELD SERVICES

A. For the equipment installed the supplier shall provide a factory trained, experienced, competent, and authorized representative of the supplier or manufacturer to the jobsite to inspect, check, and approve the equipment installation supervise initial operation, and to train operating personnel in the proper operation and maintenance of the system.

1. These services shall be performed by the supplier's representative at the jobsite for a minimum three (3) eight 8-hour days (not necessarily consecutive), when the equipment is placed in service and shall coincide with the start-up and training of the perf screens.
2. The supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchorage and has been operated under full load conditions and that it operates satisfactorily.

END OF SECTION

SECTION 43 23 13.27 – OVERHUNG CLOSE-COUPLED HORIZONTAL CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies recessed impeller vortex pumps with frames and motors for pumping abrasive slurries.

B. The intent of this project is to replace the existing equipment with similar type equipment as specified herein and install it within the same general footprint, configuration, and performance as the existing.

C. EQUIPMENT LIST:

Item	Equipment No.
Grit Pump	P 01221
Standby Grit Pump	P 01222
Grit Pump	P 01223

D. OPERATING CONDITIONS: Pumps shall be identified by the specified equipment numbers and shall operate at the following conditions:

Equipment Number	Max. pump speed, rpm	Capacity at rated head, gpm	Rated head, ft.	Max. motor horsepower	Solids passing ability, in.
P01221	1000	400	60	30	4
P01222	1000	400	60	30	4
P01223	1000	400	60	30	4

1.2 QUALITY ASSURANCE

A. GENERAL: Pumps shall be capable of continuous operation, pumping abrasive slurries such as grit and sludge.

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

1. ASTM A48 – Gray Iron Castings
2. ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality
3. ASTM A276 – Stainless and Heat-Resisting Steel Bars and Shapes
4. ASTM A532/A532M – Abrasion-Resistant Cast Irons

1.3 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00 “Submittal Procedures.”

1. Performance curves developed for specified operating conditions showing relationship between flow, head, efficiency, and horsepower.
2. Construction details and materials of construction.
3. Motor data as required in Section 46 05 13 “Common Motor Requirements for Water and Wastewater Equipment.”

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Pumps shall be Wemco Model C, Goulds Model 6100, or approved equal, modified as necessary to provide the specified features and to meet specified operating conditions.

2.2 MATERIALS

Component	Material
Casing and impeller	Ni-hard or hardened high chrome iron, ASTM A532, with Brinell hardness of 600 min
Frame	Cast iron, ASTM A48, Class 25/35
Shaft	Steel, ASTM A108, Grade 1141 or 1045
Shaft sleeve	Stainless steel, ASTM A276, Type 416 or 420, Brinell hardness of 450 min
Water lubricated seal (Reference Section 46 00 00)	
Lantern ring	Teflon
Packing ring	Nonasbestos, Teflon w/GFO fiber
Split gland	Bronze or 316 stainless steel
O-ring	Buna-N

2.3 EQUIPMENT FEATURES

A. GENERAL: Design of each pump shall be such that pumping action is provided by the vortex induced by rotation of the impeller with the impeller completely out of the flow path from the suction to the discharge. All parts have machined register fits for ease of assembly. Ground fits will not be acceptable.

B. CASING: Casing shall be 3 piece construction with separate rear liner and separate suction to allow front or back pull-out.

C. IMPELLER: The impeller shall be vortex type with vanes and an integral rim forming a cup-type design.

D. SHAFT PACKING: Shaft packing shall be as specified in Section 43 23 13.27 “Overhung Close-Coupled Horizontal Centrifugal Pumps.” The seal liquid shall be provided from an external source.

E. BEARINGS: Bearings shall be oil lubricated (100,000 hours, L-10 rated life), at maximum efficiency, as specified in Section 46 00 00

F. DRIVE UNIT: Each pump shall be V-belt driven by a Type 2, 1750rpm motor conforming to Section 22 05 13. Maximum motor horsepower shall be as specified in Section 43 23 13.27 1.01 C. Motor shall be provided on an adjustable base with adjustable pitch sheaves as specified in Section 46 05 13.

G. BASE: Pump and drive unit shall be mounted on a common, one-piece base provided with grout holes.

2.4 SPARE PARTS

A. The following spare parts shall be provided for each size pump:
   1 – set of all gaskets
   1 – shaft of sleeves
   2 – sets of packing
   1 – lantern ring
B. Spare parts shall be tagged and stored as specified in paragraph 46 05 13 “Common Motor Requirements for Water and Wastewater Equipment.”

2.5 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 “Submittal Procedures:”
   1. Motor data as specified in Section 46 05 13“Common Motor Requirements for Water and Wastewater Equipment.”
   2. Applicable operation and maintenance information specified in Section 01 70 00.
   3. Electric motor manufacturer’s standard overhaul instructions for motors 5 HP and larger.
   4. Mill certificates confirming hardness of casings, suction pieces, impellers, wear plates and shaft sleeves.
   5. Manufacturer’s Installation Certification.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Contractor and Manufacturer shall provide O&M Manual(s) as described in Section 01 70 00 “Execution and Closeout Requirements” and Section 23 05 00 “General Mechanical Requirements.”

3.2 PUMPS

A. Each pump shall be aligned, connected and installed in accordance with the manufacturer’s instructions. The installation and initial operation of all components shall be field certified by a Manufacturer’s Representative.

END OF SECTION

SECTION 46 00 00 – GENERAL REQUIREMENTS FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies general requirements which are applicable to all mechanical equipment. The Contractor is responsible for ensuring that all mechanical equipment meets the requirements of this section in addition to the specific requirements of the individual equipment specification section.

B. EQUIPMENT LISTS: Equipment lists, presented in these specifications and as specified on the Drawings, are included for convenience of the Contractor and are not complete listings of all equipment, devices, and material to be provided under this contract. The Contractor agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

1.2 QUALITY ASSURANCE

A. ARRANGEMENT: The arrangement of equipment shown on the drawings is based upon information available to the Owner at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revisions to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations.

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

1. AFBMA Std 9 - Load Rating and Fatigue Life for Ball Bearings
2. AFBMA Std 11 - Load Ratings and Fatigue Life for Roller Bearings
3. ANSI B1.1 - Unified Screw Threads
4. ANSI B1.20.1 - Pipe Threads, General Purpose (Inch)
5. ANSI B16.1 - Cast Iron Pipe Flanges and Flanges Fittings, Class 125
6. ANSI B18.2.1 - Square and Hex Bolts and Screws, Including Askey Head Bolts, Hex Cap Screws, and Log Screws
   ANSI - Square and Hex Nuts

C. UNIT RESPONSIBILITY: Equipment systems made up of two or more components shall be provided as a unit by the responsible manufacturer. Unless otherwise specified, the Contractor shall obtain each system from the supplier of the driven equipment, which supplier shall provide all components of the system to enhance compatibility, ease of construction, and efficient maintenance. Contractor is responsible to the Owner for performance of all systems.

Where the detailed specification requires a Contractor to furnish a certificate from the Unit Responsibility manufacturer, such certificates shall be signed by an officer of the manufacturer’s corporation and shall be notarized. No other submittal material will be processed until a certificate attesting to unit responsibility assignment has been received and has been found to be satisfactory.

PART 2 - PRODUCTS

2.1 FLANGES AND PIPE THREADS

A. Flanges on equipment and appurtenances provided under this section shall confirm in dimensions and drilling to ANSI Bl6.1, Class 125. Pipe threads shall conform in dimension and limits of size to ANSI Bl.1, coarse thread series, Class 2 fit.

B. Threaded flanges shall have a standard taper pipe thread conforming to ANSI Bl.20.1. Unless otherwise specified, flanges shall be flat faced.

C. Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.l.

2.2 BEARINGS

A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

B. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain, and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alumite type.

C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with a filler pipe and an external level indicator gage.

2.3 V-BELT ASSEMBLIES

A. Unless otherwise specified, V-belt assemblies shall be Dodge Dyna-V belts with matching Dyna-V sheaves and Dodge Taper-lock bushings, Wood’s Ultra V-belts with matching Ultra-V sheaves and Wood’s Sure-Grip bushings, or equal.

B. Sheaves and bushings shall be statically balanced. Additionally, sheaves and bushings which operate at a peripheral speed of more than 5500 feet per minute shall be dynamically balanced. Sheaves shall be separately mounted on their bushings by means of three pull-up grub or cap tightening screws. Bushings shall be key seated to the drive shaft.

C. Belts shall be selected for not less than 150 percent of rated driver horsepower and, where two sheaves sized are specified, shall be capable of operating with either set of sheaves. Belts shall be antistatic type where explosion proof equipment is specified.

2.4 PUMP SHAFT SEALS

A. GENERAL: Seals for water and wastewater pump shafts shall be either stuffing box or mechanical seals. Unless specified otherwise, stuffing boxes and mechanical seals shall conform to the requirements set forth in this paragraph.

B. MECHANICAL SEALS : Where mechanical seals are specified, the seal shall be of a nondestructive (nonfretting) type which requires no wearing sleeve for the shaft. Shafts for pumps specified with mechanical seals shall be furnished with no reduction in size through the seal area. Mechanical seals shall be the cartridge type, requiring no field assembly, other than insertion into the pump. Metal parts shall be type 316 or 316L stainless steel. Springs shall be Hastelloy C. Rotary faces shall be tungsten carbide or silicon carbide. Stationary faces shall be ceramic, tungsten carbide, or silicon carbide.

Mechanical seals for overhung shaft, constant speed pumps and split case, centrifugal pumps shall be self-aligning, single, rotary type, Chesterton 123, Crane 88 S, or equal.

Mechanical seals for variable speed, overhung shaft pumps shall be double, balanced, self-aligning type, Crane 88 D, Chesterton 222 or 241, or equal.

Boxes for mechanical seals on pumps for contaminated water service (sludge, grit, wastewater, scum, reclaimed water, etc.) shall be drilled and tapped for installation of clean water barrier fluid supply piping.

C. SHAFT PACKING: Where shaft packing is specified, stuffing boxes shall be tapped to permit introduction of seal liquid and shall hold a minimum of five rows of packing. Stuffing boxes shall be face attached. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal specified in Section 46 00 00, paragraph 2.04B for the applicable pump and operating conditions.

Unless otherwise specified, lantern rings shall be bronze, packing shall be die-molded packing rings of non-asbestos material suitable for the intended service and as recommended the manufacturer, and glands shall be bronze, two piece split construction. Lantern rings shall be of two-piece construction and shall be provided with tapped holes to facilitate removal. Lantern rings shall be drilled and tapped 1/4 NC-20. Threaded lantern ring removal tools shall be provided with spare parts for each pump.

