AGREEMENT AND SPECIFICATIONS

BOONE INTERCEPTOR REPLACEMENT PHASE 2A

BID NUMBER 05-23

VOLUME 1 OF 2

CONTRACT DOCUMENTS

FEBRUARY 2023

el paso WATER

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY FERNANDO SILVA, P.E. 96157 ON FEBRUARY 28, 2023

Brown AND Caldwell

TBPE No. F-2139

CIP No. S0440055
Eng. / Proj. ID 0000001268

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

PSB BID NO. 05-23

INFORMAL NOTICE

Sealed proposals for construction of the Boone Interceptor Replacement Phase 2A 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 April 18, 2023, 1:30 p.m. local time. **After 1:30 p.m., bids will not be accepted.** Bid Opening will occur at 2:00 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:

- Furnish and install approximately 2073 LF of 30-inch PVC C-905 sewer interceptor, fittings and appurtenances
- Furnishing and installing combination air/vacuum valves
- Furnishing and installing 30-inch access manways
- Furnishing and installing 6-inch blow-off valves
- Furnishing and install one trenchless installation of 83 LF of 48" steel casing
- Furnishing and installing a SS knife gate valve and appurtenances
- Furnishing FRP stop logs and installing SS guides in an active wastewater Plant junction box
- Connection to existing structure (active) at Wastewater Treatment Plant
- Support and temporary relocations of existing utilities
- The work under this contract will also include all site work such as clearing, grubbing, grading, rockwalls and fence, furnishing and installing 2-sack flowable fill backfill and base, pavement removal and replacement, concrete header, concrete curb and gutter, concrete sidewalk, concrete pavement removal and replacement, trench excavation and safety, preparation and implementation of TPDES requirements, traffic control, removal and disposal of sewer piping, removal and disposal of substandard soil conditions and backfill with engineered fill; all fittings and appurtenances, labor, materials, transportation, and start-up for a complete and workable system; and any other items described in the plans and specifications.

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 April 4, 2023 at 2:30 p.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

BOONE INTERCEPTOR REPLACEMENT PHASE 2A

Bid Number 05-23

CITY OF EL PASO, TEXAS

TABLE OF CONTENTS

BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT

TECHNICAL SPECIFICATIONS

(See Attached)

SECTION 00020

INVITATION TO BID

Sealed proposals for construction of the Boone Interceptor Replacement Phase 2A 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 April 18, 2023, 1:30 p.m. local time. **After 1:30 p.m., bids will not be accepted.** Bid Opening will occur at 2:00 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:

- Furnish and install approximately 2073 LF of 30-inch PVC C-905 sewer interceptor, fittings and appurtenances
- Furnishing and installing combination air/vacuum valves
- Furnishing and installing 30-inch access manways
- Furnishing and installing 6-inch blow-off valves
- Furnishing and install one trenchless installation of 83 LF of 48" steel casing
- Furnishing and installing a SS knife gate valve and appurtenances
- Furnishing FRP stop logs and installing SS guides in an active wastewater Plant junction box
- Connection to existing structure (active) at Wastewater Treatment Plant
- Support and temporary relocations of existing utilities
- The work under this contract will also include all site work such as clearing, grubbing, grading, rockwalls and fence, furnishing and installing 2-sack flowable fill backfill and base, pavement removal and replacement, concrete header, concrete curb and gutter, concrete sidewalk, concrete pavement removal and replacement, trench excavation and safety, preparation and implementation of TPDES requirements, traffic control, removal and disposal of sewer piping, removal and disposal of substandard soil conditions and backfill with engineered fill; all fittings and appurtenances, labor, materials, transportation, and start-up for a complete and workable system; and any other items described in the plans and specifications.

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 April 4, 2023 at 2:30 p.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 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 via Teams. Please join the meeting from your computer, tablet, or smartphone using the link below:

Microsoft Teams meeting

Join on your computer, mobile app or room device

Click here to join the meeting

Meeting ID: 267 695 528 415

Passcode: q5JVp5

Download Teams | Join on the web

Or call in (audio only)

+1 915-255-2297,,246663679# United States, El Paso

Phone Conference ID: 246 663 679#

Find a local number | Reset PIN

Learn More | Meeting options

BID OPENING INSTRUCTIONS

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

To View Bid Opening Click the Link Below:

05-23 Boone Interceptor Replacement Phase 2A
Apr 18, 2023, 2:00 – 2:30 PM (America/Denver)

Please join my meeting from your computer, tablet or smartphone.
https://meet.goto.com/357700557

You can also dial in using your phone.
Access Code: 357-700-557
United States (Toll Free): 1 877 309 2073
United States: +1 (646) 749-3129

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

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. Bidder's four (4) Key Personnel (Project Manager, Superintendent, Foreman and Project Scheduler) each must demonstrate two (2) successful projects with similar complexity and scope of a sewer line installation 24-inches in diameter or larger within the past five (5) years. At least two Key Personnel must have been an employee of the Company bidding this project.
2. Bidder's four (4) Key Personnel (Project Manager, Superintendent, Foreman and Project Scheduler) each must demonstrate two (2) successful projects with multiple tie-ins to existing sewer systems within the past five (5) years.
3. This project requires careful planning and adherence to a strict schedule for meeting milestone dates. Bidder's Project Scheduler must demonstrate two (2) successful projects with similar scope which involved milestone dates and successful completion of these projects within the strict schedule.
4. This project requires installation of a sewer line in several busy streets and intersections which will require a detailed traffic control plan. Bidder must demonstrate two (2) successful projects with similar scope which involved detailed traffic control plans and strict adherence to them with successful completion. Subcontractor is acceptable with the minimum experience to satisfy this requirement.
5. Project involves trenchless installation of 48-inch. Bidder must demonstrate two (2) successful projects with similar work and trenchless method to be used within the past five (5) years utilizing a casing of 42-inch or larger per the proposed method. The requirement may be satisfied by employing the services of a qualified Subcontractor, providing a list of trenchless projects and resume of the superintendent to be assigned to this project.
6. Bidder must demonstrate that he/she will assign the required Key Personnel on a full time basis for the duration of the project. The Key Personnel include the Project Manager, Superintendent, Foreman and Project Scheduler. Resumes shall be provided for each Key Personnel. Scheduler shall be experienced in the use of critical path method construction scheduling.

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 2:30 p.m., local time, on the 4th day of April, 2023 virtually using Microsoft Teams software. The link for the meeting will be posted on the EPWater website. 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: Boone Interceptor Replacement Phase 2A

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.
	12.

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

PROJECT IDENTIFICATION: El Paso Water Utilities

Boone Interceptor Replacement Phase 2A

BID NO.: 05-23

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	Mobilization and Demobilization; shall be no more than 5% of Items 2-25 (If Item No. 1 exceeds 5%, bid may be deemed non-responsive).	$_____	$_____
2.	1	LS	Pre-Construction and Post Construction Video Recording Of Project Route; Complete in Place.	$_____	$_____
3.	1	LS	Provide and Maintain Traffic Control; Complete in Place.	$_____	$_____
4.	1	LS	Preparation and Implementation of Texas Pollutant Discharge Elimination Requirements; Complete in Place.	$_____	$_____
5.	2250	LF	Furnish and Install 30-Inch Sewer Pipe - Green Colored PVC C-905 DR41 and Appurtenances, as Specified; Complete in Place.	$_____	$_____

Item No.	Estimated Quantity	UOM	Brief Description of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
6.	20	LF	Furnish and Install 8-Inch Sewer Pipe - Green Colored PVC D-3034 DR 26 and Appurtenances, as Specified; Complete in Place.	$_____	$_____
7.	3	EA	Furnish and Install 30-Inch Access Manways with Standard 60-Inch Pre- Cast Concrete Manhole (Type "C"); Complete in Place.	$_____	$_____
8.	2	EA	Furnish and Install 8-Inch Wastewater Combination Air Release Valve, w/30-inch Access Manway, and Manhole; Complete in Place.	$_____	$_____
9.	4020	SY	Removal and Replacement of 2.5-Inch Hot Mix Asphalt Cement (HMAC); Complete in Place	$_____	$_____
10.	3022	SY	Removal and Replacement of 3-Inch Hot Mix Asphalt Cement (HMAC); Complete in Place	$_____	$_____
11.	4000	SY	Furnish and Install Fog Seal on Existing HMAC Parking Lot; Complete in Place	$_____	$_____
12.	2600	CY	Furnish and Install Two Sack Flowable Fill as base material, Complete in Place.	$_____	$_____
13.	2876	CY	Removal and Disposal of Uncontaminated Stained Soil and Backfill with Approved Fill; Complete in Place	$_____	$_____

Item No.	Estimated Quantity	UOM	Brief Description of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
14.	400	CY	Removal and Disposal of Contaminated Stained Soil and Backfill with Approved Fill; Complete in Place	$_____	$_____
15.	1	EA	Furnish and Install 6-Inch Blow-Off Valve And Manhole; Complete in Place.	$_____	$_____
16.	83	LF	Furnish and Install 48-Inch Steel Casing by Approved Trenchless Method within City of El Paso R.O.W. (Delta Drive); Complete in Place, including temporary fencing, bore pits, and monitoring/settlement monitoring.	$_____	$_____
17.	1	EA	Furnish and Install 30-Inch SS Knife Gate Valve and Manhole; Complete in Place.	$_____	$_____
18.	1	EA	Furnish and Install FRP Stop Logs, with 316 SS guides; Complete in Place.	$_____	$_____
19.	1	LS	Tie-In at Elevated Junction Box at Haskell Wastewater Treatment Plant, Complete in Place.	$_____	$_____
20.	2250	LF	Furnish and Install Trench Safety System; Complete in Place.	$_____	$_____
21.	20	LF	Remove and Replace Concrete Curb and Gutter, complete in place.	$_____	$_____
22.	15	SY	Remove and Replace Concrete Sidewalk, complete in place.	$_____	$_____

Item No.	Estimated Quantity	UOM	Brief Description of Item	Unit Bid Price	Extended Amount (Qty. x Unit Price)
23.	1	EA	Removal and Replacement of Concrete ADA Access Ramp; Complete in Place	$_____	$_____
24.	1	Allowance	Relocation of Existing Utilities; Complete in Place	$55,000.00	$55,000.00
25.	1	Allowance	Removal and Replacement of existing Landscape and Irrigation systems; Complete in Place	$30,000.00	$30,000.00

TOTAL BID PRICE (ITEMS 1 THROUGH 25) $ _____

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 260 Calendar Days from the date when the Contract Time commences to run as provided in Paragraph 2.03 of the General Conditions, 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 290 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.

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

   A. 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 _____

      _____

   B. 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 or 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	OTHER
Prime Contractor:						

C. 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 Boone Interceptor Replacement Phase 2A, Bid No. 05-23 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: 05-23

BID TITLE: Boone Interceptor Replacement Phase 2A

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

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:	2020		2021		2022	
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: _____

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 is _____, _____, _____, _____, _____.
(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

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:

_____

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. 05-23: 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:

_____

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

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

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

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

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

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

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

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

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

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

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

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.

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:

BOONE INTERCEPTOR REPLACEMENT PHASE 2A

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

- Furnish and install approximately 2073 LF of 30-inch PVC C-905 sewer interceptor, fittings and appurtenances
- Furnishing and installing combination air/vacuum valves
- Furnishing and installing 30-inch access manways
- Furnishing and installing 6-inch blow-off valves
- Furnishing and install one trenchless installation of 83 LF of 48" steel casing
- Furnishing and installing a SS knife gate valve and appurtenances
- Furnishing FRP stop logs and installing SS guides in an active wastewater Plant junction box
- Connection to existing structure (active) at Wastewater Treatment Plant
- Support and temporary relocations of existing utilities
- The work under this contract will also include all site work such as clearing, grubbing, grading, rockwalls and fence, furnishing and installing 2-sack flowable fill backfill and base, pavement removal and replacement, concrete header, concrete curb and gutter, concrete sidewalk, concrete pavement removal and replacement, trench excavation and safety, preparation and implementation of TPDES requirements, traffic control, removal and disposal of sewer piping, removal and disposal of substandard soil conditions and backfill with engineered fill; all fittings and appurtenances, labor, materials, transportation, and start-up for a complete and workable system; and any other items described in the plans and specifications.

ARTICLE 2. ENGINEER

The Project has been designed by Brown and Caldwell 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 260 Calendar Days from the date when the Contract Time commences to run as provided in Paragraph 4.01 of the General Conditions, 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 290 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 two hundred and ninety dollars ($2,290) 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 three hundred and thirty dollars ($1,330) 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) – IF APPLICABLE

7.8 General Wage Rates (Section 00840)

7.9 Specifications bearing the title Project Manual for the Construction of BOONE INTERCEPTOR REPLACEMENT PHASE 2A consisting of division numbers Division 01 Division 40 listed in table of contents thereof.

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

BOONE INTERCEPTOR REPLACEMENT PHASE 2A

(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 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
	13. Traffic Control Plan
	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**

TEXAS COMPTROLLER OF PUBLIC ACCOUNTS

SUSAN COMBS • COMPTROLLER • AUSTIN, TEXAS 78774

July 30, 2007

CERTIFICATE OF ACCOUNT STATUS

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)

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

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

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

EL PASO WATER UTILITIES - PUBLIC SERVICE BOARD

ENGINEER'S CERTIFICATE OF SUBSTANTIAL COMPLETION

BOONE INTERCEPTOR REPLACEMENT PHASE 2A, BID NO. 05-23

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

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.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE®
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

1801 Alexander Bell Drive, Reston, VA 20191-4400

(800) 548-2723

www.asce.org

NOTE: EJCDC publications may be purchased at www.ejcdc.org, or from any of the sponsoring organizations above.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

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

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

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.

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.

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.

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.

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

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.

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

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.

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

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.

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.

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

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.

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

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;

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

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

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

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

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

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.

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);

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

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.

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.

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;

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.

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.

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.

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.

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.

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.

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.

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

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

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:

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.

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

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

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

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

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.

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

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

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.

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,

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,

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

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.

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;

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

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

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.

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,

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.

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,

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

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.

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.

SECTION 00800
SUPPLEMENTARY CONDITIONS
TABLE OF CONTENTS

Page

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 KTXELPAS147 (FMI El Paso) weather monitoring station at FMI on Trowbridge (FM 76) near Rod Mill Road. 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
General Geotechnical Subsurface Soil Evaluation Report – EPWater Boone Interceptor Replacement Phase II Project – Route Study and Design	July 17, 2020	Subsurface Soils Evaluation
Boone Street Sewer Interceptor Replacement Phase 2 – Tunnel Crossings Geotechnical Baseline Report OUTLINE (DRAFT)	February 2018	GBR for casing installations

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 Such Drawings Exist		

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-5.03.A Delete Paragraphs 5.03.A and 5.03.C in their entirety and insert the following in their place:

SC-5.03.A No reports of explorations or tests of subsurface conditions at or contiguous to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

SC-5.03.C Not Used.

5.06 *Hazardous Environmental Conditions at Site*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Limited Phase II Environmental Site Assessment – Boone Siphon Sanitary Sewer Improvements	November 2022	Identifies Potential Residual Impacts due to Historical Use of Site
Boone Siphon System Sanitary Sewer Improvements – Environmental Information Document	August 2020	Identifies Possible Environmental (non-hazardous) Issues

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
No such drawings exist		

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) N/A .

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) or (will not) 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 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	

6.04 Builder's Risk and Other Property Insurance

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 $500,000. 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) N/A

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, and shall insure against at least the following perils or causes of loss: theft, vandalism and malicious mischief, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations;

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. Not used.

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 an 8-hour day between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday.

2. Owner's legal holidays will be established at the inception of the project.

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "…all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday."

SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion and with approval from Owner.

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 $100 per hour plus mileage at the current Federal rate for RPR services.

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. Not applicable.

3. Not applicable.

4. 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 5 pages, applicable to the Project is part of the Contract Documents.

b. Not used.

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.

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*

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

9.13 Owner's Site Representative

A. Owner will furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site

Representative will be identified at the beginning of the project. The authority and responsibilities of Owner's Site Representative shall be as established by EPWater.

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 $2,290 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 $1,330 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 for Construction Equipment. 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.

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.

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 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 (NOT APPLICABLE)*

SC-18.14 Add the following new paragraph(s) immediately after Paragraph 18.12:

SC-18.14 *Railroads – NOT APPLICABLE*

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).

Contractor Insurance Check List

Project	BOONE INTERCEPTOR REPLACEMENT PHASE 2A			
Bid Number	05-23			
Job Description	Furnish and install approximately 2073 LF of 30-inch PVC C-905 sewer interceptor, fittings and appurtenances, Furnishing and installing combination air/vacuum valves, Furnishing and installing 30-inch access manways, Furnishing and installing 6-inch blow-off valves, Furnishing and install one trenchless installation of 83 LF of 48" steel casing, Furnishing and installing a SS knife gate valve and appurtenances, Furnishing FRP stop logs and installing SS guides in an active wastewater Plant junction box, Connection to existing structure (active) at Wastewater Treatment Plant ,Support and temporary relocations of existing utilities. The work under this contract will also include all site work such as clearing, grubbing, grading, rockwalls and fence, furnishing and installing 2-sack flowable fill backfill and base, pavement removal and replacement, concrete header, concrete curb and gutter, concrete sidewalk, concrete pavement removal and replacement, trench excavation and safety, preparation and implementation of TPDES requirements, traffic control, removal and disposal of sewer piping, removal and disposal of substandard soil conditions and backfill with engineered fill; all fittings and appurtenances, labor, materials, transportation, and start-up for a complete and workable system; and any other items described in the plans and specifications.			
Contract Cost				
Final Completion				
Contractor				
Engineer	Brown and Caldwell			
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			

Contractor Insurance Check List

	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.

APPLICATION FOR PAYMENT NO. ___

Check One: PARTIAL ____ FINAL ____

OWNER: El Paso Water Utilities
Public Service Board
1154 Hawkins Blvd.
El Paso, Texas 79925

PROJECT: Boone Interceptor Replacement Phase 2A

BID NO.: 05-23

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: _____

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					

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

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	Fence Erector (Permanent Fence) if needed
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	Entire project with exception of Permanent Fences

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.

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

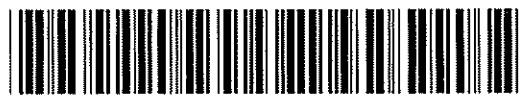


TABLE OF CONTENTS

PART B--TECHNICAL SPECIFICATIONS
BOONE INTERCEPTOR REPLACEMENT PHASE 2A

03 20 00	CONCRETE REINFORCING
03 30 00	CAST-IN-PLACE CONCRETE
03 40 00	CONCRETE PAVEMENT
03 60 00	GROUTING

DIVISION 05 METALS

05 05 20	ANCHOR BOLTS
05 50 00	METAL FABRICATIONS
05 59 20	STEEL CASINGS

DIVISION 31 EARTHWORK

31 10 00	SITE CLEARING
31 23 00	EXCAVATION AND FILL
31 23 01	FLOWABLE AND NON-FLOWABLE FILL
31 23 19	CONTROL OF WATER
31 41 00	SHORING
31 41 00.A	OSHA REQUIREMENTS
31 73 13	ANNULAR SPACE GROUTING
31 73 29	CEMENT TUNNEL GROUTING

DIVISION 32 EXTERIOR IMPROVEMENTS

32 11 23	AGGREGATE BASE COURSE
32 12 16	ASPHALT PAVING
32 12 36	ASPHALT FOG SEAL COAT
32 17 23	PAVEMENT MARKINGS
32 17 23.33	THERMOPLASTIC PAVEMENT MARKINGS
32 31 13	CHAIN LINK FENCE
32 91 13	SOIL PREPARATION
32 91 19	LANDSCAPE GRADING
32 93 13	TREE, SHRUBS AND GROUNDCOVER

DIVISION 33 UTILITIES

33 05 13	MANHOLES AND STRUCTURES
33 05 13.16	PRECAST MANHOLES FRAMES AND COVERS
33 05 23	TRENCHLESS UTILITY INSTALLATION
33 39 13	SANITARY UTILITY MANHOLES, FRAMES, AND COVERS

DIVISION 40 PROCESS INTEGRATION

40 05 01	PIPING SYSTEMS
40 05 02	PIPING SYSTEM SCHEDULES
40 05 02.43	PRESSURIZED AND GRAVITY WASTEWATER SYSTEMS
40 05 06.13	JOINT GASKETS
40 05 06.16	PIPING CONNECTIONS
40 05 11	SANITARY SEWER PIPE LOW PRESSURE AIR AND DEFLECTION TESTING
40 05 12	PRESSURE TESTING OF PIPING
40 05 19	DUCTILE IRON PIPE
40 05 20	PLASTIC PIPE
40 05 45	PIPING SYSTEM IDENTIFICATION
40 05 59.14	FRP STOP LOGS
40 05 60	VALVES
40 05 61.17	KNIFE GATE VALVES
40 05 78.23	AIR/VACUUM VALVES FOR WASTEWATER SERVICE

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. The overall project will consist of furnishing and installing 36-inch and 24-inch nominal diameter sewer pipes. The project will also consist of furnishing and installing casing, manholes, a metering station manhole with electrical appurtenances, excavation and backfill, trench safety, base course, pavement removal and replacement, curb and gutter replacement, and traffic control.

1.02 DESCRIPTION OF OWNER'S PROJECT

A. The 30-inch pipe will begin just on Tobin Place, approximately 175 feet north of Orchard Avenue. The route proceeds south and then turns west on Orchard Avenue, then south along the Delta Center parking lot, and then proceed west on Delta Drive to the Haskell WWTP. The final tie-in will be made at the Haskell WWTP, Junction Box B. One trenchless crossing will be utilized at the intersection of Delta Drive/Shelter Place.

1.03 CONTRACTS

A. The 30-inch sewer interceptor route will be considered as one phase of this contract. The contractor shall cooperate with the agencies, trades, or contractors which are involved in the execution of other portions of this project.

1.04 WORK OF THIS CONTRACT

A. SCOPE:

Generally, the project will consist of the following:

- Furnish and install approximately 2073 LF of 30-inch PVC C-905 sewer interceptor, fittings and appurtenances
- Furnishing and installing 72-inch Manholes
- Furnishing and installing combination air/vacuum valves
- Furnishing and installing 30-inch access manways
- Furnishing and installing 8-inch blow-off valves
- Furnishing and install one trenchless installation of 83 LF of 48” steel casing
- Connection to existing structure (active) at Wastewater Treatment Plant
- Support and temporary relocations of existing utilities
- The work under this contract will also include all site work such as clearing, grubbing, grading, rockwalls and fence, furnishing and installing 2-sack flowable fill backfill and base, pavement removal and replacement, concrete header, concrete curb and gutter, concrete sidewalk, concrete pavement removal and replacement, trench excavation and safety, preparation and implementation of TPDES requirements, traffic control, removal and disposal of sewer piping, removal and disposal of substandard soil conditions and backfill with engineered fill; all fittings and appurtenances, labor, materials, transportation, and start-up for a complete and workable system; and any other items described in the plans and specifications.

B. COORDINATION

The project will require close coordination with the El Paso Water Utilities (EPWater). Contractor shall notify Mr. Javier Dominguez of EPWater at (915) 594-5675, 48-hours prior to any work. Contractor shall be responsible for meeting all of the requirements of the City of El Paso and EPWater and for complying with the terms of the permit issued to the Owner.

C. EXISTING UTILITIES

The Contractor shall be fully responsible for all underground facilities which are shown on the drawings or which can be located by the Contractor with reasonable effort, or which are brought to the attention of the Contractor in any manner. The Contractor shall be responsible for notifying the Engineer if any unknown facilities are uncovered and for protecting those facilities after they are uncovered.

Known utilities and structures adjacent to or encountered in the work are shown on the Drawings. The locations shown are taken from existing records and information available from existing plans; however, it is expected that there may be discrepancies and omissions in the locations and quantities of utilities and structures shown. Those shown are for the convenience of the Contractor only, and no responsibility is assumed by either the Owner or the Engineer for their accuracy or completeness.

Neither the Owner nor his officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.

The Contractor shall at all times provide unobstructed access to fire hydrants, underground conduit, manholes, and water or gas valve boxes.

Where the Contractor's operations could cause damage which might result in material expense, loss, and inconvenience when his operations are adjacent to or near telephone, television, power, oil, gas, water, sewer, irrigation, or other systems, no operations shall be commenced until the Contractor has made all arrangements necessary for the protection of these utilities and services.

The Contractor shall be responsible for the protection of all electric power poles, overhead lines, light poles, etc. which occur along the boring routes. The Contractor shall provide whatever temporary shoring is necessary to ensure that all poles are adequately supported, braced, etc. so that the pole does not sink, shift, tilt, or otherwise move from its original position. Any removal of guy wires or anchors and setting of any guy wires or anchors shall be done at the Contractors expense. Any measures the Contractor takes to support any type of pole shall be based upon approval of El Paso Electric Company and the Engineer. El Paso Electric Company and the Engineer shall be notified of probable work on the pole no later than within the first week of Contractor's work, and again 5 business days prior to the work being done. Removal of temporary supports of guy wires shall be with the approval of El Paso Electric Company and the Engineer. Said removal of temporary facilities shall only be accomplished upon 5 business days notification of El Paso Electric Company and the Engineer.

The Contractor shall coordinate the work with all utility companies having facilities within the area of work for the relocation, by-passing or protection of their existing utility lines. Any work associated with the protection, relocation or by-passing of existing utility lines shall be reflected in the Contractor's project schedule so that the work may be completed without

delay to the project. All the requirements of the contract documents will apply to any subcontractor who performs any relocation, by-passing, or protection of existing utility lines. All work associated with the relocating, by-passing, protection of existing utility lines or replacement shall be at the expense of the Contractor. Prior to the commencement of any protection, relocation, or by-pass work, the Contractor shall submit a work plan to the utility line owner and the Engineer for approval. No relocation, by-pass or replacement work shall be performed without prior written approval of the work by the owner of the utility line and the Engineer. Emergency protection of existing utility lines to protect the line from immediate damage may be performed by the Contractor without prior approval; however, the Contractor shall take every action available to notify the Owner and the Engineer of the situation as quickly as possible.

The Contractor shall notify all utility offices that are affected by the construction operation at least 15 days in advance of commencing construction operations. The Contractor shall not expose any utility without first obtaining permission from the affected agency. Once permission has been granted, locate and, if necessary, expose and provide temporary support for all existing underground utilities in advance of operations.

In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage due to construction operations, the Contractor shall promptly notify the proper authority and cooperate with said authority in restoration of service as promptly as possible and bear all costs of repair. In no event shall interruption of any water or utility service be allowed unless prior approval is granted by the owner of the utility.

The Contractor shall replace, at his own expense, any and all other existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract Documents.

Contractor shall submit a schedule and plan to cross and support existing utilities to the Engineer prior to conducting any work.

When notified by the Contractor that an interference or conflict has been determined to exist, the Engineer will determine whether such interference shall be considered as required by construction or as incidental to construction. Any such change will be considered as incidental to the Contract unless the Contractor had no reasonable means of obtaining knowledge of such conflict prior to bid.

D. CONTRACTOR'S RESPONSIBILITY FOR COMPLETE FACILITY:

It is the intent of these specifications that the Project be a complete workable, facility, functioning in accordance with the general description provided herein. Therefore, it is the direct responsibility of the Contractor to furnish, install and construct the complete facilities required by the plans and specifications at the stated bid prices in the Contract, and to take into account all related fittings, valves, and incidental requirements on this project to ensure complete and functioning facilities in accordance with the specified requirements.

E. RIGHT-OF-WAY (ROW):

OWNER PROPERTY: The Contractor shall confine his operations to the limits of the El Paso Water Utilities property as shown on the drawings.

CITY OF EL PASO ROW: Construction of the project will require work within the City of El Paso ROW. Whenever work is to be carried out, the City shall be notified 2 weeks in advance. All traffic control shall be provided by the Contractor and maintained as long as necessary and in such a manner that any disruption of traffic be held to a minimum.

TRAFFIC CONTROL PLAN: The implementation of a traffic control per the attached plans for work within City ROW shall be the responsibility of the Contractor.

F. CONTRACTOR'S SUPERINTENDENCE:

The Contractor shall keep on the project, at all times during its progress, a qualified competent Resident Superintendent, satisfactory to the Engineer. The Resident Superintendent shall speak English fluently and be capable of communicating with the Public, the Engineer, and the Owner. The Superintendent shall be cooperative, and authorized to receive orders and to act for the Contractor. In the event a competent Superintendent is not available, the Owner may suspend work until one is available. Changes of Superintendent must be approved by the Engineer and the Owner.

G. SAFETY AND SECURITY:

The Contractor shall be fully responsible for the safety and security of all work areas at all times. Security includes protection of both the Owner's and Contractor's properties. The Contractor shall take such measures as are necessary to prevent access of animals and unauthorized persons onto the project site. Such measures shall include fencing, posting of signs, temporary closure of excavations, or other means, and shall be maintained throughout the course of the work including nighttime, weekend, and holiday periods. Work procedures deemed to be adequate by the Engineer to meet this requirement shall be immediately corrected by the Contractor.

H. AS-BUILT DIMENSIONS AND DRAWINGS:

The Contractor shall make appropriate and accurate daily measurements of the facilities constructed (horizontal and vertical) and keep accurate records of the as-built information.

The Contractor's "As-Built" drawings will be reviewed as a condition of payment each month based on being up to date and acceptably accurate to the site conditions in accordance to Section 01-78-39.

Upon completion of the facilities, the Contractor shall furnish the Engineer with one set of direct prints, marked with red pencil, to show as built dimensions and locations of work constructed.

I. TRAFFIC CONTROL:

The Contractor shall prepare a plan for the control of traffic on City of El Paso ROW during construction. The Traffic Control Plan shall conform to the standards of The City of El Paso Standards, and must be approved by TxDOT where applicable. The approved plan must be submitted to the Engineer before beginning construction. The Contractor shall be responsible for adhering to the Traffic Control Plan during his operations.

J. WORKING HOURS:

Normal working hours shall be 7:00 a.m. to 6:00 p.m., weekdays. Working hours within the TxDOT R.O.W. shall be in accordance with the TxDOT permit.

Notification of special circumstances or emergency conditions that require work beyond the hours specified above shall be provided as follows:

1. The Contractor shall notify the Engineer 48 hours in advance of any proposed extended work hours for preauthorization. Notification shall include a written request for authorization to perform work specified and the circumstances that warrant this request. This notification shall include any additional measures to mitigate noise generated by this construction activity if deemed necessary by the Engineer. The Contractor shall pay for the overtime of the inspector if work is to be done during extended hours, weekends, night work or holidays. The rate for overtime inspection shall be $100/hour.

2. If an emergency situation occurs that warrants extended hours, the Contractor shall notify the Engineer immediately upon determining the need for this work.

K. APPROVAL OF EQUIPMENT AND MATERIALS:

All materials shall be new and shall be designed for the function and service specified herein. No materials shall be used in the project except those that have been approved by the Engineer. Approval for installation or incorporation in the project will be given only after submittal and subsequent examination of shop and installation drawings, manufacturer's specifications, test results, or other data required in the various section of these specifications. Final approval and acceptance of items will be made only after such items are in operation and have met all specified tests.

L. SHOP DRAWINGS REVIEW COSTS:

One initial shop drawing submittal and one re-submittal will be reviewed by the Engineer at no cost to the Contractor. Subsequent reviews on resubmitted shop drawings will be reviewed at a cost to the Contractor of $165.00 per hour.

M. CONFLICT BETWEEN SPECIFICATIONS AND DRAWINGS:

In case of conflict between the specifications and drawings, the specifications shall govern. In the event an item of work is described differently in two or more locations on the drawings and in the specifications, the Contractor shall request a clarification from the Engineer.

N. CONTRACT TIME:

Time shall be of the essence of the contract. The Contractor shall promptly start the work after the date of the notice to proceed and shall prosecute the work so that the project shall be complete within the times specified in the Contract Documents. During periods when weather or other conditions are unfavorable for construction, the Contractor shall pursue only such portions of the work as shall not be damaged thereby. No portions of the work where acceptable quality or efficiency will be affected by unfavorable conditions shall be constructed while those conditions exist. It is expressly understood and agreed by and between the Contractor and the Owner that the contract time for completion of the work described herein is a reasonable time taking into consideration the average climatic conditions and other factors prevailing in the locality of the work.

The Contractor shall furnish such manpower, materials, facilities and equipment as may be necessary to insure the prosecution and completion of the work in accordance with the accepted schedule. If work falls 14 days or more behind the accepted construction schedule, the Contractor agrees that he will take some or all of the following actions to return the project to the accepted schedule. These actions may include the following:

1. Increase manpower in quantities and crafts.

2. Increase the number of working hours per shift, shifts per working day, working day per week, or the amount of equipment, or any combination of the foregoing.

3. Reschedule activities.

If requested by the Engineer, the Contractor shall prepare a proposed schedule revision demonstrating a plan to make up the lag in progress and insure completion of the work within the contract time. The proposed revision shall be submitted to the Engineer in accordance with Section 01 33 00 - Submittal Procedures. Upon receipt of an acceptable proposed revision to the project schedule, the revision to the construction schedule shall be made in accordance with Section 01 32 16 - 1.04 of Construction Progress - Schedule Revisions. All actions to return the project to the accepted schedule are at the Contractor's expense.

The Contractor shall pay all costs incurred by the Owner which result from the Contractor's action to return the project to its accepted schedule. Contractor agrees that Owner shall deduct such charges from payments due the Contractor. It is further understood and agreed that none of the services performed by the Engineer in monitoring, reviewing and reporting project status and progress shall relieve the Contractor of responsibility for planning and managing construction work in conformance with the construction schedule.

Avoidable delays in the prosecution of the work shall include delays which could have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or his subcontractors. No extension of Contract time shall be granted for avoidable delays. Avoidable delays include:

1. Delays which may in themselves be avoidable but which affect only a portion of the work and do not necessarily prevent or delay the prosecution of other parts of the work or the completion of the whole work within the contract time.

2. Time associated with the reasonable interference of other contractors employed by the Owner which do not necessarily prevent the completion of the whole work within the contract time.

Unavoidable delays in the prosecution or completion of the work shall include delays which result from causes beyond the control of the Contractor and are specified in Section 00-72- 00 Article 4.05 and as modified in Section 00-73-00.

The Owner may grant an extension of time for avoidable delays if he deems it in his best interest. If the Owner grants an extension of time for avoidable delay, the Contractor agrees to pay actual costs, including charges for engineering, inspection and administration, incurred during the extension.

Everything charged to the Contractor under the terms of this contract for liquidated damages shall be paid by the Contractor to the Owner on demand. Such charges will be deducted by the Owner from money due or to become due to the Contractor under the contract. The Owner may recover such charges from the Contractor or from his surety.

A rain, windstorm, high water or other natural phenomenon for the specific locality of the work, which might reasonably have been anticipated from historical records of the general locality of the work, shall not be construed as abnormal.

Contractor and Engineer shall meet each month prior to the Contractor submitting the progress payment request for the previous month. The purpose of the meeting is to review project status in relation to the construction schedule; review value of work completed during the previous month; and, if applicable, review Contractor's plans to return project status to that required by the schedule. Within 5 days following this meeting, the Contractor shall submit a written progress report comprising:

1. A copy of the current construction schedule marked up to indicate percent complete, actual completion or start dates since the previous review, and the estimated remaining duration for each activity in progress.

2. Reasons any activities are behind schedule and of the corrective steps being taken.

Materials and equipment shall be stored so as to insure the preservation of their quality and fitness for the work. Stored equipment and materials shall be located so as to facilitate inspection. The Contractor shall be responsible for damages that occur in connection with the care and protection of materials and equipment until final acceptance of the work.

If inspection and testing of materials or equipment in the vicinity of the work by the Owner is not practicable, the specifications may require that such inspection and testing or witnessing of tests takes place at the point of manufacture. In this case and in the event the remote inspection and testing is not specified and is requested by the Owner, the required travel, subsistence, and labor expenses shall be paid by the Owner. If the Contractor requests the Owner to inspect and test material or equipment at the point of manufacturer, then the additional cost to the Owner for travel, subsistence, and labor expenses shall be paid by the Contractor.

The Contractor shall provide a daily report to the Engineer covering manpower by craft, appropriate to each applicable Wage Scale, equipment and material delivered daily for the General Contractor and each subcontractor working on the project. This report shall be in a form acceptable to the Engineer and will be made for each calendar day during the construction period. Each calendar day's report will be delivered to the Engineer by 10:00 a.m. the following business day.

Engineer may refuse to recommend payments because: Persistent failure of the Contractor to perform the work in accordance with the contract documents, including failure to maintain the progress of the work in accordance with the construction schedule. Persistent failure to maintain the progress of the work shall mean that for a period of two consecutive months following a written notice from the Engineer, the Contractor fails to correct a behind-schedule condition at a rate that would reasonably indicate that he will finish the project on schedule.

O. PUBLIC RIGHT-OF-WAY REQUIREMENTS:

Trenching in Public Right-of-Way: Except where otherwise specified, indicated on the plans, or accepted in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion, shall not exceed the linear footage as set forth in the following. The definition of "open trench" for the purpose of this description will include excavation, pipe laying, and backfilling. The descriptions under the area designations are general in nature and may be amended in writing by the Engineer due to particular or peculiar field conditions.

- Business District Areas – 100 Linear Feet: Store front area.
- Commercial Area – 100 Linear Feet: Industrial, shopping centers, churches, schools, hotels, motels, markets, gas stations, government and private office buildings, hospitals, fire and police stations, and nursing homes.
- Residential Areas – One (1) Block or 100 Linear Feet, whichever is the Least: Single and multi-family residence, apartments, and condominiums.
- Undeveloped Areas – 1200 Linear Feet: Parks, golf courses, farms, undeveloped subdivided land.

Any excavated areas shall be considered as "open trench" until all backfilling has been completed and a suitable temporary wearing surface has been provided or permanent pavement replacements have been made, in accordance with these Contract Documents. Trenches across streets shall be completely backfilled and a suitable temporary wearing material or permanent pavement in place within 24 hours after laying the pipe.

The Contractor shall provide steel plates with trench bracing which shall be used to bridge across trenches at street and alley crossings and at commercial or private driveways, where trench backfill and temporary patches have not been completed before the end of the Contractor's regular working hours, weekends and holidays. Asphalt pavement shall be placed along the edges of the steel plate to form a smooth transition between the existing pavement and steel plate. Safe and convenient passage for pedestrians shall be provided at all times. The Engineer may designate an enclosed or railed passage for the safe access of pedestrian traffic at any location adjacent to construction activities, as he deems necessary. Access to fire stations, fire hydrants, and hospitals shall be maintained at all times.

Additional Requirements for work in Public Right-Of-Way:

1. The jurisdictional agency will need to be contacted during backfill operations, concrete formwork placement, flowable fill placement, and paving operations in their ROW.

2.. The Contractor shall contact the jurisdictional prior to excavating for bore pits, trenching, pot holing, and any other excavations.

3. Information on storm drainage system is available from the jurisdictional agency.

4. The Contractor shall preserve, during construction, all stop signs, speed limit signs, underground signal conduits and all other traffic regulatory signs, coordination shall be the corresponding Department.

5. Contractor shall coordinate with corresponding Departments for the location and spotting of traffic signal conduits.

6. The Contractor shall submit a project schedule, commencement and completion of the construction, for review by the jurisdictional agency, prior to construction. Contractor shall provide a two-week construction schedule, updated weekly, to the jurisdictional agency.

7. The jurisdictional agency shall be notified and consulted with before any deviation from the approved location or if any abnormality is encountered.

8. All restorations, sidewalks, driveway, and handicap curb ramps shall be Texas Accessibility Standards (TAS) or City of El Paso compliant.

The Contractor shall notify the corresponding Departments immediately, if subsurface contamination is encountered or suspected during pot holing, excavation or boring. All excavation and construction operations shall be ceased until further notice from the Owner's Environmental Consultant.

All adjacent properties, along the proposed route(s) construction and/or installation, shall be kept undisturbed.

P. COORDINATION WITH RESIDENCES, BUSINESSES, SCHOOLS, ETC.

The Contractor shall be responsible for coordinating the Construction activities with the residences, businesses, schools and other affected entities within the project area. The Contractor shall provide written notifications (flyers) to inform the local community; the Contractor shall submit to the Engineer the proposed flyer, in both English and Spanish, for approval prior to distributing

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01 11 80

ENVIRONMENTAL CONDITIONS

PART 1 GENERAL

1.01 ENVIRONMENTAL CONDITIONS

A. This section describes the environmental conditions which have been observed at the site of the work and which may reasonably be anticipated throughout the life of the project.

1.02 CLIMATE CONDITIONS

A. The site of the work is at an elevation of 3700 feet above mean sea level.

B. Climate conditions are described as follows:

Description	Range of Conditions
Winter	Cold desert climate
Summer	Hot desert climate, Monsoon season from July through September
Relative humidity, percent	
• Indoors	30 to 60
• Average outdoors	20 to 60
Air temperature, degrees F	
• Outdoors	15 to 110
• Indoors	55 to 90
Barometric pressure, inches, mercury	25.84 to 26.04

1.03 ADDITIONAL CONDITIONS

A. Additional conditions which may be applicable are specified in other sections.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 12 16

WORK SEQUENCE

PART 1 GENERAL

1.01 CONTINUITY OF PLANT OPERATIONS

A. The existing wastewater treatment plant is currently and continuously receiving and treating sewage, and those functions shall not be interrupted except as specified herein. The Contractor shall coordinate the work to avoid any interference with normal operation of plant equipment and processes.

1.02 BYPASSING

A. Bypassing of untreated or partially treated sewage to surface waters or drainage courses is prohibited during construction. In the event accidental bypassing is caused by the Contractor's operations, the Owner shall immediately be entitled to employ others to stop the bypassing without giving written notice to the Contractor.

B. Penalties imposed on the Owner as a result of any bypass caused by the actions of the Contractor, his employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Owner resulting directly or indirectly from the bypass. Under the terms of discharge permits issued to the Owner, in the event accidental bypassing occurs, the Owner is liable for the following penalties:

1.03 SUBMITTAL

A. In accordance with Section 01 33 00, the Contractor shall submit a detailed outage plan and time schedule for operations which will make it necessary to remove a tank, pipeline, channel, electrical circuit, equipment, or structure from service. The schedule shall be coordinated with the construction schedule specified in the General Conditions of the Contract Documents and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the Contractor's method for preventing bypassing of other treatment units, the length of time required to complete said operation, the necessary plant, and equipment which the Contractor shall provide in order to prevent bypassing of associated treatment units.

B. The Contractor shall observe the following restrictions:
   1. Systems or individual equipment items shall be isolated, dewatered, decommissioned, deenergized, or depressurized in accordance with the detailed outage plan and schedule.
   2. The Construction Manager shall be notified in writing at least one week in advance of the planned operation.

1.04 SEQUENCE AND SCHEDULE OF CONSTRUCTION

A. There are fundamental tasks that shall be sequentially pursued by the Contractor in the process of completing the project. The Contractor shall incorporate each task described herein into his construction schedule. Refer to the Sequence of Construction included on Drawing C-210 for work within the Haskell Wastewater Treatment Plant. The Contractor shall retain possession of all facilities until achieving Substantial Completion.

B. MILESTONES COMPLETION (SUBSTANTIAL, FINAL)

Upon completion of construction of the entire project, the Contractor shall perform a detailed inspection of the work to confirm completion of all items. When the Contractor has verified that all of the construction is complete after mechanical completion has been achieved , he shall notify the Engineer in writing in the form of a notice of completion of each individual milestone.

C. SUBSTANTIAL COMPLETION:

The Contractor shall notify the Engineer and Owner in writing within 10 calendar days of achieving Substantial Completion. Substantial Completion is defined as the level of completion by which the Contractor has attained the capability for the infrastructure to be put in service.

All required tests needed to verify acceptability for the system shall have been successfully accomplished before activities for mechanical completion shall begin. Installation of all piping and associated valves, fittings, and tie-ins shall have been completed, and tested prior to commencement of the initial start-up operations. All roadways, site work, and site grading must be complete. All other work such as site facilities and access roadways shall be completed to the level that only punch-list items remain to be finished.

The Contractor is required to check and adjust all new equipment and place it in operation using manufacturer's installation requirements and inspection services, as specified. Instrumentation and control elements are to be provided and installed by the Contractor as defined in the specifications. The Contractor is responsible for all instrument verifications and calibrations, testing, and loop checks of the control elements and equipment monitored. The Contractor shall employ personnel capable of accomplishing these tasks. All instrument verifications, testing, and loop checks shall be completed by the Contractor and witnessed by the Engineer and Owner before beginning initial start-up activities needed to achieve Substantial Completion.

A plan describing the initial start-up procedures shall be prepared by the Contractor and approved by the Engineer at a minimum of 2 weeks prior to the beginning of these activities. The plan shall address all electrical and mechanical equipment.

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.

Within ten (10) days after receipt of the Contractor's written notice of substantial completion of the work, the Engineer shall perform a detailed inspection and may create a "punchlist" for any remaining omissions and defects. All punchlist items shall be satisfactorily completed within two weeks.

D. FINAL COMPLETION:

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

submitted all Contract close-out documentation including final payrolls from Prime Contractor and Subcontractors and resolution of all outstanding payroll issues.

Final inspection of the work by the Engineer will be made within ten (10) days after receipt of the Contractor's written request for final inspection. The work will be deemed complete as of the date of such inspection if, upon such inspection, the Engineer finds that no further punchlist or other contractual work remains to be done. Before acceptance and final payment will be issued, all closeout documents must have been submitted and a certificate of final completion must be issued.

Refer to the General and Supplemental Conditions for further requirements

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 14 19

USE OF SITE

PART 1 GENERAL

1.01 SUMMARY

A. The Owner's operating personnel will be responsible for operating the existing treatment plant throughout the execution of this contract. Equipment presently installed in the treatment plant must be available to plant personnel at all times for use, maintenance, and repair. If it is necessary in the course of operating the plant, for the Contractor to move his equipment, materials, or any material included in the work, he shall do so promptly and place that equipment or material in an area which does not interfere with the plant operation. The Contractor shall not adjust or operate serviceable or functioning equipment or systems except as specifically required by this contract.

B. The existing treatment plant will remain in operation throughout the execution of this contract. The Contractor shall schedule and conduct his work to minimize necessary shutdowns and interference with normal plant operations and maintenance.

C. The Contractor shall notify the Construction Manager, in accordance with Section 01 12 16, 1 week in advance of the time it is necessary to take out of service any existing tank, pipeline, channel, electrical circuit, equipment or structure. The Contractor shall be responsible for providing whatever temporary piping, pumping, power, and control facilities as are required to maintain continuous plant operation and complete treatment except as otherwise specified. The integrity of existing plant utilities shall be maintained by the Contractor at all times.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 20 01

TPDES REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

The work covered under this The Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit to Discharge Wastes (TXR150000) (General Permit) was issued March 5, 2018 and Amended January 28, 2022 (Construction General Permit). The Construction General Permit allows operators to obtain permit coverage for storm water conveyance from Small and Large Construction Activities. The TPDES program implements the federal National Pollutant Discharge Elimination System (NPDES) program in the state of Texas, which requires that operators of Small or Large Construction Activities obtain permit coverage prior to the commencement of construction activities.

The Engineer has estimated that the project will disturb approximately 0.7 acres of land which is defined by Texas Commission on Environmental Quality (TCEQ) as a Small Construction Activity. Based on the Contractor's construction activities, he will need to report the actual total number of acres to be disturbed by the project including his construction support activities in accordance with the Construction General Permit.

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the TPDES Construction General Permit Number TXR 150000, effective March 5, 2018 (Construction General Permit).

B. Implementation, maintenance, inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, and other applicable practices shown on the drawings or specified elsewhere in the Contract.

1.02 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity is defined as a project that:

1. disturbs five (5) acres or more, or
2. disturbs less than five (5) acres but is part of a large common plan of development that will disturb five acres or more of land.

C. Small Construction Activity is a project that:

1. disturbs one (1) or more acres but less than five (5) acres, or
2. disturbs less than one (1) acre but is part of a larger common plan of development that will ultimately disturb one (1) or more acres but less than five (5) acres.

D. Operator is a person or persons who have day-to-day operation control of the construction activities, which are necessary to ensure compliance with the stormwater pollution prevention plan (SWP3) for the site.

PART 2 PRODUCTS

2.01 SUBMITTALS

A. Submit the following, in accordance with this Section

1. STORM WATER POLLUTION PREVENTION PLAN
2. Revisions
3. Co-permittee Agreement
4. Construction Site Notice
5. Storm Water Certification Statement

B. Approval to Discharge to Publicly-owned Treatment Works: For storm water discharges associated with construction activity that are discharged to a publicly owned conveyance or treatment system, prior to commencing discharges, submit system owner's written approval for such discharges

C. Storm Water Site Plan Updates: Within three days after each storm water inspection, submit updated storm water site plan.

PART 3 EXECUTION

3.01 STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. The Contractor shall have an SWP3 prepared in accordance with Part III of the General Permit. A professional engineer licensed in the state of Texas shall prepare the SWP3.

B. Support Activities within 1-mile distance of project boundary of the permitted construction site, which directly supports the project, should be included in the Storm Water Pollution Control Plan prepared for the Contractor. These activities include but are not limited to:

1. Equipment Staging Areas
2. Material Storage Yards
3. Material Borrow Areas
4. Excavated Material Disposal Areas
5. Concrete Batch Plants
6. Asphalt Batch Plants

Refer to Part II, Section A of the Construction General Permit for a description of Discharges Eligible for Authorization under the Construction General Permit.

C. The SWP3 will be updated as needed during construction following Part III, Section E of the General Permit. Updates to the SWP3 shall be prepared by the Contractor and submitted to Owner. SWPPP Revision shall include CONTRACTOR's proposed temporary means for storm water control during all phases of the Work and include plans for storm

water conveyance and retention, as applicable. Should CONTRACTOR propose deviations to the SWPPP included in the Contract Documents, or if Project-specific modifications of the SWPPP are required to conform to field conditions. CONTRACTOR shall provide additional SWPPP Revisions as necessary, in accordance with requirements of authorities having jurisdiction and applicable permits.

D. The SWP3 shall be submitted to the Engineer 15 days after award of the contract. Any comments provided shall be addressed prior to commencing construction activities.

E. The SWP3 shall be submitted to the City of El Paso for Review and Approval seven (7) days prior to commencement of construction activities. Refer to Part 3.02, Section E and Part 3.03, Section B for additional submittal requirements for Large and Small Construction Activities, respectively.

F. The SWP3 shall be implemented prior to commencement of construction activities and maintained through the duration of construction. CONTRACTOR shall pay civil penalties and other costs incurred by OWNER, including additional engineering, RPR, and inspection services, associated with non-complying with applicable permits related to storm water discharges associated with construction activity and sediment and erosion controls associated with the Work. Contract Price includes all material, labor, and other permits and incidental costs related to:

1. Preparing SWPPP Revisions and other documents that are CONTRACTOR's responsibility, in accordance with this Section.
2. Installing and maintaining structural and non-structural items used in complying with the SWPPP and its revisions.
3. Clean-up, disposal, and repairs following wet weather events or spills caused by CONTRACTOR.
4. Implementing and maintaining "best management practices", as defined in applicable permits and Laws or Regulations, to comply with requirements that govern storm water discharges at the Site.

3.02 LARGE CONSTRUCTION ACTIVITY

NOT USED

3.03 SMALL CONSTRUCTION ACTIVITY

A. CONSTRUCTION SITE NOTICE

1. Fill out, sign, and date the Small Construction Site Notice. Submit the signed copy of the Small Construction Site Notice to the City Engineer (City Engineering) at least two days before commencement of construction activities.
2. Post a signed copy of the Small Construction Site Notice near the main entrance of a construction site in a prominent place for viewing by the general public and local, state, and federal authorities prior to commencing construction activities, and maintain it in that location until completion of the construction. Post name and telephone number of Contractor's local contact person, brief project description and location of SWP3.

3. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.

B. STORM WATER POLLUTION PREVENTION PLAN APPLICATION

1. Fill out and sign the City or County of El Paso Storm Water Pollution Prevention Plan Application.
2. Provide the Engineer with a copy of the signed application 10 days prior to commencing construction activities.
3. Submit the original signed application along with any fee required by the City of El Paso and two copies of the SWP3 to the City of El Paso One-Stop Shop for review and approval seven days prior to commencing construction activities.

3.04 CERTIFICATION REQUIREMENTS

A. Contractor shall provide a Certification Form to include the Operator's signature, name, title and organization.

B. Contractor and Subcontractors shall sign and date Contractor's / Subcontractor's Certification for TPDES Permitting including Contractor's name, address, and telephone number, and the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information. Include this certification with other Project certification forms.

C. Submit properly completed certification forms to the engineer for review before commencing construction.

D. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measure read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use EPA's NPDES Construction Inspection Form. Controls must be inspected once every fourteen (14) calendar days and within twenty four (24) hours of the end of a storm event of 0.5 inches or greater, in accordance with Part III, Section F, of the Construction General Permit.

3.05 RETENTION OF RECORDS

Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity, and maintain it in that location until completion of the construction. Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3.

3.06 ON-SITE WASTE MATERIAL STORAGE

On site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of the updated list

with the SWP3. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1—GENERAL

This section deals with measuring the material and labor used on the project and the method of payment.

1.01 GENERAL REQUIREMENTS

A. 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 contract documents (drawings and 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 materials 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 contract documents and in accordance with contract-unit prices and schedule of values. Incidental work and items not listed in the contract-unit 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. A claim by the Contractor for extra compensation for an item not shown on the contract documents will not be considered for any reason including a claim that it does not fall within the scope of one of the Bid items.

D. Contractor shall submit a schedule of values in accordance with Section 01 32 16. Parameters for the schedule of values shall be by the Contractor's construction schedule and total contract price.

E. Cost of work or materials shown on the Drawings, called for in the Specifications and on which no separate payment is made, shall be included in the bid price on the various pay items for which they are associated. A claim by the Contractor for extra compensation for an item required but not shown on the Drawings or described in the Specifications will not be considered for any reason including a claim that it does not fall within the scope of one of the Bid items.

PART 2 MEASUREMENT AND PAYMENT

2.01 INTERCEPTOR BID ITEMS

BIDS WILL BE CONSIDERED NON-COMPLIANT AND BE DISCARDED IF PRICING IS NOT GIVEN TO EACH SPECIFIED BID ITEM. PROJECT TO BE AWARDED BASED SOLELY ON TOTAL BID PRICE FOR ALL ITEMS 1 THROUGH 25.

A. BID ITEM 1 – INSURANCE, BONDS, MOBILIZATION & DEMOBILIZATION:

Payment shall include all costs for Contractor's mobilization and demobilization, insurance and bond, construction permits and fees, job trailers, site administration expenses, stand pipe and temporary meter service, and utilities to the job trailers including power, telephone, construction water needs, etc. for the entire project. This shall include all costs for contract closeout, site cleanup, and all costs associated with Contractor's demobilization from the site. Mobilization/Demobilization and all work included in this item shall be limited to five (5) percent of the total for Bid Items No. 2 through 25 and is payable one half at mobilization and one half at demobilization.

Measurement shall be made in the stated lump sum for the mobilization, demobilization, insurance, bonds, and all other expenses associated with this project. Bid Item 1 shall not exceed 5% of the total project cost excluding Bid Item 1 and is payable one half at mobilization and one half at demobilization.

B. BID ITEM 2 – PRE-CONSTRUCTION AND POST CONSTRUCTION VIDEO RECORDING OF PROJECT ROUTE:

Measurement shall be made in the stated lump sum for the pre-construction and post construction video recording right-of-way survey and project site.

Payment shall be for audio/video recording of the site and surroundings, easements, pipeline route, and other areas where the work is to take place and on properties where ingress and egress will impact the properties, prior to and after construction and shall include duplication, dating and labeling of two recordings. Recordings shall be high definition 720p or 1080p resolution, two (2) pre-construction DVDs or USB drives shall be turned over to the Engineer prior to commencing construction and two (2) post-construction DVDs or USB drives after construction has finished.

C. BID ITEM 3 – TRAFFIC CONTROL:

Measurement shall be made in the stated lump sum for the preparation and approval of Traffic Control Plan, and implementation and maintenance of the traffic control for the project.

Payment shall be for a traffic control plan(s) for the project including City of El Paso ROW and El Paso Water property where the water system is to be installed and shall include any and all permit fees. The traffic control plan and traffic control on the streets shall meet the jurisdictional agency requirements for ingress and egress, detours, etc. If the jurisdictional agency requires the re-design of the traffic control, it shall be the Contractor's responsibility to incur all costs associated with the re-design.

D. BID ITEM 4 – PREPARATION AND IMPLEMENTATION OF TPDES REQUIREMENTS:

Measurement for this item shall be made on a lump sum basis for the development and implementation of the TPDES requirements per Section 01 20 01 including but not limited to preparing the storm water pollution prevention plan (SWP3) per the provisions of the TPDES permit requirements that covers the entire project site, applicable permit fees, obtaining permit approval, and displaying the plan/permit requirements at the job site prior to commencing construction activities.

Payment of this item shall be made at the stated lump sum price and shall include implementation of SWP3, displaying the plan/permit requirements at the job site,

installation and maintenance of best management practices (BMP's) prior to commencing construction activities, all labor, equipment, and any incidentals necessary perform the work complete in place, and maintaining the SWP3 throughout the duration of the work.

E. BID ITEM 5 – 30-INCH SEWER PIPE:

Measurement shall be made on the length of pipe installed along the centerline through and including appurtenances. Measurement shall be made horizontally to the nearest 0.1 foot.

- Payment shall be made at the stated unit price per linear foot. The payment shall be for the sewer siphon lines installed in place and shall cover: Survey Control, Construction staking, construction facilities, coordination, and site preparation
- Clearing and grubbing the route of the wastewater system
- Excavation of trench and disposal of excess material
- Furnishing, placing and compaction of bedding and backfill material
- Furnishing and laying the pipe joint assembly
- Furnishing and placing incidental appurtenances not included in other bid items
- Locating, protecting, supporting, relocating, if required, and repairing damage to any underground or overhead utilities, services or structures encountered in the process of the work
- Cleaning and pressure testing the sewer system
- Protection of adjacent utilities and pertinent structures and support systems for existing utilities
- City of El Paso Parks light poles support or removal and reinstallation as needed
- Coordination with property owners, schools, agencies, businesses, utility companies, and any other entity affected by the Contractor's work.
- Installation of warning tape and tracer wire
- Temporary bypass, if required. This includes installing and maintaining bypass pumps as may be necessary.
- Steel road plates
- Repair and replacement of medians and parkways
- Furnishing and placing megalug restraints at fittings and bends as noted in the construction plans
- Installation of carrier pipe through steel casing with restrained casing insulator
- Plugs and fittings
- Repair of rock walls, sidewalks, and fences, if required
- Removal and replacement of adjacent utility strictures (i.e. manholes) as required
- Support and/or relocation of power poles by El Paso Electric Company
- Permits as may be required from Jurisdictional agencies
- Temporary utility bypasses if required.
- Coordination with utility companies and agencies.
- Furnishing and installing of pipe connections and all appurtenances to tie-in to existing sewer systems
- Locating, protecting, supporting, relocating, if required, and repairing damage to any utilities, services or structures encountered in the process of the work
- Dust control
- Cleaning of roadways
- Temporary Fencing

Included are 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 the concrete specifications.

F. BID ITEM 6 – 8-INCH SEWER PIPE:

Measurement shall be made on the length of pipe installed along the centerline through and including appurtenances. Measurement shall be made horizontally to the nearest 0.1 foot.

- Payment shall be made at the stated unit price per linear foot. The payment shall be for the sewer siphon lines installed in place and shall cover: Survey Control, Construction staking, construction facilities, coordination, and site preparation
- Excavation of trench and disposal of excess material
- Furnishing, placing and compaction of bedding and backfill material
- Furnishing and laying the pipe joint assembly, including all required appurtenances
- Furnishing and placing incidental appurtenances not included in other bid items
- Cleaning and pressure testing the sewer system
- Protection of adjacent utilities and pertinent structures and support systems for existing utilities

Payment shall be made at the stated unit price per lineal foot.

G. BID ITEM 7 - 30-INCH ACCESS MANWAYS WITH STANDARD 60-INCH PRE-CAST CONCRETE MANHOLE (TYPE "C"):

Measurement shall be made for each furnished and installed access manway and manhole as called for on the plans and specifications.

Payment shall be made at the stated unit price for each manhole, including manhole frames and cover, manway tees with flange insulation kits, boxes, bases with reinforcement, barrels, riser, cones and spacers, waterproofing manhole and joint where pipe penetrates manhole, coating, concrete collar around ring/cover, excavation, backfill, compacting, disposal of excess unsuitable material; for furnishing and installing all material, labor, tools, equipment and incidentals necessary to complete the work. This bid item shall include the total depth of each manway including all rings necessary.

H. BID ITEM 8 - COMBINATION AIR RELEASE VALVE WITH ACCESS MANWAY:

Measurement shall be made for each 8-inch Combination Air release valve that is installed per the plan and detail drawings.

Payments shall be made at the stated unit price for each Combination Air Vacuum Valve installed including access manway tees with flange insulation kit, access manway manhole, manhole ring and cover, manhole base, supports, equipment, grout, gravel sumps, pipe vent, pipe penetrations, valves, and other pipe and valve appurtenances shown on combination air release and manhole details. It shall include all labor, equipment, materials, appurtenances, and any incidentals necessary to complete the installation at each location shown.

I. BID ITEM 9 – 2.5-INCH HOT MIX ASPHALT CEMENT (HMAC) PAVEMENT REMOVAL AND REPLACEMENT:

Pavement (HMAC) shall be measured in square yards, limited to the areas within the limits of cut shown on the plans. The actual number of square yards of pavement to be paid for shall be equal to the actual area of the surface accepted by the Engineer. Any pavement replacement outside the limits shown on the plans necessitated by the terms of the requirement or any other reason shall be replaced by the Contractor without compensation.

Payment shall be made at the stated unit price per square yard for the number of square yards paved. Payment shall include: saw cutting existing pavement, removal and disposing of the pavement, base course and or existing two sack flowable fill; and machine applied 2.5-inch thick minimum asphaltic pavement, and per the jurisdictional agency; bonnet boxes, manhole covers, monuments brought to grade, dust control for furnishing and installing all materials; repair of traffic control facilities damaged during construction to include, but not be limited to, traffic signs, paint on streets, and other traffic control facilities; for all labor, tools, equipment and any incidentals necessary to complete the work.

J. BID ITEM 10 – 3-INCH HOT MIX ASPHALT CEMENT (HMAC) PAVEMENT REMOVAL AND REPLACEMENT:

Pavement (HMAC) shall be measured in square yards, limited to the areas within the limits of cut shown on the plans. The actual number of square yards of pavement to be paid for shall be equal to the actual area of the surface accepted by the Engineer. Any pavement replacement outside the limits shown on the plans necessitated by the terms of the requirement or any other reason shall be replaced by the Contractor without compensation.

Payment shall be made at the stated unit price per square yard for the number of square yards paved. Payment shall include: saw cutting existing pavement, removal and disposing of the pavement, base course and or existing two sack flowable fill; and machine applied 3-inch thick minimum asphaltic pavement, and per the jurisdictional agency; bonnet boxes, manhole covers, monuments brought to grade, dust control for furnishing and installing all materials; repair of traffic control facilities damaged during construction to include, but not be limited to, traffic signs, paint on streets, and other traffic control facilities; for all labor, tools, equipment and any incidentals necessary to complete the work.

K. BID ITEM 11 – FOG SEAL ON EXISTING HMAC PARKING LOTS:

Fog seal (emulsion coating) shall be measured in square yards, limited to the parking areas shown on the plans. The actual number of square yards of pavement to be paid for shall be equal to the actual area of the surface accepted by the Engineer.

Payment shall be made at the stated unit price per square yard for the number of square yards paved. Payment shall include all materials, products, preparation, and labor and equipment required for complete installation.

L. BID ITEM 12 - TWO SACK FLOWABLE FILL:

Measurement and payment shall be made at the stated unit price per cubic yard times the number of cubic yards of flowable fill placed. Placement of 12 inches of flowable fill shall be placed in the trench below the proposed HMAC and other locations indicated on the plans. Placement of flowable fill also includes filling the structure and interconnect pipes at the 30" siphon location with 2-sack flowable fill.

M. BID ITEM 13 – REMOVAL AND DISPOSAL OF UNCONTAMINATED SOIL AND BACKFILL WITH APPROVED FILL:

Based on previous projects in the area, the Contractor may encounter trash during the installation of the pipe near the Haskell R. Street WWTP. If trash is encountered, the Contractor shall notify the Engineer immediately.

Measurement shall be made per cubic yard of trash excavated, removed and disposed of at an approved landfill. The cubic yards shall be determined based on the truck capacity and the number of trucks required to dispose of any trash encountered. Landfill trip tickets shall be provided per truck load.

Payment shall be for removal and disposing of trash encountered during excavation activities. It shall include providing and placing approved fill, coordination, disposal of trash to landfill, trucking an disposal fees, labor, equipment and any incidentals necessary to complete the work.

N. BID ITEM 14 – REMOVAL AND DISPOSAL OF CONTAMINATED STAINED SOIL AND BACKFILL WITH APPROVED FILL:

Some contaminated areas may be encountered. Contractor shall notify Engineer immediately to coordinate the proper containment and disposal methods.

Measurement shall be made per cubic yard of trash excavated, removed and disposed of at an approved landfill. The cubic yards shall be determined based on the truck capacity and the number of trucks required to dispose of any trash encountered. Landfill trip tickets shall be provided per truck load.

Payment shall be for removal and disposing of trash encountered during excavation activities. It shall include providing and placing approved fill, coordination, fees, disposal of trash to landfill, labor, equipment and any incidentals necessary to complete the work.

O. BID ITEM 15 – 6-INCH BLOW-OFF VALVE AND MANHOLE:

Measurement shall be made for each 6-inch blow-off valve that is installed per the plan and detail drawings.

Payments shall be made at the stated unit price for each blow-off valve installed including manhole with ring and cover, bonnet box, cover, concrete support, concrete collar, marker posts, gate valves, valve stem extensions, valve stem extension guides, drain holes, gravel sumps, grout, blind flanges, reinforcement, pipe penetrations, waterproof sealants, and coupling restrainers. It shall include all labor, equipment, materials, appurtenances, and any incidentals necessary to complete the installation at each location shown.

P. BID ITEM 16 - 48-INCH TUNNELED CASING:

Measurement shall be made on the length of casing furnished and installed. Thickness of casing shall be as noted on the plans. Care shall be taken to keep the pipe casing on proper line and grade. The ends of the casing shall be properly sealed as called for in the specifications and plans.

Payment shall be made at the stated unit price per linear foot times the number of feet of new casing installed. Price shall be full compensation for all excavation of the jacking and receiving pits, cutting and capping of utilities and temporary relocation within the jacking and receiving pits, support or bypass of utilities within bore pit, steel encasement pipe, pipe restraints, annular space contact grouting, grout ports, reinforcing steel, restrained casing spacers, pipe skids, pipe end seals with power seal clamps, settlement monitoring points, utility monitoring points, vent pipes, surface settlement monitoring points, backfill with suitable material, compaction, backfill annular space with blown sand, disposal of excess of unsuitable material, chain link fence to protect the pits, and restoration of property. Payment shall also include obtaining right of entry permit and/or any other required permit to perform utility potholes or crossing, including any associated permit fees. It shall include all labor, tools, equipment and any incidentals necessary to complete the work.

Q. BID ITEM 17 - 30-INCH KNIFE GATE VALVE ASSEMBLY:

Measurement shall be made at the stated unit price for each knife gate valve assembly that is installed per the plan and detail drawings.

Payments shall be made at the stated unit price for each knife gate valve assembly installed including valve bonnet, manhole, manhole ring and cover, manhole base, supports, equipment, grout, pipe penetrations, bonnet box and cover, and other pipe and valve appurtenances shown on the gate valve assembly detail. It shall include all labor, equipment, materials, appurtenances, and any incidentals necessary to complete the installation at each location shown.

R. BID ITEM 18– FRP STOP LOGS:

Measurement shall be made at the stated unit price for furnishing and installing FRP stop logs and all appurtenances required for operation.

Payments shall be made at the stated unit price and shall include FRP stop log guides, stop log bottom shelf, stop logs necessary to reach the top of Junction Box B (20 stop logs if 1-foot), and storage rack for the stop logs. It shall include all labor, equipment, materials, appurtenances, bypassing if necessary, and any incidentals necessary to complete the installation at each location shown.

S. BID ITEM 19 - TIE-IN AT HASKELL WASTEWATER TREATMENT PLANT:

Measurement for these items shall be made on a lump sum basis for tie-in connection that is performed and completed per the plan and profile drawings complete in place. Tie-in may require night work, special coordination with area residents, and bypass pumping as needed based on the Contractor's means and methods. Work shall include installation of a temporary plate to plug the existing three siphons and for installation of the new siphon. Payment shall be made on the lump sum basis for each tie-in connection. It shall include

all labor, equipment, owner furnished pipe and appurtenances and any incidentals necessary to complete the tie-in at each location shown.

T. BID ITEM 20 – TRENCH SAFETY SYSTEM:

Measurement for trench excavation safety support system shall be based on the complete trench safety support system required to complete this item for all pipeline and structure excavation. Measurement will be made for partial payments based on the percentage (lineal feet) of the trench safety system work completed at the partial payment cutoff date. The percentage of the work complete will be based on the submitted "Excavation, Trenching and Shoring Plan" to be provided by the Contractor and submitted to the Engineer, and the associated breakdown of lump sum cost items also to be provided by the Contractor.

Payment for the trench excavation safety support system shall be made at the unit price per linear foot of "Trench Safety System". Payment will be full compensation for the trench safety support system including design by a Licensed Texas Professional Engineer, testing, inspection or additional excavation and backfill required, for furnishing bracing; for all jacking and jacking removal for the installation of the pipeline work performed. Partial payment will be made based on the measured amount of trench safety support system completed as defined above, at the partial payment cutoff date.

U. BID ITEM 21 – CURB AND GUTTER:

Measurement shall be made per linear feet of curb and gutter removed and replaced in accordance with regulatory agency Standards.

Payment shall be for removal and disposing of existing curb and gutter, furnishing and installing new curb and gutter. It shall include construction staking, construction facilities, coordination, site preparation, disposal of existing curb and gutter, furnishing, placing and compaction of subgrade material, forming, expansion joints, concrete, concrete curing compound, labor, tools, equipment and any incidentals necessary to complete the work.

V. BID ITEM 22 – CONCRETE SIDEWALK:

Measurement shall be made per square yard of concrete sidewalk installed complete in place.

Payment shall be made at the stated unit price per square foot. The payment shall include removal and disposal of existing sidewalk, forming, reinforcing steel, placement of concrete, concrete, expansion joints, curing compound, and removal of forms. It shall include all labor, tools, equipment and any incidentals to complete the work.

W. BID ITEM 23 – CONCRETE ADA ACCESS RAMPS REMOVAL AND REPLACEMENT:

Measurement shall be made for each concrete sidewalk ADA access ramp removed and installed complete in place.

Payment shall be made at the stated unit price. The payment shall include removal and disposal of existing sidewalk or ramp; and forming, reinforcing steel, placement of concrete, concrete, expansion joints, curing compound, installation of truncated domes,

and removal of forms. It shall include all labor, tools, equipment and any incidentals to complete the work.

X. BID ITEM 24 – RELOCATION OF EXISTING UTILITIES (ALLOWANCE):

Measurement shall be made as a percentage or portion of the stated lump sum allowance for all associated costs relating to the relocation of existing unknown utilities or removal of abandoned unknown utilities throughout the project, complete in place and be billed on a time and material basis.

Payment shall be for all requirements relating to the relocation of existing utilities that interfere with the design intent of the plans and specifications.

Y. BID ITEM 25 – LANDSCAPE & IRRIGATION REMOVAL AND REPLACEMENT (ALLOWANCE):

Measurement shall be made on a lump sum basis for all landscape removed and replaced in accordance with City of El Paso Parks Department.

Payment shall be for removal and disposing of existing landscape, furnishing and installing new sod and shrubs in-kind, and new sprinkler lines and sprinkler heads that are disrupted during construction activities. It shall include construction staking, construction facilities, coordination, site preparation, disposal of existing grass, furnishing, placing and compaction of subgrade material, placing new sod, replacing broken sprinkler system lines or sprayer heads, labor, tools, equipment and any incidentals necessary to complete the work. A licensed irrigator shall be on hand to witness installation prior to being accepted by the City Parks Department.

END OF SECTION

SECTION 01 29 90

CONSTRUCTION MANAGEMENT SOFTWARE - PROCORE

PART 1 GENERAL

1.01 DESCRIPTION

A. The project will incorporate the use of Procore, a construction management software. The tools found in Procore are common in typical construction management and are packaged together within one software. Contractors and Construction Managers will be required to use many of the tools within Procore. Other tools available and not required may be used at the Contractor's discretion. The required tools include submittals, requests for information (RFIs), and file management.

B. Following the Notice of Award, the Contractor, including all necessary users, will be sent an invitation email to the Procore project (from EPWater/BC CM). Each user will need to create a password and login. Procore may be accessed through a computer or a smartphone/tablet using Procore's App.

C. The following will give a brief description of each tool and a basic step-by-step introduction to using each tool. Within the software, there are several tips, training videos, and tutorials to learn how the program works and answer most questions.

1.02 RELATED SECTIONS

A. Section – 00700 General Conditions

B. Section – 00800 Supplementary Conditions

C. Section – 01 02 50 Measurement and Payment

D. Section – 01 33 00 Submittals

E. Section – 01 78 39 Record Drawings

1.03 CORE TOOLS

A. Home Tool: The home tool is a general overview of the construction project. This page may be used to connect to the various tools or recently updated documents. The page includes the following:
   1. Project team and contact information.
   2. Important contract dates and milestones.
   3. Visual graphic for the status of RFIs, Submittals, Schedule, Inspections, and Punch List.
   4. Users' current open items.
   5. Recently updated items from any user on the project team.

6. Daily schedule update.

B. Reports Tool: The reports tool has an extensive collection of pre-formatted reports for various functions. Types of reports include project status, financial, schedule, daily and logs. This tool is not mandatory for use.

C. Documents Tool: The documents tool is a file share point for items related to the project but not including Contract Documents, submittals, RFIs, and commitments. The tool works in conjunction with Procore Drive (PD). PD can be downloaded separately and accessed using the same login information as Procore. PD will share the exact same folder structure as the documents tool. Items uploaded through PD will automatically show up in the Procore Documents tool. This tool is recommended to ease clutter through email.

1.04 PROJECT MANAGEMENT TOOLS

A. Emails Tool: This tool replaces or supplements the need for standard email. The benefit is that it tracks all correspondence within the Procore project. Critical emails may have the best benefit from originating here. This tool is not required but may be used as necessary.