2.5 COUPLINGS

A. Unless otherwise specified in the equipment sections, equipment with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations. The flexible member shall consist of a tire with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws, and the flanges shall be attached to the stub shaft by means of taper lock bushings which shall give the equivalent of a shrunk-on fit. There shall be no metal-to- metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower speed of rotation, and type of service.

B. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, Thomas-Rex, Falk Steel Flex, or equal, couplings will be acceptable provided they are sized in accordance with the equipment manufacturer’s recommendations and sizing data are submitted. They shall be installed in conformance to the coupling manufacturer’s instructions.

2.6 GUARDS

A. Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of 14-gage steel, 1/2-13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and sha11 be designed to be readily removable to facilitate maintenance of moving parts. Reinforced holes shall be provided. Provisions shall be made to extend lube fittings through guards.

2.7 CAUTION SIGNS

A. Equipment with guarded moving parts which operate automatically, or remote control shall be identified by signs reading **"CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME."**

B. Signs shall be constructed of fiberglass material, minimum 1/8 inch thick, rigid, suitable for post mounting. Letters shall be white on a red background. The sign size and pattern shall be as shown on the drawings. Signs shall be installed near guarded moving parts.

2.8 GAGE TAPS, TEST PLUGS AND GAGES

A. Gage taps shall be provided on the suction and discharge sides of pumps, blowers and compressors. Pressure and vacuum gages shall be provided where specified. Gage taps, test plugs, and gages shall be as specified in Division 40.

2.9 NAMEPLATES

A. Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible location with stainless steel screws or drive pins.

2.10 LUBRICANTS

A. The Contractor shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the Owner's current lubricant supplier. The Contractor shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the Contractor shall provide the Owner with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

2.11 ANCHOR BOLTS

A. Anchor bolts shall be designed for lateral forces for both pullout and shear in accordance with the provisions of Section 40 05 07 "Hangers and Supports for Process Piping." Unless otherwise stated in the detailed specification, anchor bolt materials shall conform to the provisions of Section 40 05 07 "Hangers and Supports for Process Piping."

2.12 SPARE PARTS

A. Spare parts, where required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with a hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words “spare parts”. A neatly typed inventory of spare parts shall be taped to the underside of the cover.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. Installation of equipment accessories included in this section shall be as recommended by the equipment manufacturer unless otherwise specified in the individual equipment specification section.

END OF SECTION

SECTION 46 05 13 – COMMON MOTOR REQUIREMENTS FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies alternating current induction motors, 250 horsepower or less, to be provided with the driven equipment. This section does not specify median voltage (2300 volts and greater) motors and specialty motors such as submersible motors, hoist motors, valve operator motors or torque rated motors. Unless specified otherwise, electric motors shall be provided by the manufacturer of the driven equipment under the provisions of Section 46 00 00. This section refers to motors by enclosure type as defined in NEMA MG 1, except as noted.

1.2 QUALITY ASSURANCE

A. GENERAL: Motors shall be built in accordance with UL 674, UL 1004, NEMA Standard MG l, and to the requirements specified.

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

1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings
2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings
3. IEEE 112 - Polyphase Induction Motors and Generators
4. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies
5. NEMA ICS - Enclosures for Industrial Controls and Systems
6. NEMA MG - Motors and Generators
7. UL 674 - Motors and Generators, Electric, for Use in Hazardous Locations, Class I, Groups C and D, Class II, Groups E, F and G
8. UL 1004 - Motors, Electric

1.3 SUBMITTALS

A. Motor data shall be submitted each item of motor-driven equipment to be provided under this contract. Submittal data shall be furnished in accordance with Section 01 33 00 “Submittal Procedures” and shall include a specified motor data and, for motors 100 horsepower and larger, a motor heating curve.

1.4 AMBIENT CONDITIONS

A. Unless specified otherwise, motors shall be suitable for continuous operation at an elevation of 3,800 feet above sea level. Motors to be installed outdoors, exposed to the weather, shall be suitable for continuous operation in a 40 degree ambient temperature; motors to be installed indoors shall be suitable for continuous operation in a 40 degree ambient temperature.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Motor nameplates shall be engraved or stamped stainless steel. Information shall include those items enumerated in NEMA Standard MG 1, paragraph 10.37, 10.38 or 20.60, as applicable.

B. Additionally, nameplates for motors 1/2 horsepower and larger shall indicate the AFBMA L-10 rated life for the motor bearings. Nameplates for high efficiency motors shall list the nominal efficiency. Nameplates for explosionproof motors shall also indicate UL frame temperature limit code.

C. Nameplates shall be permanently fastened to the motor frame and shall be positioned to be easily visible for inspection.

2.2 CONSTRUCTION

A. Unless specified otherwise, all motors provided under this specification shall have the following features of construction:

1. Cast iron frames.
2. Cast metal fan blades and shrouds.
3. Stainless steel hardware.
4. Non hydroscopic leads.

2.3 MOTORS LESS THAN 1/2 HORSEPOWER

A. GENERAL: Unless otherwise specified, motors less than 1/2 horsepower shall be squirrel cage, single phase, capacitor start, induction run type. Construction features listed in Section 46 05 13; paragraph 2.2 may be as normally supplied by the equipment manufacturer. Single phase motors shall have Class B insulation. Small fan motors may be split-phase or shaded pole type. Windings shall be copper.

B. RATING: Unless specified otherwise, motors shall be rated for operation at 115 volts, single phase, 60 Hz, and shall be continuous-time rated in conformance with Standard MG 1, paragraph 10.35. Dual voltage 115/230 rated motors are acceptable if all leads are brought out to the conduit box. Motors shall be non-overloading at all points of the equipment operation.

C. ENCLOSURES: Unless otherwise specified, motors shall have totally enclosed fan cooled or totally enclosed nonventilated enclosures.

D. Explosionproof motors shall bear the label for Class I, Division 1, Group D hazardous locations. An over temperature device in the enclosure shall be provided to detect and automatically de- energize the motor if the enclosure surface temperature exceeds 280 degrees C. The nameplate shall be marked with the UL frame temperature limit code T2A.

2.4 MOTORS 1/2 HORSEPOWER THROUGH 250 HORSEPOWER

A. GENERAL: Unless otherwise specified, motors 1/2 horsepower through 250 horsepower shall be 3 phase, squirrel cage, full voltage starts induction type. Unless otherwise specified, motors shall have a NEMA MG 1-1.16 design letter B or C torque characteristic as required by the driven equipment’s starting torque requirements.

B. RATING: Unless otherwise specified, motors shall be rated for operation at 460 volts, 3 phase, 60 Hz, and shall be continuous time rated in accordance with NEMA standard MG 1, paragraph 10.35. Dual voltage 1230/460) rated motors are acceptable if all leads are brought out to the conduit box. Unless specifiedotherwise, motors shallhave aservicefactorof 1.15 and shall not be required toexceedits nameplate rating.

C. ENCLOSURE INSULATION:

1. GENERAL: Motors shall be classified as Type 1 (General Duty), Type 2 (Process), and Type 3 (Explosion proof). Enclosures and insulation systems shall be as specified in the following paragraphs. Temperature rise for all motor types shall not exceed that permitted by Note II, paragraph 12.42, NO MG 1. The insulation shall be non-hygroscopic.
2. TYPE 1 MOTORS (NONPROCESS) : Unless specified otherwise,Type1motorsshall havedrip proof guarded enclosures with Class Binsulation.
3. TYPE 2 MOTORS (PROCESS): Type 2 motors shall be totallyenclosed,fancooled withClassFinsulation.Motorsrated 10horsepowerandlargershallhaveClassFinsulation withClass Btemperaturerise. Allinternal surfaces shallbecoatedwithan epoxypaint. Aluminumframemotorswillnotbepermitted. Steel frame motors will be permitted for motors with frames 184and smaller.
4. TYPE3 MOTORS (EXPLOSIONPROOF): Explosion proof motors shall be UL listed in accordance with UL 674 for Class I, Group D hazardous atmospheres. The motor shall have a Class F insulation. Steel frame motors will not be permitted. A UL-approved breather/ drain device shall be provided in the motor drain hole. The motor shall be provided with a frame temperature thermostat which meets the UL frame temperature limit code T2A (280 degrees C). The thermostat shall contain an automatically reset, normally closed contact rated 2 amperes at 115 volts AC.

D. MOTORS FOR VARIABLE FREQUENCY DRIVES: Motors intended for use with variable frequency drives shall be compatible with the characteristics of the intended variable frequency generators. Motors shall be Type 2 or Type 3 as specified in the detailed specification Section 46 05 13 in paragraphs 2.4 C.3 and 2.4 C.4, except insulation for all motors operating with variable frequency drives shall be Class F with Class B temperature rise. Variable frequency drive motors shall be energy-efficient motors as specified in Section 46 05 13, paragraph 2.04 E.

Motorsforvariablefrequencysystemsshallnotberequiredto delivermorethan80percentofthe motor'sservicefactorrating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

E. ENERGY EFFICIENT MOTORS: Where specified as energy efficient motors, Type 2 and e 3 motors shall be designed to comply with the minimum nameplate efficiency in Schedule A. Motor efficiency shall be tested in accordance with IEEE-112, Test Method B with stray load loss adjustment as modified by NEMA MG 1-12.531a) and lb). Motor nameplate efficiency shall conform with the nominal values shown in NEMA MG 1, Table 12-6, and with the minimum acceptable efficiencies listed in Schedule A. Energy-efficient motors shall be Reliance Electric Duty Master XE, Baldor Super-E, or equal.

SCHEDULE A, MINIMUM NAME PLATE EFFICIENCY

Horsepower range	SPEED, RPM 1200	1800	3600
1-2	82.5	84.0	82.5
3-5	89.5	88.5	86.5
7-25	90.2	90.2	89.5
30-60	92.4	93.0	
75-200	94.1	95.0	94.1

F. VERTICAL MOTORS: Unless otherwise specified, vertical motors shall be full voltage with a Type P base specifically designed for vertical installation. Universal position motors are not acceptable. Vertical motors shall have solid shafts unless specified otherwise. Vertical motors shall conform to either Type 2 or Type 3 requirements as specified under Section 46 05 13,.paragraphs 2.4 C.3 and 2.4 C.4. Thrust bearing rating shall be compatible with the loads imposed by the driven equipment. Vertical motors shall be energy efficient in accordance with paragraph 2.4 E of this specification section; however, minimum motor efficiencies shall be adjusted to account for increased bearing losses in the vertical motor design.