B. RFI Tool: The RFI tool page displays a complete list of all RFIs related to the project. Information displayed includes details about the RFI and status. This tool is required to be used for the construction project. Below is a brief step-by-step tutorial to begin using the RFI tool.
   1. Create an RFI:
      a. Click the orange "Create RFI" button at the top right of the page.
      b. Populate fields – fill in as much information as possible. Certain fields are mandatory as indicated.
      c. Click grey "create" button at bottom right of the page.
      d. An automatic email will be sent to the project team members indicated in the fields, including the RFI manager.
      e. The RFI Manager will be the Construction Manager. They will then assign the RFI to the appropriate project team member for response. Once this has been assigned an automatic sequential number will be assigned to the RFI. The "Ball in Court" will be assigned to the responder until the response is received through Procore, at which point the "Ball" will be in the RFI Manager's court.
      f. The typical RFI turnaround time is set for 3 days. Once this date is exceeded, the responsible party will be notified daily via email for a response.
      g. There are several filters and search tools for locating specific RFIs.

C. Submittals Tool: The Submittal Tool page displays a complete list of all submittals related to the project (to be developed prior to starting the project). Information displayed includes details about the submittal and status. This tool is required to be used for this project. Below is a brief step-by- step tutorial to begin using the Submittal Tool.
   1. Create a Submittal:

a. Click the orange "Create Submittal" button at the top right of the page.
b. Populate fields – fill in as much information as possible. Certain fields are mandatory as indicated.
c. Submittals will be arranged by Specification, no exception. A sequential number will be automatically assigned for each new entry.
d. Click grey "Create and Send Emails" button at bottom right of the page.
e. An automatic email will be sent to the project team members indicated in the distribution field.
f. The submittal will be sent to the approver for approval, the submittal will follow through the workflow as detailed by the originator of the submittal.
g. The typical submittal turnaround time is set for 14 days. Once this date is exceeded, the responsible party will be notified daily via email for a response.
h. There are several filters and search tools for locating specific submittals.

D. Meetings Tool: The Meetings Tool can be utilized to coordinate meetings and have a stored log on the project database. This tool is required to be used for this project.

E. Schedule Tool: The Schedule Tool is a supplement or replacement of common construction scheduling software. Procore works in conjunction with many third-party scheduling software companies for ease of use and ability to upload schedules from other software onto Procore. Use of this tool is strongly encouraged to provide the most current schedule for all project team members.

   This tool works in conjunction with PD. Third-party schedules may only be uploaded through PD. Navigate to the Schedule Tab on PD and follow prompts to upload schedule. Once uploaded, schedule will appear in Schedule Tool in Procore. Schedule updates will be made the same way. Copies of schedules will be saved within Documents both in Procore and PD.

F. Photos Tool: The Photos Tool is a share point for project-related photos. This tool works in conjunction with PD. PD can be downloaded separately and accessed using the same login information as Procore. PD will share the exact same folder structure as the Photos Tool. Items uploaded through PD will automatically show up in the Procore Photos Tool. This tool is recommended to ease clutter through email.

G. Drawings Tool: The Drawing Tool contains only the Conformed Contract Drawings approved for construction. The Construction Manager will upload the Drawings into Procore for the project team's use. Drawings contained in this tool may be edited by approved users and linked to RFIs, submittals, inspections, punch lists, etc. Use of this tool is strongly encouraged to provide up-to-date Record Drawings. The following is a brief step-by-step tutorial to begin using the Drawing Tool:
   1. Click on a Drawing.
   2. Menu at top has several tools for editing, sharing, tracking, and searching.
   3. Markup tool has common tools for editing, commenting, creating revisions, and linking construction documents.
   4. Text and revision tools allow for notes and links to RFIs, submittals, inspections, and punch lists. Upon completion of adding notes, revisions, and comments, editor can

publish changes and update project team.

H. Specifications Tool: The Specifications Tool contains only the Conformed Contract Specifications approved for construction. The Construction Manager will upload the specifications into Procore for the project team's use. Use of this tool is strongly encouraged.

1.05 QUALITY AND SAFETY TOOLS

The tools contained here are intended for inspectors, materials' testing specialists, and engineers/architects. The tools include Inspections, Observations, Punch List, and Daily Log. These tools are optional for this project and will be addressed by the Construction Manager; however, the Punch List Tool is strongly encouraged for ease of maintaining and tracking these items during construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

This section of the specifications describes the mandatory meeting and bi-weekly meetings during the project.

1.02 PRECONSTRUCTION MEETING

The Engineer will schedule and conduct one preconstruction conference at the Owner's office prior to the commencement of any work at the site, to which all interested agencies and utility companies will be invited to discuss their interests and requirements relating to the project. Contractor's key personnel and all primary subcontractor representatives shall attend.

1.03 CONSTRUCTION PERIOD MEETINGS

Construction period meetings will be conducted bi-weekly or at some other frequency if approved by the Contractor and Engineer. These meetings shall be attended by the Engineer and the Contractor's Project Manager, Superintendent and any others that are invited by these people. The minutes of the meetings will be prepared and distributed by the Engineer to the attendees and Owner within 1 week after the meeting.

The specific purpose of the bi-weekly meetings is to coordinate the efforts of all concerned so that the project progresses without delay to completion, with the least interference. The Contractor shall bring to each bi-weekly meeting a written list containing the following information:

1. Work in progress.
2. Work completed past work period.
3. Work anticipated next two weeks.
4. Subcontractors scheduled on site.
5. Subcontractors on site the next month.
6. Contract document deficiencies or questions noted prior month, including Schedule updates and payroll issues.
7. Schedule, cost and quantity variances.
8. Reports of any accidents.
9. Reports/complaints by public.
10. Other items of concern.
11. As-builts' status.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SCOPE

A. This section specifies the procedures for preparing and revising the cost-loaded construction schedule used for planning and managing construction activities. The schedule provides a basis for determining the progress status of the project relative to the completion time, specific dates, and for determining the acceptability of the Contractor's progress payment estimates.

1.02 DESCRIPTION

A. The Contractor shall provide a graphic construction schedule prepared by the critical path method of analysis. The critical path schedule shall be prepared from estimates of the required duration and sequence for each item of work and function to be performed. A general guide for preparing such a schedule is contained in "The Use of CPM in Construction, A Manual for Contractors," published by the Associated General Contractors of America. Tabulation and analysis of the work schedule shall be performed by computer using a commercially available critical path software program. In addition to the capability to produce tabular reports, the computer software shall plot the construction schedule after the Contractor has produced it in a draft form as required by paragraph 1.03 Submittal Procedures.

B. The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted, including all shutdowns and tie-ins by the Contractor in accordance with the General Conditions of the Contract Documents. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.

C. Time for completion and all specific dates as specified in the Contract Documents and sequencing requirements described in Section 01 12 16 shall be shown on the schedule. Activities making up the critical path shall be identified.

D. No activity on the schedule shall have a duration longer than 21 days or assigned value greater than $100,000, except activities comprising only fabrication, and delivery may extend for more than 21 days. Activities which exceed these limits shall be divided into more detailed components. The schedule duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

1.03 SUBMITTAL PROCEDURES

A. Within 20 days after the date of the Notice to Proceed, the Contractor shall complete a construction schedule conforming to paragraph 1.02 Description and representing in detail all planned procurement and on-site construction activities. The schedule shall be prepared on reproducible paper and may be in draft form with legible freehand lines and lettering. Upon completion of the schedule, the Contractor shall submit the original and two copies to the Construction Manager in accordance with Section 01 33 00.

B. Within 7 days after receipt of the submittal, the Construction Manager shall review the submitted schedule and return one copy of the marked up original to the Contractor. If the Construction Manager finds that the submitted schedule does not comply with specified requirements, the corrective revisions will be noted on the submittal copy, returned to the Contractor for corrections and resubmitted as specified in Section 01 33 00. Upon receipt of a schedule and breakdown of contract prices per the General Conditions of the Contract Documents, the Construction Manager will computerize the Contractor's scheduling and cost data. Within 14 days, the Construction Manager will deliver three computer reports to the Contractor. The reports will be on 8-1/2-inch by 11-inch sheets as follows:

1. Tabular listing of activities showing early and late start and finish dates.
2. Bar chart schedule of all activities.
3. Report on cost and payment status for each activity.

C. These reports will serve as the basis for the Contractor's progress payment requests. Computerization of the Contractor's schedule and furnishing reports to the Contractor by the Construction Manager shall not relieve the Contractor of responsibility for the adequacy of the schedule and for managing all construction activities including those of subcontractors and suppliers.

1.04 SCHEDULE REVISIONS

A. Revisions to the accepted cost-loaded construction schedule may be made only with written approval of the Contractor and Owner. Changes in timing for activities which are not on the critical path may be modified with written agreement of the Contractor and Construction Manager. A change affecting the contract value of any activity, the timing of any activity on the critical path, the completion time and specific dates in the Contract Documents and work sequencing (Section 01 12 16) may be made only in accordance with applicable provisions of the General Conditions of the Contract Documents.

1.05 PROJECT STATUS UPDATE

A. Within 7 days of acceptance by the Construction Manager of the Contractor's written progress report specified in the General Conditions of the Contract Documents, the Construction Manager will process the update data by computer and generate the reports outlined in paragraph 1.03 Submittal Procedures. These reports will reflect the current status of the work and will be provided to and used by the Contractor as the basis of his progress payment request.

END OF SECTION

SECTION 01 32 23

SURVEY AND LAYOUT DATA

PART 1 GENERAL

1.01 SURVEY AND LAYOUT

A. The Owner will establish reference benchmarks and baselines as specified.

B. From the information provided, the Contractor shall develop and make such additional surveys as are needed for construction, such as control lines, slope stakes, batter boards, stakes for pipe locations and other working points, lines, and elevations.

C. Survey work shall be performed under the supervision of a licensed land surveyor or registered civil engineer. Contractor shall reestablish reference benchmarks and survey control monuments destroyed by his operations at no cost to the Owner.

1.01 SURVEY BY CONTRACTOR

A. The Contractor shall complete the layout of the work beyond that provided by the survey stakes, and shall be responsible for all measurements that may be required for the execution of the work to the location and limits prescribed on the drawings.

B. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Owner until authorized to remove them, and if such marks are destroyed by the Contractor or through its negligence prior to their authorized removal, they may be replaced by the Engineer, at the Engineer's discretion, and the expense of replacement will be deducted from any amounts due, or to become due the Contractor.

C. The Engineer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking of the work.

D. Precise survey measurements shall be taken on all final locations of buried or concealed items. Coordinates and elevations shall be listed at starting and ending points and every 30 feet along any deviation from a linear line. Coordinates from the survey shall be listed on the “As Built” drawings. This survey shall be completed before any burial by earthen, concrete or other materials.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for submittals.

1.02 ADMINISTRATIVE REQUIREMENTS

A. General:

1. Furnish submittal items as specified in the contract documents.
2. Review submittal information to verify it is accurate and fulfills specified submittal requirements before submitting for review and comment.
3. Edit submittal content to clearly indicate only those items, models, or series of equipment, which are being submitted for review. Cross out or otherwise obliterate extraneous materials.
4. Ensure there is no conflict with other submittals and notify the Owner's Representative in each case where the submittal may affect the work of another contractor or the Owner.
5. Coordinate submittals among subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in the contract documents.
6. For each submittal, certify field conditions, compliance with the Contract Documents, and review of the submittal prior to submitting for review.
7. Designate the installation location within the facility, application, or intended purpose for each submittal item. Review comments are soley applicable to the circumstances designated in the submittal.
8. Coordinate submittals with the work so that work will not be delayed. Coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with others.
9. No extension of time will be allowed because of failure to properly schedule, coordinate or compile submittals.
10. Submittals will be rejected for lack of legibility, lack of coordination, ambiguity, or are incomplete. Incomplete submittals will be returned without review.
11. Do not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."
12. If desired, authorize material or equipment suppliers to deal directly with the Owner's Representative regarding a submittal. Such dealings require written authorization from the Contractor and are limited to contract interpretations to clarify and expedite the work.

B. Request for substitution procedures:

1.03 DEFINITITIONS

A. ACTION SUBMITTALS –

1. Action Submittals content require review and response by the Owner's Representative before proceeding with incorporating the subject equipment, materials, or procedure into the work.
2. Review comments on Action Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.

B. INFORMATIONAL SUBMITTALS-

1. Informational Submittals are examined to verify that the specified submittal contents have been furnished as specified.
2. The Contractactor's actions are not contingent on the disposition of review comments on Informational Submittals.
3. Review comments on Informational Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.

C. CLOSEOUT SUBMITTALS –

1. Closeout Submittals consist of documentation that is not available for review at the time Action Submittals are submitted for review or documentation that is typically generated or furnished following incorporation of the equipment, materials, or procedure into the work. Closeout submittals include spare parts inventory listing, spare parts, extra stock materials, special tools and other materials or components that are furnished separate from the installed and completed work.
2. Review comments on Closeout Submittals, and perform the subsequent actions based on the REVIEW ACTION requirements specified below.

D. SAMPLES

1. Samples include partial sections of components, cuts, or containers of materials, color range sets, and swatches showing color, texture and pattern.
2. Samples may be Action or Informational submittals.

E. MOCK-UPS

1. Mock-ups are scale representations of items to be constructed as part of the work as required in the Contract Documents.
2. Mock-ups are Action Submittals.

F. REVIEW ACTIONS:

1. The following definitions and actions are associated with the REVIEW ACTIONS DEFINED below:
   a. NO EXEPTIONS TAKEN: If the review indicates that the material, equipment or work method complies with the Contract Documents, submittal will be marked "NO EXCEPTIONS TAKEN." Implement the work method or incorporate the material or equipment covered by the submittal.
   b. MAKE CORRECTIONS NOTED: If the review indicates limited corrections are required, submittals will be marked "MAKE CORRECTIONS NOTED." Implement the work method or incorporate the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, provide a corrected copy.

c. AMEND AND RESUBMIT: If the review reveals that the submittal is insufficient or contains incorrect data, submittals will be marked "AMEND AND RESUBMIT." Do not undertake work until the submittal has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

d. REJECTED – SEE REMARKS: If the review indicates that the material, equipment, or work method does not comply with Contract Documents, the submittal will be marked "REJECTED - SEE REMARKS." Do not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" except at your own risk.

1.04 MASTER SUBMITTAL LIST

A. A minimum of five (5) business days prior to Notice to Proceed, the Owner's Representative will provide a Master Submittal List listing submittal requirements for the contract.

B. After receiving the Master Submittal List, update the list as submittals are completed and transmitted to the Owner's Representative. Provide updated list to Owner's Representative monthly.

C. Include the following as a minimum in the updated list:
   1. Submittal number.
   2. Date submitted.
   3. Requested time for return of comments.
   4. Special requests, if any, for that particular submittal.

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

A. General
   1. Owner's Representative will review submittal information and indicate a REVIEW ACTION. Review of submittals does not relieve the Contractor of responsibility for performance of the work according to the Contract Documents.
   2. Coordinate submittal transmittal for related elements of work to ensure the submittals are processed as needed to meet the intent of the work and that delays are minimized.
   3. Submittal review activity will be prioritized based on the order received unless otherwise requested by the Contractor.
   4. Submittal sequencing should coincide with the Construction Schedule in Section 01 32 16.
   5. A review duration of 10 calendar days is allotted for each submittal, from the date of receipt by the Owner's Representative to the date of return to the Contractor.

B. Submittal Preparation:

1. Excepting, mock-ups, spare parts, physical samples, and other items that cannot be converted to electronic media, furnish submittal contents electronically in a searchable PDF format.
    a. Include a table of contents and labeled divider sheets that are coordinated with the table of contents.
    b. Diagrams, drawings, pictures, and illustrations presented with a consistent orientation.
2. If electronic submittals are not possible, place a permanent label or title block on each hard copy submittal for identification and submit the following:
    a. Action and Closeout Submittals:3 copies of submitted information plus one reproducible original.
    b. Informational Submittals: 3 copies of submitted information.
3. Shop Drawings, Samples and Mock-ups:
    a. Submit one electronic copy per the requirements described above and the following:
        1) Shop Drawings: 1 reproducible and 3 prints for job site reference. One marked up print will be returned to the Contractor when the review is complete.
        2) Samples: 2 samples
        3) Mock-up: As required by individual specification
        4) Demonstrations: As required to facilitate installation and inspection
    b. Reference applicable specifications for additional requirements

C. Submittal Completeness:
1. Submittals without all required information are not acceptable and may be marked "REJECTED" and returned without review.
2. For a submittal to be deemed complete, provide the information required below and specified in specification sections, including those elements in the special transmittal procedures where required.

D. In the event of the need to "revise and resubmit", provide a complete stand-alone submittal with corrections, revisions, and new information clearly identified.

E. Resubmit changes to submittals that require a stamp and signature by a licensed engineer or other certification with the requisite stamp and signature or certifications.

3.02 TRANSMITTAL PROCEDURE

A. General:
1. Include the following information on the submittal transmittal form:
    a. Project names and date, including Owner's Project Number
    b. Name of Contractor and Subcontractor
    c. Name of supplier and name of manufacturer
    d. Number and title of appropriate specification section
    e. Drawing number and detail references, as appropriate
2. Equipment and Material Submittals: Unless otherwise specified, complete the Transmittal Form 01 33 00-A specified in Section 01 99 90.

3. Operation and maintenance manuals, information and data Submittals: Complete the Transmittal Form 01 78 23-A specified in Section 01 99 90.
4. Use a separate form for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which a submittal is required. Identify the appropriate equipment numbers for submittal documents common to more than one piece of equipment. Submit a single form for multiple items, if the items taken together constitute a manufacturer's package or are functionally related, to facilitate checking or reviewing the group or package as a whole.
5. Assign a unique sequential number to each transmittal form accompanying each item submitted.
    a. Format submittal numbers as follows: "XXX"; where "XXX" is the sequential number assigned to the original submittal.
    b. Format resubmittals as follows: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.
6. Deviation from contract: If deviations from the material, equipment or method of work are proposed, describe the proposed deviation and explain the reason for proposing the deviation under "deviations" on the transmittal form accompanying the submittal copies.

B. Document Management System Specific Procedures [Procore]:

C. Check Marked Specification Transmittal Procedures
1. When submittal requirements require a "marked" copy of the specification, provide a copy of the specification marked as indicated below. Provide the following when transmitting the submittal:
    a. Provide a copy of the specification section(s) that specifies a marked copy of the specification. Include addendum updates and referenced specification sections, with addendum updates. Complete the following:
        1) Check-mark each paragraph to indicate submittal compliance with that specification requirement. Check marks (✓) shall denote full compliance with that paragraph as a whole.
        2) Mark paragraphs where deviations are proposed by underlining text that is the subject of the proposed deviation. Denoting each proposed deviation with a number in the margin to the right of the identified paragraph and provide a detailed written explanation for each numbered deviation. The remaining portions of the paragraph not underlined signify compliance with specified requirements.
        3) The Engineer is the final authority for determining acceptability of requested deviations.
    b. For equipment specifications, provide a copy of the control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the subject equipment. Complete the following:
        1) Mark drawings or diagrams to show specific changes necessary for the equipment proposed in the submittal.
        2) If no changes are required, mark the drawings or diagrams with "no changes required".

D. Provide a Certificate of Unit Responsibility assigning unit responsibility in accordance with the requirements of the specification Section. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with the Specifications.

1.02 REVIEW PROCEDURE

A. General:
   1. Owner's Representative will review each submittal, indicate a REVIEW ACTION, and return to the Contractor.
   2. Returned submittals indicate one of the following REVIEW ACTIONS: NO EXEMPTIONS TAKEN, MAKE CORRECTIONS NOTED, AMEND AND RESUBMIT, or REJECTED – SEE REMARKS.

1.03 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS:

A. General:
   1. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, does not relieve the Contractor of responsibility for errors therein and is not regarded as an assumption of risks or liability by the Owner's Representative or the Owner, or by any officer or employee thereof, and the Contractor has no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" means that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

END OF SECTION

SECTION 01 35 29

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

PART 1 GENERAL

1.01 REQUIREMENTS

A. Portions of the existing plant are exposed to wastewaters of varying degrees of treatment. The Contractor, certifies that he is experienced and qualified to anticipate and meet the safety and health requirements of this project.

B. Workmen involved in the removal, renovation, or installation of equipment within the treatment plant may be exposed to disease-producing organisms in wastewater. The Contractor shall require his personnel to observe proper hygienic precautions.

C. Solvents, gasoline, and other hazardous materials enter the plant with incoming sewage, and, therefore, certain areas are hazardous to open flame, sparks, or unventilated occupancy. The Contractor shall take measures to assure his personnel observe proper safety precautions when working in these areas.

1.02 SAFETY AND HEALTH REGULATIONS

A. The Contractor shall comply with Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as set forth in Title 29, C.F.R. Copies of these regulations may be obtained from Labor Building, 14th and Constitution Avenue N.W., Washington, DC 20013.

B. The Contractor shall also comply with the provisions of the Federal Occupational Safety and Health Act, as amended.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 35 43

ENVIRONMENTAL PROCEDURES

PART 1 GENERAL

1.01 SITE MAINTENANCE

A. The Contractor shall keep the work site clean and free from rubbish and debris. Materials and equipment shall be removed from the site when they are no longer necessary. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

1.02 TEMPORARY DAMS

A. Except in time of emergency, earth dams are not acceptable at catch basin openings, local depressions, or elsewhere. Temporary dams of sand bags, asphaltic concrete, or other acceptable material will be permitted when necessary to protect the work, provided their use does not create a hazard or nuisance to the public. Such dams shall be removed from the site as soon as they are no longer necessary.

1.03 AIR POLLUTION CONTROL

A. The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. He shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water, or other means as necessary. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

1.04 NOISE CONTROL

A. Between 7:30 p.m. and 7:00 a.m., noise from Contractor's operations shall not exceed limits established by applicable laws or regulations and in no event shall exceed 86 dBA at a distance of 50 feet from the noise source.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements for quality control services, field inspections and field testing of civil and structural constructs required for this project. Contractor is responsible for the quality assurance and quality control of their respective work.

1.02 DEFINITIONS

A. Quality Control System (QCS): The quality control, assurance, and inspection system established and carried out to ensure compliance with the Plans and Specifications.

B. QCS Supervisor: That person in responsible charge of the work occurring, as designated by the Contractor in the QCS Plan.

C. QCS Inspector: Responsible, certified personnel inspecting the various constructs at specified milestones and during the project overall and designated by the Construction Manager. The Special Inspector is part of the QCS Inspector team.

D. Factory Test: Tests made on various materials, products and component parts prior to shipment to the job site.

E. Field Tests: Tests and analyses made at or in the vicinity of the job site in connection with the actual construction.

F. Certified Inspection Report: Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report

G. Certificate of Compliance: Certificate from the manufacturer of the material or equipment identifying said manufacturer, product and referenced standard, and shall be signed by a designated officer of the manufacturer.

H. Standard Compliance: Condition whereby specified materials or equipment must conform to the standards of organizations such as the American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) or similar organization.

I. Quality Assurance: The day-to-day, in-process supervisory observations of work and materials conducted by the Contractor to assure that the proper methods and materials are being used and installed by tradesmen.

J. Source Quality Control: The in-process testing and inspections conducted by the QCS Inspector(s) to verify that the materials, equipment, workmanship and shop manufactured constructs are in compliance with the Contract Documents, applicable Codes and standards.

K. Field Quality Control: The testing and inspections conducted by the QCS Inspector(s) in the field during and at the completion of each construct to verify that the in-process and completed construction is in compliance with the Contract Documents, applicable Codes and standards.

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization, or if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ASTM C1021	Practice for Laboratories Engaged in the Testing of Building Sealants.
ASTM C802	Practice for Conducting an Inter-Laboratory Test Program to Determine the Precision of Test Methods for Construction Materials.
ASTM C1093	Practice for Accreditation of Testing Agencies for Masonry.
ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
IBC	2015 International Building Code, locally amended

1.04 CONTRACTOR'S RESPONSIBILITIES

A. Monitor quality assurance over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Coordinate with, schedule specified inspections by, and provide normal and customary assistance to the QCS Inspectors.

C. Comply fully with manufacturers' instructions, including each step in sequence.

D. Should manufacturers' instructions conflict with Contract Documents, request clarification before proceeding from Construction Manager.

E. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

F. Perform work by persons qualified to produce workmanship of specified quality.

1.05 REGULATORY REQUIREMENTS

A. General:
   1. Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, sitework and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.

B. Special Inspection:
   1. Special Inspection shall be performed by the Special Inspector under contract with the Construction Manager in conformance with the IBC. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.

C. Structural Observation:
   1. Engineer shall make visual inspections of the work to assess general conformance with the Contract Documents at significant construction stages and at completion of the structural system. The QCS shall include a preliminary set of Structural Observations and what items are expected to be observed. Contractor shall request this preliminary set from Engineer through Construction Manager and submit as part of their QCS submittal.
   2. The following structural milestones shall be considered significant construction stages:
      a. Structure fill and deep foundations including piling.
      b. Foundations prepared for concrete placement, including grade beams, pile caps, strip, matt and pad footings, and monolithic slabs on grade.
      c. Preparation of concrete, water-retaining walls prior to placement of concrete.
      d. Completion of bearing walls prior to cover-up with non structural elements, including concrete, masonry, cold formed steel, and lumber.
      e. Roof and floor framing, including framed and sheathed systems, slabs, and composite systems.
      f. Completion of lateral force resisting system elements not included in the above categories including moment connections, bracing, diaphragms, or other.
      g. Completion of structural system after all significant architectural, mechanical, plumbing, heating/ventilation equipment, electrical, and finish elements are installed.

1.06 FIELD SAMPLE PROCEDURES

A. When field samples are specified in a unit of work, construct each field sample to include work of all trades required to complete the field sample prior to starting related field work. Field samples may be incorporated into the project after acceptance by Construction Manager. Remove unacceptable field samples when directed by Construction Manager. Acceptable samples represent a quality level for the work.

1.07 CONTRACTOR DESIGNED STRUCTURAL SYSTEMS

A. Design Engineering:
   1. Contractor shall employ and pay for engineering services from a Professional Engineer registered in the State of Texas for structural design of Contractor designed structural systems including but not limited to temporary shoring and bracing, formwork support, interior structural wall and ceiling systems, and support systems for fire sprinkler, plumbing, mechanical, and electrical systems and equipment

B. Tests and Inspections of Contractor Designed Structural Systems:
   1. Contractor shall pay for preliminary testing of concrete, grout, and mortar mix designs where required by Code or the submittal process prior to start of such work. Contractor shall pay for required shop and site inspection of Contractor designed structural systems where required by Code or these specifications, to the extent such testing and inspection exceeds that required for the structural system on the drawings and in these specifications.

1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification sections, product suppliers or manufacturers shall provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to provide instructions when necessary. Contractor shall submit qualifications of observer to Construction Manager 30 days in advance of required observations. QCS Inspector shall record observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.09 JOB SITE CONDITIONS

A. Schedule to ensure all preparatory work has been accomplished prior to proceeding with current work. Proceeding with the work constitutes acceptance of conditions. Allow adequate time for materials susceptible to temperature and humidity to "stabilize" prior to installation. Establish and maintain environmental conditions (i.e., temperature, humidity, lighting) as recommended by the various material manufacturers for the duration of the work.

1.10 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00 :
   1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to

include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Written description of Contractor's proposed QCS plan in sufficient detail to illustrate understanding and approach. The QCS plan and submittal shall include a log showing anticipated inspections, Special Inspections, and source and field Quality Assurance procedures. Preliminary submittal of the QCS plan may be made prior to commencing field work. The preliminary submittal will illustrate the project's initial three (3) month's work, and be followed one month later by a final QCS plan submittal.
3. Contractor's proposed QCS Supervisor, qualifications, and if requested, references.
4. Preliminary structural observation set as described in paragraph 1.05 Structural Observation.
5. Complete structural system information describing Contractor designed structural systems, including sealed calculations, shop and erection drawings, product literature for the various components, ICBO Evaluation Reports for structural components, and a discussion of risk issues associated with the proposed system which could adversely impact overall project completion.
6. If requested by the Construction Manager during the work, manufacturer's field services and reports. If not so requested, treat same as Product Data.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Contractor Responsibilities:
   1. Provide source quality control according to the reviewed and accepted QCS plan and paragraph 1.04 herein. Coordinate with Construction Manager to facilitate the work of the Testing Laboratory specified in Section 01 45 29 and Special Inspector. Provide ready access to sampling and inspection locations and incidental labor customary in such sampling and inspections. Timely prepare and submit submittals, and revise as indicated by review comments. Comply with technical requirements in each specification Section that applies to the work.

B. Construction Manager Responsibilities:
   1. Review Contractor's tracking of QCS activities at monthly meetings. Facilitate completion of submittal review per Section 01 33 00. Assist Contractor to ensure that Special Inspection occurs where and when specified.

C. Acceptance Criteria:
   1. Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

2.02 PRODUCT DATA

A. The following product data shall be provided in accordance with Section 01 33 00.
   1. Manufacturers' field services and reports unless requested by Construction Manager to be submitted for review.
   2. Special Inspection reports, unless otherwise directed in each technical specification Section.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Field quality control responsibilities of the Contractor and Construction Manager are substantially the same as described in paragraph 2.01, with the exception that this work occurs primarily on the jobsite as the work progresses, and Special Inspection will occur more often than at the source.

B. Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

3.02 REGULATORY COMPLIANCE – SPECIAL INSPECTIONS

A. The following types of work require Special Inspection according to Chapter 17 of the IBC and each system's specification Section:
   1. Structure Fill.
   2. Deep foundations including piling.
   3. Structural concrete and reinforcing.
   4. Anchor bolts and post-installed anchor systems.
   5. Masonry systems, complete.
   6. Structural steel and aluminum including connections.
   7. Cold formed structural steel including connections.
   8. Steel deck and wood sheathing.
   9. Structural lumber including sawn and manufactured including connections.
   10. All components of the lateral force resisting system not included in the above.

B. Section 01 45 29 describes Testing Laboratory sampling, testing and reporting, much of which is conforming to Special Inspection requirements, and need not be replicated.

C. Contractor designed structural systems are subject to the same Special Inspection requirements as all other work.

3.03 CORRECTION OF DEFECTIVE WORK

A. Remove and replace defective, rejected, and condemned work at Contractor's expense until such work meets the requirements of Contract Documents.

END OF SECTION

SECTION 01 41 26

PERMIT REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

The Contractor shall keep itself fully informed of all local ordinances as well as state and federal laws, which in any manner affect the work herein specified. The Contractor shall always comply with said ordinances, laws and regulations.

1.02 PERMITS TO BE OBTAINED BY OWNER AND CONTRACTOR

The Contractor shall prepare and submit to the proper authority all information required for the issuance of permits and shall pay all costs thereof, including agency inspections unless specifically provided otherwise in these Contract Documents. The Contractor shall provide a copy of each such permit to the Engineer.

The Contractor shall obtain the following permits for the project:

Permit	Issuing Entity
Pavement Cut	**City of El Paso** **Streets and Maintenance Department** Electronic Application: http://www.elpasotexas.gov/streets/pavement-cut **(915) 212-0151** **FEES ARE EXEMPT**
Traffic Control	**City of El Paso** **Streets and Maintenance Department** Electronic Application: http://home.elpasotexas.gov/epdot/traffic-control-permit-application.php 915.212.0118 **FEES ARE EXEMPT**
Storm Water Pollution Prevention Plan	**City of El Paso** **One Stop Shop** (915) 212-0104 **FEES ARE EXEMPT**
Waste Disposal Permit and Haul Route (Contractor is Responsible for tipping fees)	**City of El Paso** **One Stop Shop** (915) 212-0104 **FEES ARE EXEMPT**
Grading Permit	**City of El Paso** **One Stop Shop** (915) 212-0104 **FEES ARE EXEMPT**

All applicable permit fees shall be paid by the Contractor.

1.03 POSTING PERMITS AND EASEMENTS

All permits and easements shall be posted at the site of the work.

1.04 WASTE DISPOSAL

All existing pavement, curb, soil, vegetation, and granular material which is removed under this contract shall be disposed of off-site at the Contractor's expense. The Contractor shall be responsible for obtaining necessary permits prior to disposing of waste.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

PART 1 GENERAL

1.01 ABBREVIATOINS

A. Wherever used in the project manual, the following abbreviations will have the meanings listed:

Abbreviation	Meaning
AA	Aluminum Association Incorporated P.O. Box 753 Waldorf, MD 20604
AABC	Associated Air Balance Council 1518 K Street N.W. Washington, DC 20005
AAMA	American Architectural Manufacturers Association 1540 East Dundee Road, Suite 310 Palatine, IL 60067
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, DC 20001
ABMA	American Bearing Manufacturers Association 1200 19th Street N.W., Suite 300 Washington, DC 20036
ACI	American Concrete Institute 22400 West Seven Mile Road P.O. Box 19150, Redford Station Detroit, MI 48219
AEIC	Association of Edison Illuminating Companies 600 North 18th Street P.O. Box 2641 Birmingham, AL 35291
AGA	American Gas Association ATTN: Records 1515 Wilson Boulevard Arlington, VA 22209
AGMA	American Gear Manufacturer's Association, Inc. 1500 King Street, Suite 201 Alexandria, VA 22314
AHA	American Hardboard Association 1210 West Northwest Highway Palatine, IL 60067
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601

Abbreviation	Meaning
AISI	American Iron and Steel Institute 1101 Seventeenth Street, NW, Suite 1300 Washington, DC 20036
AITC	American Institute of Timber Construction 7012 South Revere Parkway, Suite 140 Englewood, CO 80112
ALSC	American Lumber Standard Committee P.O. Box 210 Germantown, MD 20875
AMCA	Air Movement and Control Association, Inc. 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 11 West 42nd Street, 13th Floor New York, NY 10036
APA	American Plywood Association 7011 South 19th Street Tacoma, WA 98466
API	American Petroleum Institute 1220 "L" Street N.W. Washington, DC 20005
ARI	Air-Conditioning and Refrigeration Institute 4301 North Fairfax Drive, Suite 425 Arlington, VA 22203
ASCE	American Society of Civil Engineers United Engineering Center 345 East 47th Street New York, NY 10017
ASCII	American Standard Code for Information Interchange United States of America Standards Institute 10 East 40th Street New York, NY 10016
ASE Code	American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017

Abbreviation	Meaning
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428
AWPA	American Wood-Preservers' Association 9549 Old Fredrick Road Ellicott City, MD 21042
	or P.O. Box 286 Woodstock, MD 21163-0286
AWS	American Welding Society 550 NW LeJeune Road P.O. Box 351040 Miami, FL 33135
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BOCA	Building Officials and Code Administrators, International, Inc. 4051 West Flossmoor Road Country Club Hills, IL 60478
CALTEST	Materials Manual, State of California, Business and Transportation Agency Department of Public Works State of California, Department of Transportation 6002 Folsom Boulevard Sacramento, CA 95819
CALTRANS	Standard Specifications, State of California, Department of Transportation State of California, Business and Transportation Agency P.O. Box 1499 Sacramento, CA 95807
CBM	Certified Ballast Manufacturers 2120 Keith Building Cleveland, OH 44115
CMAA	Crane Manufacturers Association of America, Inc. (Formerly called: Overhead Electrical Crane Institute) (OECI) 8720 Red Oak Boulevard, Suite 201 Charlotte, NC 28217
CRSI	Concrete Reinforcing Steel Institute 933 N Plum Grove Road Schaumburg, IL 60173
CSA	Canadian Standards Association 178 Rexdale Boulevard Rexdale, Ontario, M9W IR3, Canada
DEMA	Diesel Engine Manufacturer's Association 30200 Detroit Road Cleveland, OH 44145

Abbreviation	Meaning
DHI	Door and Hardware Institute 14170 Newbrook Drive Chantilly, VA 22021
DIS	Division of Industrial Safety California Department of Industrial Relations 2422 Arden Way Sacramento, CA 95825
EEI	Edison Electric Institute 90 Park Avenue New York, NY 10016
EIA	Electronic Industries Association Order from: Global Engineering Documents 18201 McDurmott West Irvine, CA 92714
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
ESO	Electrical Safety Orders California Administrative Code, Title 8, Chap. 4, Subarticle 5 Office of Procurement, Publications Section P.O. Box 20191 8141 Elder Creek Road Sacramento, CA 95820
FEDSPEC	Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch Washington Navy Yard, Bldg. 197 Washington, DC 20407
FEDSTDS (see FEDSPECS)	Federal Standards
FM	Factory Mutual Engineering and Research Corporation 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062
HEI	Heat Exchange Institute 1300 Sumner Avenue Cleveland, OH 44115
HI	Hydraulic Institute 9 Sylvan Way, Suite 180 Parsippany, NJ 07054
HPVA	Hardwood Plywood & Veneer Association 1825 Michael Faraday Drive P.O. Box 2789 Reston, VA 22090-2789

Abbreviation	Meaning
IAPMO	International Association of Plumbing and Mechanical Officials 20001 Walnut Drive S Walnut, CA 91789
ICBO	International Conference of Building Officials 5360 Workman Mill Road Whittier, CA 90601
ICEA	Insulated Cable Engineers Association P.O. Box 440 South Yarmouth, MA 02664
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane P.O. Box 1331 Piscataway, NJ 08855
IES	Illuminating Engineering Society of North America 120 Wall Street New York, NY 10017
ISA	Instrument Society of America 67 Alexander Drive P.O. Box 12277 Research Triangle Park, NC 27709
JIC	Joint Industrial Council 7901 West Park Drive McLean, VA 22101
MFMA	Metal Framing Manufacturers Association 401 N. Michigan Avenue Chicago, IL 60611
MILSPEC	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
MSS	Manufacturers Standardization Society of the Valve & Fittings Industry, Inc. 127 Park Street, N.E. Vienna, VA 22180
NAAMM	National Association of Architectural Metal Manufacturers 11 South La Salle Street, Suite 1400 Chicago, IL 60603
NACE	National Association of Corrosion Engineers 1440 South Creek Drive Houston, TX 77084
NBC	National Building Code Published by BOCA

Abbreviation	Meaning
NEC	National Electric Code National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269
NELMA	Northeastern Lumber Manufacturers Association, Inc. P.O. Box 87A Cumberland Center, ME 04021
NEMA	National Electrical Manufacturer's Association 2101 L Street, NW, Suite 300 Washington, DC 20037
NESC	National Electric Safety Code American National Standards Institute 1430 Broadway New York, NY 10018
NFOR	National Forest Products Association (Formerly National Lumber Manufacturer's Association) 1111 19 Street NW, Suite 700 Washington, DC 20036
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269
NHLA	National Hardwood Lumber Association 6830 Raleigh LaGrange P.O. Box 34518 Memphis, TN 38184-0518
NSF	National Sanitation Foundation 3475 Plymouth Road P.O. Box 130140 Ann Arbor, MI 48113
OSHA	Occupational Safety and Health Act U.S. Department of Labor Occupational and Health Administration San Francisco Regional Office 450 Golden Gate Avenue, Box 36017 San Francisco, CA 94102
PCI	Precast/Prestressed Concrete Institute 175 West Jackson Blvd., Suite 1859 Chicago, IL 60604
PPIC	The Plumbing & Piping Industry Council, Inc. 510 Shatto Place, Suite 402 Los Angeles, CA 90020

Abbreviation	Meaning
RIS	Redwood Inspection Service California Redwood Association 405 Enfrente Dr., Suite 200 Novato, CA 94949
RMA	Rubber Manufacturers Association 1400 K Street NW, Suite 900 Washington, DC 20005
SAE	Society of Automotive Engineers, Inc. 400 Commonwealth Drive Warrendale, PA 15096
SAMA	Scientific Apparatus Makers Association One Thomas Circle Washington, DC 20005
SBC	Standard Building Code Published by SBCCI
SBCCI	Southern Building Code Congress International Inc. 900 Montclair Road Birmingham, AL 35213
SCMA	Southern Cypress Manufacturers Association 400 Penn Center Boulevard, Suite 530 Pittsburg, PA 15235
SDI	Steel Door Institute 30200 Detroit Road Cleveland, OH 44145
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. P.O. Box 221230 Chantilly, VA 22021
SPI	Society of the Plastics Industry, Inc. 1275 K Street NW, Suite 400 Washington, DC 20005
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway Pensacola, FL 32504
SSPC	Society for Protective Coatings 40 24th Street, 6th Floor Pittsburgh, PA 15222
SSPWC	Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034
TEMA	Tubular Exchanger Manufacturer's Association 25 North Broadway Tarrytown, NY 10591
TPI	Truss Plate Institute 583 D'Onofrio Drive, Suite 200 Madison, WI 53719

Abbreviation	Meaning
UBC	Uniform Building Code Published by ICBO
UL	Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062
UMC	Uniform Mechanical Code Published by ICBO
UPC	Uniform Plumbing Code Published by IAPMO
USBR	Bureau of Reclamation U.S. Department of Interior Engineering and Research Center Denver Federal Center, Building 67 Denver, CO 80225
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns St. P.O. Box 23145 Portland, OR 97223
WWPA	Western Wood Products Association (Formerly called: West Coast Lumbermen's Association (WCLA)) Yeon Building 522 SW 5th Avenue Portland, OR 97204

END OF SECTION

SECTION 01 45 00

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services, field inspections and field testing of civil and structural constructs required for this project.

B. The Contractor is responsible for the quality assurance and quality control of their respective work for the construction of this project in accordance with the Contract Documents.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related section. Additional related sections may apply that are not specifically listed below.

1. Section 01 45 23 Testing and Inspection Services

1.03 DEFINITIONS

A. Quality Control System (QCS): The quality control, assurance, and inspection system established and carried out to ensure compliance with the Plans and specifications.

B. QCS Supervisor: That person in responsible charge of the work occurring, as designated by the Contractor in the QCS Plan.

C. QCS Inspector: Responsible, certified personnel inspecting the various constructs at specified milestones and during the project overall and designated by the Construction Manager.

D. Factory Test: Tests made on various materials, products and component parts prior to shipment to the job site.

E. Field Tests: Tests and analyses made at or in the vicinity of the job site in connection with the actual construction.

F. Certified Inspection Report: Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report.

G. Certificate of Compliance: Certificate from the manufacturer of the material or equipment identifying said manufacturer, product and stating that the mateiral or equipment meet specified standards, and shall be signed by a designated officer of the manufacturer.

H. Standard Compliance: Condition whereby specified materials or equipment must conform to the standards of organizations such as the American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) or similar organization.

I. Quality Assurance: The day-to-day, in-process supervisory observations of work and materials conducted by the Contractor to assure that the proper methods and materials are being used and installed by tradesmen.

J. Source Quality Control: The in-process testing and inspections conducted by the QCS Inspector(s) to verify that the materials, equipment; workmanship and shop manufactured constructs are in compliance with the Contract Documents, applicable Codes and standards.

K. Field Quality Control: The testing and inspections conducted by the QCS Inspector(s) in the field during and at the completion of each construct to verify that the in-process and completed construction is in compliance with the Contract Documents, applicable Codes and standards.

L. Special Inspector – A qualified individual employed or retained by an approved agency and approved by the local governing authorities having jurisdiction (AHJ) as having the competency necessary to inspect a particular type of construction requiring special inspection.

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
4. Written description of Contractor's proposed QCS plan in sufficient detail to illustrate adequate measures for verification and conformance to defined requirements. The QCS plan and submittal shall include a log showing anticipated inspections, QCS Inspectors, Special Inspections, and source and field Quality Assurance procedures. Submittal of the QCS plan shall be made prior to commencing field work.
5. Contractor's proposed QCS Supervisor and QCS Inspectors (other than the Special Inspectors provided by Owner), including qualifications, responsibilities, and if requested, references.
6. Complete structural system information describing Contractor designed structural systems, including sealed calculations, shop and erection drawings, product literature for the various components, International Code Council (ICC) Evaluation Reports for structural components, and a discussion of risk issues associated with the proposed system which could adversely impact overall project completion.
7. If requested by the Construction Manager during the work, manufacturer's field services and reports.

A. Informational Submittals:

1. Procedures: Section 01 33 00.
2. Manufacturers' field services and reports unless requested by Construction Manager to be submitted for review.
3. Special Inspection reports, unless otherwise directed in each technical specification Section.

1.05 REGULATORY REQUIREMENTS

A. GENERAL: Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, site work and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.

B. SPECIAL INSPECTION: Special Inspection shall be performed by the Special Inspector under contract with the Owner or registered design professional in responsible charge acting as the Owner's agent in conformance with the IBC. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.

C. STRUCTURAL OBSERVATION: Registered Design Professional shall make visual inspections of the work to assess general conformance with the Contract Documents at significant construction stages and at completion of the structural system in accordance with IBC 1704.6 Structural Observations requirements.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. Monitor quality assurance over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Coordinate with, schedule specified inspections by, and provide normal and customary assistance to the QCS Inspectors and Owner provided Special Inspectors.

C. Coordinate with, schedule specified structural observations by Engineer, and provide normal and customary assistance to Engineer performing structural observations.

D. Comply fully with manufacturers' instructions, including each step in sequence.

E. Should manufacturers' instructions conflict with Contract Documents, request clarification before proceeding from Construction Manager.

F. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

G. The Contractor shall retain the services of a licensed land surveyor, registered in the State ofTexas, to perform survey work including but not limited to establishing line and grade, in advance of the construction; and to perform other surveying services for the work included under the Contract. The surveyor to be retained by the Contractor shall not be the same surveyor engaged for the Engineer's use. The surveyor shall be subject

to the approval of the Engineer. Survey drawings shall be submitted to the Engineer for approval.

H. The Contractor shall take all necessary measurements in the field to verify pertinent data and dimensions shown on the Drawings or to determine the exact dimensions of the Work.

1.07 FIELD SAMPLE PROCEDURES

A. When field samples are specified in a unit of work, construct each field sample to include work of all trades required to complete the field sample prior to starting related field work. Field samples may be incorporated into the project after acceptance by Construction Manager. Remove unacceptable field samples when directed by Construction Manager. Acceptable samples represent a quality level for the work.

1.08 CONTRACTOR DESIGNED STRUCTURAL SYSTEMS

A. DESIGN ENGINEERING: Contractor shall employ and pay for engineering services from a Professional Engineer registered in the State of Texas for structural design of Contractor designed structural systems including but not limited to temporary shoring and bracing, formwork support, interior wall and ceiling systems, and support systems for fire sprinkler, plumbing, mechanical, and electrical systems and equipment.

B. TESTS AND INSPECTIONS OF CONTRACTOR DESIGNED STRUCTURAL SYSTEMS: Contractor shall pay for preliminary testing of concrete, grout, and mortar mix designs where required by Code or these specifications prior to start of work. Contractor shall pay for required shop and site inspection of Contractor designed structural systems where required by Code or these specifications.

1.09 JOB SITE CONDITIONS

A. Schedule to ensure all preparatory work has been accomplished prior to proceeding with current work. Proceeding with the work constitutes acceptance of conditions. Allow adequate time for materials susceptible to temperature and humidity to “stabilize” prior to installation. Establish and maintain environmental conditions (i.e., temperature, humidity, lighting) as recommended by the various material manufacturers for the duration of the work.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. CONTRACTOR RESPONSIBILITIES: Provide source quality control according to the reviewed and accepted QCS plan and paragraph 1.06 herein. Coordinate with Construction Manager to facilitate the work of the Testing Laboratory specified in Section 01 45 23 and Special Inspector. Provide ready access to sampling and inspection locations and incidental labor customary in such sampling and inspections. Timely prepare and submit submittals, and revise as indicated by review comments. Comply with technical requirements in each specification Section that applies to the work.

B. CONSTRUCTION MANAGER RESPONSIBILITIES: Review Contractor's tracking of QCS activities at meetings. Facilitate completion of submittal review per Section 01 33 00. Assist Contractor to ensure that Special Inspection occurs where and when specified.

C. ACCEPTANCE CRITERIA: Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Field quality control responsibilities of the Contractor and Construction Manager are substantially the same as described in paragraph 2.01, with the exception that this work occurs primarily on the jobsite as the work progresses, and Special Inspection will occur more often than at the source.

B. Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

3.02 REGULATORY COMPLIANCE – SPECIAL INSPECTIONS

A. The types of work requiring Special Inspection are specified in the Construction Documents and required to obtain regulatory approval by State or required by local governing authorities having jurisdiction over the building permit of the project.

B. Section 01 45 23 describes Testing Laboratory sampling, testing and reporting.

C. Contractor designed structural systems are subject to the same Special Inspection requirements as all other work.

3.03 CORRECTION OF DEFECTIVE WORK

A. Any defective or imperfect Work, equipment, or materials furnished by the Contractor which is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the Engineer and approved for payment. The Contractor shall repair such defect, without compensation, in a manner satisfactory to the Engineer.

B. Unsuitable materials and equipment may be rejected, notwithstanding that such defective Work, materials and equipment may have been previously overlooked by the Engineer and accepted or approved for payment.

C. If any workmanship, materials or equipment shall be rejected by the Engineer as unsuitable or not in conformity with the Specifications or Drawings, the Contractor shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to Owner. Equipment or materials rejected by the Engineer shall be tagged as such and shall be immediately removed from the site.

D. The Engineer may order tests of imperfect or damaged Work equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor, and the nature, tester, extent and supervision of the tests will be as determined by the Engineer.

If the results of the tests indicate that the required functional capability of the Work, equipment, or material was not impaired, the Work, equipment or materials may be deemed acceptable, in the discretion of the Engineer. If the results of such tests reveal that the required functional capability of the questionable Work, equipment or materials has been impaired, then such Work, equipment or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect Work, equipment or material in lieu of performing the tests.

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies Quality Control testing and reporting performed by the Testing Laboratory.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A880	Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C802	Conducting an Inter-Laboratory Test Program to Determine the Precision of Test Methods for Construction Materials
ASTM C1021	Laboratories Engaged in the Testing of Building Sealants
ASTM Cl077	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C1093	Accreditation of Testing Agencies for Unit Masonry
ASTM D3666	Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3740	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4561	Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
ASTM E4	Force Verification of Testing Machines
ASTM E329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E543	Agencies Performing Nondestructive Testing
ASTM E994	Calibration and Testing Laboratory Accreditation Systems General Requirements for Operation and Recognition.
	2015 International Building Code (IBC)

1.03 TESTING LABORATORY QUALIFICATIONS

A. Testing Laboratory shall satisfy the following qualifications:
   1. Recommended Requirements for Independent Laboratory Qualification, published by American Council of Independent Laboratories.
   2. Conform to the requirements of ASTM E329 in particular, and other reference standards as generally pertain to this project.
   3. Authorized to operate in the State of Texas, with personnel and equipment based sufficiently close to the project to allow short-notice site access for sampling and testing.
   4. Acceptable to Owner, Construction Manager, and local building authorities.

1.04 TESTING LABORATORY RESPONSIBILITIES

A. Testing Laboratory shall provide qualified personnel at the site and cooperate with Construction Manager and Contractor in performance of the following services:
   1. Perform specified independent inspection, sampling, and testing of products in accordance with specified standards, to determine compliance with requirements of Contract Documents.
   2. Provide sampling equipment and personnel, deliver samples to the testing laboratory, record field measurements, and cure samples as required by Contract Documents.
   3. Perform Building Department required tests and inspections, including Special Inspection as specified in Section 01 40 00.
   4. Timely prepare and deliver reports summarizing results of tests and inspections.
   5. Attend pre-construction conferences and, if requested, a limited number of progress meetings where Quality Control, testing, and inspection issues require discussion.
   6. When directed by the Construction Manager or requested by the Contractor, provide special and additional tests and inspections to verify material compliance with requirements of Contract Documents.
      a. Contractor shall pay for additional tests and inspections where work fails to comply with Contract Document requirements (re-inspection) and for costs associated with cancelled or short-notice re-scheduling of requested sampling, testing, and inspection. Testing Laboratory work requested by Contractor to fulfill submittal requirements shall also be considered additional tests.

1.05 CONTRACTOR RESPONSIBILITIES

A. Contractor shall deliver adequate samples of materials proposed to be used and which require testing to the Testing Laboratory. Contractor shall cooperate with Testing Laboratory personnel, and provide access to the work and to manufacturer's facilities. Contractor shall provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

B. Contractor shall notify Testing Laboratory and Construction Manager 24 hours prior to

expected time for operations requiring inspection, sampling and testing services.

1.06 COSTS

1. El Paso Water shall bear the costs of QA/QC testing for geotechnical and structural compliance. Costs for subsequent re-testing and re-inspection of items found not to be in compliance with Construction Documents shall be borne by the Contractor.

2. Additional tests and inspections not herein specified, but requested by the Owner, shall be paid for by the Owner. However, if the results of such tests or inspections are found to be not in compliance with Construction Documents, the Contractor will be back charged for all costs for initial testing as well as re-testing, re-inspection and Owner's Consultants services.

3. Costs for additional tests or inspections required because of Contractor changes to reviewed and accepted products or materials provided, or source, or supply shall be borne by the Contractor.

4. Costs for any Work which is required to correct any deficiencies shall be borne by the Contractor.

5. Costs of any testing which is required solely for the convenience of Contractor in its scheduling and performance of the Work shall be borne by the Contractor.

6. Costs for verification testing of Work done without prior notice, with improper supervision, or contrary to construction practice shall be borne by the Contractor.

7. The cost, if any, of providing access for inspections and tests shall be considered part of the normal expense of conducting business and therefore non-reimbursable.

8. In those instances where inspector(s) arrive at the agreed-upon location, at the agreed upon date and time, and find articles to be inspected are not ready for inspection, the inspector(s) shall return to their home office and all expenses incurred shall be borne by the Contractor.

1.07 TEST AND INSPECTION REPORTS

A. Report Contents:
   1. At a minimum, Test and Inspection Reports shall include the following:
      a. Project name and date of report.
      b. Testing Laboratory name, address, telephone number, name of laboratory field sampling personnel, lab testing personnel, or QCS Inspector as applicable.
      c. Date, time, and location of sampling, testing, and inspecting.
      d. Ambient temperature and weather conditions at the site or shop and curing conditions of samples.
      e. Product identification and referenced specification Section number.
      f. Type of sample, test, and inspection and industry standard for sampling and

testing.

g. Results of sample, test, and inspection.

h. Evaluation of compliance with requirements in Contract Documents.

i. Certified Inspection Reports shall specifically indicate the qualification of the inspector to render judgment and certify said inspection.

j. When requested by Construction Manager, interpretation of test results.

B. Distribution of Test and Inspection Reports:

1. Test and Inspection reports shall be submitted to the Construction Manager for distribution as Product Data described in Section 01 33 00. Test reports shall be submitted not more than two days after completion of required tests. Inspection reports shall be submitted immediately if deficiencies or significant irregularities are noted, and in no case less than two working days after said inspection. Provide three (3) copies of all reports and one copy to the jurisdictional agency.

1.08 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Documentation of conformance with Testing Laboratory Qualifications as specified in paragraph 1.03 herein.

3. Form 01 45 29 described in paragraph 3.03 by both Testing Laboratory and Contractor.

1.09 LIMITS ON TESTING LABORATORY AUTHORITY

A. Testing Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents. Testing Laboratory may not approve or accept any portion of the work, nor assume any duties of Contractor. Testing Laboratory has no authority to stop the work

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. General:

1. Source quality control is defined in Section 01 40 00. This Section provides general guidelines as to the sampling, tests, and inspections required of products and manufactures prior to delivery to the project site, and should be considered a minimum. Additional information and requirements are provided in each technical specification Section and those requirements shall control over this Section when in conflict. Absence of a test, inspection or requirement listed herein from a subsequent specification Section does not relieve the Testing Laboratory or the Contractor from their respective responsibilities specified in this Section.

B. Reference Standards in Other Sections:

1. Codes, standards, and other references called out below, but which are not listed in paragraph 1.02 are described in other specification Sections and not repeated herein.

C. Fill Materials:

1. Imported Fill Materials: Testing Laboratory may conduct additional testing on behalf of Contractor to prepare required submittals specified in Section 31 23 00.
2. Type C Fill Material: Testing Laboratory shall conduct required testing to verify on-site materials proposed for fill conforms to specification Section 31 23 00. Contractor shall pay Testing Laboratory for such sampling and testing. Sampling and testing shall determine Liquid Limit, Plasticity Index, optimum moisture content and density relationship, and other data as required for proper use of this material.

D. Paving Materials:

1. Provide sampling and testing requested by Construction Manager or additional testing as requested by Contractor to verify materials proposed for use conform to specification Section 31 23 00 and 32 12 16.

E. Concrete Reinforcing:

1. Provide sampling and testing requested by Construction Manager or additional testing as requested by Contractor to verify materials proposed for use conform to specification Section 03 20 00.

F. Cast-In-Place Concrete:

1. Provide sampling and testing requested by Construction Manager or additional testing as requested by Contractor to verify materials proposed for use conform to specification Section 03 30 00. At Contractor's expense, Testing Laboratory may assist Contractor in formulating concrete mix designs, testing and reporting same, and providing the services of a Professional Engineer to review and seal the mix design.

G. Precast Concrete:

1. Precast Yard Inspection: Source quality inspection is not required for PCI Certified facilities unless otherwise directed by the Building Official.
2. Vaults, Manholes, And Non-Structural Precast Concrete Items: Precast yard inspection is not required unless so directed by the Construction Manager due to

quality concerns or lack of experience by the manufacturer. Such inspection and testing shall be paid for by the Contractor, and conform to this Section's requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. General:

1. Field quality control is defined in Section 01 40 00. This Section provides general guidelines as to the sampling, tests, and inspections required of work in progress or completed in the field, and should be considered a minimum. Additional information and requirements are provided in each technical specification Section and those requirements shall control over this Section when in conflict. Absence of a test, inspection or requirement listed herein from a subsequent specification Section does not relieve the Testing Laboratory or the Contractor from their respective responsibilities specified in this Section.

B. Reference Standards in Other Sections:

1. Codes, standards, and other references called out below, but which are not listed in paragraph 1.02 are described in other specification sections and not repeated herein.

C. Fill:

1. Subgrade Preparation and Compaction: Verify depth of scarification, moisture content within optimal limits for compaction, and degree of compaction specified in Section 31 23 00. Frequency of testing shall generally conform to 25 foot maximum spacing for strip footings, each isolated pad footing, every 900 square feet for slabs and mat foundations, or as directed by the Construction Manager in light of actual geometry and conditions extent.
2. Structure Fill: Verify material provided, lift thickness, and compaction density. Frequency of sampling and testing shall be the same as for Subgrade Preparation and Compaction.
3. Structure Backfill: Verify material provided, lift thickness, and compaction density. Frequency of sampling and testing shall be as directed by the Construction Manager but not less than every 2 feet vertical (lifts) and every 1600 square feet of filled area.
4. Other Fill Materials: Verify material used, lift thickness, and compaction density. Frequency of sampling and testing shall be as directed by the Construction Manager.

D. Paving:

1. Earthwork and Base Aggregate: Provide sampling and testing same as Fill described above, and specified in Section 31 23 00. Frequency shall conform to Asphalt Concrete Pavement, below.
2. Asphalt Concrete Pavement: Sample and test pavement thickness and installation per TxDOT Standard Specifications. Thickness verification shall be made at a frequency not to exceed 1600 square feet of roadway or parking zones or as directed

by the Construction Manager.

3. Sitework Concrete at Pavement: Sitework concrete at pavement consists of curbs, gutters, monolithic curb/sidewalk, inlet structures, catch basins, and other concrete construction in contact with paving or necessary for a complete paving job but not associated with buildings, process structures, or structural work. Testing Laboratory shall conduct sampling and testing the same as specified for cast-in-place concrete in Section 03 30 00, except strength cylinder testing shall occur at one-half the frequency (placing rate) as for structural concrete.

E. Concrete Reinforcing:
   1. Mill certificates shall be provided for all reinforcing.

F. Cast-In-Place Concrete:
   1. Sample the first daily truck load of ready mixed concrete and every 50 cubic yards thereafter, complying with ASTM C172.
   2. Perform one slump test for the first daily truck load of ready mixed concrete and every 50 cubic yards thereafter or as requested by Construction Manager if consistency is in question, complying with ASTM C143.
   3. Perform one air content test for each set of compressive strength specimens, complying with ASTM C31.
   4. Fabricate compressive strength specimens, complying with ASTM C39.
   5. Make one set of 6 of compressive strength specimens for each day of structural concrete placing or each 100 cubic yards or fraction thereof for each class of concrete.
   6. Test two specimens after curing 7 days, two specimens after curing 28 days, and retain two specimens for later testing if required.
   7. Comply with ACI 350 Section 5.6 (ACI 318 for non-water retaining structures) for evaluation and acceptance of concrete.

G. Precast Concrete:
   1. Site Inspection of Precast Concrete Structural Assemblies: Visually inspect precast plank, beam, hollow core, or other precast systems after units are set in place, mechanically anchored, reinforcing and details completed but prior to placing concrete or grout which would prevent such inspection. Verify precast pieces conform to expected geometry, bearing conditions and camber.
   2. Completion Of Precast Concrete Structural Assemblies: Inspect reinforcing, placement of concrete or grout fill as specified for those materials.

H. Anchor Bolts and Anchors:
   1. Special Inspections: Provide Special Inspection for wedge anchors, undercut anchors, adhesive anchors, epoxy anchors, and all other anchoring systems installed in hardened concrete and masonry as required by that product's ICBO Evaluation Report, or equivalent.
   2. Site Inspection of Structural Anchor Bolts: Visually inspect all structural anchor bolts

for grade, diameter, embedment, geometry or type (“J” bolt or hex-head), quantity and general location. Contractor shall assume all responsibility for detailed dimensions locating each individual bolt, each bolt group in total, and locations of bolts within each group (template).

I. Grout:

1. Site Inspection of Masonry Grouting: See Masonry section of this specification.

2. Cementitious Grout for Structural Bearing: Visually inspect all column baseplates, and grouted zone between structural struts/beams and their supporting wall elements. Determine complete fill beneath baseplate by tapping with hammer and noting hollow reports. Verify grout conforms to specification by observing empty bags, which Contractor shall leave visible adjacent to area used until inspection complete.

J. Masonry:

1. NOT USED

K. Coating Systems:

1. NOT USED

L. Inspection and Testing of Field Welded Joints

1. All field butt welds shall be inspected as soon as practicable after the welding of the field joint is completed. The Contractor’s Independent Tester shall inspect the joint by ultrasonic methods in accordance with API Standard 1104. All welds that are defective welds, or have defects, shall be removed and that section of joint shall then be re-welded. After the repair is made, the joint shall be checked by repeating the original test procedure, at no expense to the Owner.
2. Fillet welds shall be Contractor tested by method per Magnetic Particle Inspection ASME Section VIII, Div. 1, Appendix VI, or liquid dye penetrant per ASTM E165 - Method A. Defects shall be removed, re-welded, and retested.
3. Repair of Welds: All welds that are defective shall be repaired by the Contractor to meet the requirements of the applicable sections of these specifications. Defects in welds or defective welds shall be removed, and that section of the joint shall then be re-welded. Only sufficient removal of defective material that is necessary to correct the defect is required. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.
4. Joint Air Test: All double lap welds shall be air tested in accordance with AWWA C206.

3.02 EVALUATION AND CORRECTION

A. Evaluation:

1. Satisfactory completion of work will be judged on results of laboratory, shop, and site tests and inspections.

B. Corrections:

1. If results of tests and inspections indicate work is below requirements of Contract Documents, that portion of work is defective and shall be repaired or replaced by the Contractor at no additional expense to the City by methods specified in each material or system's Section. Corrective action shall continue until such work meets the requirements of the Contract Documents.

3.03 SCHEDULE OF INSPECTIONS AND TESTS

A. Form 01 45 29 below shall be used to coordinate sampling and testing provided by Testing Laboratory, Construction Manager, Contractor, and other parties, if any. Testing Laboratory shall fill out Form 01 45 29 with anticipated inspections, sampling, and testing, submit for review by Construction Manager and for information to Contractor, and revise as directed. After receipt of Testing Laboratory's Form 01 45 29 submittal, Contractor shall submit Form 01 45 29 to identify sampling and testing requested for submittal preparation, and with an allowance for additional inspections. Such allowance shall not be less than five percent (5%) of the anticipated Field Quality Control budget for the Testing Laboratory, but shall not contractually commit Contractor to such expenditure, unless additional inspections requested and then only to their extent.

FORM 01 45 29

ANTICIPATED SAMPLING, TESTING, AND INSPECTIONS BY TESTING LABORATORY AND CONTRACTOR

Prepared by:_____Testing Laboratory_____Contractor (check one).

Electronic version available upon request. Expand each cell as necessary to provide a complete scope description.

Specification Section	Source Quality Control	Field Quality Control
31 23 00 – Excavation and Fill		
32 12 16 – Asphalt Paving		
03 20 00 – Concrete Reinforcing		
03 30 00 – Cast-in-Place Concrete		
03 60 00 – Grouting		
32 12 16 – Asphalt Paving		

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies furnishing and maintaining Contractor facilities, utilities, security, permits and other miscellaneous facilities required during construction. The Contractor shall coordinate with the Owner prior to using the Arsenic Treatment Facility and existing tank sites for construction staging areas. The Contractor shall coordinate the location of any other the staging area with the Engineer and Owner at the preconstruction meeting.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 CONTRACTOR'S OFFICE, PARKING AND STAGING AREA

The Contractor's use of a staging area selected by the Contractor, with approval of Engineer and Owner, shall be limited to its portable office, if desired, parking, short-term staging, small parcel deliveries, and short-term construction related visitor parking.

The Contractor shall include in its bid all work necessary to prepare the staging area for use, and to restore the area after its use. After its use the Contractor shall regrade the staging area to its original condition.

If the Contractor requires parking in addition to the staging area space, the Contractor shall decide with the Engineer for a designated parking area. The Contractor shall be responsible for adding a gravel base for any parking area and restoring the space.

3.02 POWER

The Contractor shall provide temporary power for its construction work activities at the project site. The Contractor shall decide with the electrical utility for power service connection points, voltage and phasing requirements, transformers and metering and shall pay all costs and fees arising there from. The Contractor shall provide the special connections required for the Contractor's work.

3.03 TELEPHONE

The Contractor shall provide, for its own use, telephone service at its construction site office. These telephone costs shall be paid by the Contractor.

3.04 WATER FOR CONSTRUCTION

The Contractor shall make his own arrangements for a supply of potable drinking water for his employees and shall keep such supply available always.

Water to be used for construction shall be furnished to the Contractor by the Owner under set conditions and charges. The Contractor shall contact the El Paso Water Utilities at 915-594-5526 for these conditions and an estimation of the fees. The Contractor shall pay for water use at cost, with no mark up.

The Contractor may, with approval of the Engineer, make other arrangements and secure water for construction purposes from a source of his own choosing.

3.05 TEMPORARY HEATING

The Contractor shall provide temporary heating of the buildings and enclosures as necessary to protect all work and material against damage by dampness and cold and to facilitate completion of the work. The Contractor shall supply all the fuel, equipment and materials required for temporary heating.

3.06 PERMANENT FACILITIES

Unless otherwise authorized by the Engineer, the Contractor is specifically prohibited from utilizing permanent facilities, such as air compressors, pumps, heating and ventilation equipment, water, air and power systems, cranes and hoists, in the construction of the project.

3.07 SANITARY FACILITIES

The Contractor shall provide toilet facilities for its work force at the site of work. The facilities shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

3.08 STORAGE AND WORKSHOP FACILITIES

The Contractor shall provide acceptable on-site storage facilities for the protection of equipment, materials, supplies and fabricated items. Workshop facilities shall be provided to assure that the environment for all on-site assembly and fabrication is maintained. Storage and workshop facilities shall be in the Contractor's staging area.

3.09 TOOLS AND EQUIPMENT

The Contractor shall supply all necessary tools and equipment for accomplishing the work. Unless otherwise indicated, no tools and equipment will be available for the Contractor's use.

3.10 BARRIERS AND SIGNS

A. CONSTRUCTION FENCE:

The Contractor or designee shall erect and maintain, during the construction period, fences which shall enclose the designated areas of the site. Construction fences shall be erected at locations requiring safety measures to prevent pedestrians or vehicles from entering hazardous areas. Also, any perimeter security fences that are removed to accommodate new work shall be temporarily replaced with a construction fence. Gates shall be provided at access points where required and these shall be kept locked during off-work hours. Provide barriers to prevent unauthorized entry to site or construction areas and to protect existing facilities from damage during construction and demolition operations.

B. CONSTRUCTION SIGNS:

NOT USED

3.11 DAMAGE TO EXISTING PROPERTY

Contractor will be held responsible for any damage to existing structures, work, materials or equipment because of its operations, and shall repair or replace any damaged structures, work, materials or equipment to the satisfaction of, and at no additional cost to the Owner.

Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring or other work necessary for such protection.

Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, signs or other public or private property, which may be caused by transporting equipment, materials or workers to or from the work site. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

All areas affected by the pipe placement shall be restored to their original condition or better. All county, state, and railroad guidelines, specifications and ordinances that may affect the existing structures shall be adhered to.

3.12 CONTRACTOR'S SECURITY

The Contractor shall be responsible for the security of its equipment and material on the site.

3.13 DISPOSAL SITE

The Contractor shall make provisions for a legal, off-site debris disposal site. Contractor is responsible for disposing of any asbestos cement pipe that is removed during repairing or connecting to the water distribution system.

3.14 PUBLIC ACCESS AND HAUL ROADS

The Contractor shall comply with all laws and regulations, including posted speed limits. All streets used by Contractor's trucks or any other equipment hauling material to and from the area, shall be kept clean by the Contractor and shall be continuously serviced by the Contractor's use of sprinkling trucks to alleviate dust.

Where the Contractor's haul operations cause material to be deposited on public roads, the Contractor shall have the material removed with a power broom as soon as practicable, but no later than the end of the working day. If deemed necessary by the Engineer or the responsible road agency, the Contractor shall clean the area using a power washing truck or vacuum broom, at no additional cost to the Owner.

Cleaning, sprinkling, and dust palliative application shall be at the Contractor's expense.

Any damage to roadway surfaces as the direct or indirect result of the Contractor's operation shall be repaired by the Contractor to the satisfaction of El Paso County Roads and Bridges and the Engineer.

The Contractor shall be responsible for obtaining all necessary street use permits in connection with Contractor's operations.

The Contractor shall comply with the requirements of Section 01 35 43.

END OF SECTION

SECTION 01 55 26

TRAFFIC CONTROL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work consists of furnishing, erecting and maintaining temporary barricades, signs, flaggers, lights, road surfaces, detours and other safeguards necessary to protect life, health and safety of the public during performance of project work along City of El Paso right-of-way (ROW), TXDOT ROW, City of El Paso Parks property and El Paso Water property.

1.02 REFERENCE STANDARDS

A. Manual on Uniform Traffic Control Devices (MUTCD), Chapter 6, Temporary Traffic Control, in the version adopted by the Texas Department of Transportation.

B. TxDOT: Standard Specifications for Construction of Highways, Streets and Bridges, most recent addition.

1.03 CONSTRAINTS

A. A traffic control plan shall be provided by the Contractor and approved by the jurisdictional agency. The traffic control shall be utilized on all City, State and Private streets, dirt roads and streets intersecting the pipeline route while the pipeline is being installed. Street closures will only be allowed with written permission from the jurisdictional agency.

B. No spoils shall be placed on Roads, unless permission is granted from the jurisdictional agency. No private entrances on driveways shall be blocked at any time during construction. The Contractor shall be responsible for providing, erecting and maintaining temporary barriers, signs, flaggers, lights, road surfaces, detours and other safeguards necessary to protect life, health and safety of the public during performance of the work as called for in the traffic control plans.

1.04 JOB COORDINATION

A. The Contractor shall be responsible for coordination of all construction to offer the least possible obstruction and inconvenience to the public and shall have under construction no greater length or amount of work than can be prosecuted properly with due regards to the rights of the public. The Contractor shall not open sections of work and leave them unfinished but shall finish work in process insofar as practicable.

B. Revisions to the traffic control plans shall be coordinated with the jurisdictional agency and the Engineer. Traffic controls shall be kept in operation unless otherwise directed for the benefit of the traveling public during progress of the work. Signs and other

traffic control devices damaged or lost by the Contractor shall be replaced or repaired by the Contractor at no cost to the Owner.

C. Existing street lighting systems shall be kept in operation during progress of the work.

1.05 NOTIFICATIONS

A. Contractor shall notify the residents and businesses 10 working days prior to commencing work and 1 day prior to digging in the area. Notification (door flyer) regarding work performed shall be in such detail as to give the time of commencement and completion of work, schedule of operation, routes of detours, Contractor contact name and title and emergency contact number etc. Door Flyers shall be written in both English and Spanish.

B. Notification to the jurisdictional (City, TxDOT, EPWater) personnel regarding work performed shall be in such detail as to give the time of commencement and completion of work, schedule of operations, routes of detours, etc.

1.06 CONSTRUCTION AND MAINTENANCE OF DETOURS

A. The Contractor shall construct, maintain in a safe condition, keep open to traffic, and remove detours that will accommodate diverted traffic during construction.

1.07 SUBMITTALS

A. The Contractor shall submit copies of the Traffic Control Plan to the jurisdictional agency (when working in or near their right-of-way) for review and approval. A copy of the approved Traffic Control Plan shall be submitted to the Engineer.

PART 2 PRODUCTS

2.01 SPECIAL SIGNS

Signs with special or non-standard messages shall properly convey information to the motorist. The Contractor shall be responsible for installing and maintaining these signs. Signs shall be in accordance with the requirements of the standards referenced in Paragraph 1.02 of this section.

PART 3 EXECUTION

3.01 TRAFFIC MAINTENANCE

A. The Contractor shall take all necessary measures to maintain a normal flow of vehicles, to prevent accidents, and to protect the work throughout the construction stages until completion of the work. The Contractor shall make the necessary arrangements to reroute traffic, provide and maintain barriers, cones, guards, barricades, and construction warning and regulatory signs. All regulatory devices provided by the Contractor shall be suitable for nighttime operation. The Contractor shall take effective measures necessary to protect all other portions of the work during construction on

weekdays, weekends, holidays, and until completion. This includes providing and maintaining all barricades, lights, construction signs, guards, temporary crossovers, and flaggers in accordance with the standards referenced in Paragraph 1.02 of this section. Contractor shall inspect traffic control every weekend to determine if all barrier cones, guards, barricades, construction warning and regulatory signs are standing upright and warning lights are functioning properly.

3.02 SAFETY

A. The Contractor shall provide safeguards, safety devices and protective equipment, and take any other needed actions, on its own responsibility or as the Engineer may determine reasonably necessary, to protect life, health and safety of the public and to protect property in connection with the performance of work covered by the Contract.

B. The Contractor shall provide such flaggers, signs and other devices, and shall erect and maintain all barricades, guards, standard construction signs, warning signs and detour signs, as are necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations.

C. Where flaggers are employed by the Contractor to safeguard traffic, the flaggers' equipment shall be in accordance with the referenced standards.