G. CONDUIT BOXES: Conduit boxes shall be cast iron, split construction with threaded hubs. Conduit boxes shall be designed for rotation to permit installation in four positions at least 90 degrees apart. Motors shall be furnished with petroleum-resistant gaskets at the base of the conduit box and between the halves of the conduit box. Motors shall have a grounding lug located within the box for the ground connection.

H. BEARINGS: Bearings may be oil or grease lubricated ball, or angle contact roller bearings rated for a minimum L-10 life of 100,000 hours in accordance with AFBMA 9 or 11 at the ambient temperature specified herein. Motor designs employing cartridge type bearings will not be accepted. Bearings shall be fitted with lubricant fill and drain or relief fittings.

I. LIFTING EYES: Motors weighing more than 50 pounds shall be fitted with at least one lifting eye.

J. CURRENT IMBALANCE: Current imbalance shall not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:

Under 5 horsepower:	25 percent
5 horsepower and above:	10 percent

Imbalance criteria shall be based upon the lowest value measured.

K. SPECIAL FEATURES:

1. GENERAL: Where specified or required by this paragraph, special features, as specified below, shall be provided.
2. WINDING OVER TEMPERATURE PROTECTION: Stator winding over temperature protection shall be provided on all motors rated 200 horsepower and larger and all motors served by variable frequency drives. Motors rated less than 200 horsepower, unless specified otherwise, shall have stator winding overtemperature protection only if required by the specific equipment specification section or if recommended by the driven equipment manufacturer. Explosion proof of motors shall be protected as specified in Section 46 05 13, paragraphs C-2.3 C or 2.4 C.4.

Overtemperature protection shall be NEMA NC 1-12.53, Type 1, winding running and locked rotor overtemperature protection. Two detectors shall be provided per phase. Detectors shall be positive thermal protection (PTC) thermistors type, with leads brought out to a terminal strip in a NEMA 4 enclosure in Type 2 motors and a NEMA 7C or 9 enclosures for Type 3 motors. Detector controller shall be furnished by the motor manufacturer and shipped loose with the motor for remote mounting as specified. Detector controller output shall be normally closed, rated 3 amperes, 120 VAC.

3. HEATERS: Heaters shall be provided in motor enclosures to guard against condensation after shutdown. Motor winding heaters shall be provided for all motors installed outdoors or where required by the specific requirement specification section. Heaters shall be cartridge or flexible wraparound type. Heaters shall be rated 120 volts, single phase, 60 Hz. The heater rating in watts and volts shall be noted on the motor nameplate or on a second nameplate. Space heater terminals shall be brought to a separate terminal block or pigtails in the conduit box.

2.5 PRODUCT DATA

A. The following information shall beprovided foreachmotorin accordance with Section 01 33 00 “Submittal Procedures:”

1. Motor outline, dimensions, and weight.
2. Manufacturer ’s general descriptive information relative to motor features.
3. Where a winding overtemperature device is required, providearesponse curve forthetemperature device.
4. Applicable operation and maintenance information specified in Section 01 70 00. Provide Overhaul Instructions for each motor 5 HP and over.

PART 3 - EXECUTION

3.1 WINDING INSULATION RESISTANCE AND CURRENT IMBALANCE TESTING

A. Shall be performed asspecified in Section 26 05 00 “Basic Electrical Methods.”

END OF SECTION

SECTION 46 05 53 - IDENTIFICATION FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Labels.
   5. Lockout devices.

B. Related Requirements:
   1. Section 09 90 00 “Painting and Coating:” Execution requirements for painting specified by this Section.

1.2 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
B. Product Data: Submit manufacturers catalog literature for each product required.
C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for equipment identification and schedule, including equipment number, location, function, and manufacturer's name and model number.
D. Samples: Submit two nameplates and tags for each size used on Project.
E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
G. Include separate Paragraphs for additional certifications.
H. Qualifications Statement:
   1. Submit qualifications for manufacturer.

1.3 QUALITY ASSURANCE

A. Perform Work according to applicable standards.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Craftmark
   2. Seton Identification Products
   3. Kolbi Pipe Marker
   4. Substitutions: Section 01 60 00 “Product Requirements.”

B. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

A. Plastic Tags:
   1. Manufacturers:
      a. Brady
      b. Craftmark
      c. Seton
      d. Substitutions: Section 01 60 00 “Product Requirements.”
   2. Description:
      a. Laminated three-layer plastic with engraved black letters on light, contrasting background color.
      b. Minimum Tag Size and Configuration: 1 1/2-inch square.

B. Information Tags:
   1. Manufacturers:
      a. Brady
      b. Seton
      c. Substitutions: Section 01 60 00 “Product Requirements.”
   2. Description:
      a. Clear plastic with printed DANGER and message.
      b. Minimum Tag Size: 3-1/4 by 5-5/8 inch .
      c. Furnish grommet and self-locking nylon ties.

2.3 LABELS

A. Manufacturers:
   1. Brady
   2. Seton
   3. Substitutions: Section 01 60 00 “Product Requirements.”

B. Description:
   1. Laminated Mylar construction.
   2. Minimum Size: 1.9 by 0.75 inch.
   3. Adhesive backed, with printed identification.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 01 70 00 “Execution and Closeout Requirements:” Requirements for installation preparation.
B. Degrease and clean surfaces to receive adhesive for identification materials.
C. Prepare surfaces as specified in Section 09 90 00 “Painting and Coating” for stencil painting.

3.2 INSTALLATION

A. Identify equipment with plastic nameplates.
B. Identify inline pumps and other small devices with tags.
C. Identify control panels and major control components outside panels with plastic nameplates.
D. Apply stencil painting as specified in Section 099000 - Painting and Coating.
E. Install identifying devices after completion of coverings and painting.
F. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

G. Labels:
   1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
   2. For unfinished covering, apply paint primer before applying labels.

H. Install tags using corrosion-resistant chain.

END OF SECTION

SECTION 46 21 14 – PERFORATED ROTATING PLATE SCREENS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes: Requirements for furnishing two (2) fine screens with perforated filter panels and associated controls. Equipment shall be installed as indicated in the contract drawings, as specified herein, and in compliance with all local, state, and federal codes and regulations.

B. Each fine screen shall be furnished with perforated filter panels, drive chain, sprockets, and bearings, rotating self-adjusting cleaner brush, deflector roller, spray water system, drive motors, gear reducers, anchor bolts, controls and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.

C. EQUIPMENT LIST
Equipment identification as follows:

Item	Equipment No.
Bar screen 1	BSN01101
Bar screen 2	BSN01111

D. Related specifications sections: Section 41 12 13.36 Screw Bulk Material Conveyors, Section 41 52 13 Screenings Bin-Level Lodor, Section 46 21 73 Screenings Washing and Compacting Equipment.

1.02 MANUFACTURER

A. The screening equipment specified in this section shall be the SAVÉCO® North America, Inc. FSM Perforated Filter Screen Model FRSIII 1300 x 75/6HF, Fixed Installation, non-rotating.

B. The screen type and design has been specially selected for this project by the Owner. No other screen equipment and/or manufacturer is acceptable. Furthermore, the screen(s) are the primary component of an engineered fully integrated screenings system that consists of the specified screens, specified wash presses, specified horizontal screenings conveyor, and the specified specially covered storage screenings bins. The specified wash presses, and horizontal conveyor shall be provided by the same manufacturer and supplier as that of the screens. The supplier of the covered storage screenings bins shall be the same supplier as the screens, wash press, and conveyance equipment.

1.03 REFERENCES

A. The FSM Perforated Filter Screen Model FRSIII shall, as applicable meet the requirements of the following industry standards:

- AISI (American Iron and Steel Institute)
- ANSI (American National Standards Institute)
- ABMA (American Bearing Manufacturers Association)
- AGMA (American Gear Manufacturers Association)
- NEMA (National Electrical Manufacturer's Association)
- NFPA (National Fire Protection Association)
- ASTM (American Society for Testing and Materials)

- WSC (American Welding Society Code)
- ASME (American Society of Mechanical Engineers)
- NEC (National Electrical Code)
- UL (Underwriters Laboratory Standards)

1.04 EXPERIENCE

A. To establish a quality standard for the manufacture and production of the equipment, the manufacturer shall meet the requirements listed in this section.

B. Manufacturer shall have a minimum of ten years of experience in producing substantially similar equipment and shall be able to show evidence of at least fifty (50) installations in satisfactory operation for at least five years.

C. The minimum acceptable standards for the equipment shall conform to the project contract documents as outlined in the respective sections of the specifications and drawings.

1.05 SUBMITTALS

A. The Manufacturer shall furnish the required number of submittals (and an electronic version if required) within 4 - 6 weeks of receipt of the order to verify compliance with the specification. The submittals shall include:

1. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
2. A list of all deviations from drawings and specifications.
3. Descriptive literature, bulletins and/or catalogs of the equipment.
4. Complete data on motors and gear reducers.
5. Wiring diagrams and electrical schematics for all control equipment to be furnished.
6. Describe the automatic adjusting cleaner brush.
7. Describe method of checking and adjusting drive chain tension.
8. Provide details of the area at the bottom of the screen to show how the screen will pick up large objects off the channel floor.
9. Provide details of the bottom of the screen that shows the method employed to prevent buildup of grit and small stones beneath the screen and to prevent wear on the screen elements.
10. Provide independent certified test data confirming screen SCR value with perforated panels of the same size as specified herewith. Testing shall confirm the percentage of all material captured by the screen as documented by the National screen evaluation facility at Chester Lee Street in England by TRPM and Northumbrian Water. The documented report of the test which shows the result of screenings capture rate (SCR) must be provided with submittals.

1.06 WARRANTY

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of one (1) year from date of startup. Items specifically not covered by the warranty are consumable wear parts as identified in the O&M manual.

B. The screens shall be unconditionally guaranteed to meet or exceed design criteria detailed in Part 2 of this specification.

C. Lower bearing/bottom revolving guide disk with incorporated bearing shall be guaranteed for five (5) years.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. SAVÉCO North America, Inc. – FSM Perforated Screen FRSIII. 1300 x 75/6 HF.

2.02 QUALITY ASSURANCE

A. Equipment manufacturer shall be ISO 9001 certified.

B. The Perforated Filter Screen shall be fully assembled and run to confirm fit and function of the screen. A certificate of the shop run test shall be supplied with the shipping documents.

C. The Perforated Filter Screen shall be shipped to the site fully assembled, if possible, and dependent upon the height of the screen. Some ancillary components may be removed to prevent damage during shipment.

D. Shop Surface Preparation/Coating: All weldments shall be cleaned and passivated using a full dip passivation process to remove weld spatter, slag and discoloration. Bearings, electrical devices, drive and wiper chains and sprockets, motor and gear reducer shall be provided with the manufacturer's standard coating system. Screen weldments not full dipped passivated, using spray on cleaning solutions, passivating welds only or bead blasting shall not be allowed.

E. Definitions

1. Screen Height: The height between the operating floor and the top of the perforated plate screens.
2. Discharge Height: The height between the operating floor and the screenings discharge.
3. Head Loss: Total difference in elevation of the water level upstream of the upstream screening elements and downstream of the downstream return elements.
4. Percent Blinded: Percentage of submerged area of partially blinded perforations relative to total area of non-blinded perforations.
5. Maximum Differential Head: Maximum difference in elevation of the water level upstream and downstream of the upstream screening elements that the screen will experience during emergency conditions (i.e., screen fully plugged).
6. Screenings Capture Rate (SCR) / Efficiency: Percentage of all material captured by the screen as documented by the National screen evaluation facility at Chester Lee Street in England by TRPM and Northumbrian Water. The documented report of the test which shows the result of screenings capture rate (SCR) must be provided with submittals.
7. Screen Angle: Angle of screen frame incline from horizontal plane parallel with mounting floor.

2.03 PERFORMANCE REQUIREMENTS

A. Perforated Filter Screens

1. Solids will collect on a continuous belt of perforated filter panels perpendicular to the flow, elevating solids to the discharge point. The perforated filter panels shall be

cleaned by means of an automatic adjusting rotating cleaner brush. Screens that do not have an automatic adjusting rotating cleaner brush shall not be allowed.

2. The perforated filter panels shall be driven by drive sprockets secured to the main drive shaft.
3. Perforated plate screens shall be designed in accordance with the following performance and configuration requirements:

Conditions	**Unit**
Number of screens	Two (2)
Influent Type	Municipal Wastewater
Average flow per screen (MGD)	8.75
Peak flow per screen (MGD)	17.5
Downstream Liquid Level at Peak Flow (in)	36
Headloss at Peak Flow @ 0% Blinding (in)	6.1
Headloss at Peak Flow @ 40% Blinding (in)	11.2
Screen Panel Perforation Diameter (mm)	6
Channel Width (in)	60
Channel Depth (in)	102
Screen Inclination	75 degrees
Screenings discharge height from top of channel (ft)	4.4
Minimum Screenings Capture Ratio (SCR)	85%
Maximum Head Differential (ft)	4.0

4. Manufacturer shall provide certification letter that the screenings capture rate (SCR) for 6 mm perforation is minimum 85% screenings capture rate at the specified screen inclination.

2.04 UTILITY REQUIREMENTS/ENVIRONMENTAL CONDITIONS

Requirements/Locations	**Unit**
Spray water flow and pressure:	35 gpm at 45 psi
Power Supply (V/P/Hz)	480/3/60
Screen Installation Location (indoor/outdoor)	Indoor
Screen NFPA Classification Requirement	Class I, Div. 2
Control Panel Location (indoor/outdoor)	Indoor
Control Panel NFPA Classification Requirement	Non-hazardous

2.05 MATERIALS OF CONSTRUCTION

A. All moving wetted parts, all wetted parts on which moving parts ride, all filter belt components under guiding, bearing, or driving loads shall be 304L stainless steel, wear resistant heat treated, high tensile, wear resistant steel**,** or UHMW-PE as noted below:

1. The frame shall be minimum 4 mm thick type 304L stainless steel.
2. The discharge chute, and all covers shall be type 304L stainless steel.
3. The screen and brush drive shafts shall be type 304 stainless steel.
4. The rotating deflector shall be from type 304 stainless steel.
5. The lower sprocket stub shafts shall be from type 304 stainless steel.
6. The upper and lower sprockets shall be type 304 stainless steel with only the wear area hardened.

7. The screening elements shall be one piece curved from type 304 stainless steel and will not require upstream protection using coarse bar screens. Screens that require upstream protection shall not be permitted.
8. The special designed heavy duty drive links will be from type 304 stainless steel.
9. The side and bottom seals shall be replaceable contoured UHMW-PE with 304 stainless steel fasteners.
10. The bottom seal between the lower end of the screen frame and the width of the filter panels shall be from Buna-N rubber and shall include a triple layer polyester brush with a 304L stainless steel adjustable holder.
11. The screening element support rails shall be 304 stainless steel with UHMW-PE wear surface or equivalent.
12. Spray bars shall be 304 stainless steel.
13. All fasteners shall be 304 stainless steel.
14. All other appurtenances shall be of manufacturer's standard coated material.

2.06 EQUIPMENT DESIGN FEATURES

A. General

1. The screen shall be designed to provide maximum solids filtration and thus maximize capture of debris and minimize rate of head loss increase through the screen. This shall be achieved by means of one piece perforated curved filter elements. The maximum perforated opening shall be 6 mm. The screen will be operated intermittently by means of differential head measurement.
2. The screen shall be mounted by fastening to the top of the channel with a flanged baseplate for mounting screen assembly to top of channel-304 stainless (non-rotating, fixed installation).The screen mounting system shall be constructed of 304 stainless steel and complete as required to function in accordance with the specification. Routine service, repair, or replacement of damaged parts shall be possible with the screen in the channel.
3. The use of roller chain, filter shafts and rollers and/or two or more motors for screen rotation is not acceptable.
4. Unit shall be designed so that maintenance of the drive mechanism can be accomplished at operating floor level. Screen elements shall be capable of removal at the operating level without taking the screens out of the channel or effecting the continuous or intermittent rotation of the screen.
5. The screen shall be factory assembled and tested prior to delivery and shall be delivered to the site fully assembled (other than the motor/reducer unit, discharge chute, and support legs). It shall be capable of being set in place and field erected by the contractor with minimal field assembly.
6. The influent screening system shall include a perforated plate screen and an integrated washer/compactor conveyance system with all pieces of equipment provided by the same manufacturer and supplier. The perforated plate screen shall be a self-contained screening system used to capture and transport wastewater debris to the washer/compactor system.
7. Influent screening system shall be designed for continuous and intermittent operation. The perforated plate screens shall be installed in the channel as shown on the Contract Drawings.
8. All components shall be amply proportioned for all stresses that may occur during manufacturing, transportation, erection, and operation.

B. Filter Screen

1. The one-piece curved screening elements shall be nominal 1/8" thick and fixed by four fasteners to the heavy-duty chain drive links having 7.87" pitch x 1.38" x 0.2" thick section which shall ride on 2" x 1.5" thick UHMW-PE supports located on the upstream and downstream sides of the screen. On every tenth screen panel a set of static, non-engaging 'finger' type lifters shall be attached to the lower edge of the panel, designed specifically to lift spherical and large size solids (stones, square lumber cans, bottles, rag clumps, etc.) from the bottom of the channel. Screens that use lifting ledge on top of the panel thereby preventing the removal of solids from the bottom of the channel floor will not be permitted. Screens which do not support the drive chains on the downstream side will not be approved.
2. A submerged stainless-steel plate shall be provided at the base of the screen. The base of the screen shall be fitted with a rubber seal 10 mm thick directly followed by a polyester brush along the full length of the filter panel to prevent ingress of stones and grit and to prevent solids bypass.
3. Two (2) upper sprockets from ¾-inch thick type 304 stainless steel with 7.87-inch pitch. Upper sprockets shall be split to allow removal without having to remove the drive shaft.
4. Two (2) revolving ¾-inch thick lower guides with 7.87-inch pitch. Lower revolving guide bearings shall be slide bushing from bronze with a 316 stainless steel 3.15-inch stub shaft. Complete unit sealed with stainless steel cover, O-rings, and v-rings seals. Grease line from stainless steel brought to operating level. Ball or roller bearings or slide bushings made of plastic or ceramic shall not be accepted as a lower sprocket bearing.
5. To prevent deflection, the one-piece filter elements shall have a minimum thickness of 1/8" and shall be made of curved stainless steel. This is required to ensure structural integrity and smooth operation. Engaging tines, fingers or engaging elements, which can bind or jam, will not be acceptable. Filter panels that are not curved shall not be acceptable. Filter panels with a flat face inclined and a horizontal ledge shall not be allowed.
6. The screening elements are to be of the engineered curved shaped so that they can be cleaned with optimum efficiency with an automatic adjusting rotating cleaner brush. Minimum diameter of rotating cleaner brush is 450 mm. The rotation direction of the brush drive must be in the opposite direction of the belt drive.
7. The rotating cleaner brush shall be nylon and have a minimum diameter of 450 mm and be self-adjusting with no manual or motorized adjuster mechanism. The motorized cleaner brush will automatically adjust as the brush wears during use. The automatic adjustment will maintain consistent cleaning efficiency at a SCR value of 85%. The distance between the cleaner brush and filter panels will be automatically controlled to ensure the distribution and magnitude of pressure is equal across the entire filter panel surface. Systems that use gas springs or struts to adjust brush shall not be permitted. Screens with rotating cleaner brushes requiring manual adjustment or adjustment with gas cylinders or a motor shall not be permitted.
8. The lifting fingers are located on each tenth filter plate. The lifting fingers must be located on the lower area of the filter element. Systems where these fingers are near the middle or top of the element are not permitted. They will be designed to remove spherical solids from the bottom of the channel, which may otherwise roll back off the screen face and accumulate thus creating a wear problem as the screen elements are moving thru the solids as they ascend on the upstream side of the screen.