D. Any standard signs as well as any other signs prescribed by the Engineer necessary for the work shall be furnished by the Contractor. The Contractor shall erect signs on posts and supports and maintain them at its own expense in a neat and presentable condition until the necessity for them has ceased. When the need for any signs has ceased, the Contractor, upon approval by the Engineer, shall take down such signs. All control signs necessary for nighttime traffic control, or remaining in place during the night, shall be fully reflectorized.

E. The Contractor shall patrol traffic control areas and reset all disturbed signs and traffic control devices immediately. All non-applicable signs shall be removed or covered during periods not needed.

F. Upon failure of the Contractor to provide immediately such flaggers and provide, erect, maintain, and remove such barricades and lights, and erect, maintain, and remove standard signs when ordered to do so by the Engineer, the Engineer shall be at liberty, without further notice to the Contractor and the Contractor's Surety, to provide the necessary flaggers, to provide, erect, maintain, and remove barricades and lights, and to erect, maintain, and remove standard signs and deduct all of the costs thereof from any payments due or coming due the Contractor.

G. The Contractor shall be responsible for providing adequate flaggers, barricades, lights and signs for protection of the work and the public at all times regardless of whether or not such flaggers, barricades, lights and signs are ordered by the Engineer, and the Contractor and the Contractor's Surety shall be liable for injuries and damages to persons and property suffered by reason of the Contractor's operations or any negligence in connection therewith.

H. In the event any traffic signal or beacon is made inoperative by or at request of the Contractor, the Contractor shall at no cost to the Owner provide a uniformed flagger or suitable traffic control devices for control and movement of traffic during the time that the signal or beacon is inoperative. The types of traffic control devices used shall be subject to review and acceptance by the Engineer.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 GENERAL

1.01 DAMAGE

A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Construction Manager.

1.02 PIPE

A. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

PART 2 EQUIPMENT

2.01 PACKAGE AND MARKING:

A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.

B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.

2.02 IDENTIFICATION:

A. Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

2.03 SHIPPING:

A. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.

B. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.

2.04 FACTORY APPLIED COATINGS:

A. Unless otherwise specified, each item of equipment shall be shipped to the site of the work with the manufacturer's shop applied epoxy prime coating. The prime coating shall be applied over clean dry surfaces in accordance with the coating manufacturer's recommendations. The prime coating will serve as a base for field-applied finish coats.

Electrical equipment and materials shall be painted by manufacturer as specified in Section 09 90 00-3.03 Electrical and Instrumentation Equipment and Materials.

2.05 STORAGE:

A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.

B. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

2.06 PROTECTION OF EQUIPMENT AFTER INSTALLATION:

A. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.01 STRUCTURES

A. The Contractor shall take all precautions necessary to protect the integrity and usefulness of all existing plant facilities. If necessary, the Contractor may, with the approval of the Owner, remove such existing structures, including curbs, gutters, pipelines and utility poles as may be necessary for the performance of the work, and shall rebuild the structures thus removed in as good a condition as found with the requirements specified. He shall also repair existing structures which may be damaged as a result of the work under this contract.

1.02 ROADS AND STREETS

A. Unless otherwise specified, roads and streets in which the surface is removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be resurfaced and brought to the original grade and section. Roadways used by the Contractor shall be cleaned and repaired. Before resurfacing material is placed, edges of pavements shall be trimmed back far enough to provide clean, solid, vertical faces, and shall be free of loose material. All paved surfaces shall be cut with a pavement saw. Rough cuts are not allowed. Repair work shall conform to the paving specifications.

1.03 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS

A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored as nearly as possible to their original condition. Restoration shall take place within 1 week or sooner as directed by the Construction Manager.

B. Existing guard posts, barricades, and fences shall be protected and replaced if damaged.

1.04 PROTECTION OF EXISTING INSTALLATIONS

A. The Contractor shall protect all existing operating facilities and structures from damages. However, if damage occurs, the Contractor shall immediately correct or replace existing equipment, controls, systems, structures, or facilities which are damaged in any way as a result of his operations.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SCOPE

A. Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.

B. O&M instructions must be submitted and accepted before on-site training may start.

1.02 TYPES OF INFORMATION REQUIRED

A. General:
   1. O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.

B. Operating Instructions:
   1. Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:
      a. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
      b. Operator Prestart: Provide requirements to set up and prepare each system for use.
      c. Start-Up, Shutdown, And Postshutdown Procedures: Provide a control sequence for each of these operations.
      d. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.
      e. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
      f. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.
      g. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

C. Preventive Maintenance:
   1. The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

a. Lubrication Data: Provide lubrication data, other than instructions for lubrication in accordance with paragraph 1.02 Operator Service Requirements.
    1) A table showing recommended lubricants for specific temperature ranges and applications;
    2) Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and
    3) A lubrication schedule showing service interval frequency.
b. Preventive Maintenance Plan And Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

D. Corrective Maintenance:
1. Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.
    a. Troubleshooting Guides And Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
    b. Wiring Diagrams And Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
    c. Maintenance And Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.
    d. Removal And Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test and illustrations.
    e. Spare Parts And Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.
    f. Corrective Maintenance Manhours: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

E. Appendices:
1. The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

a. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

b. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

c. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

d. Testing Equipment And Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.03 TRANSMITTAL PROCEDURE

A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01 33 00 accompanied by Transmittal Form 01 78 23-A and Equipment Record Forms 01 78 23-B and/or 01 78 23-C, as appropriate, all as specified in Section 01 99 90. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.

B. Three (3) copies of the specified O&M information shall be provided. Digital copies will not be acceptable. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information. One electronic copy(PDF format) of the complete FINAL O&M shall be provided.

C. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

1.04 PAYMENT

A. Acceptable O&M information for the project must be delivered to the Construction Manager prior to the project being 65 percent complete. Progress payments for work in excess of 65 percent completion will not be made until the specified acceptable O&M information has been delivered to the Construction Manager.

1.05 FIELD CHANGES

A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the Contractor to reflect any field changes or information requiring field data.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 DRAWINGS

A. Record drawings refer to those documents maintained and annotated by the Contractor during construction and are defined as
   1. a neatly and legibly marked set of contract drawings showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;
   2. additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the specifications; and
   3. Contractor layout and installation drawings.

B. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Construction Manager during normal working hours at the Contractor's field office. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Construction Manager.

C. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:
   1. Additions - Red
   2. Deletions - Green
   3. Comments - Blue
   4. Dimensions - Graphite*

**Legibly mark to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.*

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 99 90

REFERENCE FORMS

PART 1 FORMS

1.01 DESCRIPTION

A. The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01 33 00-A	Submittal Transmittal Form
01 78 23-A	Operation and Maintenance Transmittal Form

01 33 00-A. SUBMITTAL TRANSMITTAL FORM

Submittal Transmittal

Submittal Description:	Submittal No:[1]	Spec Section:

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:
☐ Attached
☐ Under separate cover via _____
☐ Submittals for review and comment
☐ Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action[a]	Reviewer initials	Review comments attached

[a]*Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected*
Attach additional sheets if necessary.

Contractor

Certify either a or b:

a. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).

b. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature: _____

[1]See *Section 01 33 00-1.04. A, Transmittal Procedure.*

01 78 23-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date:	Submittal No:[2]
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist	Contractor		Construction Manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks:

Contractor's Signature :

[2] See Section 01 33 00-1.04.A, Transmittal Procedure.

THIS PAGE INTENTIONALLY LEFT BLANK

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 02 32 23

GEOTECHNICAL MONITORING DURING CONSTRUCTION
(VIBRATION AND SETTLEMENT MONITORING)

PART 1 GENERAL

1.01 SUMMARY

A. This section includes requirements for vibration and settlement monitoring for all structures and utilities within 100 feet of any excavation, tunneling, shoring, and backfill operations.

B. The Contractor shall provide all labor, materials, equipment and incidentals required to install, operate, and maintain geotechnical instruments and survey monitoring points for the purpose of monitoring construction vibration and settlement. The Work shall include, but not limited to installing and monitoring crack gages, observation wells, settlement markers, determining ambient vibration levels, and furnishing and measuring vibrations with seismographs.

C. Settlement monitoring points shall provide reference points for monitoring vertical and horizontal ground and structure movement and to establish a baseline record of such movement.

D. Measurements of ground and structure movement shall provide the basis for implementation of remedial measures to prevent possible damage to structures and utilities. Remedial measures, if necessary, include modifications of construction procedures, repair or replacement of damaged facilities, and restoration to original conditions of any disturbed property, structure or utility.

E. The Contractor shall keep the Engineer informed of the monitoring measurements; however, it shall be the Contractor's sole responsibility to protect onsite structures and utilities and all adjacent structures and utilities within 100 feet of any excavation, tunneling, shoring, and backfill operations. Any damage caused to any of these structures or utilities by the Contractor shall be repaired and restored by the Contractor immediately and at the Contractor's expense.

F. The Contractor is advised existing utilities and underground interference may be encountered during the Work. The Contractor shall be responsible to clear subsurface obstructions as part of the Work. No additional payment shall be made for the clearing of obstructions which are not accounted for in the Contractor's Bid. It is anticipated that all existing utilities will be removed prior to commencing this project. If utilities are encountered, the Contractor shall protect the utility in place and immediately notify the Engineer. The Engineer will determine if the utility is to be removed, reconstructed, or abandoned.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
   1. Section 01 14 19, Use of Site

2. Section 31 23 00, Excavation and Fill
3. Section 33 05 23, Trenchless Utility Installation

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A36 – Standard Specification for Carbon Structural Steel
   2. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized), Welded and Seamless for Ordinary Uses
   3. C150 – Standard Specification for Portland Cement
   4. D1785 – Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120
   5. D2488 – Standard Practice for Description and Identification of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO)
   1. H20 – Wheel Loads

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 Submittals.

B. The Settlement Monitoring Plan shall be prepared by a qualified geotechnical specialist with experience with instrumentation and shall have a minimum of five (5) years of experience in the installation, maintenance, and data collection using the specified instruments. The Settlement Monitoring Plan and resume outlining the qualifications of the qualified geotechnical specialist shall be reviewed and accepted by the Engineer.

C. Settlement monitoring points are indicated on the plans at casing installation locations which include surface monitoring point (SM), settlement control point array (SA), and utility monitoring points (UMP). Additional monitoring points shall be supplemented as recommended by the geotechnical specialist.

D. The Settlement Monitoring Plan shall also include UPRR Track and Ground Monitoring requirements specified in Section 1.06.

E. The Contractor shall submit a Settlement Monitoring Plan which shall include, but not be limited to:
   1. Individuals responsible for all monitoring, report writing, and format of reporting.
   2. Equipment to be used and its limitations.
   3. Quantity and location of all instruments and survey settlement measurement monitoring points.
   4. Schedule and sequencing of monitoring activities.
   5. Daily field data recording sheets.
   6. An updated list and testing is required when equipment is brought to the site which has not been previously tested for this Project.

F. Manufacturer's certifications that all instruments and materials meet the requirements of this specification.

G. Shop Drawings: Shop drawings for the seismographs and crack gauges shall be submitted with the Settlement Monitoring Plan. At a minimum, seismograph drawings shall include the locations of sensors, attachments, and readouts. Crack gauge drawings shall include locations, dimensions, method of attachment, and accuracy of the gauges. All instrumentation locations may be submitted on a single shop drawing.

H. Monitoring Records: Monitoring data shall be submitted to the Engineer on a daily basis following the conclusion of each measurement.

1.05 MONITORING POINTS, INDICATORS, AND CASINGS

A. The Contractor shall install additional settlement points/indicators at locations identified in the Settlement Monitoring Plan. Observation wells monitoring locations are not shown on the Plans and shall be determined by the Contractor with the review and acceptance of the Engineer when dewatering activities are required.

B. For additional monitoring locations after the Settlement Monitoring Plan is accepted, the Contractor shall submit to the Engineer in writing the description and proposed locations of such additional settlement and piezometer points, indicators, and casings and submit details of subsurface indicators, including installation details.

1.06 UPRR TRACK AND GROUND MONITORING

A. General requirement
   1. Temporary lighting may also be required by the Railroad to identify tripping hazards to train crewmen and other Railroad personnel.
   2. Any excavation, holes or trenches on the Railroad property shall be covered, guarded and/or protected. Handrails, fence, or other barrier methods must meet OSHA and FRA requirements.
   3. Track and ground monitoring are required.
   4. Additional monitoring may be required by the Railroad on a case by case basis.

B. Monitoring schedule
   1. Monitoring shall commence once any construction activity for the pit excavations have commenced.
   2. Monitoring shall continue, after installation is complete, for 30 days after installation and backfill of the crossing and pits or as required by the Railroad.

C. Track Monitoring
   1. Track Deflection Limits
      a. The top of rail shall not permanently deflect more than ¼ inch vertical or horizontal.
   2. Targets
      a. Track monitoring shall not require track access other than to place the track monitoring targets.
      b. Monitoring targets should be placed such that monitoring is possible when a

train is present. However, monitoring during the passing of a train is not required as the train will temporarily deflect the track.

c. Adhesive backed reflective targets may be attached to the side of the rail temporarily. Targets should be removed once monitoring phase is complete.

3. Monitoring Plan
   a. If the top of rail does deflect more than 1/4 inch, all operations shall stop until the matter is resolved.
   b. Provide established contingency plan, See Section 2.D, in the event of ground loss and/or the rail deviates ¼ inch vertical or horizontal.
   c. Establish a bench mark in the vicinity of the construction. Establish locations for shooting elevations on the top of rail at each area of construction.
      1. Example locations for shooting rail elevations would be at:
      - At the centerline of an under track crossing.
      - At both outside edges of the crossing. ie. For a wide excavation.
      - At multiple locations from the crossing/excavation edge but no less than 10, 20, 30, 40 and 50 feet from the crossing.
   d. Monitoring shall be continuous and recorded in a field log book dedicated for this purpose. Copies of these field log entries can be made available to all concerned parties upon request at any time during construction.
4. Ground Monitoring
   a. Provide means for monitoring ground settlement. Submit monitoring plan for Railroad review.
   b. Ground monitoring points should be in alignment above the proposed construction activities.
5. Contingency Plans
   a. The Contractor shall supply Contingency Plan(s), which anticipate reaching the Threshold and Shutdown values, for all construction activities which may result in horizontal and/or vertical track deflection.
      a. Track monitoring values:
         1. Threshold value = 1/8 inch permanent vertical or horizontal deflection
         2. Shutdown value = 1/4 inch permanent vertical or horizontal deflection
   b. The Contingency Plans shall provide means and methods, with options if necessary.
   c. The Contractor should anticipate the need to implement each Contingency Plan with required materials, equipment and personnel.
      1. Once the Threshold value is met, the contractor shall determine the appropriate Contingency Plan(s) and immediately discuss this plan with, and receive approval confirmation from, the Railroad.
      2. Once the Shutdown value is exceeded all project work shall stop and the chosen Contingency Plan shall commence.
         a. The Railroad may choose to allow and/or require the immediate implementation of specific approved Contingency Plans, submitted by the Contractor, once the Shutdown value is exceeded.

PART 2 PRODUCTS

2.01 SEISMOGRAPHS

A. The vibration monitoring equipment (seismograph) shall be portable so that it can easily be moved around the construction site to monitor vibrations caused by construction activities. The equipment system shall be specifically designed for measuring the level of ground vibrations resulting from construction activities (e.g., sheet piling, etc.). In addition, the vibration monitoring equipment shall be capable of measuring vibrations on pipes (i.e., steel, HDPE, etc.). This portable vibration monitoring equipment (seismograph) shall consist of a sensor(s), an indicator readout, and any other minor incidental system components (e.g., cables or wiring) required to perform the specified monitoring. All system components shall be of the same manufacturer unless otherwise approved for use by the manufacturer in writing.

B. The vibration monitoring equipment shall be of compact design and rugged construction. The physical and operational parameters of the vibration monitoring equipment (seismograph) system shall be as follows, unless otherwise accepted by the Engineer:

1. Seismic Requirements:
    a. Range: 0 to 9 inches/second (seismic)
    b. Trigger Levels: 0.02 to 0.25 inches/second (maximum)
    c. Accuracy: 3% at 15 Hz
    d. Acceleration, Velocity, and Displacement: Calculated using entire waveform, not estimated at peak
2. Sampling Rate: Standard 1024 samples per second per channel
3. Record Modes: Manual and trigger with full waveform recording
4. Minimum Record Time: 1 to 10 seconds in 1 second increments, plus 0.5 second pre-trigger
5. Event Storage / Printing:
    a. Full Wave Events: Storage of a minimum of 90 events
    b. Summary of Events: Storage of a minimum of 250 events
    c. Equipment shall be capable of printing event results in the field
6. Environmental Operation Temperature Range: 5 °F to 122 °F
7. Channel Inputs: A minimum of 4 channel inputs for each seismograph

C. Vibration Monitoring Equipment Manufacturers:

1. Instantel, 362 Terry Fox Drive, Kanata, Ontario, Canada, K2K 2P5, (800) 267 9111; Thomas Instruments, P.O. Box 50, Route 9, Spofford, NH 03462, (800) 343-0833; Bison Instruments, 5610 Rowland Road, Minneapolis, MN 55343, (612) 931-0051; or equal

2.02 CRACK GAUGES

A. General:

1. Mechanical crack gauges shall be used to measure the expansion and contraction of joints on existing structures. The gauges shall be secured on either side of the joint and be capable of sensing movement in expansion and contraction.

2. The gauges shall allow for surficial monitoring for taking manual measurements.
3. The mechanical crack gauges shall be of compact design and rugged construction.

B. Gauge Requirements:

1. Gauges shall be capable of measuring movements in the longitudinal direction of at least 0.75 inches and of at least 0.375 inches in the transverse direction.
2. Gauges shall operate properly within a temperature range of 5°F to 105°F.
3. Gauge material shall have a coefficient of thermal expansion specified by the manufacturer. This value, along with the air temperature at the time of the reading shall be used to calculate the movement of the joint, unless otherwise specified by the manufacturer.
4. The gauge shall have an approximate precision of at least +/- 0.05 inches.

C. Mechanical Crack Gauge Equipment Manufacturers: Crack gauges shall be manufactured by Avongard Products, U.S.A., Ltd., P.O. Box 50940, Irvine, CA 92619-4620, (800) 244-7241; PRG, P.O. Box 1768, Rockville, MD 20849-1768, (800) 774-7891; or equal.

2.03 MONITORING LOCATIONS

A. Settlement Monitoring: Settlement data shall be collected by the Contractor's surveyor accepted by the Engineer for this work and submitted to the Engineer for record purposes on the same day the data is collected.

1. Structural monitoring shall be required by the Contractor on the adjacent buildings or surface features. Locations of surface features to be monitored shall be identified in accordance with Section 01 32 36, Preconstruction Condition Survey. The Contractor shall plan for structural monitoring of all adjacent structures within 50 feet of the center line of the pipe and excavated shafts, and up to 10 additional structures identified by the Engineer.
2. Surface settlement markers to be P.K. nails / rebar placed at the trenchless crossing locations and as shown on the plans.
3. Settlement to be determined by optical survey methods for surface point indicators. Placement and access to settlement markers on TXDOT right-of-way shall be coordinated with local TXDOT field inspector.
4. Contractor shall set settlement and horizontal movement points at midpoint along the top of each shaft wall.
5. The accuracy of the optical survey methods shall be within 0.010 foot.
6. Contractor shall provide cased settlement points on selected utilities existing adjacent to or crossing the construction as directed by the Engineer. An estimated eighteen monitoring points are to be installed as part of the project and as shown on the plans.
7. Contractor shall monitor elevations of settlement points before, during and after any construction activity within 50 feet of the points.
8. Specific settlement monitoring points have been specified on the plans. Additional points shall be identified per the Contractor’s Settlement Monitoring Plan.

2.04 ADDITIONAL INSTRUMENTATION

A. The Contractor shall provide and install additional instrumentation, as necessary, to ensure the satisfactory monitoring and protection of existing structures that may be damaged as a result of the Contractor's means and methods used to perform the Work.

PART 3 EXECUTION

3.01 INSTRUMENT INSTALLATION AND EQUIPMENT PROCUREMENT

A. All instruments shall be installed at accepted locations and elevations by the Engineer.

B. Prior to installation, measurements appropriate to the type of instrument and as recommended by the manufacturer shall be taken in the field office immediately following receipt and shall be compared to the measurements recorded at shipment by the manufacturer. These measurements shall be logged and any discrepancy between the manufacturer's measurements and those taken in the field shall be evaluated. If the difference exceeds the tolerances recommended by the manufacturer, these instruments shall be immediately returned after confirmation with the manufacturer.

3.02 SEISMOGRAPH

A. Construction activities shall be implemented in a manner that prevents damage to all existing features in the vicinity. Such features may include existing treatment and office facilities, residential structures, driveways, property walls, sidewalks, curb and gutter, or adjacent utilities. Potential damage from vibrations includes cracks developing in brick, concrete and drywall, separation of joints, piping leaks, jammed doors and windows, and falling of objects.

B. Seismographs shall be mounted on structure locations determined during the condition survey as well as all adjacent structures within 50 feet of any excavation or as specified in the accepted Settlement Monitoring Plan. The seismograph units shall be located a minimum of every 100 feet along the length of a particular excavation or structure.

3.03 CRACK GAUGES

A. Crack gauges shall be placed across all existing cracks or mechanical joints along walls of the structures, the locations of which shall be determined during the condition survey prior to the commencement of any excavation or sheet pile work. The gauges shall be attached to the existing structure using mechanical methods specified by the manufacturer.

3.04 MINIMUM MONITORING CRITERIA

A. The Contractor shall retain the services of the qualified geotechnical instrumentation specialist to prepare the Contractor's Settlement Monitoring Plan and to supervise the monitoring work. All data shall be recorded and submitted to the Engineer on a daily basis to keep Engineer informed of the effects of the Contractor's work.

B. Whenever construction activities occur within a distance of 50 feet or less of existing features, the Contractor shall monitor for vibrations as follows: Record vibration for the typical construction activity over a duration sufficiently long to capture the typical vibrations generated during that activity, using a seismograph. Record vibration in terms of Peak Particle Velocity in inches per second. Submit all recorded data to the Engineer as it is generated, both the raw data, and the data organized in a spreadsheet.

C. Seismographs: The Peak Particle Velocity (PPV) shall be continuously recorded by the Contractor during site work. The PPV shall not exceed 0.5 inch/sec at frequencies less than 15 Hz for any reason. The PPV shall not exceed 0.75 inch/sec between frequencies 15Hz and 40Hz. The PPV shall not exceed 2.0 inch/sec at frequencies greater than 40 Hz for any reason. The Contractor shall report any excessive PPV values immediately to the Engineer. The Engineer reserves the right to modify (increase or decrease) the PPV if field conditions warrant. The Contractor will modify his means and methods to meet the requirements of this specification.

D. Crack Gauges:
   1. If during the course of construction the crack gauges begin to reach the limits of expansion or contraction measurement, and no corrective actions are required by the Contractor, the Contractor shall install another crack gauge directly adjacent to the existing gauge. Consequently, the Contractor shall monitor both gauges to measure the total movement of the structure.
   2. The crack gauges shall be read by the Contractor two times a day (at the start and end of the day). The Contractor shall immediately stop work and notify the Engineer of any measured movement exceeding 0.1 inches.

3.05 SETTLEMENT

A. Unless otherwise directed by the Engineer, the Contractor shall perform monitoring at those locations indicated in the Earthwork Monitoring Plan.

B. The Contractor shall record the readings prior to, during, and after construction, including dewatering activities.

C. These readings shall be submitted on the same day the readings are taken on forms acceptable to the Engineer.

D. The readings shall be, at a minimum, at the following frequency and intervals:

When	Frequency
Prior to construction	For two weeks, every seven days
During construction within 200 feet of tunnel face	Twice Daily of settlement point
After construction	For one month, every 7 days

E. All elevations shall be referenced to fixed points which are a minimum of 50 feet away from all excavations to assure that the reference points remain accurate. Any settlement noted shall be reported to the Engineer immediately for evaluation.

F. Settlement monitoring points shall be installed, monitored, protected, maintained and removed and the area restored to a minimum of preconstruction condition.

3.06 CONDITION SURVEYS

A. Preconstruction pictorial and/or audio/video survey of the area along the work route shall be performed by the Contractor with assistance from Engineer in accordance with Section 01 32 36, Preconstruction Condition Survey. Additional preconstruction condition survey may be performed at the discretion of the Engineer.

B. It is the Contractor's responsibility to assist Engineer in the recording of all pre-construction cracks and settlements in adjacent buildings and structures. The Contractor shall document the conditions along with Engineer and confirm accuracy.

C. Post-construction condition surveys shall be performed by Engineer and assisted by the Contractor to verify that existing conditions were not altered during construction.

3.07 LAND SURVEYING

A. Land surveying requirements shall be in accordance with Section 01 32 23, Survey and Layout Data.

3.08 EMERGENCY MEASURES

A. Whenever there is a condition which is likely to endanger the stability of the excavation or adjacent structures and utilities as indicated by the periodic collection of data or by visual observations, operate with a full crew for 24 hours a day, including weekends and holidays, without interruption, until those conditions are controlled and no longer jeopardize the stability of the work or adjacent structures.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 02 61 00

REMOVAL AND DISPOSAL OF CONTAMINATED SOIL

PART 1 GENERAL

1.1 DESCRIPTION

A. This section includes the preparation of a Contaminated Material Management Plan (CMMP) prepared by the Contractor's Environmental Professional, who shall be a Texas Registered Professional Environmental Engineer, a Texas Registered Geotechnical Engineer or Texas Registered Geologist with a minimum 5 years experience preparing CMMP's.

B. The Contractor shall provide detailed design services, materials, equipment, tools, labor, and supervision and incidentals required to prepare and execute the CMMP.

C. The CMMP shall include requirements for excavating, handling, stockpiling, temporarily storing, and/or disposing of existing contaminated material (e.g., soil, water, debris) either known or unknown to exist that may be encountered during the work.

D. Hazardous materials shall be identified in accordance with regulatory requirements. This section also includes procedures applicable to Contractor's generation, use, and/or release of hazardous or contaminated substances in the course of Contractor's operation, for which Contractor is responsible.

E. Environmental data provided as reference information.

F. Owner will have an onsite Certified Industrial Hygienist coordinating with the environmental firm. Contractor shall coordinate directly with Owner's onsite representative to coordinate the requirements of this specification.

1.2 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. It is the Contractor's responsibility to perform all work required by the Contract Documents. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. 31 23 00 Excavation and Fill

1.3 DEFINITIONS

A. Hazardous material is listed as hazardous by EPA and has hazardous characteristics as identified in 30 Texas Administrative Code as defined by the Texas Commission on Environmental Quality (TCEQ).

B. Samples. Physical examples that illustrate materials, equipment, or workmanship and establish standards by which the work will be judged.

C. Exclusion Zone. The contaminated area of the site requiring personal protective equipment to minimize human exposure to chemicals of concern.

1.4 GENERAL REQUIREMENTS

A. Potentially hazardous materials, or contaminated soils and/or water, will be encountered during the work that may require excavation, handling, stockpiling, temporary storing, and disposal. The Contractor shall classify and manage the soils in accordance with applicable statutes and regulations.

B. Potential contaminants that may be encountered may include petroleum hydrocarbons, lead, mercury, metals, and land fill materials (dark stained soils).

C. The extent of known contaminated materials and the types of known contaminants are provided in reference information. Notify the Engineer immediately if contaminated substances are discovered that were not previously identified or assumed, or if other discrepancies between data provided and actual field conditions discovered. Dark stained soils were encountered at depths ranging from 2.5 to 9 ft as indicated in Table 1 below, and between Station 0+00 and 20+73. Dark stained soils encountered shall be removed in their entirety and replaced with Select Fill material to a depth of 12 inches below the stained soil along the pipeline trenching limits. These soils shall follow testing, removal, storage, transportation and disposal requirements specified in the Contractor's CMMP as required by regulatory agencies. Refer to Section 31 23 00 Excavation and Fill for select fill requirements.

Table 1 - Dark Stained Soils

Borehole No.	Depths in Feet
2B-26	5 – 7½
2B-27	5 – 7½
2B-28	2½ – 5
2B-29	2½ – 5
2B-30	2½ – 5
2B-31	2½ – 7½
2B-34	2½ – 9

D. Conduct work in accordance with direction received from the Engineer; with the accepted CMMP; and with applicable federal, state, and local statutes, regulations, and guidance.

E. Obtain all required permits and notifications for removal (excavation/dewatering), storage, transportation, and disposal of contaminated material, including sanitary sewer discharge. Permits shall be obtained at no additional cost to the Owner.

F. Contractor shall be responsible for the collection, sampling (for permit compliance or disposal facility requirements), treatment (if necessary), and disposal of water (sump water and dewatering effluent). Water disposal may be permitted for sewer discharge or taken offsite for disposal at licensed facility.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 Submittals.

B. Submit CMMP to the Engineer for review and acceptance within 21 Days after Notice to Proceed. No work, with the exception of site inspections and surveys, shall be performed until the CMMP is accepted. The Contractor shall allow 14 days in the schedule for the Engineer's review. No adjustment for time or money will be made if re-submittals of the CMMP are required due to deficiencies. At a minimum, the CMMP shall include:

1. Schedule of activities
2. Waste classification, landfill selection and soil disposal.
3. Soil excavation and segregation.
4. Confirmation soil sampling.
5. Stained or contaminated soils shall not be reused onsite.
6. Temporary stockpiling of contaminated soil. Best management practices for temporary erosion and sediment control.
7. Loading and Transportation.
8. Identify personal protective equipment.
9. Spill Prevention Plan
10. Spill Contingency Plan, including procedures for documenting and reporting to the Engineer encounters with and releases of hazardous or contaminated material. Identify spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment.
11. Borrow sources and haul routes.
12. Decontamination procedures.
13. Methods and procedures of excavation and equipment to be used
14. Shoring or side-wall slopes proposed
15. Staging and storage (stockpiling) methods, procedures, and locations for segregating contaminated and potentially contaminated soils (based on soil categories), providing for runoff, leaching, and fugitive dust controls
16. Methods, procedures, and proposed documentation for the transportation, disposal, and offsite treatment, if required, of contaminated materials, including the identification of disposal and/or treatment facilities, and certified, licensed transporters
17. Equipment decontamination procedures
18. Sampling and analysis plan that shall cover Contractor sampling responsibilities for discharge permit compliance requirements (see Section 31 23 19 Control of Water).
19. Water Management Plan that describes collection, storage, and disposal of water collected during the work (see Section 31 23 19 Control of Water).
20. Refer to Section 01 35 29 Health, Safety, And Emergency Response Procedures For Contaminated Sites for additional requirements.

C. Submit qualifications of the task supervisor and the person conducting environmental sampling.

D. Submit surveys, cross-sections, and plans indicating areas of remedial excavation.

E. Confirmation soil sample collection and chemical analyses will be performed by the Contractor's testing lab. The Engineer will notify the Contractor within 7 business days to proceed with backfilling of the excavation.

F. Contaminated soil, overburden (above contaminated soil), and cut stockpile soil sample collection and chemical analyses will be performed by the Contractor in accordance with his CMMP.

G. The Contractor's Environmental Professional will complete the soil waste characterization and the offsite disposal facilities waste disposal profile and provided to the Engineer.

H. Submit records, reports, or certificates of contaminated soil disposal/treatment within 5 business days of disposal/treatment.

I. Submit records, reports, and/or certificates of contaminated water disposal/treatment within 5 business days of disposal/treatment.

J. Mark and secure excavations in accordance with 01 35 39 Health, Safety, and Emergency Response Procedures for Contaminated Sites

K. Obtain required federal, state, and local permits for excavation and storage of contaminated material.

1.6 QUALITY ASSURANCE

A. Qualifications

1. An independent Environmental Specialist shall be retained by the Contractor to assist the Contractor in the implementation of the CMMP. The Environmental Specialist shall have a minimum of three years of experience performing work in a CMMP. The Environmental Specialist shall have 40-hour HAZWOPER Site Worker Training in accordance with CFR 1910.120, and shall be current with the annual 8-hour refresher training.
2. Work shall be directed by a supervisor trained and experienced in hazardous and contaminated material handling. The supervisor shall have completed OSHA training requirements for working with hazardous substances, including the 8-hour supervisory course. The supervisor shall have a minimum of 3 years of experience in managing hazardous materials projects. Submit a copy of the supervisor's qualifications and experience for the Engineer's review.
3. Site Safety and Health Officer qualifications shall include the following, in addition to the requirements identified in Section 01 35 29 Health, Safety, And Emergency Response Procedures:
    a. Completion of required OSHA training in accordance with 29 CFR 1910.120, including completion of 40-hour supervisory training, 8-hour annual updates, and completion of 3 days onsite training by a fully qualified instructor
    b. Minimum of 3-years' experience in hazardous substance/waste site remediation or related work
    c. Current certification in first aid and cardiopulmonary resuscitation (CPR)
    d. Working knowledge of federal, state, and local occupational health and safety regulations

e. Working knowledge of air monitoring techniques and the development of health and safety programs for personnel working in potentially hazardous or toxic environments

4. Personnel working with hazardous material and substances shall have received training and have experience for the work to be performed.
5. Contractor and subcontractor personnel assigned for the purpose of performing or supervising hazardous materials work in accordance with the provisions of the Health and Safety Plan (HASP), above Level D protection, shall have received appropriate safety training in compliance with 29 CFR 1910,120, and 29 CFR 1910.134. Minimum of 40 hours health and safety training, 24 hours of "on the job" training, 8 hours annual refresher training, and annual medical monitoring by an occupational physician is required. Minimum of 8 hours additional specialized training in managing hazardous waste operations is required for supervisory personnel. Workers without current certification will not be allowed to enter the Exclusion Zone.
6. Comply with the medical surveillance program requirements of OSHA standards 29 CFR 1910.120, and 29 CFR 190.134. Provide documentation that personnel have received medical examinations and are certified for respirator use (if necessary) within the last 12 months and are cleared to work on hazardous sites before entering an Exclusion Zone or contacting hazardous materials.

PART 2 - PRODUCTS

2.1 SPILL RESPONSE MATERIALS

A. The Contractor shall provide spill response materials including, but not limited to: containers, adsorbents, shovels, and personnel protective equipment. Spill response materials shall be available at all times during which hazardous material is being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

2.2 DECONTAMINATION MATERIAL

A. Contractor shall provide facilities for equipment, tool, and personnel decontamination for the duration of the work.

2.3 STAGING MATERIAL

A. Geomembranes to be used as liner or material cover shall be chemical resistant, reinforced, and leak proof, with minimum thickness of 10 mils.

PART 3 - EXECUTION

3.1 CONTAMINATION SCREENING

A. Visual observations of discoloration or sheen and presence of chemical smell shall be reported to the Engineer as indicators of potential contamination.

3.2 CONTAMINATED SOIL REMOVAL

A. Conduct all work according to approved CMMP.

B. Strip and stockpile overburden and cut soil separately from contaminated material, in areas of contamination considered to be below action levels based on contamination screening or testing. Contractor shall be responsible for protecting this material from becoming contaminated. This may include covering the soil with plastic sheeting. Such soil that becomes contaminated as a result of Contractor activities shall be disposed of at Contractor's expense.

C. In areas where contamination is suspected, Contractor shall place soil in staging areas for disposal characterization per his approved CMMP.

D. Excavation shall be performed in a manner to limit the potential for contaminated material to mix with uncontaminated material. The Contractor shall maintain an excavation of sufficient size to allow workers ample room to complete the work. Additional screening, excavation, and sampling may be required based on analytical results. The Contractor shall conduct required soil sample collection specified in the CMMP (e.g., sample collection from the excavator bucket). If required, additional soil sample collection and chemical analyses will be performed by the Engineer.

E. Install sheeting, bracing, or shoring in the absence of adequate side slopes if there is a need for workers to enter the excavated area. Provide shoring in accordance with Contractor's approved trench safety system.

F. Construction debris (man-made materials such as metal, plastic, glass, concrete, asphalt, bricks, and wood products larger than 2 inches) encountered below grade during excavation (overburden or cut material) shall be separated from soil by use of a physical screen or rough brushing, and stored in a separate stockpile. The stockpiled and separated overburden and cut material may be reused as backfill based on chemical testing results and geotechnical suitability, as determined by the Engineer.

G. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests, and associated disposal notices and notifications necessary for accomplishment of the work.

H. Provide documentation of proper disposal or treatment to the Engineer.

3.3 CONTAMINATED MATERIAL STOCKPILING

A. Place potentially contaminated material in stockpiles immediately after excavation while awaiting test results or offsite disposal. Staging units shall be in good condition and constructed of materials compatible with the soil or liquid to be staged. If multiple staging units are required, each unit shall be clearly labeled with an identification number, and a written log shall be kept by the Contractor to track the source of contaminated material in each staging unit.

B. The Contractor shall maintain stockpiles to prevent comingling of different types of stockpiles or separately tested stockpiles. The Contractor shall also prevent mixing of excavated materials with and imported materials as a result of stockpiling operations.

C. Isolate confirmed and/or suspected contaminated material from the environment. The maximum stockpile size shall be 100 cubic yards. Stockpiles shall be constructed to include:

1. Bottom liner. The Contractor shall place all stockpiles on an impervious surface, such as concrete, asphalt, or geomembrane. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 0.5 inches in diameter and other objects that could damage the membrane.
2. Geomembrane cover to prevent precipitation from entering the stockpile. The cover material shall be anchored to prevent it from being removed by wind.
3. Berms surrounding the stockpile, a minimum of 12 inches in height. Vehicle access points shall also be bermed.
4. Liquid collected from stockpiles shall be temporarily stored in 55-gallon barrels or portable tanks. Liquid storage containers shall be watertight. Liquid shall be managed in accordance with Section 31 23 19 Site Water Control and Treatment.