9. The screening elements must be sealed against the chain by means of special knuckle joint side plates attached to each perforated plate filter element. Maximum gaps between the screen panels and side frame are 1 mm. For wear resistance, the side plates must be made in stainless steel. Screening elements with plastic for fiberglass side seal plates shall not be allowed. Simple brush systems are not permitted. This is to ensure that small items are not floated past the sides of the screening elements.
10. A rotating deflector consisting of a 304 stainless steel tube roller wiper fabricated from 3.5 inches O.D. complete with 1.75 inches diameter stainless drive steel shafts at each end supported by two-hole flange bearings and auxiliary driven by screen drive unit. The roller wiper shall turn at max 20 rpm and function to seal the gap between the filter panels and discharge chute and to direct the heavier solids removed from the screen by the revolving brush cleaner into the screenings wash press inlet hopper. The rotating deflector prevents bypassing of solids into the downstream channel. Screens supplied with a brush scraper and/or a static deflector that is not self-cleaning shall not be permitted

C. Filter Screen Panels

1. The screen filtration belt shall be provided with one piece perforated curved elements, which limits the maximum opening in any direction to the perforated opening size detailed in Paragraph 2.03.A.3-Screen Panel Perforation Diameter. This restricted opening profile prevents long thin materials from passing through the openings. Filter panels that are not curved shall not be acceptable. Filter panels with a flat face inclined and a horizontal ledge shall not be allowed.
2. No cleaning devices which cause trash to be pushed or dropped into the interior of the filtration belt will not be allowed.
3. The individual screening elements must not exert stresses on one another, and the load transmission must be exclusively via chains. Systems which involve connecting the screen elements together with other or additional attachments are therefore not permissible because of stressing. Furthermore, the elements must not be able to overlap one another, which would create spaces in which material could collect.
4. Due to the risk of high differential levels on the screen, in the event of a power failure, excess solids load condition, mechanical breakdown etc. the screen shall be designed to withstand a maximum differential head of 3.3 ft. measured from the upstream water level to the downstream water level.
5. The horizontal space between each adjoining screen panels will not exceed 1mm +/- 10 percent at any point between any adjacent panels.
6. To control the buildup of biological slimes behind the screen panels, a 1-inch diameter internal spray water wash spray bar will be provided, manufactured from stainless steel with PVDF spray nozzles. The spray bar will be attached in the internal space between the rotating screen panels and the spray water will be directed to wash each screen panel as the panel moves past the spray nozzles. The spray bar will supply approximately 9 gpm per ft. width of screen panel at a pressure of 40 - 45 psi. The spray orifices will be non-plugging and suitable for use with treated effluent water. A minimum 1-inch NPT connection will be located on one side of the screen frame above the operating floor level and the water supply connection will include an inline strainer, manual operated ball valve, and solenoid valve suitable for attaching to the 1" NPT connection. Systems that require spray bars to assist with removing screenings from the filter panels shall not be allowed. The nozzle system for cleaning the belt must be located after the cleaning by the brush. Systems with a spray bar prior to the brush are not permitted.

D. Chain and Sprockets
   1. The filter panel drive chains shall be equal in pitch to the upper and lower drive sprockets.
   2. Chain shall be heavy-duty block chain, which is supported outside the frame by UHMW-PE, a hardwearing, high lubricity synthetic material. Chain link material shall be as Paragraph 2.05.A.8. Breaking load of the chain shall be minimum 20,232 lbf (90 kN). Chain shall have no rollers. Chain shall have no metal-to-metal wear associated with running roller chain in the screen frame.
   3. Each screen shall be provided with two identical drive sprockets from material as per Paragraph 2.05.A.6. Sprocket pitch and width shall match the heavy-duty chain – 7.87-inches. The sprockets shall be mounted on a drive shaft from material as per Paragraph 2.05.A.3 mounted between grease-able bearings mounted on the external side of the frame.
   4. Chain drive shaft bearings shall be four-hole flange mounted to a stainless-steel plate. The bearings shall be grease lubricated. Chain tension adjustment is achieved via the take up screws attached to the flanged mounting plate. The take up screw shall be an acme thread type from type 18-8 stainless steel. The bearing casing shall be made of paint coated cast iron. Units using a threaded rod shall not be allowed.
   5. Chain guides shall be secured to the screen frame for the full height of travel. A guide track shall also be located at the bottom of screen to allow the chain to travel from a downward to an upward direction. The chain guides shall accurately guide the chain and filter panels. The chain guide tracks shall be as Paragraph 2.05.A.11.

E. Screen Drive Mechanism
   1. Motor: 1.0 HP 1760 rpm TEFC (Class I, Division 2) geardrive motor suitable for 460/3/60 electrical supply.
   2. Gear Reducer:
      a. Helical Worm type from SEW.
      b. Hollow, shaft type.
      c. Anti-friction bearings.
      d. AGMA I rating.
   3. All drive components shall be designed to operate the screen continuously under a calculated load resulting from the differential water level between the upstream and downstream sides of the screen.
   4. Minimum filter panel speed shall be 10 fpm.

F. Brush Drive Mechanism
   1. Motor: 2.0 HP 1760 rpm TEFC (Class I, Division 2) geared motor suitable for 460/3/60 electrical supply.
   2. Gear Reducer:
      a. Helical Worm type from SEW.
      b. Hollow, shaft type.
      c. Anti-friction bearings.
      d. AGMA I rating.

G. Rotating Deflector Drive Mechanism:
   1. Auxiliary driven from Screen drive. Screens that require a third motor for the rotary deflector shall not be allowed.

H. Discharge Chute/Hood:
   1. A discharge chute/hood shall be provided that fully encloses the discharge section of the screen. The upper section of the discharge chute/hood shall be hinged to allow complete access the screen cleaner brush. The hinged hood shall be secured with quick closing clamps and supplied with two (2) gas cylinders from stainless steel to aid opening and closing

2. Discharge chute shall be from type 304 stainless steel.
3. Each screen discharge chute/hood shall direct screenings directly to the compactor or other device. Outlet shall extend down to the inlet of the compactor and shall be designed to match the screenings compactor inlet hopper with no water leaking or screenings dropping to the floor.

I. Frame Enclosures / Covers
1. The screen shall be provided with easily removable, sufficiently stiffened covers made of 18-gauge 304 stainless steel plates with edges on all sides.
2. Covers shall be provided on the upstream and downstream portion of the screen above the operating floor.
3. Covers shall be secured in place using quarter turn tool operated stainless steel cam latches.

2.07 ELECTRICAL CONTROLS AND DEVICES

A. Control Panel: 480-volt primary control panel shall be provided with a type 304, stainless steel, NEMA 4X enclosure. Panel shall be suitable for wall mounting with the following electrical components to provide proper operation of the equipment.
1. Main disconnect with through door interlock handle.
2. Step down control transformer.
3. Branch circuit protection.
4. Screen and brush motor starters (IEC) with overloads.
5. Brush motor starter (IEC) with overloads.
6. Load monitor for screen motor overtorque/overload protection.
7. Emergency stop pushbutton.
8. Hand-Off-Auto selector switches for screen and brush drive.
9. Open – Close – Auto switch for screen wash water solenoid valve.
10. Hour meter for each motor.
11. Control power on, run and fault indicating lights.
12. Alarm reset pushbutton.
13. Programmable relay to control screen control logic functions.
14. Run and alarm auxiliary contacts for use by the customer.
15. UL label.

B. Local Emergency Stop Pushbutton: A local emergency stop pushbutton station will be provided in a NEMA 7 enclosure for field mounting at the screen unit.

C. Motor Cut-out Switch: One (1) safety microswitch will be provided, suitable for the area classification and mounted to the hinged hood.

D. Solenoid Valve: One (1) solenoid valve shall be provided to control flow to the spray wash assembly. The brass body valve shall be 120 Volt, single phase, 60 Hz with a NEMA 7 housing.

E. Ultrasonic level sensor
1. Ultrasonic Level Controller: A 120V differential level controller shall be provided in a windowed NEMA 4X polycarbonate enclosure suitable for wall mounting, to receive and interpret a 4-20mA scaled signal from an upstream and downstream transducer. The controller shall have 6 internal relays and provide an LCD display.
2. Ultrasonic Level Transducer: Two (2) ultrasonic level transducers shall be provided with type 304 stainless steel mounting brackets and expansion anchors. Each sensor shall have an ETFE housing with an integral sensor to provide compensation for acoustic variations due to temperature. Each sensor shall have a range of 1-33 ft and be supplied with a 33 ft integral cable. Sensor shall be suitable for installation in a Class 1, Division 1, Group D area.

F. One (1) NEMA 7 Local Control Station complete with:
   1. Emergency Stop Pushbutton
   2. Screen/Brush HOA Switch.
   3. Screen water solenoid valve HOA Switch.

2.08 OPERATION, MONITORING, AND CONTROL

A. Screen and Brush Hand Operation: In HAND position the operator shall be able to run the screen or brush assembly by selecting the respective HOA selector switch. Turning the screen selector switch to Off will stop the unit. Screen drive motor is interlocked with the brush motor. Brush motor must be on if the screen is in operation.

B. Screen Automatic Operation: When the Screen and Brush are in AUTO position the screen shall be controlled by the water level sensors. Screen operation shall be started when the water level sensors monitor a certain water level difference, when the sensor senses high upstream water level, high differential, or when a certain time has passed since the last operation of the screen. Screen operation shall be stopped with an adjustable delay time after the water difference is below a certain value and after the sensor reads the correct water level, or after a certain run time has expired (if operation was started by timer).

C. Wash water solenoid valve Operation: In HAND position the wash water solenoid valve will open. In the CLOSE position the wash water solenoid valve will close.

D. Wash Water Automatic Operation. The wash water solenoid valve will open and close via a repeat cycle timer whenever the screen is in operation.

E. Fault Conditions:
   1. Excessive motor power will trip the starter overload relays, immediately stop the drive or brush motor, and illuminate the alarm indicating light. This fault must be reset by depressing the associated motor starter overload reset internal to the control panel.
   2. Momentary drive high torque will trip the screen motor load monitor, immediately stopping the screen drive motor, and illuminate the alarm indicating light. Pushing the reset pushbutton will reset this fault.

2.09 ANCHORAGE AND FASTENERS

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2 inch diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. Fasteners: All fasteners shall be type 304 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.10 SPARE PARTS

A. The following spare parts shall be provided for the perforated filter screen (total) –
   1. Two (2) filter panels with side sealing and without lifting fingers.
   2. One (1) filter panel with side sealing and with lifting fingers.
   3. One (1) complete set of replacement cleaner brush elements.
   4. Five (5) feet of chain with one (1) master link.

B. Manufacturer shall recommend any additional spare parts deemed necessary based on experience with the screen in similar applications.

PART 3 - EXECUTION

3.01 PREPARATION

A. The mounting points of the channel shall be level and parallel and of proper size.

B. Contractor shall verify all dimension in the field to ensure compliance of equipment dimensions with the drawings.

3.02 INSTALLATION

A. The installation is the responsibility of the Contractor. Complete installation procedures shall be included in the O&M manual shipped with the unit.

3.03 OPERATION AND MAINTENANCE MANUAL

A. Contractor and Manufacturer shall provide O&M Manual(s) as described in Section 01 70 00 “Execution and Closeout Requirements” and Section 23 05 00 “General Mechanical Requirements.”

3.04 START UP/TRAINING/FIELD QUALITY CONTROL

A. The initial start-up of screening equipment shall be performed by an authorized manufacturer representative. Manufacturer authorized representative shall verify the proper operation and installation and provide training to the equipment operators. One (1) trip for a total of three (3) days shall be provided for each barscreen start-up.

3.05 ADJUSTING AND CLEANING

A. Information on minor periodic adjustments and cleaning shall be included in the Operating and Maintenance Manual.

END OF SECTION

SECTION 46 21 73 – SCREENINGS WASHING AND COMPACTING EQUIPMENT

PART 1 - **GENERAL**

1.1 SUMMARY

A. Section includes: Requirements for furnishing two (2) screenings wash presses and associated controls. Equipment shall be installed as shown on the Contract Drawings and as specified herein, and in compliance with all local, state, and federal codes and regulations.

B. Each screenings wash press will consist of a flange mounted gearmotor, spiral with separate thrust bearing, wash water spray system, stainless steel trough, wash zone, press zone, discharge piping, electrical controls, and all other appurtenances required and as shown on the drawings.

C. Related specifications sections: Section 41 12 13.36 Screw Bulk Material Conveyors, Section 46 21 14 Perforated Rotating Plates Screens, Section 41 52 13 Screenings BIN-Level Lodor.

1.2 MANUFACTURER

A. The screenings wash press equipment specified in this section shall be the SAVÉCO® North America, Inc. FSM Screw Wash Press Model SPW300-1300, or approved equal. Substitute equipment must be modified as necessary to provide the specified features and to meet the specified requirements.

B. The wash/press is part of an engineered fully integrated screenings system, and as such the wash/press as identified herein shall be provided by the same manufacturer as that of the screens. See Section 46 21 14 Perforated Rotating Plate Screens and Section 41 12 13.36 Screw Bulk Material Conveyors. No other wash/press equipment and/or manufacturer is acceptable. All screenings equipment shall be provided by the same supplier.

1.3 REFERENCES

A. The Screw Wash Press shall, as applicable meet the requirements of the following industry standards:

1. AISI (American Iron and Steel Institute)
2. ANSI (American National Standards Institute)
3. ABMA (American Bearing Manufacturers Association)
4. AGMA (American Gear Manufacturers Association)
5. NEMA (National Electrical Manufacturer’s Association)
6. NFPA (National Fire Protection Association)
7. ASTM (American Society for Testing and Materials)
8. WSC (American Welding Society Code)
9. ASME (American Society of Mechanical Engineers)
10. NEC (National Electrical Code)
11. UL (Underwriters Laboratory Standards)

1.4 EXPERIENCE

A. To establish a quality standard for the manufacture and production of the equipment, the manufacturer shall meet the requirements listed in this section.
B. Manufacturers shall have a minimum twenty-five (25) years history of engineering and fabricating screenings wash presses. Documentation of at least ten (10) installations having been installed for a minimum of five (5) years shall be provided.
C. The minimum acceptable standards for the equipment shall conform to the project contract documents as outlined in the respective sections of the specifications and drawings.

1.5 SUBMITTALS

A. The Manufacturer shall furnish the required number of submittals (and an electronic version) within 4-6 weeks of receipt of the order to verify compliance with the specification. The submittals shall include:
   1. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
   2. A list of all deviations from drawings and specifications.
   3. Descriptive literature, bulletins and/or catalogs of the equipment.
   4. Complete data on motors and gear reducers.
   5. Wiring diagrams and electrical schematics for all control equipment to be furnished.

1.6 WARRANTY

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of one (1) year from date of startup. Items specifically not covered by the warranty are consumable wear parts as identified in the O&M manual.

PART 2 - **PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

A. Screw Wash Press Model shall be as supplied by SAVÉCO North America, Inc. – Model SPW 300-1300, or approved equal.
B. The wash/press is part of an engineered fully integrated screenings system, and as such the wash/press as identified herein shall be provided by the same manufacturer as that of the screens. See Section 46 21 14 Perforated Rotating Plate Screens and Section 41 12 13.36 Screw Bulk Material Conveyors. No other wash/press equipment and/or manufacturer is acceptable. All screenings equipment shall be provided by the same supplier.

2.2 QUALITY ASSURANCE

A. Equipment manufacturer shall be ISO 9001 certified.
B. The Screw Wash Press shall be fully assembled and run tested to confirm fit and function of the screen. A certificate of the shop run test shall be supplied with the shipping documents.

C. The Screw Wash Press will be shipped to the site fully assembled, if possible, and dependent upon the height of the screen. Some ancillary components may be removed to prevent damage during shipment.

2.3 PERFORMANCE REQUIREMENTS

Conditions	**Unit**
Number of Wash Presses	Two (2)
Influent Type	Municipal Screenings
Inlet Solids Capacity (CFH)	105
Inlet Length	1300 mm (51.2 inches)
Volume Reduction	60 – 85%
Weight Reduction	60 – 85%
Discharged Material Dry Solids	>40%
Washed Screenings Fecal Reduction	90% (<20 mg/g BOD5)

2.4 UTILITY REQUIREMENTS/ENVIRONMENTAL CONDITIONS

Requirements/Locations	**Unit**
Spray Wash Water	16 gpm @ 20-40 psi
Motor HP	5.0
Power Supply (V/P/Hz)	480/3/60
Wash Press Installation Location (indoor/outdoor)	Indoor
Wash Press NFPA Classification Requirement	Class I, Div. 2
Control Panel Location (indoor/outdoor)	Indoor
Control Panel NFPA Classification Requirement	Non-hazardous

2.5 DESIGN REQUIREMENTS

A. General

1. The shafted screw type screenings wash press shall be a complete assembly consisting of a transition chute between the filter screen and compactor. The shafted screw wash press shall be designed to receive and wash screenings, then reduce the volume and water content by means of a pressing zone. The unit's washing and compacting performance will be as documented in Paragraph 2.3. After the compacting and dewatering process, the screenings shall be conveyed through the discharge transportation tube to a horizontal screw conveyor as shown on the drawings.
2. Screening's washers that use impellers and/or grinders to tear and shred fibrous screenings at the inlet to the compactor and therefore increase the amount of inert material returned to the plant shall not be allowed.
3. Refer to and comply with the performance requirements list in Paragraph 2.3.
4. The screw wash press shall be designed and built to withstand maximum possible forces exerted. All structural and functional parts shall be sized to prevent deflections or vibrations that may impair the screw wash press operations. All components of the screw wash press shall be made of type 304 stainless steel except the shaft screw which shall be from high strength steel with Hardox™ 400 flights throughout. Bearings, electrical devices, sprockets, motor, and gear reducer shall be of the manufacturer's standard materials.

5. Shop Surface Preparation/Coating: All weldments shall be cleaned and passivated using a full dip passivation process to remove weld spatter, slag, and discoloration. Bearings, electrical devices, drive and wiper chains and sprockets, motor and gear reducer shall be provided with the manufacturer's standard coating system. Screen weldments not full dipped passivated, using spray on cleaning solutions, passivating welds only or bead blasting shall not be allowed.
6. The screw wash press shall discharge screenings capable of passing the EPA Paint Filter Test as described in method 9095 of the EPA publication SW-486.

B. Screw Housing
1. The screw housing shall be constructed from 8mm (0.31 inch) thick type 304 stainless steel. The screw housing shall have support beams with U-profile, thickness of 5mm on each side. The screw housing shall be designed to support all required loads.
2. The interior of the screw housing shall incorporate with minimum of six (6) anti-rotation wear bars each fabricated from Hardox® 400 special high strength alloy steel with minimum Brinnel Hardness of 400.
3. The bottom of the housing shall be provided with perforated drainage sections. Perforations shall be countersunk with maximum 6 mm in diameter. Units supplied with slotted or wedgewire drainage or compaction sections shall not be allowed. Perforations not countersunk shall not be allowed.
4. An inlet area length as specified in Paragraph 2.03, will receive incoming materials. A hopper constructed from type 304 stainless steel shall be provided by the manufacturer to direct solids to the inlet area of the screening's washer.

C. Shafted Screw
1. The screw will be constructed of high strength low alloy carbon steel and Hardox® 400 flights (minimum 400 Brinell), prime coated for protection during shipment. Screw OD shall be 300 mm (11.8 inches) with 12 mm (0.47 inch) thick flights welded to a minimum 100 mm (4 inch) diameter shaft. The final flight of the screw shall be supplied dual thickness 24 mm (0.94 inch) for increased wear life. Screws that do not have the final flight from dual thickness (24 mm) and all flights from Hardox® 400 will not be allowed.
2. A replaceable nylon brush reinforced with a stainless-steel backer shall be attached to the screw flights in the drainage area with stainless steel clips and hardware. To reduce wear on the brush the design shall be such that the screw shall not be allowed to rest in the press housing. The screw shall be fully supported and cantilevered off the thrust bearing.

D. Thrust Bearing
1. An independent thrust bearing housing shall be flanged mounted to the drive and flanged mounted to the press body. The independent thrust bearing assembly shall be protected from the environment and located in a separately sealed area located inside the press body. The flange portion of the thrust bearing shall have a grease fitting centrally located for ease of maintenance.
2. The thrust bearing shall fully support the screw and handle the load created during compaction and reversal of the screw. The thrust bearing shall utilize an SKF roller bearing complete with double lip grease seals and O-rings. The mounting flange shall have an O-ring seal mounted in a machined groove to seal the housing against the press body. Designs that utilize the thrust bearing inside the gear reducer housing will not be acceptable.

E. Drain Pan
   1. A drain pan shall be mounted to the bottom of the screw housing along the full length of the housing. The pan shall be sloped to the drain, and it shall be provided with a flushing water connection. Drain connection shall be minimum 6 inch plain ended pipe. Flush connection shall be minimum 1 inch NPT connection.
   2. The pan shall be secured in place with hardware and allow for easy removal. Drain pan shall be constructed of minimum 14-gauge 304 stainless steel.

F. Wash Water Manifold
   1. The screenings washer shall be provided with a minimum of two (2) separate connections for injecting wash water into the screenings.
   2. Wash water spray nozzles shall be capable of utilizing the screened plant effluent without clogging or fouling.
   3. The wash zone shall include a spray wash system to wash organic residue from the screenings. The wash zone spray will consist of one (1) spray header with two (2) wash water injection points at 3 o'clock and 9 o'clock, two (2) brass spray nozzles, two (2) PRV's, one (1) ball valve and one (1) solenoid valve. The system will have an output of 16 gpm at 20-40 psi. The spray connection will be 1 inch NPT.