D. The Contractor shall recover and re-anchor the entire stockpile at the end of each workday.

E. The Contractor shall periodically inspect all stockpiles and perform maintenance on the impervious surfaces and cover lines as necessary. The written inspection and repair log should be included in the documentation requirements described in a later section.

F. The Contractor shall prepare one or more working stockpiles and provide at least one (1) working days' notice that soil stockpile(s) are ready for testing. The Contractor's testing lab will collect sample(s) and characterize each stockpile for reuse or disposal.

G. The Contractor will communicate stockpile status through signage as follows:

H. Class A soil designated with green sign representing soil that can be used under the soil cover, (b) Class B soil designated with a red sign representing soil that cannot be reused and must be disposed offsite, and (c) unclassified soil designated with a white sign that soil has not been tested yet.

I. The Contractor shall anticipate delays prior to the reuse of soil while waiting for soil sampling, testing, and review of analytical results. Soil designated for disposal may eventually be loaded directly for disposal, if approved by the Engineer and opportunities for dump truck sampling are provided.

J. The Contractor shall maintain all non-stockpile surfaces throughout the area free of contaminated soils to the maximum extent practicable. The Contractor shall restrict the spread of contaminated soil over the general project area.

K. The Contractor shall restore all loading area(s), haul road(s), stockpile area(s), wheel washing area(s), and other improvements constructed by the Contractor.

3.4 DUST CONTROL

A. The Contractor shall prevent dust generation at all times to the maximum extent practicable.

B. The Contractor shall minimize the potential for runoff by limiting water use to the minimum quantity necessary for adequate dust suppression.

C. Obtain written approval from the Contractor's Environmental Professional prior to the use of water on any soil stockpiles. Dust control water shall be supplied by the Contractor. The water quality shall be suitable for its use.

3.5 SAMPLING AND ANALYSIS

A. Contractor Requirements
   1. Provide the Engineer with 24 hours advance notice prior to excavation and stockpiling activities and verification sampling. Provide the Engineer with access to observe the site testing and sampling.
   2. The Contractor shall update his schedule with anticipated duration between the collection of soil samples and completion of chemical laboratory analyses.

B. Environmental Professional Requirements
   1. The Environmental Professional will inspect removal of existing contaminated material from each location. After suspected contaminated material is removed, confirmation samples from the excavation will be collected and analyzed by the Engineer. Based on test results, additional excavation may be required to remove material contaminated above action levels, as directed by the Engineer. Locations of samples shall be marked in the field and documented on the surveys and the as-built Drawings.
   2. Perform the required stockpile (contaminated, overburden, and cut) soil sampling and chemical analyses for determining onsite reuse or offsite disposal.

3.6 SPILLS

A. In the event of a Contractor spill or release of a hazardous material, as defined in this section, notify the Engineer immediately. If the spill exceeds the regulatory reporting threshold, the Contractor shall follow the pre- established procedures as described in the CMMP for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of spills or leaks. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Engineer, additional sampling and testing shall be performed by Contractor to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Port.

3.7 CREOSOTE TIES AND PILES

A. Creosote-treated ties and piles potentially encountered below grade during excavation shall be managed onsite according to the CMMP and disposed of at a facility permitted for that waste, identified in the CMMP.

3.8 OFFSITE DISPOSAL OF HAZARDOUS MATERIAL

A. Load contaminated material for offsite disposal.

B. Provide transportation in accordance with TCEQ Hazardous Material Regulations and federal, state, and local requirements, including obtaining necessary permits, licenses, and approvals. Evidence that a state-licensed transporter is being used shall be included in the submittals.

C. Treatment, Disposal, and Recycling
   1. The treatment, disposal, and recycling of contaminated materials shall be in accordance with all applicable laws and regulations, and conditions specified herein. This work shall include all necessary personnel, labor, transportation, packaging, equipment, and reports.

2. Contaminated soil can be treated or landfilled.
3. If soil is to be treated, transport contaminated soil to an approved licensed facility in accordance with applicable requirements:
    a. The treatment facility must be approved by the Engineer. The Contractor shall make arrangements for transportation and treatment of the contaminated soil with the facility operator.
4. If landfilled, dispose of contaminated soil in a licensed landfill in accordance with regulatory requirements:
5. If required, dispose of hazardous material in accordance with regulatory requirements.

3.9 RECORDS

A. Maintain records of all waste determinations, including appropriate results of analyses performed, substances and sample location, the time of collection, and other pertinent data as required by 40 CFR 280, Section 74 and 40 CFR 262 Subpart D, and other applicable regulations. Transportation, treatment, and disposal methods and dates, quantities of waste, and names and addresses of each transporter and the disposal or reclamation facility shall also be recorded and available for inspection, as well as copies of the following documents:
    1. Manifests
    2. Waste analyses or waste profile sheets
    3. Certifications of final treatment/disposal signed by the responsible disposal facility official
    4. Land disposal notification records required under 40 CFR 268 for hazardous wastes.
    5. Records shall be provided in accordance with applicable federal, state, and local regulations. Following Contract closeout, the records shall become the property of the Engineer.

B. Manifesting shall conform to TCEQ and applicable federal, state, and local regulations. For disposal of Hazardous Waste, the “Generator’s Certification” portion of the Uniform Hazardous Waste Manifest shall be signed by the Environmental Specialist and the Engineer’s representative.

3.10 DOCUMENTATION OF TREATMENT OR DISPOSAL:

A. Furnish the original return copy of the hazardous waste manifest, signed by the owner or operator of a facility legally permitted to treat or dispose of those materials furnished to the Engineer not later than 5 working days following the delivery of those materials to the facility.

B. Furnish a statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept hazardous or special wastes in the CMMP.

C. If the Contractor selects a different facility from that identified in the CMMP, documentation shall be provided to the Engineer for approval to certify that the facility is authorized and meets the standards specified in 40 CFR 264 and applicable state and local regulations.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 03 11 00

CONCRETE FORMING

PART 1 GENERAL

1.01 DESCRIPTION

A. Formwork requirements for concrete construction.

1.02 QUALITY ASSURANCE

A. References:

1. The references listed below are part of this section. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict, the requirements of this section shall prevail.

Reference	Title
ACI 117	Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.5	Specifications for Environmental Concrete Structures
National Institute of Standards - PS1	Construction and Industrial Plywood

B. Design – General:

1. Provide design of formwork, shoring and reshoring systems by the Contractor's Professional Engineer currently registered in the State of Texas.
2. Design, engineering, and construction of formwork, shoring, and reshoring systems is the responsibility of the Contractor.
3. Develop a procedure and schedule for removal of shores (and installation of reshores).
4. Structural record calculations, signed and sealed by the Contractor's Engineer, are required to prove that all portions of the structure, in combination with the remaining forming and shoring systems, have sufficient strength to safely support their own weight plus the loads placed thereon.
5. When developing procedures, schedules, and structural calculations; consider the structural system that exists, effects of imposed loads, and the strength of concrete at each stage of construction.

C. Design Criteria:

1. Design formwork in accordance with ACI 301 and ACI 318 for building structures and ACI 350 and 350.5 for environmental structures to provide concrete finishes as specified in Section 033000.
2. Design systems for full height of wet concrete pressure.
3. Design formwork to limit maximum deflection of form facing materials, as reflected in concrete surfaces exposed to view, to 1/240 of span.

1.03 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00.
   2. Manufacturer's product data with installation instructions:
      a. Form materials.
      b. Form ties (with waterstops).
      c. Form release compound.
      d. Void forms.

B. Informational Submittals:
   1. Procedures: Section 01 33 00.
   2. Letter of certification:
      a. Stating that formwork has been designed in accordance with this specification and referenced documents, sealed and stamped by the Contractor's registered design Engineer.

PART 2 PRODUCTS

2.01 FORMS

A. Wood Forms:
   1. Provide new and unused exterior grade plywood panels manufactured in accordance with American Plywood Association (APA) and bearing the trademark of that group.
      a. Forms for concrete surfaces exposed to view: use APA High Density Overlay (HDO) Plyform Class I Exterior 48" X 96" X 3/4".
      b. Forms for other concrete surfaces: use APA Douglas Fir B-B Plyform Class I Exterior 48" X 96" X 3/4-inch.
   2. When approved, plywood may be reused.

B. Metal Forms:
   1. Do not use aluminum. Provide forms free of rust and straight without dents to provide members of uniform thickness.

2.02 FORM TIES

A. Commercially fabricated for use in form construction. Fabricated so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete. Cone on ends shall be 3/4 inch to 1 inch diameter. Provide embedded portion of tie not less than 1 1/2 inch from face of concrete after cone ends have been removed. Provide ties with integral waterstops at water-retaining and below grade structures.

B. Tapered through-bolts may be used when approved. Use 1-inch minimum diameter at the smallest end. Fill tapered tie holes after cleaning to produce watertight construction. Use a mechanical waterstop plug near the center of the wall and fill each side with non-shrink cement grout. Mechanical waterstop plug shall be Greenstreak Group, Inc. "X-Plug"; or equal.

2.03 FORM RELEASE COMPOUND

A. Coat form surfaces in contact with concrete using a non-staining, non-residual, water based, bond-breaking form coating. [Use NSF approved form release agents in potable water containment structures.]

PART 3 EXECUTION

3.01 PREPARATION

A. Cover surface of forms with form release compound prior to form installation in accordance with manufacturer's recommendations.

B. Do not permit excess form coating material to stand in puddles on forms or hardened concrete surfaces against which fresh concrete is to be placed.

C. Clean surfaces of forms, reinforcing steel and other embedded items of accumulated mortar, grout, or other foregn materials from previous concreting or construction activities before concrete is placed.

3.02 FORMWORK CONSTRUCTION

A. Form vertical surfaces of cast-in-place concrete including sides of footings.

B. Construct and place forms so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings. Brace or tie forms together to maintain position and shape under the load of freshly-placed concrete.

C. Tighten forms to prevent leakage.

D. Provide temporary openings(windows) at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.

E. Provide temporary openings to limit height of free fall of concrete and to limit the lateral movement of concrete during placement. Openings are required in wall placements greater than 20 feet in height, spaced no more than 8 feet on center measured horizontally and vertically.

F. Place a 3/4-inch chamfer strip at exposed to view corners of formed surfaces.

G. At construction joints,overlap hardened concrete surface by at least 1 inch. Brace forms against hardened concrete to prevent movement, offsets, or loss of mortar at construction joint and to maintain a true surface. Where possible, locate juncture of built-in-place forms at architectural lines, control joints, or at other inconspicuous lines.

H. [Where circular sections are formed using flat faced materials, use flat form lengths not exceeding 2 feet wide and the resulting deflection angles at the joints is not greater than 3-1/2 degrees.

I. Construct wood forms for openings to facilitate loosening. Anchor forms so that movement of any part of the formwork system is prevented during concrete placement.

J. At platforms constructed to move equipment over in-place reinforcment, provid beams, struts, and/or legs, supported directly on formwork or other structural members without resting on reinforcing steel.

K. Provide a positive means of adjustment (wedges or jacks) at shores and struts to take up settlement during concrete placement. Brace forms against lateral deflection. Fasten in-place wedges and shims used for final adjustment of forms prior to concrete placement.

L. Place tapered through-bolt form ties with the larger end on the side of the structure in contact with liquid.

3.03 TOLERANCES

A. Install formwork with tolerances in accordance with ACI 117 and the following (the more stringent requirement controls):

1. Install formwork in accordance with manufacturer's written instructions.
2. Vertical surface tolerance from plumb; walls, columns, piers, and risers:
   ± 1/2 inch for entire height
   ± 1/4 inch in any 10 feet of height
3. Vertical surface tolerance from plumb; exposed wall corners, end columns, control-joint grooves, and other exposed to view vertical lines:
   ± 1/2 inch for entire height
   ± 1/4 inch in any 20 feet of height
4. Horizontal variation from level or from grade; top of slabs, slab soffits, ceilings, and beam soffits, measured before removal of supporting shores:
   ± 3/4 inch for entire length
   ± 3/8 inch for any bay or 20 foot length
   ± 1/4 inch in any 10 feet of length
5. Horizontal variation from level or from grade; exposed lintels, sills, parapets, horizontal grooves, and other exposed-to-view horizontal lines:
   ± 1/2 inch for entire length
   ± 1/4 inch in any 20 feet of length.
6. Plan position variation; columns, walls, and partitions:
   ± 3/4 inch for entire length
   ± 3/8 inch for any bay or 20 foot length
7. Plan location and size; sleeves, floor openings, walls, wall openings, beams, and columns:
   ± 1/2 inch
8. Cross sectional dimensions; columns and beams and thickness of slabs and walls:
   ± 3/8 inch
9. Plan dimensions; footings and foundations:
   minus 1/2 inch
   + 2 inches
10. Misplacement or eccentricity; footings and foundations:
    2 percent of footing width in direction of misplacement
    not more than 2 inches
11. Thickness; footings and foundations:
    minus 5 percent

no limit on the maximum increase except that which may interfere with other construction.

12. Step variance in flight of stairs:
    Rise ± 1/16 inch
    Tread from level ± 1/8 inch

B. Use control points and benchmarks for reference purposes to check tolerances. Establish and maintain reference points in an undisturbed condition until final completion and acceptance of the work.

C. Regardless of tolerances listed, no portion of a structure shall extend beyond the legal boundary of work site.

D. Camber formwork to compensate for anticipated deflections in formwork under wet load of concrete. Adjust camber to maintain above specified tolerances in hardened concrete after forms and shoring are removed.

3.04 REMOVAL OF FORMS

A. Do not impose construction loads or remove shoring from any part of the structure until that portion of the structure in combination with remaining forming and shoring systems has sufficient strength to safely support its weight and loads placed thereon.

B. If forms are loosened and not removed, proceed same day with wet curing operations to soak surfaces of concrete where forms are loosened. When wet curing is not practical or not planned, loosen, remove, and start approved curing proceedures on the same day.

C. When required for concrete curing in hot weather, required for repair of surface defects, or when required for finishing at an early age; remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.

D. Remove top forms on sloping surfaces as soon as concrete has attained sufficient stiffness to prevent sagging. Make repairs or finishing treatment on such sloping surfaces immediately after form removal.

E. Remove wood forms for wall openings as soon as this can be accomplished without damage to concrete.

F. Remove formwork from columns, walls, sides of beams, and other parts not supporting weight of concrete as soon as concrete has hardened sufficiently to resist damage from removal.

G. When shores and supports are so arranged such that non-load-carrying form facing material can be removed without loosening or disturbing other shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

H. In all cases, proceed with curing same day as form removal.

I. Where no reshoring is planned, forms and shoring used to support weight of concrete shall be left in place until concrete has attained its specified 28-day compressive strength.

3.05 RESHORING

A. Do not impose construction loads or remove shoring from any part of the structure until that portion of the structure, in combination with remaining forming and shoring systems, has sufficient strength to safely support its weight and loads placed thereon.

B. While reshoring is underway, no superimposed dead or live loads are permitted on the new construction.

C. During reshoring, do not subject concrete in structural members to combined dead and construction loads in excess of loads that the structural members can adequately support.

D. Place reshores as soon as practicable after stripping operations are complete, but in no case later than the end of working day on which stripping occurs.

E. Place reshores to carry their required loads without overstressing.

F. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength specified by the formwork engineer's structural calculations and verified by field cured test cylinders or other approved method.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes: Reinforcing steel for use in reinforced concrete.

1.02 REFERENCES:

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements For Structural Concrete
ACI SP-66	ACI Detailing Manual
ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A1064	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
AWS D1.4	Structural Welding Code - Reinforcing Steel
CRSI-PRB	Placing Reinforcing Bars
CRSI-MSP	Manual of Standard Practice
FEDSPEC QQ-W-461H	Wire, Steel, Carbon (Round, Bare, and Coated)

1.03 SUBMITTALS

A. Action Submittals
   1. Procedures: Section 01 33 00.
   2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Mill certificates of mill analysis, tensile, and bend tests for all reinforcing.
5. Manufacturer and type of proprietary reinforcing steel splices. Submit a current ICC Report and manufacturer's literature that contains instructions and recommendations for each type of coupler used.
6. Qualifications of welding operators, welding processes and procedures.
7. Reinforcing steel shop drawings showing reinforcing steel bar quantities, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing steel supports. Reinforcing steel shop drawings shall be of sufficient detail to permit installation of reinforcing steel without reference to the contract drawings. Shop drawings shall not be prepared by reproducing the plans and details indicated on the contract drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of reinforcing steel, including large scale drawings at joints detailing bar placement in congested areas. Placement drawings shall be in accordance with ACI 315. Reinforcing details shall be in accordance with ACI SP-66.

1.04 DELIVERY, STORAGE AND HANDLING

A. Ship reinforcing steel to the jobsite with attached plastic or metal tags having permanent mark numbers which match the shop drawing mark numbers. All reinforcing shall be supported and stored above ground. Use only plastic tags secured to the reinforcing steel bars with nylon or plastic tags for epoxy coated reinforcing steel bars.

PART 2 PRODUCTS

2.01 BAR REINFORCEMENT

A. Reinforcing steel bars shall be deformed billet steel in conformance with ASTM A615, Grade 60. Bars to be welded shall be deformed billet steel conforming to ASTM A706. Where specified, reinforcing steel shall be epoxy-coated in conformance with ASTM A775.

2.02 WIRE FABRIC

A. Wire fabric shall be welded steel mesh conforming to ASTM A1064.

2.03 WIRE AND PLAIN BARS

A. Wire used as reinforcement and bars used as spiral reinforcement in structures shall be cold drawn steel conforming to ASTM A1064.

2.04 SMOOTH DOWEL BARS

A. Smooth dowel bars shall conform to ASTM A615, Grade 60, with a metal end cap at the greased or sliding end to allow longitudinal movement.

2.05 REINFORCING STEEL MECHANICAL SPLICES

A. Reinforcing steel mechanical splices shall be a positive connecting threaded type mechanical splice system manufactured by Erico, Inc., Dayton Superior, Williams Form Engineering Company, or approved equal.

B. Type 1 mechanical splices shall develop in tension or compression a strength of not less than 125 percent of the ASTM specified minimum yield strength of the reinforcement and shall meet all other ACI 318 requirements. Where splices at the face of wall are shown or approved, form saver-type mechanical couplers may be used. Form-saver couplers shall have integral plates designed to positively connect coupler to formwork. Type 1 mechanical splices are typical except for locations noted below where Type 2 mechanical splices are required.

C. Type 2 mechanical splices shall meet the requirements for a Type 1 mechanical splice, plus develop the ASTM specified tensile strength of the reinforcement. Type 2 mechanical splices shall be provided at locations specifically noted on the design drawings.

2.06 TIE WIRE

A. The wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ-W-461H.

2.07 BAR SUPPORTS

A. Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI-MSP and placed in accordance with CRSI-PRB. Plastic coating on legs shall extend at least 0.5-inch upward from form surface.

B. Provide precast concrete blocks, four inches square in plan, with embedded tie wires (wire dobies) as specified by CRSI 1 MSP for footing and slabs on grade. Do not use brick, broken concrete masonry units, spalls, rocks, construction debris, or similar material for supporting reinforcing steel. Precast concrete blocks shall have same or higher compressive strength as specified for concrete in which they are located.

C. Provide stainless steel or plastic protected plain steel supports for other work.

2.08 FABRICATION:

A. Fabricate reinforcing steel bars in accordance with ACI 315 and the following tolerances:
   1. Sheared lengths: +/-1 inch.
   2. Overall dimensions of stirrups, ties, and spirals: +/-1/2 inch.
   3. All other bends: +0 inch, -1/2 inch
   4. Minimum diameter of bends of reinforcing steel bars: Per ACI 318.

PART 3 EXECUTION

3.01 PLACEMENT TOLERANCE

A. Reinforcing steel placement tolerance shall conform to the requirements of ACI 117, ACI 318, and the following:
   1. Reinforcing steel bar clear distance to formed surfaces shall be within +/-1/4 inch of specified clearance and minimum spacing between bars shall be a maximum of 1/4 inch less than specified.

2. Reinforcing steel top bars in slabs and beams shall be placed +/-1/4 inch of specified depth in members 8 inches deep or less and -1/4", +1/2 inch of specified depth in members greater than 8 inches deep.
3. Reinforcing steel spacing shall be placed within +/- one bar diameter or +/- 1 inch, whichever is greater.
4. The minimum clear distance between reinforcing steel bars shall be equal to the greater of 1 inch or the reinforcing steel bar diameter for beams, walls and slabs, and the greater of 1 1/2 inches or 1.5 times the reinforcing steel bar diameter for columns.
5. Beam and slab reinforcing steel bars shall be threaded through column vertical reinforcing steel bars without displacing the column reinforcing steel bars and still maintain clear distances for beam and slab reinforcing steel bars.

3.02 CONCRETE COVER

A. Unless specified otherwise on the Drawings, reinforcing steel bar cover shall conform to the following:
   1. Reinforcing steel bar cover shall be 3 inches for concrete cast against earth.
   2. Reinforcing steel bar cover shall be 2 inches for reinforcing steel bars for formed concrete surfaces exposed to earth and weather.
   3. Reinforcing steel bar cover shall be 2 inches for any formed surfaces exposed to or above any liquid.
   4. Reinforcing steel bar cover shall be 1 ½ inches for reinforcing not in the above categories unless noted otherwise on the design drawings.

3.03 SPLICING

A. Reinforcing steel splicing shall conform to the following:
   1. Use Class B splice lengths in accordance with ACI 318 for all reinforcing steel bars unless shown otherwise on the drawings.

3.04 CLEANING

A. Reinforcing steel bars at time of concrete placement shall be free of mud, oil, loose rust, or other materials that may affect or reduce bond. Reinforcing steel bars with rust, mill scale or a combination of both may be accepted without cleaning or brushing provided dimensions and weights including heights of deformation on a cleaned sample are not less than required by applicable ASTM standards.

3.05 PLACEMENT

A. Reinforcing steel bar placement shall conform to the following:
   1. Uncoated reinforcing steel bars shall be supported and fastened together to prevent displacement by construction loads or concrete placement. For concrete placed on ground, furnish concrete block supports or metal bar supports with non-metallic bottom plates. For concrete placed against forms furnish plastic or plastic coated metal chairs, runners, bolsters, spacers and hangers for the reinforcing steel bar support. Only tips in contact with the forms require a plastic coating.

2. Fasten coated reinforcing steel bars together to prevent displacement. Use plastic or nylon ties to hold the coated reinforcing steel bars rigidly in place. Support coated reinforcing steel bars with plastic or plastic coated chairs, runners, bolsters, spacers and supports as required.
3. Support reinforcing steel bars over cardboard void forms by means of concrete supports which will not puncture or damage the void forms nor impair the strength of the concrete member.
4. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, reinforcing steel bars in the upper layers shall be placed directly over the reinforcing steel bars in the bottom layer with the clear distance between each layer to be 2 inches unless otherwise noted on the Drawings. Place spacer reinforcing steel bars at a maximum of 3'-0" on center to maintain the minimum clear spacing between layers.
5. Extend reinforcement to within 2 inches of formed edges and 3 inches of the concrete perimeter when concrete is placed against earth.
6. Reinforcing steel bars shall not be bent after embedding in hardened concrete unless approved by the Owner's Representative.
7. Tack welding or bending reinforcing steel bars by means of heat is prohibited.
8. Where required by the contract documents, reinforcing steel bars shall be embedded into the hardened concrete utilizing an adhesive anchoring system specifically manufactured for that application. Installation shall be per the manufacturer's written instructions.
9. Bars with kinks or with bends not shown shall not be used.
10. Heating or welding bars shall be performed in accordance with AWS D1.4 and shall only be permitted where specified or approved by the Owner's Representative. Bars shall not be welded at the bend.

3.06 REPAIR OF EPOXY COATING

A. Epoxy coating damage need not be repaired in cases where the damaged area is 0.1 square inch or smaller. Repair all damaged areas larger than 0.1 square inch in conformance with ASTM A775.

3.07 FIELD QUALITY CONTROL

A. Field quality control shall include the following:
   1. Notify the Owner's Representative whenever the specified clearances between the reinforcing steel bars cannot be met. The concrete shall not be placed until the Contractor submits a solution to the congestion problem and it has been approved by the Owner's Representative.
   2. The reinforcing steel bars may be moved as necessary to avoid other reinforcing steel bars, conduits or other embedded items provided the tolerance does not exceed that specified in this section. The Engineer's approval of the modified reinforcing steel arrangement is required where the specified tolerance is exceeded. No cutting of the reinforcing steel bars shall be done without written approval of the Owner's Representative.
   3. Coated reinforcing steel bars will be inspected on the jobsite for handling defects, coating abrasion, coating thickness and continuity of coating. The Owner's Representative may defer final inspection of the coated reinforcing steel bars until

bar erection and handling is complete. Repair coated areas as directed by the Owner's Representative and completed prior to concrete placement.

4. An independent laboratory shall be employed to review and approve Contractor welding procedures and qualify welders in accordance with AWS D1.4. The laboratory shall visually inspect each weld for visible defects and conduct non-destructive field testing (radiographic or magnetic particle) on not less than one sample for each 10 welds. If a defective weld is found, the previous 5 welds by the same welder shall also be tested.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Cast-in-place concrete, which consists of providing material, mixing, transporting equipment, and labor for the proportioning, mixing, transporting, placing, consolidating, finishing, curing, and protection of concrete in the structure.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.
   1. Section 03 60 00 Grouting

1.03 REFERENCES:

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 117	Tolerances for Concrete Construction and Materials
ACI 211.1	Selecting Proportions for Normal, Heavy Weight and Mass Concrete
ACI 301	Specifications for Structural Concrete
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 214R	Guide to Evaluation of Strength Test Results in Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.1	Tightness Testing of Environmental Engineering Concrete Containment Structures
ACI 503.7	Crack Repair by Epoxy Injection
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C117	Materials Finer Than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C157	Length Change of Hardened Cement Mortar and Concrete
ASTM C172	Sampling Freshly Mixed Concrete

Reference	Title
ASTM C192	Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C595	Blended Hydraulic Cements
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989	Slag Cement for use in Concrete and Mortars
ASTM C1059	Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1315	Liquid Membrane-Forming Compounds for Curing and Sealing Concrete
ASTM C1567	Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate
ASTM C1602	Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Sampling Aggregates
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Agencies Engaged in Construction Inspection and/or Testing
CRD-C572	U.S. Corps of Engineer's Specifications for Polyvinylchloride Waterstop
IBC	International Building Code with local amendments

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
4. Each proposed mix design showing:
    a. Expected strength at 7 and 28-days
    b. Slump, before and after introduction of high-range water-reducing admixture
    c. Water/cement ratio
    d. Weights and test results of the ingredients
    e. Aggregate gradation
    f. Test results of mix design prepared by an independent testing laboratory
    g. Shrinkage test results for liquid containing structures
    h. Other physical properties necessary to review each mix design for conformance with these specifications
5. Product literature and technical data for aggregates, cement, and pozzolan.

6. Product literature, technical data, and dosage of proposed admixtures including, but not limited to, air entraining, water reducing, retarding, shrinkage reducing, etc.
7. Anticipated average delivery time from batch plant to site. If this time exceeds the limit specified in Part 3, include proposed method to extend set time without deleterious effects on final product. Owner's Representative reserves the right to accept or reject such proposed methods.
8. Lift Drawings: Submit shop drawings for concrete placements on the project before on-site construction begins. The drawings shall be organized by structure and submitted as a complete set for the Engineer's review. The drawings shall be drawn to scale and show dimensions, forming details, and placement volumes. Show location of construction joints, details of surface preparation, scheduled finish, embedments, penetrations, openings, keyways, blockouts, bulkheads, etc. The drawings shall clearly show the placement sequence and will be accompanied by a schedule that shows the schedule dates for forming, placement, and stripping for each section of concrete placed within each structure.
9. Curing program description in sufficient detail to demonstrate that the Contractor will provide acceptable strength, finish, and crack control within the completed structure.
10. Product literature and technical data for waterstops, curing and sealing compounds, bonding compoundsepoxy and chemical grout for crack injection, retardant
11. Sample panels to demonstrate formed wall surface finishes as specified in Part 3.
12. Samples of concrete floor and slab finishes as specified in Part 3.
13. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.

B. Quality Control By Owner:
   1. Special Inspection of concrete work shall be performed by the Special Inspector under contract with the Owner and in conformance with the IBC Chapter 17. Special Inspection of concrete is in addition to, not replacing, other inspections and quality control requirements specified herein. Where sampling and testing specified herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
   2. All structural concrete work shall receive Special Inspection in accordance with IBC Chapter 17. Structural concrete includes elements which resist code-defined loads and whose failure would impact life safety. Non-structural site work concrete does not require Special Inspection. Anchor bolts and anchors installed in hardened concrete require Special Inspection.
   3. Refer to Section 01 45 00 Quality Control, for Owner provided testing.

C. Quality Control By Contractor:
   1. Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329. The testing laboratory shall sample and test concrete materials as specified in this section. Costs of testing laboratory services shall be borne by the Contractor.

D. Basis For Quality:
   1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:
   1. Portland cement shall be ASTM C150, Type II or Type V, low alkali, containing less than 0.60 percent alkalis. In addition to standard requirements, cement shall satisfy optional chemical and physical requirements of ASTM C150, Tables 2 and 4, respectively.
   2. If low alkali cement is not available, aggregates shall show an expansion of less than 0.1% when tested in accordance with ASTM C1260 or ASTM C1567 concrete mix test results shall be submitted verifying that the aggregates are not reactive per the criteria in this standard. ASTM C1260 and ASTM C1567 results shall be no older than 1 year.
   3. Portland-pozzolan cement shall be ASTM C595, Type IP (MS), interground, low alkali.
   4. Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted field test records or used in the trial mixtures. See Change of Materials paragraph below.

B. Ground granulated blast-furnace slag (GGBFS), if used in conjunction with portland cement, shall be per ASTM C989.

C. Aggregates:
      a. Except as modified herein, fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates are regarded as separate ingredients. Aggregates shall be non-reactive and washed before use.
      b. Check aggregates for alkali-silica reactive constituents per ASTM C1260. Aggregate shall have less than 0.1% expansion when tested in accordance with ASTM C1260. Aggregates having 0.1% or greater expansion may still be satisfactory provided ASTM C1567 concrete mix test results are submitted and show an expansion of less than 0.1% at 16 days. Test results shall be no older than 1 year.
      c. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has optimum workability and consolidation characteristics. Establish the final combined aggregate gradation during mix design.
      d. Aggregates used in the project production concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by the submitted historical data or trial mixtures. See Change of Materials paragraph below.
   2. Fine Aggregate:
      a. Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. For classes of concrete which will be used in liquid retaining structures, fine aggregate shall not exceed 40 percent by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.

b. Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below:

U.S. standard sieve size	Permissible variation in individual tests, percent
30 and coarser	2
50 and finer	0.5

c. Other tests shall be in accordance with the following specifications:

Test	Test method	Requirements
Amount of material	ASTM C117	3 percent passing No. 200 sieve maximum by weight
Sand equivalent	ASTM D2419	Minimum 70 percent

3. Coarse Aggregate:
   a. Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 3 for Class Designation 5S. Gradation of each coarse aggregate size specified shall conform to ASTM C33, Table 2.
   b. Variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

D. Pozzolan:
   1. Pozzolan shall Class F fly ash conforming to ASTM C618. Class C fly ash is not allowed. Pozzolan supplied during the life of the project shall have been formed at the same single source. See Change of Materials paragraph below.
   2. The pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.
   3. Use pozzolan materials that are of the same brand and type and from the same plant of manufacture as the materials used in the concrete represented by the submitted field test records or used in the trial mixtures.

E. Admixtures:
   1. General:
      a. Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Use admixtures in accordance with the manufacturer's recommendations and add separately to the concrete mix. Water reducing retarders and admixtures shall reduce the water required by at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1. Retarder dosage shall result in set time consistent with requirements specified in Part 3.
   2. Water Reducing Admixtures:
      a. Conform to ASTM C494, Type A. Acceptable products include: BASF “MasterPozzolith 322”; SIKA Chemical Corp. “Plastocrete 161”; Euclid Chemical Co. “Eucon WR 91”; or approved equal.
   3. Water Reducing and Retarding Admixtures:

a. Conform to ASTM C494, Type D. Acceptable products include: BASF "MasterPozzolith 80"; Sika Chemical Corp. "Plastiment"; Euclid Chemical Co. "Eucon Retarder 75"; or approved equal.

4. High Range Water Reducing (Superplasticizing) Admixtures:
   a. Conform to ASTM C494, Type F. Acceptable products include: BASF "MasterGlenium" Series; Sika Chemical Corp. "Viscocrete 2100" or "Viscocrete 2110" (Hot Weather) or "Viscocrete 6100" (Cold Weather); Euclid Chemical Co. "Eucon 37"; W.R. Grace "ADVA 195"; or approved equal.
5. High Range Water Reducing And Retarding Admixtures:
   a. Conform to ASTM C494, Type G. Acceptable products include: W.R. Grace "Daracem 100"; Sika Chemical Corp. "Sikaplast 200" ; Euclid Chemical Co. "Eucon 537"; or approved equal.
6. Air Entraining Agent:
   a. Conform to ASTM C260 and produce air entrained concrete as specified in the Mix Proportioning table below. Acceptable products include: Sika Chemical Corp. "AEA-15"; Euclid Chemical Co. "AEA-92"; or approved equal.

F. Water:
   1. For washing aggregate, mixing, and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; comply with the requirements of ASTM C1602. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

G. Change of Materials:
   1. After each concrete mix design is approved, no changes of any sort or source will be allowed without prior written approval from the Engineer. When brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data, data from new trial mixtures, or evidence that indicates that the change will not affect adversely the relevant properties of the concrete shall be submitted for approval by the Engineer before use in concrete.

2.02 CONCRETE CHARACTERISTICS

A. Mix Proportioning:
   1. Concrete shall be normal weight concrete composed of cement, pozzolan, admixtures, aggregates, and water; proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. It is acceptable to substitute interground Portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of Portland cement and pozzolan. Water-cementitious material (w/cm) ratio is based on the combined contents of cement and pozzolan.
   2. Provide concrete mix designs in accordance with the following guidlines:

Concrete class	Minimum[a] 28-day compressive strength, psi	ASTM coarse aggregate size	Maximum water-cementitious materials (w/cm) ratio	Minimum cementitious materials content (pounds/CY)	Pozzolan, percent by weight of cementitious materials	Air content (percent)	Slump range[f] (inches)
A	4000[b]	467	0.42	515	20-35	4-6	3-5
B	3000	57 or 67	0.45	560	15-20[d]	4-6	3-5
C-1	4500	57 or 67	0.40	560	15-20	4-6	3-5
D-1	4000	8	0.42	600	15-20[d]	4-6	3-5
E[c]	2000	57	--	-	15-20[d]	Not Required	4-8
F	500[e]	-	--		15-20[d]	Not Required	4-8

[a] *Determine compressive strength at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.*

[b] *Compressive strength of Class A concrete may be determined at 56 days.*

[c] *Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.*

[d] *Pozzolan use is optional for this class of concrete.*

[e] *Minimum 28-day compressive strength shall be 500 psi and maximum 28-day compressive strength shall be 1,000 psi.*

[f] *Slump before addition of high range water reducing admixture (superplasticizer). Maximum slump after addition of high range water reducing admixture shall be 8".*

B. Use:

1. Provide concrete by class for the uses listed below.

Concrete class	Type of use
B	Non-structural concrete (sidewalks, curbs, pavers, etc.)
C-1	Typical cast-in-place structural concrete
E[a]	Pipe bedding and encasement, electrical conduit encasement (duct banks) and concrete fill
F	Encasement of reinforcement extension for future construction

[a] *Contractor's option to use the same concrete mix for pipe encasement as the concrete slab above.*

C. Control Tests:

1. General:

a. Select and adjust proportions of ingredients in accordance with ACI 211.1. Verification of mix characteristics for submittal may be achieved using either the

Trial Mix Design method or Field Experience Data method. Do not place concrete prior to submittal and acceptance of proposed mix.