G. Inlet Hopper
   1. The inlet hopper shall be designed to accept discharge screenings from the filter screen discharge chute. The hopper shall directly interface with the filter screen discharge with no solids or water bypass.
   2. The inlet hopper shall be fabricated from minimum 12-gauge type 304 stainless steel.

H. Discharge Pipe
   1. The discharge pipe shall be flanged and mounted to the press body by a minimum 17-inch diameter flange.
   2. The discharge pipe shall be designed to transport the washed, dewatered, and compacted screenings as shown on the Drawings to the discharge point without plugging.
   3. The diameter of the discharge pipe shall increase in size to ease the transportation of the screenings and to properly connect to the horizontal screw conveyor shown on the Drawings.
   4. For increased washing and compaction performance the discharge pipe will include a manually controlled back pressure device. The back pressure is manually generated by a stainless-steel plate positioned by operating personnel. Access to the back pressure device is through a stainless-steel access box fitted with a bolt in place hatch with handle. The access box is integral to the discharge pipe. Material of construction shall be 304 stainless steel.
   5. The discharge pipe elbow shall be fabricated from minimum 11-gauge type 304 stainless steel.
   6. The discharge piping following the elbow shall be fabricated from minimum 12-gauge type 304 stainless steel.

I. Drive Assembly

1. The gear reducer shall be a flanged mounted directly to the thrust bearing housing and the compactor frame. Gear reducer shall be a helical gear type with hollow input shaft. The unit will be provided with a cast iron frame and be designed in accordance with AGMA recommendations for Class I service based on the horsepower required to operate the screen. Units that do not bolt the gear reducer directly to the unit's frame will not be allowed.
2. The motor shall be TEFC (Class I, Division 2), 5.0 HP, 460 Volt, 3 phase, 60 Hz, 1760 RPM. The motor shall be NEMA design code B and be direct coupled to the reducer.
3. Chain drives, belt drives, and hydraulic drives will not be accepted.

2.6 ELECTRICAL CONTROLS AND DEVICES

A. In addition to the drive motor, the equipment supplier shall furnish all electrical items specifically called for in this specification section. The contractor shall supply all other electrical items, and interconnecting wiring of proper size, including all conduit and supports required to place the equipment into service.

1. The following components will be included in the associated screen panel to provide proper operation of the equipment:
    a. Branch circuit protection.
    b. Compactor motor starter with overloads.
    c. Hand-Off-Auto selector switches for the screw drive, and screenings spray wash water.
    d. Motor load monitor for overload and over torque protection.
    e. Hour meter for motor.
    f. Run and fault indicating lights.
    g. Run and alarm auxiliary contacts for use by the customer.

B. Local Emergency Stop Pushbutton: A local emergency stop pushbutton station will be provided in a NEMA 7 enclosure for field mounting at the unit.

C. Solenoid Valve: One (1) solenoid valve shall be provided to control flow to the spray wash assembly. The brass body valve shall be 120 Volt, single phase, 60 Hz with a NEMA 7 housing.

2.7 OPERATION, MONITORING, AND CONTROL

A. Sequence of Operation

1. HAND OPERATION: When HAND mode is selected, the spiral will run continuously. When spray wash HAND mode is selected, the spray wash will run continuously.
2. INTERMITTENT AUTOMATIC OPERATION: The control panel will be equipped to control the wash cycle and screw movement. The wash cycle and the screw movement will be controlled independently using timers and counters. The drive motor and spray wash will be controlled automatically when the selector switches are placed in the Auto position.
    a. The press motor starts after an adjustable accumulated run time from the interlocked feeding equipment (barscreen).
    b. The wash water solenoid is open whenever the screw is in operation.
    c. The washing solenoid closes, and the press motor runs for an adjustable length of time, typically set at 30 seconds, to dewater and discharge the screenings.

3. EMERGENCY STOP: The unit can be deactivated at any time by pressing either the control panel mounted, or unit mounted Emergency Stop push buttons.
4. FAULT CONDITIONS: Motor overload, high motor torque, or high motor current conditions will stop the motor and illuminate the fault light.

2.8 Anchorage and Fasteners

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2 inch diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.
B. Fasteners: All fasteners shall be Type 304 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.9 SPARE PARTS

A. The following spare parts shall be provided for the Screenings Wash Press: One (1) brush with mounting clips and hardware for screw.
B. Manufacturer shall recommend any additional spare parts deemed necessary based on experience with the screen in similar applications.

PART 3 - **EXECUTION**

3.1 PREPARATION

A. The mounting points TOC shall be level and parallel and of proper size.
B. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the Drawings prior to fabrication. Indicate field measurements in Shop Drawings.

3.2 INSTALLATION

A. The installation is the responsibility of the Contractor. Complete installation procedures to be included in the O&M manual shipped with the unit.
B. The Contractor and Supplier shall furnish an installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

3.3 OPERATION AND MAINTENANCE MANUAL

A. Contractor and Manufacturer shall provide O&M Manual(s) as described in Section 01 70 00 "Execution and Closeout Requirements" and Section 23 05 00 "General Mechanical Requirements."

3.4 START UP/TRAINING/FIELD QUALITY CONTROL

A. The initial start-up of equipment shall be performed by an authorized manufacturer representative. The authorized representative shall verify the proper operation and installation and provide training to the equipment operators which shall be included with the barscreen start-up and training.

3.5 ADJUSTING AND CLEANING

A. Information on minor periodic adjustments and cleaning shall be provided in the Operating and Maintenance Manual.

END OF SECTION

SECTION 46 23 23 – VORTEX GRIT REMOVAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies circular, vortex type, grit removal units. All appurtenant items as described herein shall also be furnished. Components of the existing units are to be replaced as shown on the Drawings.

B. The intent of this project is an "In-Kind" replacement of two (2) existing vortex grit removal equipment units and associated components as identified on the drawings. The existing grit removal mechanism was manufactured John Munier Products.

C. TYPE: The grit removal equipment shall be of the circular vortex type.

D. EQUPMENT IDENTIFICATION NUMBERS:

Item	Equipment Number
Grit removal unit 1	SEP 01201
Grit removal unit 2	SEP 01211

1.2 QUALITY ASSURANCE

A. GENERAL: The grit removal device shall have a head loss of less than 1/4-inch, at maximum flow, and shall be capable of removing grit from screened wastewater and depositing it in the grit storage chamber.

All devices, lubrication and support equipment bearings shall be readily accessible from the access walkway at ground level.

The grit shall be directed downward onto the floor of the grit chamber, hydraulically washed by the propeller or paddles, and shall pass into the grit storage chamber through an opening between the two chambers.

The manufacturer shall guaranty performance as specified for the grit removal device and shall carry out a test to prove that the equipment performs as specified. Full scale factory tests performed under actual design flow conditions or independent test data for an equivalent unit operating under similar design flow conditions will be an acceptable substitute for field performance testing of grit removal. Model tests utilizing other than full scale equipment operating at the published design capacity are not an acceptable substitute for the specified tests.

B. OPERATING CONDITIONS: The vortex grit removal system shall guaranteed by the manufacturer to provide the following grit removal performance at unit's peak rated capacity, based on grit with specific gravity of 2.65.

95% removal of grit greater than or equal to 50 mesh particle size
85% removal of grit greater than or equal to 70 mesh and less than 50 mesh particle size
65% removal of grit greater than or equal to 100 mesh and less than 70 mesh particle size
38% removal of grit greater or equal to 140 mesh and less than 100 mesh particle size

The grit chamber shall handle all flows less than the hydraulic peak flow of 20 mgd without loss of grit removal efficiency.

Grit will be removed from the storage chamber by means of a recessed impeller torque flow pump provided under a separate contract.

The drive unit shall be designed for 24-hour per day continuous service.

1.3 ENVIRONMENTAL CONDITIONS

A. The equipment to be furnished under this section will be installed outdoors in the headworks of a municipal wastewater treatment plant in El Paso, Texas, which serves a predominantly residential community. However, some minor qualities of commercial and industrial wastes may be present in the wastewater. The equipment shall be suitable for continuous operation outside under the conditions in El Paso, Texas.

1.4 SUBMITTALS

A. The mechanism manufacturer shall submit 4 copies of the following information to the Contractor in accordance with Section 01 33 00 "Submittal Procedures:"
   1. Required openings and anchor bolt information.
   2. Shop drawings and materials of construction.
   3. Detailed installation instructions and drawings.
   4. Electrical diagrams.
   5. Motor data form in accordance with Section 46 05 13 "Common Motor Requirements for Water and Wastewater Equipment.
   6. Results of factory testing demonstrating compliance with the performance specified, or proposed field test procedures.

1.5 WARRANTY

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of one (1) year from date of startup. Items specifically not covered by the warranty are consumable wear parts as identified in the O&M manual.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The replacement equipment shall be John Meunier MECTAN C classic induced Vortex Grit Removal System, Model Number JMDC/5-42SMXV and shall include associated components identified in this specification.

2.2 MATERIALS

Component	Material
Gearmotor enclosure	non-corrosive aluminum or heavy cast iron
Gears	Hardened and heat treated alloy steel
Spur gear pinion	High strength normalized steel
Bull gear	Wear resisting heat treated steel for cast components
Gear case	Heavy cast iron or fabricated steel

2.3 EQUIPMENT

A. GENERAL: The manufacturer shall furnish all the necessary appurtenant items to produce a fully functioning normally operating grit removal unit.

The floor of the grit separation channel shall be flat and there shall be a maximum 3-inch opening for grit to pass through to a storage hopper. The manufacturer shall supply a floor plate to cover the grit storage hopper. The plate shall consist of two sections with lifting loops to allow access to the grit storage hopper.

B. PROPELLER: The grit removal unit shall have a variable pitch propeller or paddle for gently agitating the flow and maximizing the removal of organics. The propeller or paddle pitch and speed shall be factory set for optimum grit removal efficiency at an initial flow range of 6.0 to 17.5 mgd.

C. DRIVE: The propeller shall be driven by a totally enclosed gearmotor with a service factor of 2.0 or better. Drive shall be via a drive tube driven by a spurgear supported by a turntable bearing. The gearmotor shall drive a large spur tooth bull gear enclosed in a grease packed or oil-filled gear case. The drive shall be protected from torque overload by means of a shear pin device.

Gear teeth shall be hobbed and crown-shaved or crown ground. Helical gearing shall be oil lubricated. The bull gear shall be mounted on a turntable bearing with a minimum diameter of 20 ½ inches. Pinion and bull gears shall have a service factor of 5.0 or better.