2. Trial Mix Design:
    a. Mixes verified by this method shall have the samples produced for testing, manufactured at the batch plant which will supply concrete to the project, using materials proposed for the Work and material combinations listed above. Testing, data, and reporting shall conform to ACI 318 and the following:
        1) Required compressive strength used as the basis for selecting concrete proportions (f'cr) shall be the specified concrete strength (f'c) + 1000 psi for specified concrete strengths less than 3,000 psi and f'c + 1200 psi for specified concrete strengths between 3000 psi and 5000 psi.
        2) Make at least three different trial mixtures for each class of concrete qualified by the Trial Mix Design. Each trial mixture shall have a different w/cm ratio or different cementitious materials content that will produce a range of compressive strengths encompassing f'cr.
        3) Design trial mixtures to produce a slump within ¾ inch of the maximum specified and an air content within 0.5 percent of the maximum specified.
        4) For each w/cm ratio or cementitious materials content, cast and cure at least twelve standard test cylinders in accordance with ASTM C192. Four cylinders from each batch tested at age 7-days, 14-days, and 28-days or as required to comply with ACI 318.
        5) From results of the cylinder tests, plot a curve showing the relationship between w/cm ratio and compressive strength.
        6) From the curve of w/cm ratio versus compressive strength, select the w/cm ratio that will produce f'cr. This is the maximum w/cm ratio to be used unless a lower w/cm ratio is specified above.
3. Field Experience Data:
    a. When sufficient test data for a particular mix design is available which is identical or substantially similar to that proposed for use, Contractor may substitute use of this data in lieu of a trial mix design. Field data, reports, and analysis shall conform to ACI 318, except as modified herein.
        1) Historical mix design proportions for which data are submitted may vary from the specified mix within the following limits:
            a) f'c as specified or up to 500 psi above
            b) w/cm ratio as specified or lower
            c) pozzolan content within 5 percent of that specified
            d) maximum coarse aggregate size may not vary smaller, but gradation of coarse aggregate may vary
            e) slump after introduction of admixtures +0/-1 inch.
    b. Use of historical Field Experience Data does not allow modification of the project mix specifications herein without review and acceptance by the Engineer.
    c. Liquid containing structures using Class C-1 concrete mix are intended to be watertight. Provide test results for Class C-1 concrete mix meeting the following requirement: drying shrinkage limit of 0.032 percent in the laboratory at 35-days (7-days moist cure and 28-days drying) as tested in accordance with ASTM C157 and the following modifications:

1) Wet cure specimens for a period of 7-days (including the period of time the specimens are in the mold). Wet cure may be achieved either through storage in a moist cabinet or room in accordance with ASTM C 511, or through storage in lime saturated water.
2) Slump of concrete for testing shall match job requirements and need not be limited to restrictions as stated in ASTM C 157 section 8.4.
3) Report results in accordance with ASTM C 157 at 0, 7, 14 & 28-days of drying.

d. Concrete shall not be placed in the field prior to acceptance of the concrete mix. To meet the drying shrinkage limit, it is recommended that a shrinkage reducing admixture be considered for use in concrete for liquid containing structures.

2.03 WATERSTOPS

A. NOT USED

2.04 SEALANTS AND JOINT FILLERS

A. NOT USED

2.05 BONDING COMPOUNDS

A. Epoxy resin bonding compounds for use in wet areas shall conform to ASTM C881 Types IV or V, Class A, B, or C depending on temperature at use. Acceptable products include: BASF “MasterEmaco ADH 327RS” or “MasterEmaco ADH 1490”; Sika Chemical Corporation “Sikadur 32”; or approved equal.

B. Non-epoxy bonding compounds for use in dry areas for non-structural bonding or as noted on the drawings shall conform to ASTM C1059 Type II. Acceptable products include: Edoco “Burke Acrylic Bondcrete”; ChemMasters “Cretelox”; or approved equal.

C. Apply bonding compounds in accordance with the manufacturer’s instructions.

2.06 EPOXY FOR CRACK INJECTION

A. Use a two-component, moisture insensitive, high modulus, injection grade, 100 percent solids, epoxy-resin blend. Consistency as required to achieve complete penetration into cracks. Material shall conform to ASTM C881 Type 1 Grade 1. Acceptable products include: Sika Corporation “Sikadur 52”; Adhesives Technology Corporation “Crackbond SLV302”; or approved equal.

B. Use epoxy injection for structural crack repairs except as noted below for non-structural cracks in liquid-containing concrete structures. The Engineer shall determine whether a crack is classified as structural or non-structural.

2.07 CHEMICAL GROUT FOR CRACK INJECTION

A. Use hydrophobic polyurethane grout at the Engineer's discretion as an alternative for sealing non-structural cracks in concrete structures intended to be watertight. Acceptable products include: DeNeef Construction Chemicals "Hydro Active Cut" and “Flex SLV PURe” or Sika Corporation “SikaFix HH Plus” and “SikaFix HH LV”; or approved equal.

1.01 RETARDANT

A. Retardant for exposing aggregate for unformed surfaces in construction joints shall be Sika Corporation “Rugasol-S”; W.R. Grace “Top-Cast”; or approved equal.

B. Apply retardant in accordance with manufacturer’s instructions sufficient to assure a minimum penetration of 1/4 inch.

2.08 SURFACE HARDENER

A. Moderate Duty Hardener:
   1. Use a premixed, non-colored, and non-metallic hardener. Acceptable products include: BASF “MasterTop 100”; or approved equal.
   2. Apply hardener in accordance with manufacturer’s instructions, in an amount of at least 0.75 pounds per square foot for commercial, light duty traffic and 1.25 pounds per square foot for heavy duty traffic and process spaces. Product and/or application procedure shall be coordinated with air content of concrete being placed.

B. Apply concrete hardener to all concrete floor surfaces

2.09 CURING AND SEALING COMPOUNDS

A. Acceptable products include: BASF “MasterKure CC 250SB”; Dayton Superior “Cure & Seal 25% J22UV”; or approved equal, conforming to ASTM C309 and ASTM C1315.

B. Compound shall be clear and applied in accordance with the manufacturer’s instructions.

C. Curing and sealing compound shall be certified compliant with final finish system if applicable.

PART 3 EXECUTION

3.01 GENERAL

A. Use only truck-mixed, ready-mixed concrete conforming to ASTM C94. Proportion materials by weighing.

B. Introduce pozzolan into the mixer with cement and other components of the concrete mix; do not introduce pozzolan into a wet mixer ahead of other materials or with mixing water.

C. Introduce water at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified w/c ration and slump is not exceeded and the maximum total water per the approved mix design is not exceeded.

D. Arrange with the testing laboratory for inspection as required to comply with these specifications.

E. Deliver concrete to the site and complete discharge within 90 minutes after introduction of water to the mixture. Extension of allowable time beyond this limit requires a

Contractor proposed remedial action plan to be reviewed and accepted by the Owner's Representative.

3.02 CONVEYING AND PLACING CONCRETE

A. Convey concrete from the mixer to the forms in accordance with ACI 301. Remove concrete that has segregated in conveying from the site of the work.

B. Placing Concrete:
   1. General:
      a. Place concrete in accordance with ACI 301. Do not permit concrete to drop freely more than 4-ft.
   2. Placing Concrete By Pumping:
      a. Concrete placed by pumping is at Contractor's discretion and shall not be the cause to change or relax specified mix design characteristics. Concrete shall possess the specified characteristics at the point of placement.
      b. Measure slump at the hose discharge, except as follows: Initial slump testing in each placement shall occur at both the pumping unit inlet hopper and hose discharge. Slump loss in pumping, measured between the inlet hopper and the hose discharge, shall not exceed 1 inch. After these criteria have been satisfied, slump may be measured at the inlet hopper with allowable slump increased by the earlier measured difference, not to exceed 1 inch.
      c. Measure air content at the hose discharge, except as follows: Initial air content testing shall occur at both the pumping unit inlet hopper and the hose discharge. Loss of air content shall be measured between the inlet hopper and the hose discharge. Increase the air content of the delivered concrete at the inlet hopper to provide the specified air content at the hose discharge. After these criteria have been satisfied, air content may be measured at the inlet hopper.
      d. Before starting each pumping operation, prime the pump and line with a cement slurry to lubricate the system. Waste cement slurry outside the forms. Equip hose tip with a safety chain for recovery in case of hose blowout during pumping. Hose or accessories shall not remain in the freshly placed concrete.
      e. Use tremie placing techniques and equipment for pump placed concrete. Pump discharge system shall remain full of concrete from pump to discharge point at all times. Concrete pumping shall not occur until Owner's Representative has verified equipment including the tremie plug. Should the discharge line become open, with zones empty of concrete, cease pumping and re-primed with tremie plug installed before continuing.
   3. Placing Concrete In Hot Weather:
      a. In temperatures above 80 degrees F, place concrete in accordance with ACI 305.1.
   4. Placing Concrete In Cold Weather:
      a. In temperatures below 45 degrees F, place concrete in accordance with ACI 306.1.

3.03 CONSOLIDATING CONCRETE:

A. Consolidate concrete in accordance with ACI 301. If evidence of inadequate consolidation is observed, concrete placement will be suspended until Contractor provides a revised plan to achieve proper consolidation.

3.04 CURING AND SEALING

A. General:
   1. Cure concrete using water, a clear membrane curing compound, or by a combination of both methods. Coordinate repairs or treatment of concrete surfaces so that interruption of curing will not be necessary.
   2. Maintain concrete surface temperature between 50 degrees F and 80 degrees F for at least 5 days. Cure concrete in hot weather (above 80 degrees F) in accordance with ACI 305.1. Cure concrete in cold weather (below 45 degrees F) in accordance with ACI 306.1.

B. Water Curing:
   1. Keep concrete continuously wet for a minimum of 10-days after placement. Absorptive mats or fabric may be used to retain moisture during the curing period.
   2. Use water curing in hot weather for liquid containment structures. Cover forms and keep moist. Loosen forms as soon as possible without damage to the concrete, and make provisions for curing water to run down inside them. During form removal, take care to provide continuously wet cover to newly exposed surfaces.

C. Curing Compound:
   1. When curing compound is allowed, apply it as soon as the concrete has set sufficiently so as not to be marred by the application or apply it immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, application procedures, and installation precautions shall follow manufacturer's instructions. For liquid containing structures, apply curing compound at twice the manufacturer's recommended dosage rate, applied in two coats perpendicular to each other.
   2. Do not use curing compound on concrete surfaces to be coated, waterproofed, moisture-proofed, tiled, roofed, or where other coverings are to be bonded In these cases, use water curing unless the curing compound is first removed or is compatible with the final finish covering.

3.05 PROTECTION

A. Protect concrete from injurious action by sun, rain, flowing water, frost, and mechanical means.

B. Loading green concrete is not permitted. Green concrete is defined as concrete with less than 100 percent of the specified strength.

C. Backfill shall not be placed against concrete walls until the concrete has reached the specified strength, connecting slabs and beams have been cast and have also reached the specified strength, and watertightness testing and repairs have been completed for liquid containing strutures to the satisfaction of the Owner's Representative.

D. Arrangements for covering, insulating, heating, and protecting concrete in cold weather shall be in accordance with ACI 306.1.

3.06 CONSTRUCTION JOINTS

A. General:
   1. Place concrete in each unit of construction continuously. Before new concrete is placed on or against concrete which has set, retighten forms and clean foreign matter from the surface of the set concrete. Provide waterstops as specified.

B. Construction:
   1. Form construction joints by producing a rough surface of exposed aggregates using a surface retardant; include joints between the slab and topping concrete. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, remove retarded surface mortar either by high pressure water jetting or stiff brushing or combination of both so as to expose coarse aggregate. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/4 inch of laitance film and expose coarse aggregate to ensure adequate bond and watertightness at the construction joints.

C. Locations:
   1. Provide construction joint locations as follows:
      a. Cast walls exceeding 50 feet in length in panels not to exceed 30 feet in length. Cast adjoining panels only after 5-days have elapsed. Joints are not allowed within the lesser of 10 feet or 25 percent of the wall length from a corner unless specifically detailed thus on the drawings.
      b. Locate joints in beams or girders at or near the quarter point between supports.
      c. Make joints in the members of a floor system at or near the quarterpoint of the span.
      d. Make joints in walls and columns at the underside of floors, slabs, beams or girders and at the tops of footings or floor slabs.
      e. Cast slab panels in checkerboard patterns not to exceed 40 feet in length and not to exceed 900 square feet in area, with maximum 1 ½ to 1 ratio of side lengths. Minimum lapsed time between placing adjacent panels shall be 3-days. The requirements for size of slab panel is waived if joints are located on the Drawings.
   2. Vertical construction joints shall have edges grooved or beveled at faces exposed to view including interior faces of basins and tanks. Seal grooves subjected to wetting or weather with joint sealant.
   3. Continue reinforcing steel through construction joints. Beams, girders, and floor slabs shall not be constructed over columns or walls until at least one day has elapsed to allow for initial shrinkage in the column or wall. No joint will be allowed between a slab and a beam or girder unless otherwise shown. Joints shall be perpendicular to the main reinforcement. Provide waterstops in construction joints as specified.

3.07 INSERTS AND EMBEDMENTS

A. Inserts:

1. Where pipes, castings, or conduits are to pass through structures, position in forms before placing concrete; or where shown on Drawings or approved by the Owner's Representative, provide openings in the concrete for subsequent insertion of such pipes, castings, or conduits. Provided waterstops and a slight flare in the form to facilitate grouting and permit the escape of entrained air during grouting.
2. Provide additional reinforcement around openings. Use non-shrink grout to infill around inserts.
3. Place horizontal conduits and pipes, in slabs and beams, between the top and bottom layers of reinforcement. Spacing and size limitations shall conform to ACI 318.
4. Conduits and pipes shall not run directly beneath a column.
5. Position conduit, pipe, dowels, and other ferrous items such that there will be a minimum of 2-inches clearance between said item and concrete reinforcement. Welding inserts to reinforcement is not permitted.
6. The outside diameter of conduit or pipe shall not exceed one-fourth the slab or beam thickness.

B. Embedments:
1. Gate frames, gate thimbles, special castings, channels, grating frames, or other miscellaneous metal parts to be embedded in concrete shall be secured in the forms prior to concrete placement.
2. Embed anchor bolts and inserts in concrete as shown. Provide inserts, anchors, or other bolts necessary for the attachment of piping, valves, metal parts, and equipment.
3. Provide nailing blocks, plugs, strips, and the like necessary for the attachment of trim, finish, and similar work. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent entry of concrete. Do not use continuouse anchor slots or strips in concrete intended to be watertight.
4. Positon operators or sleeves for gate or valve stems to clear reinforcing steel, conduit, and other embedments, and to align accurately with equipment.

3.08 EXPANSION JOINTS

A. Expansion joints shall be as shown. Do not extend reinforcement or other embedded metal items through expansion joints. Provide waterstops where indicated.

3.09 WATERSTOPS

A. Waterstops shall conform to ACI 301. Tie waterstops in position prior to placement of concrete to prevent movement and deformation.

B. Provide waterstops in construction and expansion joints as follows:
1. Joints in parts of structures exposed to ground or water on one side and occupied by non-submerged equipment or by personnel on the other.
2. Wall and slab joints of tanks and channels subject to water pressure.
3. Waterstops shall be provided for the full height of the walls.
4. Provide at other locations shown on the Drawings.

C. Field splices shall be at straight sections using heat fused welded, butt splices only. Lapping of splices or joining by means other than heat fused welding is not allowed.

D. Install hydrophilic waterstops according to manuacturer's recommendations. Surfaces of concrete shall be prepared level/plumb and to the smoothness required by manufacturer. Grind surface as necessary. Provide bonding adhesive and concrete nails with fender washers to hold waterstop in position during concrete placment.

3.10 MODIFICATION OF EXISTING CONCRETE

A. General:
   1. Verify structural dimensions related to or controlled by previously constructed or existing structures prior to concrete work.

B. Cutting or Coring Concrete:
   1. Saw cut concrete to a depth of 1 inch to form straight outlines of concrete areas to be removed. Where reinforcement is exposed due to saw cutting or core drilling and no new material is to be placed on the cut surface, provide a protective epoxy coating to the entire cut surface.
   2. Coat surfaces of oversized openings with an epoxy bonding compound prior to re-finishing with profiling mortar to the required opening size.
   3. Grind existing joint edges to create a chamfer matching those used on adjacent construction.
   4. Investigate concrete to be drilled, cored, or sawcut to determine location of reinforcing steel. Locate penetrations to clear existing reinforcing steel. Where not possible to avoid reinforcing steel, consult the Engineer as to acceptability of cutting reinforcing steel and provide new reinforcing systems as directed.
   5. Locating methods include chipping to expose reinforcing steel, ground penetrating radar, X-ray, or magnetic flux devices. Locates of existing reinforcing shall be by the Contractor.

C. Joining New Concrete To Existing:
   1. Existing concrete surfaces to be joined with new concrete shall be cleaned and roughened by abrasive blasting, bush hammering, or other method to achieve ¼-inch amplitude surface. Remove existing metalwork, embeds, or other interfering items. Coat existing surface with epoxy bonding compound prior to placement of new concrete.

D. Post-Installed Anchors and Dowels:
   1. Use non-destructive methods for locating reinforcement prior to drilling operations. For anchor and dowel locations that interfere with reinforcement, attempt to relocate to avoid drilling through the reinforcement if possible.
   2. For situations that do not allow relocation, cutting of reinforcement for installation is subject to the following:
      a. Prior to drilling through reinforcement, the Contractor shall consult the Owner's Representative or Engineer.
      b. Drill holes with a hammer drill and carbide bit (core drilled holes are not allowed), followed by brushing and air-cleaning with oil-free compressed air.

c. Holes drilled through reinforcement must be in compliance with adhesive anchor assumptions for roughened hole surface typical of a hammer drill and carbide bit. No smooth hole surfaces are allowed.

d. Do not cut slab rebar within 24 inches of a supporting wall, column, or an opening in the slab.

e. No cutting of rebar is allowed in the middle third of slab spans for anchors with diameters equal to or greater than 3/4 inch.

f. Maximum of two rebar may be cut in any 10 foot width of slab.

g. Maximum of two rebar may be cut within any 10 foot width of concrete wall.

h. Maximum of one rebar may be cut within any 8 foot width of CMU wall.

3. For anchors that cannot be moved and that conflict with the above requirements, consult Engineer for direction. It is not acceptable to cut reinforcement in beams, columns, precast members, or stairs.

4. Use a pre-manufactured, self-mixing, injectable, two-component, epoxy adhesive, as per Section 03 60 00. Follow manufacturer's recommendations and ICC Evaluation Report for installation.

E. Waterstops:

1. Where a waterstop between new and existing concrete is required, install either a hydrophilic waterstop or a retrofit waterstop as indicated.

3.11 FORMED SURFACE FINISHES

A. Repair Of Surface Defects:

1. Repair surface defects, including tie holes, minor honeycombing, or otherwise defective concrete in accordance with ACI 301. Clean areas to be repaired. Cut and chip out honeycombed or otherwise defective areas to solid concrete, to a depth of at least 1-inch. If defective area includes exposed reinforcing steel, correct by removing concrete a minimum of 1-inch beyond the reinforcing. Make edges of the cut perpendicular to the surface of the concrete in a neat rectangular patern.

2. Joints shall be grooved to a radius or bevel of ¾-inch depth.

3. Finish patches on exposed surfaces to match and blend with adjoining work. Cure patches as specified for the concrete. Protect finished surfaces from stains and abrasions.

B. Formed Surface Finishes:

1. Finish A - Grout Rubbed Finish

a. After repair of surface defects, apply a grout rubbed finish in accordance with ACI 301 except that all form fins and other protrusions shall be completely removed. Lightly sandblast surfaces prior to sacking. Sandblasting shall occur after the specified curing period.

b. Add a PVA bonding compound to the mix water used in sacking mortar; as recommended by the manufacturer.

c. Provide Finish A at uncoated surfaces of stair wells, interior surfaces of equipment rooms, galleries, tunnels, operations areas, exposed channels and tanks from 1 foot below minimum water surfaces and up, and at permanently exposed vertical and sloped surfaces such as pipe chases.

d. Do not provide Finish A at concrete surfaces receiving a coating.

2. Finish B - Smooth Surface Finish
    a. Initial surface preparation is the same as Finish A; repair surface defects and remove all form fins.
    b. Provide Finish B at surfaces to be coated. See Section [09 90 00] for additional concrete surface preparation, including filling of bug holes, and coating requirements.
3. Finish C - Rough Form Finish
    a. Repair surface defects and imperfections greater than 3/8 inch in any dimension. Remove form fins and protrusions down to less than 3/8 inch projection.
    b. Provide Finish C or smoother, for interior surfaces of wet wells, tanks, and channels; from 1 foot below minimum water surface and down.
    c. Also apply Finish C to unoccupied interior areas not otherwise specified.
4. Finish D – Unfinished Surface
    a. Repair surface defects and otherwise leave the surfaces as they come from the forms, except plug tie holes and repair or remove defects greater than 1/2 inch in any dimension.

C. Sample Of Formed Surface Finish A:
1. Provide a sample concrete panel, minimum 4 feet by 4 feet; representative of formed surface Finish A. The panel shall be representative of the workmanship and finish required, including repair of defects, filling of tie holes, sandblasting, and rubbing.
2. The sample shall be approved by the Owner's Representative prior to the start of production work. The sample shall be on display at the job site, and finished surfaces shall match sample.

3.12 SLAB FINISHES

A. General:
1. The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Do not use dry cement on new concrete surfaces to absorb excess moisture. Round edges to a radius of 1/2 inch.
2. Slope floors to drain uniformly within a room or space. Unless otherwise specified, slope shall be a minimum of 1/8 inch per foot toward nearest drain. Restrict use of floor drains with only locally depressed slabs to locations specifically noted.
3. Immediately after final finish is applied, the surface shall be cured and protected as specified in Curing, Sealing, and Protection paragraphs above.
4. Where finish is not specified, floor slabs shall receive a Steel Trowel Finish.

B. Float Finish:
1. Perform floating with a hand or power-driven float in accordance with ACI 301. Begin floating when the bleed water sheen has disappeared and the surface has stiffened sufficiently. Float as required to meet tolerance requirements of ACI 117 for a conventional surface.
2. Floating shall close cracks and checks plus compact and smooth the surface. Refloat the slab to a uniform texture.
3. Applly float finish to surfaces of channels, tank bottom slabs, tops of footings, and surfaces to receive insulation or roofing.

C. Steel Trowel Finish:
   1. Float the concrete surface as indicated above and then trowel in accordance with ACI 301.
   2. Provide Steel Trowel Finish on floors and walking surfaces unless specified otherwise.

D. Broom Finish:
   1. Float the concrete surface as indicated above, then immediately give the concrete a coarse transverse scored texture by drawing a broom or burlap belt across the surface in accordance with ACI 301.
   2. Provide a Broom Finish for walks, top of tank walls, slabs-on-grade exposed to atmosphere, and where otherwise indicated.

E. Samples Of Concrete Slab Finishes:
   1. Provide a sample concrete slab, minimum 4 feet by 4 feet, representative of workmanship and each specified finish.
   2. Samples shall be approved by the Owner's Representative prior to the start of production work. The samples shall be on display at the job site, and finished surfaces shall match samples.

3.13 RELATED SURFACES

A. Finishing of Unformed Surfaces:
   1. Adjacent Unformed Surfaces:
      a. Tops of walls, buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be Float Finished to a texture reasonably consistent with that of the adjacent formed surface.
      b. Continue final treatment of formed surface uniformly across the top of the unformed surface.
   2. Pavements and Sidewalks:
      a. The surface of the concrete shall be screeded to grade and sloped to drain. After screeding, the surface shall be Float Finished followed by a Broom Finish.
      b. Round edges and expansion joints to a radius of 1/2 inch. Control joints shall be grooved or sawcut to a minimum depth of 1/4 the slab thickness.

3.14 FIELD SAMPLING AND TESTS

A. General:
   1. Field sampling and tests shall be performed by an independent testing laboratory. Samples of aggregates and concrete will be obtained at such times to represent the quality of the materials and work throughout the project.
   2. The laboratory shall provide necessary labor, materials and facilities for sampling aggregate and for casting, handling, and initially storing the concrete samples at the work site.
   3. The minimum number of samples and tests are specified in Testing paragraph below.

B. Sampling:

1. Aggregates:
    a. General:
        1) Sample fine and coarse aggregates in accordance with ASTM D75 not less than 30 days prior to the use of such aggregates in the work.
        2) Take samples at the discharge gates of the bins feeding the weigh hopper. Repeat sampling when the source of material is changed or when unacceptable deficiencies or variations from the specified requirements of materials are found.
        3) Aggregate samples shall be tagged and their sources idenified.
    b. Coarse Aggregate:
        1) Take a sample weighing between 50 and 60 pounds after the batch plant is brought up to full operation.
        2) Take samples to obtain a uniform cross section, accurately representing the materials on the belt or in the bins for sieve analysis.
    c. Fine Aggregate:
        1) Take samples as specified for coarse aggregate.
        2) Take samples of sand when the sand is moist for sieve analysis and specific gravity tests.
2. Concrete:
    a. Take samples of plastic concrete in accordance with ASTM C172.
    b. Take samples at the hopper of mixing equipment or transit mix truck, except as noted in the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

C. Testing:
1. Aggregate:
    a. A minimum of one test of coarse aggregate per 400 cubic yards of concrete used and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, cleanliness and sand equivalent.
    b. A maximum of one test per day of each aggregate is required.
    c. Repeat of the entire concrete mix design test program is required before source changes will be accepted.
2. Concrete:
    a. Strength Tests:
        1) The strengths specified for the design mix shall be verified by the independent testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site. Cylinders shall be 4 by 8 inch or 6 x 12 inch.
        2) Concrete samples shall represent the concrete placed in the forms. One set of six standard 6 x 12 inch (or nine 4 x 8 inch) cylinders shall be cast of each class of concrete for each 100 cubic yards or less, or for each 5,000 square feet of slab or wall surface area placed per day. Provide additional cylinders when an error in batching is suspected. Each set of cylinders are cast from material taken from a single load of concrete.

3) Casting, handling and curing of cylinders shall be in accordance with ASTM C31. For the first 24 hours after casting, keep cylinders moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the testing laboratory will transport the cylinders to their laboratory.

4) Testing of specimens for compressive strength shall be in accordance with ASTM C39. Each test shall consist of two 6 x 12 inch (or three 4 x 8 inch) test cylinders from each group of six (or nine) specimens. Test at the end of 7 days and at the end of 28 days. The remaining cylinders shall be tested at the end of 56 days if the 28-day strength reports below specification.

5) A strength test shall consist of the average strength of two 6 x 12 inch (or three 4 x 8). If one cylinder shows evidence of low strength due to improper sampling, casting, handling, or curing, the result of the remaining cylinders may be used if approved by the Owner's Representative.

6) The average of any three consecutive 28-day strength test results of the cylinders representing each class of concrete for each structure shall be equal to or greater than the specified strength. Not more than 10 percent of the individual strength test results shall have values less than the specified 28-day strength for the total job concrete. No individual strength test result shall be less than the specified strength by more than 500 pounds per square inch.

7) Provide certified reports of the test results directly to the Owner's Representative and the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump, water/cement ratio, air content, temperature of concrete, and ambient temperature shall be noted.

8) The 28-day strength test results shall be evaluated in accordance with ACI 214R. Quality control charts showing field test results shall be included with the test results for each class of concrete in each major structure. Charts shall be prepared in accordance with ACI 214R. Quality control charts shall be maintained throughout the entire project and shall be available for the Owner's Representative's inspection at any time.

9) If the 28-day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Report changes and adjustments in writing to the Owner's Representative.

10) If compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or load tests acceptable to the Engineer. Costs of such tests and/or anlysis shall be borne by the Contractor.

b. Tests for Consistency of Concrete:

1) Measure slump in accordance with ASTM C143. Take samples for slump determination from concrete during placement. Tests shall be made at the beginning of concrete placement operation, whenever test cylinders are cast, and at subsequent intervals to ensure that the specification requirements are met.

2) For pumped concrete, measure slump in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

3) When high range water reducer is added at the site, slump tests shall be taken before and after addition of the admixture.

c. Tests for Temperature and Air Content:

1) Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Perform temperature tests whenever test cylinders are cast.

2) Measure air content in accordance with ASTM C231 whenever test cylinders are cast. For pumped concrete, measure air content in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

D. Final Laboratory Report:

1. The testing laboratory shall provid a final report at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure.
2. Include final quality control charts for compressive strength tests for classes of concrete specified in each major structure. Also include the concrete batch plant's coefficient of variation and standard deviation results for each class of concrete.

3.15 REPAIR OF DAMAGED AND CRACKED CONCRETE:

A. Acceptance Of Concrete:

1. Completed cast-in-place concrete work shall conform to the applicable requirements of ACI 301 and the Contract Documents. Concrete work that fails to meet these requirements shall be repaired, as approved by the Engineer, to bring the concrete into compliance. Repair methods shall be in accordance with ACI standards, including ACI 503.7, and are subject to the approval of the Engineer.
2. Concrete that cannot be brought into compliance by approved repair methods will be rejected. Remove and replace rejected concrete work.
3. The cost of repairs and replacement of defective concrete shall be borne by the Contractor.

B. Repair Methods:

1. Damaged/defective concrete or concrete with crack widths exceeding 0.004 inches at liquid-containing and conveying structures or crack widths exceeding 0.006 inches for other structures shall be repaired by one of the following methods (only the Engineer may determine that a defect or crack does not require repair):
   a. Perform watertightness testing and repair as needed to meet leakage criteria in this specification even when liquid-containing and conveying structures meet the crack width criteria defined above.
   b. Damaged or defective concrete includes surface defects, honeycomb, rock pockets, indentations greater than 3/16 inch, spalls, chips, air bubbles greater than 1/2 inch diameter, pinholes, bugholes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins, projections, form popouts, texture irregularities, and stains or other color variation that cannot be removed by cleaning.

1) Damaged or defective concrete is repaired according to procedures outlined above under finish requirements, Repair of Surface Defects.

2. Crack Repair Method 1:
   a. Fill the joint or crack by drilling holes to the affected area (following the product manufacturer's details), install injection ports, and force epoxy or chemical grout (expanding urethane) into the joint under pressure.
   b. Material type and repair proceedures shall be approved by Engineer.
   c. After injection and curing; ports, sealing mix, and surface shall be cleaned and worked to match the adjacent specified finish.
3. Crack Repair Method 2:
   a. Fill cracks with low viscosity epoxy, applied by pouring/flooding crack zone until cracks are filled. Prepare surface, install, and cure according to manufacturer's recommendations.
   b. At a minimum, prepare surface to be clean and dry with no visible detrimental material in cracks to be filled. Conform to temperature limitations of epoxy. Clean and refinish to match adjacent surfaces.
4. Crack Repair Method 3:
   a. Cut a bevel groove 3/8 to 1/2 inch in width and depth, use backer rod or tape, and fill with sealant in accordance with manufacturer's instructions.
   b. This repair method is only used where approved by Engineer.
   c. Groove and sealant shall be applied on wet or hydrostatic pressure side of surface.

C. Repair Method Use:
1. Repair Method 1: For cracks in walls, surfaces sloped 1:1 or greater, beams, columns, structural slabs, overhead surfaces, and liquid retaining surfaces. Need for repair depends upon crack width, location, and leakage.
2. Epoxy grout is used for repair of structural cracks and chemical grout (expanding urethane) for repair of non-structural cracks at liquid-containing structures. The Engineer shall determine whether a crack is classified as structural or non-structural.
3. Repair Method 2: Utilized in lieu of Method 1 for slabs when approved by Owner's Representative. Final finish shall match adjacent surfaces.
4. Repair Method 3: Limited to dry-surface slabs, walls subject to less than three feet of liquid pressure, or as approved by Engineer. Repair Method 3 is not an equivalent repair method to Repair Methods 1 or 2, which shall be considered the standards.

3.16 CLEANUP

A. Upon completion of the work and prior to final inspection, clean all concrete surfaces as follows: Sweep with a broom to remove loose dirt, then mop and/or flush with clean water. Scrub by hand or machine as required to remove and blend stains or discolored areas .

B. Clean floors that have curing and sealing compound as stated above, followed by the final application of curing and sealing compound.

END OF SECTION

SECTION 03 40 00

CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This item shall consist of finished concrete pavement constructed of Portland cement concrete on the prepared subgrade over crushed stone base course, in conformity with the plans, as herein specified to match the existing concrete pavement lines and grades.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work:
   1. Section 03 11 00 Concrete Forming
   2. Section 03 20 00 Concrete Reinforcing
   3. Section 03 30 00 Cast-In-Place Concrete

1.03 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00.
   2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
   4. Each proposed mix design showing:
      a. Expected strength at 7 and 28-days
      b. Slump, before and after introduction of high-range water-reducing admixture
      c. Water/cement ratio
      d. Weights and test results of the ingredients
      e. Aggregate gradation
      f. Test results of mix design prepared by an independent testing laboratory
      g. Shrinkage test results for liquid containing structures
      h. Other physical properties necessary to review each mix design for conformance with these specifications
   5. Product literature and technical data for aggregates, cement, and pozzolan.
   6. Product literature, technical data, and dosage of proposed admixtures including, but not limited to, air entraining, water reducing, retarding, shrinkage reducing, etc.

7. Anticipated average delivery time from batch plant to site. If this time exceeds the limit specified in Part 3, include proposed method to extend set time without deleterious effects on final product. Engineer's Representative reserves the right to accept or reject such proposed methods.
8. Placement Drawings: Submit shop drawings for concrete placements on the project before on-site construction begins. The drawings shall be organized by concrete panel and submitted as a complete set for the Engineer's review. The drawings shall be drawn to scale and show dimensions, forming details, and placement volumes. Show location of construction joints, expansion joints and contraction joint; details of surface preparation, scheduled finish, embedments, penetrations, openings, etc. The drawings shall clearly show the placement sequence and will be accompanied by a schedule that shows the schedule dates for forming, placement, and stripping for each section of concrete placed within each structure.
9. Curing program description in sufficient detail to demonstrate that the Contractor will provide acceptable strength, finish, and crack control within the completed structure.
10. Product literature and technical data for curing and sealing compounds, bonding compounds, epoxy and chemical grout for crack injection, and retardant.
11. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.

1.04 QUALITY ASSURANCE

A. Quality Control By Engineer:
1. Special Inspection of concrete work shall be performed by the Special Inspector under contract with the Engineer and in conformance with the IBC Chapter 17. Special Inspection of concrete is in addition to, not replacing, other inspections and quality control requirements specified herein. Where sampling and testing specified herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
2. All structural concrete work shall receive Special Inspection in accordance with IBC Chapter 17. Structural concrete includes elements which resist code-defined loads and whose failure would impact life safety. Non-structural site work concrete does not require Special Inspection. Anchor bolts and anchors installed in hardened concrete require Special Inspection.
3. Refer to Section 01 45 00 Quality Control, for Engineer provided testing.

B. Quality Control By Contractor:
1. Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329. The testing laboratory shall sample and test concrete materials as specified in this section. Costs of testing laboratory services shall be borne by the Contractor.

C. Basis For Quality:
1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

PART 2 PRODUCTS

2.01 MATERIALS:

A. **Cast-In-Place Concrete.** Provide concrete in accordance with Specification 03 30 00 Cast-In-Place Concrete. Provide Class A concrete designed to meet a minimum average compressive strength of 2,800 psi at 7-days or a minimum average compressive strength of 4,000 psi at 28-days. Test in accordance with ASTM C78 and TxDOT standard laboratory test procedure Tex-448-A or Tex-418-A.

Use Class B concrete for curbs that are placed separately from the pavement. Provide concrete that is workable and cohesive, possesses satisfactory finishing qualities, and conforms to the mix design and mix design slump.

B. **Reinforcing Steel.** Provide Grade 60 deformed steel for bar reinforcement in accordance with Specification 03 20 00 Concrete Reinforcing. Provide approved positioning and supporting devices (baskets and chairs) capable of securing and holding the reinforcing steel in proper position before and during paving in accordance with Section 2.01.C, "Positioning and Support Devices for Reinforcement and Joint Assemblies." Provide corrosion protection when shown on the plans.

1. **Dowels.** Provide smooth, straight dowels of the size shown on the plans, free of burrs, and conforming to the requirements of 03 20 00 Concrete Reinforcing. Coat dowels with a thin film of grease or other approved de-bonding material. Provide dowel caps on the lubricated end of each dowel bar used in an expansion joint. Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of the expansion joint.

2. **Tie Bars.** Provide straight deformed steel tie bars. Provide either multiple-piece tie bars or single-piece tie bars as shown on the plans. Provide multiple-piece tie bars composed of 2 pieces of deformed reinforcing steel with a coupling capable of developing a minimum tensile strength of 125% of the design yield strength of the deformed steel when tensile-tested in the assembled configuration. Provide a minimum length of 33 diameters of the deformed steel in each piece. Use multiple-piece tie bars from the list of "Prequalified Multiple Piece Tie Bar Producers" maintained by the TxDOT Construction Division, or submit tested samples in accordance with TxDOT standard laboratory test procedure Tex-711-I. A laboratory test report from an independent laboratory that has conducted Tex-711-I on the unapproved multiple piece tie bar may also be submitted to the Engineer for consideration.

C. **Positioning and Support Devices for Reinforcement and Joint Assemblies.** These devices shall be of sufficient structural quality to prevent movement of the dowels or steel reinforcement during concrete placement and finishing. Devices shall be of a type approved by the Engineer.

Positioning and supporting devices (chairs) for steel reinforcement bars shall be either plastic or metal and of sufficient number to maintain the position of the bars within the allowable tolerances.

Metal positioning and supporting devices for expansion and contraction joint assemblies (such as welded wire bar chairs, bar stakes, etc.) where used shall be as shown on the plans or may be similar devices of equivalent or greater strength, approved by the

Engineer. The support devices shall secure the joint assembly and dowels within the allowable tolerances while providing no restraint against joint movement. Dowels used in joint assemblies shall be secured in parallel position by a transverse metal brace of the type and design shown on the plans, or may be secured by other devices approved by the Engineer. The devices shall provide positive mechanical connection between the brace and each unit (other than by wire tie) and prevent transverse movement of each load transmission device.

D. **Curing Materials.** Provide Type 2 membrane curing compound conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants." Provide materials for other methods of curing conforming to the requirements of Specification 03 30 00 Cast-In-Place Concrete.

E. **Epoxy.** Provide Type III epoxy in accordance with TxDOT DMS-6100, "Epoxies and Adhesives," for installing all drilled-in reinforcing steel.

F. **Evaporation Retardant.** Provide evaporation retardant conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants."

G. **Joint Sealants and Fillers.** Provide Class 5 or Class 8 joint-sealant materials and fillers unless otherwise shown on the plans or approved and other sealant materials of the size, shape, and type shown on the plans in accordance with TxDOT DMS-6310, "Joint Sealants and Fillers."