The bull gear box shall be specifically designed for this service. It shall have an opening for a minimum 10-1/2-inch diameter drive torque tube to the propeller or paddle. The gearbox shall be sealed with ground joints. The bottom opening shall have an air bell or splash plate around the drive torque tube to prevent water from entering the gearbox.

All bearings shall be rated for 50,000-hour life in accordance with Section 46 00 00 and AFBMA 9-90.

D. MOTOR: The motor shall be rated for 460VAC, 3 phase, 60 hertz. The motor shall be non-overloading under any normal operating conditions encountered and shall be 2 HP maximum.

E. CORROSION PROTECTION: Corrosion protection shall be as specified in Section 09 90 00.

F. ANCHOR BOLTS AND EMBEDDED ITEMS: All required anchor bolts, templates, and embedded items shall be furnished in accordance with manufacturer’s requirements.

2.4 PRODUCT DATA

A. In accordance with the General Conditions, the following information shall be provided to the Owner:
   1. Operation and maintenance data and manuals in accordance with Section 01 70 00 “Execution and Closeout Requirements” and Section 23 05 00 “General Mechanical Requirements.”

PART 3 - EXECUTION

3.1 PRODUCT DATA

A. Grit removal unit shall be factory assembled and tested before being shipped.

3.2 FIELD TEST

B. When required in accordance with the provisions of paragraph 1.2A., a field test shall be conducted under the supervision of the manufacturer’s representative in the presence of the Engineer. In any event, the manufacturer shall provide 2 days of field service by a qualified field service engineer to inspect and test the completed installation for proper alignment, lubrication, free operation, adjustment, etcetera, and to instruct the owner’s operating personnel in the proper operation, and maintenance of the equipment.

END OF SECTION

SECTION 46 23 63 – GRIT CLASSIFYING AND WASHING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes equipment for separating and dewatering pumped grit slurries.

B. The intent of this project is to replace the existing equipment with similar type equipment as specified herein and install it within the same general footprint, configuration, and performance as the existing.

C. TYPE: Grit cyclones shall be the top overflow, bottom discharge cyclonic type. Grit separators shall be the helical screw classifier type.

D. EQUIPMENT LIST: Equipment numbers are as follows:

Item	Equipment No.
Grit Cyclone 1	SEP 01241
Grit Cyclone 2	SEP 01251
Grit Separator 1	SEP 01242
Grit Separator 2	SEP 01252

1.2 QUALITY ASSURANCE

A. PERFORMANCE: The grit cyclones and grit separators shall be designed to separate and dewater solids from a grit slurry generated from screened domestic wastewater containing up to 10 percent solids by volume. The grit slurry will be comprised of sand, sticks, gravel, petroleum products, industrial solvents, organic solids and detergents. Grit cyclones shall be capable of removing no less than 99 percent of all grit particles in the inlet slurry having a diameter equal to or greater than that retained on a 150-mesh U.S. standard sieve and specific gravity of 2.65 or greater.

B. The grit separator unit shall be designed to dewater grit from the underflow of the grit cyclones. The unit shall be capable of dewatering the grit slurry to a moisture content of not less than 65 percent. The unit shall be designed to capture no less than 95 percent of all particles having a diameter greater than that retained on a 150-mesh U.S. standard sieve.

C. OPERATING REQUIREMENTS:

1. GRIT CYCLONE

Inlet flow rate, gpm	420
Inlet pressure, psig	5
Underflow rate, gpm	32
Inlet port size, inches	6
Overflow port size, inches	8
Apex diameter, inches	3
Vortex finder diameter, inches	6

2. GRIT SEPARATOR

Classifier size, inches	18
Maximum overflow rate, gpm/sf	2
Maximum motor horsepower	1
Motor type	TEFC
Maximum screw speed, rpm	8
Acceptable range of linear rate of travel up screw, feet/min	4-6

D. REFERENCES: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   1. ASTM A395 - Ferritic Ductile Iron Pressure-Retaining Casting for use at Elevated Temperatures
   2. ASTM A131 – Structure Steel for Ships

1.3 ENVIRONMENTAL CONDITIONS

A. Grit cyclones and grit separators shall be designed for continuous operation in a municipal wastewater treatment plant situated in El Paso, Texas.

1.4 SUBMITTLS AND DELIVERY

A. The following submittals shall be provided in accordance with Section 01 33 00 “Submittal Procedures:”
   1. Fabrication drawings with full dimensions.
   2. Motor Data in accordance with Section 46 05 13 “Common Motor Requirements for Water and Wastewater Equipment.”

1.5 SPARE PARTS

A. The following spare parts shall be provided:
   1. Grit cyclone:
      a. One set of all liners
      b. One vortex finder gasket
      c. One retainer ring
   2. Grit separator:
      a. One lower bearing assembly
      b. One lock bushing
      c. One set wearing shoes with bolts and nuts

1.6 WARRANTY

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of one (1) year from date of startup. Items specifically not covered by the warranty are consumable wear parts as identified in the O&M manual.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Equipment shall be Wemco Hydrogritter, or approved equal, modified to provide the specified features, meet specified operating conditions, and fit within the existing space and configuration as existing equipment being replaced.

2.2 MATERIALS

A. GRIT CYCLONE:

Component	Material
Cone housing	Aluminum
Cone lining	Natural rubber
Inlet head housing	Ductible iron, ASTM A395
Vortex finder	Ni-hard cast iron
Apex housing	Aluminum
Cylinder housing	Steel, A131, 1015
Cylinder lining	Natural rubber
Retainer ring	Steel, A131 105 to 1020

B. GRIT SEPARATOR:

Component	Material
Tank assembly	Stainless steel 304L
Lower bearing assembly	Cast iron
Pivot beam and motor support	Steel
Spiral screw assembly	Steel
Wear shoes	Nihard with a minimum Brinell hardness of 550
Lifting device	Steel
Separator support	Stainless steel 304L
Spray assembly	Stainless steel 304
Spiral guards	Stainless steel 304

2.3 EQUIPMENT FEATURES

A. GRIT CYCLONES:

1. INLET AND OVERFLOW: Inlet and overflow for each separator shall be provided with fittings suitable for use with grooved end pipe couplings. The inlet shall be provided with a 0- to 25-psig pressure gage, calibrated in a 0.20-psi increments and complete with sealed diaphragm.
2. APEX: The apex housing shall be of the fixed type. Quick disconnecting devices shall be provided to allow the removal of the apex assembly without disconnecting any other piping.

B. GRIT SEPARATORS:

1. SETTLING TANK: The settling tank shall be a full flare fabricated stainless steel tank constructed of not less than 1/4-inch stainless steel 304L plate, as a complete unit after fabrication. It shall be suitably reinforced, mounted on stainless steel legs and designed to provide a settling compartment where grit regulated by an adjustable overflow weir at the end of the settling tank. Adjustable weirs for water level regulations shall provide a minimum pool depth of 150 percent of the dewatering conveyor diameter. The overflow weir shall discharge into an overflow launder box which shall be equipped with grooved mechanical overflow drain connections. The design of the settling tank shall prevent the accumulation of scum

on the tank's water surface by providing a full width overflow weir and a flow pattern which sweeps scum over the weir.

The slope of the settling tank bottom shall not exceed four inches per foot.

2. DEWATERING CONVEYOR: The grit shall be removed from the bottom of the settling compartment and discharge by means of a 50 percent pitch helical conveyor. The helix shall be made up from preformed 10 gauge steel flight sections welded to the shaft, fitted with Ni-Hard wearing shoes. The wearing shoes shall be replaceable and shall be mounted on the flights by means of countersunk stainless steel bolts and nuts.

   The pipe shaft of the conveyor shall be designed with a maximum stress of 3,000 psi, and a fatigue life, at 98-percent reliability, 20 years minimum.
   The classifier shall be equipped with a spray nozzle for washing the removed grit as a it travels up the dewatering beach.

3. CONVEYOR SUPPORTS AND BEARINGS: The lower end of the conveyor shall be supported by a bearing attached to a manually operated handwheel and screw-type lifting device designed to allow the entire assembly to be lifted above the maximum water level. The upper end of the conveyor shall be rigidly connected to, and supported by, the drive unit. The drive and motor assembly shall in turn be supported by a pivoted frame. The pivot shall be located at the same level as the conveyor shafter centerline to permit raising of the conveyor without disconnecting the drive unit. The lower bearings shall be oil lubricated with a cast iron housing. The bearing shall be encapsulated and provided with a permanent seal to prevent leakage of oil and entrance of grit or foreign particles into the bearing. The seal shall be of the self-compensating type consisting of two mating hardened steel alloy rings, each held in place by a rubber toric. The wearing surfaces of the rings shall be precision lapped to form an initial sealing band of approximately 1/32-inch wide. The seal assembly shall be so designed that as the seal rings wear down through operation, the pressure from the rubber torics shall push the rings further again each other to form a broadened contact band. The only maintenance for the bearing shall be as manufactured by Caterpillar Tractor Company, without substitution. The Owner knows of no equal.

   The upper end of the conveyor shall be connected to a cycloidal motion speed reducer by a flanged, rigid coupling. The cycloidal speed reducer shall be designed so that all torque is transmitted by rollers and shall be capable of withstanding shock loads of 500 percent of rated loading. The cylodrive shall take radial and all thrust loads from the shaft, and at maximum load provide a minimum B-10 bearing life of 50,000 hours.

4. DRIVE UNIT: The separator drive unit shall be a 1,750-rpm Type 3 motor driving the cycloidal speed reduce described in paragraph 2.2 B.3. by means of a V-belt drive. Gear type speed reducers are not acceptable. The motor shall comply with the requirements of Section 46 05 13 "Common Motor Requirements for Water and Wastewater Equipment.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Contractor and manufacturer shall provide O&M Manual(s) as described in Section 01 70 00 “Execution and Closeout Requirement” and Section 23 05 00 “General Mechanical Requirements.”

3.2 STARTUP, TRAINING AND TESTING

A. Contractor shall provide for on-site start-up and training services by a qualified factory-trained equipment manufacturer’s representative. As a condition precedent to final acceptance of the work, the manufacturer’s representative shall demonstrate to the Contractor that the equipment has been properly installed, aligned, and tested and meets all requirements for satisfactory performance under the conditions specified herein. The Contractor shall provide the Engineer with five (5) copies of the manufacturer’s certification stating that the equipment has been properly installed, aligned, and tested and meets all requirements for satisfactory performance under the conditions specified herein.

B. Manufacturer authorized representative shall provide training to the equipment operators. One (1) trip for a total of three (3) days shall be provided.

END OF SECTION