2.02 EQUIPMENT:

A. Furnish and maintain all equipment in good working condition. Use measuring, mixing, and delivery equipment conforming to the requirements of Specification 03 30 00 Cast-In-Place Concrete. Obtain approval for other equipment used.

B. **Placing, Consolidating, and Finishing Equipment.** Provide approved self-propelled paving equipment that uniformly distributes the concrete with minimal segregation and provides a smooth machine-finished consolidated concrete pavement conforming to plan line and grade. Provide an approved automatic grade control system on slip-forming equipment. Provide approved mechanically operated finishing floats capable of producing a uniformly smooth pavement surface. Provide equipment capable of providing a fine, light water fog mist.

Provide mechanically operated vibratory equipment capable of adequately consolidating the concrete. Provide immersion vibrators on the paving equipment at sufficiently close intervals to provide uniform vibration and consolidation of the concrete over the entire width and depth of the pavement and in accordance with the manufacturer's recommendations. Provide immersion vibrator units that operate at a frequency in air of at least 8,000 cycles per minute. Provide enough hand-operated immersion vibrators for timely and proper consolidation of the concrete along forms, at joints and in areas not covered by other vibratory equipment. Surface vibrators may be used to supplement equipment-mounted immersion vibrators. Provide tachometers to verify the proper operation of all vibrators.

For small or irregular areas or when approved by the Engineer, the paving equipment described in this Section is not required.

C. **Forming Equipment.**

1. **Pavement Forms.** Provide metal side forms of sufficient cross-section, strength, and rigidity to support the paving equipment and resist the impact and vibration of the operation without visible springing or settlement. Use forms that are free from detrimental kinks, bends, or warps that could affect ride quality or alignment. Provide flexible or curved metal or wood forms for curves of 100 foot radius or less.

2. **Curb Forms.** Provide curb forms for separately placed curbs that are not slip formed that conform to the requirements of Specification 03 11 00 Concrete Forming and as indicated on the plans.

D. **Reinforcing Steel Inserting Equipment.** Provide inserting equipment that accurately inserts and positions reinforcing steel in the plastic concrete parallel to the profile grade and horizontal alignment in accordance to plan details.

E. **Texturing Equipment.**

1. **Carpet Drag.** Provide a carpet drag mounted on a work bridge or a moveable support system. Provide a single piece of carpet of sufficient transverse length to span the full width of the pavement being placed and adjustable so that a sufficient longitudinal length of carpet is in contact with the concrete being placed to produce the desired texture. Obtain approval to vary the length and width of the carpet to accommodate specific applications. Use an artificial grass-type carpet having a molded polyethylene pile face with a blade length of ⅝ to 1 inch, a minimum weight of 70 oz. per square yard, and a strong, durable, rot-resistant backing material bonded to the facing.

2. **Tining Equipment.** Provide a self-propelled transverse metal tine device equipped with 4 to 6 inch steel tines and with cross-section approximately 1/32 inch thick by 1/12 inch wide, spaced at 1 inch, center-to-center. Hand-operated tining equipment that produces an equivalent texture may be used only on small or irregularly shaped areas or, when permitted, in emergencies due to equipment breakdown.

F. **Curing Equipment.** Provide a self-propelled machine for applying membrane curing compound using mechanically pressurized spraying equipment with atomizing nozzles. Provide equipment and controls that maintain the required uniform rate of application over the entire paving area. Provide curing equipment that is independent of all other equipment when required to meet the requirements of Article 4.I, “Curing.” Hand-operated pressurized spraying equipment with atomizing nozzles may be used on small or irregular areas or when permitted.

G. **Sawing Equipment.** Provide power-driven concrete saws to saw the joints shown on the plans. Provide standby power-driven concrete saws during concrete sawing operations. Provide adequate illumination for nighttime sawing.

H. **Grinding Equipment.** When required, provide self propelled powered grinding equipment that is specifically designed to smooth and texture concrete pavement using circular diamond blades. Provide equipment with automatic grade control capable of grinding at least a 3 foot width longitudinally in each pass without damaging the concrete.

I. **Testing Equipment.** Provide testing equipment regardless of job-control testing responsibilities in accordance with Specification 03 30 00 Cast-In-Place Concrete, unless otherwise shown in the plans or specified.

J. **Coring Equipment.** When required, provide coring equipment capable of extracting cores in

accordance with the requirements of TxDOT standard laboratory test procedure Tex-424-A.

K. **Miscellaneous Equipment.** Furnish both 10 foot and 15 foot steel or magnesium long-handled standard straightedges. Furnish enough work bridges, long enough to span the pavement, for finishing and inspection operations. Furnish date stencils to impress pavement placement dates into the fresh concrete, with numerals approximately 2 inches high by 1 inch wide by ¼ inch deep.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Obtain approval for adjustments to existing grade-line to maintain thickness over minor subgrade or base high spots while maintaining clearances and drainage. Maintain subgrade or base in a smooth, clean, compacted condition in conformity with the required section and established grade until the pavement concrete is placed. Keep subgrade or base damp with water sufficiently in advance of placing pavement concrete. Adequately light the active work areas for all nighttime operations. Provide and maintain tools and materials to perform testing.

B. **Paving and Quality Control Plan.** Unless otherwise shown on the plans, submit a paving and quality control plan for approval before beginning pavement construction operations. Include details of all operations in the concrete paving process, including longitudinal construction joint layout, sequencing, curing, lighting, early opening, leave-outs, sawing, inspection, testing, construction methods, other details and description of all equipment. List certified personnel performing the testing. Submit revisions to the paving and quality control plan for approval.

C. **Job-Control Testing.** Unless otherwise shown on the plans, perform all fresh and hardened concrete job-control testing at the specified frequency. Provide job-control testing personnel meeting the requirements of 03 30 00 Cast-In-Place Concrete. Provide and maintain testing equipment, including strength testing equipment at a location acceptable to the Engineer. Use of a commercial laboratory is acceptable. Maintain all testing equipment calibrated in accordance with pertinent test methods. Make strength-testing equipment available to the Engineer for verification testing.

Provide the Engineer the opportunity to witness all tests. The Engineer may require a retest if not given the opportunity to witness. Furnish a copy of all test results to the Engineer daily. Check the first few concrete loads for slump, air, and temperature on start-up production days to check for concrete conformance and consistency. Sample and prepare strength test specimens (2 specimens per test) on the first day of production and for each 3,000 square yards or fraction thereof of concrete pavement thereafter. Prepare at least 1 set of strength-test specimens for each production day. Perform slump, air, and temperature tests each time strength specimens are made. Monitor concrete temperature to ensure that concrete is consistently within the temperature requirements. The Engineer will direct random job-control sampling and testing. Immediately investigate and take corrective action as approved if any Contractor test result, including tests performed for verification purposes, does not meet specification requirements.

When job-control testing by the Contractor is waived by the plans, the Engineer will perform the testing; however, this does not waive the Contractor's responsibility for providing

materials and work in accordance with this Item.

1. **Job-Control Strength.** Unless otherwise shown on the plans or permitted by the Engineer, use 7-day job-control concrete strength testing in accordance with TxDOT standard laboratory test procedure Tex-418-A.

   For 7-day job-control by compressive strength, use a compressive strength of 2,800 psi or a lower job-control strength value proven to meet a 28-day compressive strength of 4,000 psi as correlated in accordance with TxDOT standard laboratory test procedure Tex-427- A.

   Job control of concrete strength may be correlated to an age other than 7-days in accordance with TxDOT standard laboratory test procedure Tex-427-A when approved.

   When a job-control concrete strength test value is more than 10% below the required job- control strength or when 3 consecutive job-control strength values fall below the required job-control strength, investigate the strength test procedures, the quality of materials, the concrete production operations, and other possible problem areas to determine the cause. Take necessary action to correct the problem, including redesign of the concrete mix if needed. The Engineer may suspend concrete paving if the Contractor is unable to identify, document, and correct the cause of low strength test values in a timely manner. If any job-control strength is more than 15% below the required job-control strength, the Engineer may evaluate the structural adequacy of the pavements. When directed, remove and replace pavements found to be structurally inadequate at no additional cost.

2. **Split-Sample Verification Testing.** When indicated on the plans, perform split-sample verification testing with the Engineer on random samples taken and split by the Engineer at a rate of at least 1 for every 10 job-control samples. The Engineer will evaluate the results of split-sample verification testing. Immediately investigate and take corrective action as approved when results of split-sample verification testing differ more than the allowable differences shown in Table 1, or when the average of 10 job-control strength results and the Engineer's split-sample strength result differ by more than 10%.

Table 1 Verification Testing Limits

Test Method[1]	Allowable Differences
Temperature, Tex-422-A	2°F
Slump, Tex-415-A	1 inch
Air content, Tex-414-A or Tex-416-A	1%
Compressive strength, Tex-418-A	10%

[1] TxDOT standard laboratory test procedures

D. **Reinforcing Steel and Joint Assemblies.** Accurately place and secure in position all reinforcing steel as shown on the plans and in accordance with the requirements herein. Place dowels at mid-depth of the pavement slab, parallel to the surface. Place dowels for transverse contraction joints parallel to the pavement edge. Tolerances for location and alignment of dowels will be shown on the plans. Stagger the longitudinal reinforcement splices to avoid having more than ⅓ of the splices within a 2 foot longitudinal length of each lane of the pavement. Use multiple-piece tie bars or drill and epoxy grout tie bars at longitudinal construction joints. Verify that tie bars that are drilled and epoxied into concrete at longitudinal construction joints develop a pullout resistance equal to a minimum of ¾ of the yield strength of the steel after 7-days. Test 15 bars using ASTM E-488, except that

alternate approved equipment may be used. All 15 tested bars must meet the required pullout strength. If any of the test results do not meet the required minimum pullout strength, perform corrective measures to provide equivalent pullout resistance. Repair damage from testing. Acceptable corrective measures include but are not limited to installation of additional or longer tie bars.

1. **Manual Placement.** Secure reinforcing bars at alternate intersections with wire ties or locking support chairs. Tie all splices with wire.
2. **Mechanical Placement.** If mechanical placement of reinforcement results in steel misalignment or improper location, poor concrete consolidation, or other inadequacies, complete the work using manual methods.

E. **Joints.** Install joints as shown on the plans. Joint sealants are not required on concrete pavement that is to be overlaid with asphaltic materials. Clean and seal joints in accordance with TxDOT Item 438, "Cleaning and Sealing Joints and Cracks (Rigid Pavement and Bridge Decks)." Repair excessive spalling of the joint saw groove using an approved method before installing the sealant. Seal all joints before opening the pavement to all traffic. When placing of concrete is stopped, install a rigid transverse bulkhead, accurately notched for the reinforcing steel and shaped accurately to the cross-section of the pavement.

1. **Placing Reinforcement at Joints.** Where the plans require an assembly of parts at pavement joints, complete and place the assembly at the required location and elevation with all parts rigidly secured in the required position. Accurately notch joint materials for the reinforcing steel.
2. Transverse Construction Joints.
    a. **Jointed Concrete Pavement.** When the placing of concrete is intentionally stopped, install and rigidly secure a complete joint assembly and bulkhead in the planned transverse contraction joint location. When the placing of concrete is unintentionally stopped, install a transverse construction joint either at a planned transverse contraction joint location or mid-slab between planned transverse contraction joints. For mid-slab construction joints, install tie bars of the size and spacing used in the longitudinal joints.
    b. **Curb Joints.** Provide joints in the curb of the same type and location as the adjacent pavement. Use expansion joint material of the same thickness, type, and quality required for the pavement and of the section shown for the curb. Extend expansion joints through the curb. Construct curb joints at all transverse pavement joints. For non-monolithic curbs, place reinforcing steel into the plastic concrete pavement as shown on the plans unless otherwise approved. Form or saw the weakened plane joint across the full width of concrete pavement and through the monolithic curbs. Construct curb joints in accordance Specification 03 11 00 Concrete Forming and as specified on the plans.

F. **Placing and Removing Forms.** Use clean and oiled forms. Secure forms on a base or firm subgrade that is accurately graded and that provides stable support without deflection and movement by form riding equipment. Pin every form at least at the middle and near each end. Tightly join and key form sections together to prevent relative displacement.

Set side forms far enough in advance of concrete placement to permit inspection. Check conformity of the grade, alignment, and stability of forms immediately before placing

concrete, and make all necessary corrections. Use a straightedge or other approved method to test the top of forms to ensure that the ride quality requirements for the completed pavement will be met. Stop paving operations if forms settle or deflect more than ⅛ inch under finishing operations. Reset forms to line and grade, and refinish the concrete surface to correct grade.

Avoid damage to the edge of the pavement when removing forms. Repair damage resulting from form removal and honeycombed areas with a mortar mix within 24 hours after form removal unless otherwise approved. Clean joint face and repair honeycombed or damaged areas within 24 hours after a bulkhead for a transverse construction joint has been removed unless otherwise approved. When forms are removed before 72 hours after concrete placement, promptly apply membrane curing compound to the edge of the concrete pavement.

Forms that are not the same depth as the pavement but are within 2 inches of that depth are permitted if the subbase is trenched or the full width and length of the form base is supported with a firm material to produce the required pavement thickness. Promptly repair the form trench after use. Use flexible or curved wood or metal forms for curves of 100 foot radius or less.

G. **Concrete Delivery.** Clean delivery equipment as necessary to prevent accumulation of old concrete before loading fresh concrete. Use agitated delivery equipment for concrete designed to have a slump of more than 5 inches. Segregated concrete is subject to rejection. Place agitated concrete within 60 minutes after batching. Place non-agitated concrete within 45 minutes after batching. In hot weather or under conditions causing quick setting of the concrete, times may be reduced by the Engineer. Time limitations may be extended if the Contractor can demonstrate that the concrete can be properly placed, consolidated, and finished without the use of additional water.

H. **Concrete Placement.** Do not allow the pavement edge to deviate from the established paving line by more than ½ inch at any point. Place the concrete as near as possible to its final location, and minimize segregation and re-handling. Where hand spreading is necessary, distribute concrete using shovels. Do not use rakes or vibrators to distribute concrete.

1. **Pavement.** Consolidate all concrete by approved mechanical vibrators operated on the front of the paving equipment. Use immersion-type vibrators that simultaneously consolidate the full width of the placement when machine finishing. Keep vibrators from dislodging reinforcement. Use hand-operated vibrators to consolidate concrete in areas not accessible to the machine-mounted vibrators. Do not operate machine-mounted vibrators while the paving equipment is stationary. Vibrator operations are subject to review.
2. **Date Imprinting.** Imprint dates in the fresh concrete indicating the date of the concrete placement. Make impressions approximately 1 foot from the outside longitudinal construction joint or edge of pavement and approximately 1 foot from the transverse construction joint at the beginning of the placement day. Orient the impressions to be read from the outside shoulder in the direction of final traffic. Impress date in DD MM YY format. Imprinting of the Contractor name or logo in similar size characters to the date is allowed.
3. **Curbs.** Where curbs are placed separately, conform to the requirements of 03 30 00 Cast-In-Place Concrete.

4. **Temperature Restrictions.** Place concrete that is between 40°F and 95°F when measured in accordance with TxDOT standard laboratory test procedure Tex-422-A at the time of discharge, except that concrete may be used if it was already in transit when the temperature was found to exceed the allowable maximum. Take immediate corrective action or cease concrete production when the concrete temperature exceeds 95°F.

   Do not place concrete when the ambient temperature in the shade is below 40°F and falling unless approved. Concrete may be placed when the ambient temperature in the shade is above 35°F and rising or above 40°F. When temperatures warrant protection against freezing, protect the pavement with an approved insulating material capable of protecting the concrete for the specified curing period. Submit for approval proposed measures to protect the concrete from anticipated freezing weather for the first 72-hours after placement. Repair or replace all concrete damaged by freezing.

I. **Spreading and Finishing.** Unless otherwise shown on the plans, finish all concrete pavements with approved self-propelled equipment. Use power-driven spreaders, power-driven vibrators, power-driven strike-off, and screed, or approved alternate equipment. Use the transverse finishing equipment to compact and strike off the concrete to the required section and grade without surface voids. Use float equipment for final finishing. Use concrete with a consistency that allows completion of all finishing operations without addition of water to the surface. Use the minimal amount of water fog mist necessary to maintain a moist surface. Reduce fogging if float or straightedge operations result in excess slurry.

   1. **Finished Surface.** Perform sufficient checks with long-handled 10 foot and 15 foot straightedges on the plastic concrete to ensure that the final surface is within the tolerances specified in Surface Test A in TxDOT standard test procedure Item 585, “Ride Quality for Pavement Surfaces.” Check with the straightedge parallel to the centerline.

   2. **Maintenance of Surface Moisture.** Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens and the use of evaporation retardants. Apply evaporation retardant at the rate recommended by the manufacturer. Reapply the evaporation retardant as needed to maintain the concrete surface in a moist condition until curing system is applied. Do not use evaporation retardant as a finishing aid. Failure to take acceptable precautions to prevent surface drying of the pavement will be cause for shut down of pavement operations.

   3. **Surface Texturing.** Complete final texturing before the concrete has attained its initial set. Drag the carpet longitudinally along the pavement surface with the carpet contact surface area adjusted to provide a satisfactory coarsely textured surface. Prevent the carpet from getting plugged with grout. Do not perform carpet dragging operations while there is excessive bleed water.

      A metal-tine texture finish is required for all areas with a posted speed limit in excess of 45 mph. A metal-tine texture finish is required unless otherwise shown on the plans for areas with a posted speed limit less than 45 mph. Immediately following the carpet drag, apply a single coat of evaporation retardant at a rate recommended by the manufacturer. Provide the metal-tine finish immediately after the concrete surface has set enough for consistent tining. Operate the metal-tine device to obtain grooves spaced at 1 inch, approximately 3/16 inch deep, with a minimum depth of ⅛ inch, and approximately 1/12 inch wide. Do not overlap a previously tined area. Use manual

methods to achieve similar results on ramps and other irregular sections of pavements. Repair damage to the edge of the slab and joints immediately after texturing. Do not tine pavement that will be overlaid or that is scheduled for blanket diamond grinding or shot blasting.

When carpet drag is the only surface texture required by the plans, ensure that adequate and consistent micro-texture is achieved by applying sufficient weight to the carpet and keeping the carpet from getting plugged with grout, as directed by the Engineer. Target a carpet drag texture of .04 inch, as measured by Tex-436-A Correct any location with a texture less than .03 inch by diamond grinding or shot blasting. The Engineer will determine the test locations at points located transversely to the direction of traffic in the outside wheel path.

4. **Small or Irregular Placements.** Where machine placements and finishing of concrete pavement are not practical, use hand equipment and procedures that produce a consolidated and finished pavement section to the line and grade.

5. **Emergency Procedures.** Use hand-operated equipment for applying texture, evaporation retardant, and cure in the event of equipment breakdown.

J. **Curing.** Keep the concrete pavement surface from drying as described in Section 3.01.I.4, "Maintenance of Surface Moisture," until the curing material has been applied. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days. A curing day is defined as a 24 hour period when either the temperature taken in the shade away from artificial heat is above 50°F for at least 19 hours or when the surface temperature of the concrete is maintained above 40°F for 24 hours. Curing begins when the concrete curing system has been applied. Stop concrete paving if curing compound is not being applied promptly and maintained adequately. Other methods of curing in accordance with 03 30 00 Cast-In-Place Concrete, may be used when specified or approved by the Engineer.

1. **Membrane Curing.** Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of not more than 180 square feet per gallon. Do not allow the concrete surface to dry before applying the curing compound. Use a towel or absorptive fabric to remove any standing pools of bleed water that may be present on the surface before applying the curing compound. Apply the first coat within 10 min. after completing texturing operations. Apply the second coat within 30 minutes after completing texturing operations.

   Before and during application, maintain curing compounds in a uniformly agitated condition, free of settlement. Do not thin or dilute the curing compound.

   Where the coating shows discontinuities or other defects or if rain falls on the newly coated surface before the film has dried enough to resist damage, apply additional compound at the same rate of coverage to correct the damage. Ensure that the curing compound coats the sides of the tining grooves.

2. **Asphalt Curing.** When an asphaltic concrete overlay is required, apply a uniform coating of asphalt curing at a rate of 90 to 180 square feet per gallon as required. Apply curing immediately after texturing and just after the free moisture (sheen) has disappeared. Obtain approval to add water to the emulsion to improve spray distribution. Maintain the asphalt application rate when using diluted emulsions. Maintain the emulsion in a mixed condition during application.

K. **Sawing Joints.** Saw joints to the depth shown on the plans as soon as sawing can be

accomplished without damage to the pavement regardless of time of day or weather conditions. Some minor raveling of the saw cut is acceptable. Use a chalk line, string line, sawing template, or other approved method to provide a true joint alignment. Provide enough saws to match the paving production rate to ensure sawing completion at the earliest possible time to avoid uncontrolled cracking. Reduce paving production if necessary to ensure timely sawing of joints. Promptly restore membrane cure damaged within the first 72 hours of curing.

L. **Protection of Pavement and Opening to Traffic.** Testing for early opening is the responsibility of the Contractor regardless of job-control testing responsibilities unless otherwise shown in the plans or directed. Testing result interpretation for opening to traffic is subject to the approval of the Engineer.

1. **Protection of Pavement.** Erect and maintain barricades and other standard and approved devices that will exclude all vehicles and equipment from the newly placed pavement for the periods specified. Before opening to traffic, protect the pavement from damage due to crossings using approved methods. Where a detour is not readily available or economically feasible, an occasional crossing of the roadway with overweight equipment may be permitted for relocating equipment only but not for hauling material. When an occasional crossing of overweight equipment is permitted, temporary matting or other approved methods may be required.

   Maintain an adequate supply of sheeting or other material to cover and protect fresh concrete surface from weather damage. Apply as needed to protect the pavement surface from weather.

2. **Opening Pavement to All Traffic.** Pavement that is 7 days old may be opened to all traffic. Before opening to traffic, clean pavement, place stable material against the pavement edges, seal joints, and perform all other traffic safety related work.

3. **Opening Pavement to Construction Equipment.** Unless otherwise shown on the plans, concrete pavement may be opened early to concrete paving equipment and related delivery equipment after the concrete is at least 48 hours old and opening strength has been demonstrated in accordance with Section 4.K.4, "Early Opening to All Traffic," before curing is complete. Keep delivery equipment at least 2-feet from the edge of the concrete pavement. Keep tracks of the paving equipment at least 1 foot from the pavement edge. Protect textured surfaces from the paving equipment. Restore damaged membrane curing as soon as possible. Repair pavement damaged by paving or delivery equipment before opening to all traffic.

4. **Early Opening to All Traffic.** Concrete pavement may be opened after curing is complete and the concrete has attained a compressive strength of 2,800 psi.

   a. **Strength Testing.** Test concrete specimens cured under the same conditions as the portion of the pavement involved.

   b. **Maturity Method.** Unless otherwise shown on the plans, the maturity method, TxDOT standard laboratory test procedure Tex-426-A, may be used to estimate concrete strength for early opening pavement to traffic. Install at least 2 maturity thermocouples for each day's placement in areas where the maturity method will be used for early opening. Thermocouples, when used, will be installed near the day's final placement for areas being evaluated for early opening. Use test specimens to verify the strength–maturity relationship in accordance with TxDOT standard laboratory test procedure Tex-426-A, starting with the first day's placement corresponding to the early opening pavement section.

After the first day, verify the strength–maturity relationship at least every 10 days of production. Establish a new strength–maturity relationship when the strength specimens deviate more than 10% from the maturity-estimated strengths. Suspend use of the maturity method for opening pavements to traffic when the strength– maturity relationship deviates by more than 10% until a new strength–maturity relationship is established.

When the maturity method is used intermittently or for only specific areas, the frequency of verification will be as determined by the Engineer.

5. **Emergency Opening to Traffic.** Under emergency conditions, when the pavement is at least 72 hours old, open the pavement to traffic when directed in writing by the Engineer. Remove all obstructing materials, place stable material against the pavement edges, and perform other work involved in providing for the safety of traffic as required for emergency opening.

M. **Pavement Thickness.** Unless otherwise shown on the plans, the Contractor will perform 1 thickness test consisting of 1 reading at approximately the center of each lane every 500 feet or fraction thereof. The Contractor shall check the thickness in accordance with TxDOT standard laboratory test procedure Tex-423-A unless other methods are shown on the plans. Core where directed in accordance with TxDOT standard laboratory test procedure Tex-424-A to verify deficiencies of more than 0.2 inch from plan thickness and to determine the limits of deficiencies of more than 0.75 inch from plan thickness. Fill core holes using a concrete mixture and method approved by the Engineer.

1. **Thickness Deficiencies Greater than 0.2-inch.** When any depth test measured in accordance with TxDOT standard laboratory test procedure Tex-423-A is deficient by more than 0.2 inch from the plan thickness, take one 4-inch diameter core at that location to verify the measurement.

   If the core is deficient by more than 0.2 inch but not by more than 0.75 inch from the plan thickness, take 2 additional cores from the unit (as defined in Section 3.01.M.3, "Pavement Units for Payment Adjustment") at intervals of at least 150 feet and at locations selected by the Engineer, and determine the thickness of the unit for payment purposes by averaging the length of the 3 cores. In calculations of the average thickness of this unit of pavement, measurements in excess of the specified thickness by more than 0.2 inch will be considered as the specified thickness plus 0.2 inch.

2. **Thickness Deficiencies Greater than 0.75-inch.** If a core is deficient by more than 0.75 inch, take additional cores at 10 foot intervals in each direction parallel to the centerline to determine the boundary of the deficient area. The Engineer will evaluate any area of pavement found deficient in thickness by more than 0.75 inch but not more than 1 inch. As directed, remove and replace the deficient areas without additional compensation or retain deficient areas without compensation. Remove and replace any area of pavement found deficient in thickness by more than 1 inch without additional compensation.

3. **Pavement Units for Payment Adjustment.** Limits for applying a payment adjustment for deficient pavement thickness from 0.2 inch to not more than 0.75 inch are 500-feet of pavement in each lane. Lane width will be as shown on typical sections and pavement design standards.

For greater than 0.75 inch deficient thickness, the limits for applying zero payment or requiring removal will be defined by coring or equivalent nondestructive means as determined by the Engineer. The remaining portion of the unit determined to be less than 0.75 inch deficient will be subject to the payment adjustment based on the average core thickness at each end of the 10 foot interval investigation as determined by the Engineer.

Shoulders will be measured for thickness unless otherwise shown on the plans. Shoulders 6 feet wide or wider will be considered as lanes. Shoulders less than 6 feet wide will be considered part of the adjacent lane.

Limits for applying payment adjustment for deficient pavement thickness for ramps, widenings, acceleration and deceleration lanes, and other miscellaneous areas are 500 feet in length. Areas less than 500 feet in length will be individually evaluated for payment adjustment based on the plan area.

N. **Surface Test.** Conduct Surface Test Type A and corrections in accordance with TxDOT Item 585, "Ride Quality for Pavement Surfaces."

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes: Grout for column base plates, other structural supports, equipment bases, reinforcing bar dowels, surface repair, grout toppings, patching of fresh concrete, and uses other than masonry. Grout for masonry is specified in Section 04 22 00. Adhesive anchor bolt grouting is specified in Section 05 05 20. Topping concrete over precast elements and clarifier topping concrete is specified in Section 03 30 00.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 03 30 00 Cast-In-Place Concrete
   2. Section 04 22 00 Concrete Unit Masonry
   3. Section 05 05 20 Anchor Bolts
   4. Section 43 05 13 Rigid Equipment Mounts

1.03 REFERENCES:

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens)
ASTM C230	Flow Table for Use in Tests of Hydraulic Cement
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
ASTM C939	Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

Reference	Title
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C942	Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
COE CRD-C611	Flow of Grout for Preplaced Aggregate Concrete
COE CRD-C621	Non-shrink Grout
IBC	International Building Code

1.04 SUBMITTALS

A. Action Submittals
   1. Procedure: Section 01 33 00:
   2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   4. Complete product literature, including mixing, handling and placement instructions for the following: Cementitious non-shrink grout, epoxy grout, adhesive for reinforcing bar dowel grouting, concrete repair mortar, and prepackaged cement grout products to be used on the project.
   5. Mix design for cement grout that is not prepackaged, including product data for aggregates and cement in accordance with Section 03 30 00.
   6. Current ICC Evaluation Service reports for adhesives used for reinforcing dowels.
   7. Installer certification in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.

8. Certified test results verifying the compressive strength, shrinkage and expansion requirements specified herein.

1.05 QUALITY ASSURANCE

A. Quality Control by Owner
   1. The Owner will provide the services of a qualified Special Inspector in accordance with Section 01 45 29.
   2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.
      a. The Special Inspector shall furnish a report to the Engineer, Owner's Representative and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Quality Control by Contractor
   1. Provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 if a product other than those listed below is proposed and test data is not available from the supplier to demonstrate equivalence to the specified grout. The testing laboratory shall sample and test the proposed grout materials. Costs of testing laboratory services shall be borne by the Contractor.

C. Certifications
   1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.

D. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications.
   1. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.
   2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

E. Manufacturer Qualifications
   1. Manufacturer shall have a minimum of five years experience of producing products substantially similar to that required and shall be able to submit documentation of at least five satisfactory installations that have been in successful operation for at least five years each.
   2. When required, provide services of manufacturer's full-time employee, factory-trained in handling, use, and installing the products required, with at least five years of experience in field applications of the products required.

PART 2 PRODUCTS

2.01 CEMENTITIOUS NON-SHRINK GROUT

A. The grout material shall be an approved ready to use mixture requiring only water for use at the job site. The 2-inch cubes shall have a minimum compressive strength of 3,000 psi at 7 days and 7,000 psi at 28 days.

B. Cementitious non-shrink non-metallic aggregate grout shall be:
   1. BASF, Masterflow 928
   2. Euclid Chemical Company, Hi-Flow Grout
   3. Five Star Products, Inc., Five Star Grout
   4. Sika Corporation, SikaGrout 212
   5. Approved Equal

C. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes.

D. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.

2.02 EPOXY GROUT FOR EQUIPMENT MOUNTING:

A. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.

B. Epoxy grout for equipment mounting shall be a non-cementitious, resin based, multi-component formulation. Epoxy grout shall be flowable, with shrinkage minimized to achieve minimum 98% effective bearing area. Epoxy grout shall be:
   1. BASF, Masterflow 648
   2. Euclid Chemical Company, E3-G
   3. Sika Corporation, Sikadur 42
   4. Approved Equal.

C. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.
   1. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.
   2. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
   3. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
   4. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.
   5. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.

2.03 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

A. Adhesive for setting dowels in concrete shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report. Adhesive shall be:
   1. Hilti, HIT-RE 500v3
   2. Simpson Strong Tie, SET XP
   3. Approved Equal (equivalent product must have ICC approval for use in cracked concrete in areas with high seismic risk).

B. Adhesive for setting dowels in concrete masonry shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report or IAPMO Report. Adhesive shall be:
   1. Hilti, HIT-HY 70
   2. Simpson Strong Tie, SET XP
   3. Government Approved Equal (equivalent product must have ICC approval for use in cracked concrete in areas with high seismic risk).

2.04 CONCRETE REPAIR MORTAR

A. Horizontal Applications: Repair mortars shall be:
   1. BASF, MasterEmaco S 466CI
   2. Sika Corporation, SikaTop 111 Plus
   3. Approved Equal

B. Vertical and Overhead Applications: Repair mortars shall be:
   1. BASF, MasterEmaco 1500HCR Vertical Overhead
   2. Sika Corporation, SikaTop 123 Plus
   3. Approved Equal

2.05 CEMENT GROUT

A. Cement grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed in accordance with this Section.
   1. Minimum Compressive Strength: 4,500 psi at 28 days.
   2. Maximum Water Cement Ratio: 0.42 by weight.
   3. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
   4. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
   5. Air Content: Five percent (plus or minus one percent).
   6. Minimum Cement Content: 564 pounds per cubic yard.
   7. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine and accept existing conditions before beginning work.

3.02 CEMENTITIOUS NONSHRINK GROUT

A. Non-shrink, cementitious, nonmetallic aggregate grout shall be used for column base plates, structural bearing plates, and all locations where the general term “non-shrink grout” is indicated on the Drawings. Use of this grout to support the bearing surfaces of machinery shall be as specified in Section 43 05 13 or as detailed on the Drawings for specific locations or pieces of equipment. If guidance is not provided in locations noted above, use of non-shrink grout for equipment mounting shall be limited to equipment less than 25 horsepower or 750 pounds. Grout shall be placed and cured in accordance with the manufacturer's instructions.

B. Non-shrink cementitious grout shall not be used as a surface patch or topping. Non-shrink cementitious grout must be used in confined applications only.

3.03 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

A. Follow manufacturer’s instructions.

3.04 CONCRETE REPAIR MORTAR

A. Concrete repair materials and procedures shall be submitted for review to the Owner’s Representative and shall be accepted prior to commencement of the repair work.

B. Follow all manufacturer's instructions, including those for minimum and maximum application thickness, surface preparation and curing. Add aggregate as required per manufacturer's recommendations. Any deviations from the manufacturer's instructions shall be submitted for review to the Owner’s Representative and shall be accepted prior to commencement of the work.

3.05 CEMENT GROUT

A. Cement grout shall be used for grout toppings less than four inches thick and for patching of fresh concrete.

B. Grouting shall comply with temperature and weather limitations in Section 03 30 00, Cast-In-Place Concrete.

C. Cure grout in accordance with grout manufacturer’s instructions for prepackaged grout and Section 03 30 00, Cast-In-Place Concrete, for non-prepackaged cement grout.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 05 05 20

ANCHOR BOLTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Bolts and all-thread rods used to attach structural elements and equipment to concrete Included are cast-in-place and post-installed anchors (adhesive systems and wedge type expansion anchors), nuts and washers.

B. Cast-in-place and post-installed anchors shall be Type 316 stainless steel unless noted otherwise.

1.01 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01 73 24 Design Requirements for Nonstructural Components and Nonbuilding Structures
   2. Section 03 30 00 Cast-In-Place Concrete
   3. Section 03 60 00 Grouting

1.02 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Structural Concrete
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A563	Carbon and Alloy Steel Nuts
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Anchor Bolts, Steel, 36, 55, 105-ksi Yield Strength
IBC	International Building Code with local amendments

1.03 SUBMITTALS

A. Action Submittals
   1. Procedures: Section 01 33 00.
   2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   4. Anchor bolt placement plans.
   5. Anchor bolt, nut, and washer material information, including material certifications.
   6. Record copy of design calculations and details showing the required diameter, length, embedment, edge distance, confinement, anchor reinforcement, anchor bolt sleeves, connection redesign, and other conditions, stamped and signed by a Professional Engineer currently registered in the state of Texas. Calculations shall comply with the provisions of ACI 318-14, Chapter 17 ACI 318, Appendix D. Base anchor capacity determination on cracked concrete condition and compressive strength of new concrete per Section 03 30 00. Assume compressive strength of existing concrete is 3,000 psi unless otherwise noted.
   7. Product Data:
      a. ICC Evaluation Service Reports for post-installed adhesive type anchors and expansion (wedge type) anchors when allowed. Products shall be ICC approved for use in cracked concrete in high seismic areas (Seismic Design Category D, E and F).
      b. Product data indicating load capacity charts/calculations.
      c. Chemical resistance.
      d. Temperature limitations.
      e. Manufacturers written installation instructions.
   8. Installer certification for horizontal or upwardly inclined adhesive anchors in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program.

1.04 QUALITY ASSURANCE

A. Quality Assurance By Owner
   1. Special inspection of anchor bolts shall be performed by the Special Inspector under contract with the Owner and in accordance with IBC Chapter 17.
   2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.
   3. The Special Inspector shall furnish a report to the Engineer, Owner's Representative, and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the

approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Certifications

1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined adhesive anchors.

PART 2 PRODUCTS

2.01 GENERAL

A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment mounting and vibration isolation systems shall be provided as specified in Sections 43 05 13 and 43 05 18, respectively.

B. Tapered washers shall be provided where mating surface is not square with the nut.

C. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings. Substitution of post-installed anchors will not be permitted unless specifically requested by the Contractor and approved by the Engineer.

2.02 PERFORMANCE/DESIGN CRITERIA

A. Anchor bolts for equipment shall be designed by the equipment manufacturer to include equipment operational loads combined with seismic and wind forces when applicable. Design criteria provided in Section 01 73 24.

B. Design anchor bolts for support and bracing of non-structural components and non-building structures for loading specified in Section 01 73 24.

2.03 MATERIALS

A. Anchor bolt materials shall be as specified in the following table:

Material	Specification
Stainless Steel Anchor Bolts	ASTM A193 or A320, Type 316
Stainless Steel Threaded Rods	ASTM F593, Type 316
Stainless Steel Nuts	ASTM A194 Heavy Hex Nuts, Type 316 ASTM F594 Heavy Hex Nuts at Adhesive Anchors, Type 316
Stainless Steel Washers	Type 316 to match bolt material
Concrete Adhesive Anchors	Hilti "HIT-RE 500v3", Simpson Strong-Tie "SET-XP", or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Expansion (wedge) Anchors *	Hilti "KWIK BOLT TZ", or approved equal, Type 316 Stainless Steel

**Post installed anchors shall always be an adhesive type anchor system except where noted otherwise or when Contractor makes a request for a specific application and Engineer approves.*

2.04 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:
   1. Formulated to resist washout.
   2. Acceptable manufacturers are Bostik, Saf-T-Eze, or equal.

2.05 ANCHOR BOLT SLEEVES

A. Provide anchor bolt sleeves as shown on design drawings and as required by equipment manufacturer's design.
   1. Provide high density polyethylene plastic sleeves of single unit construction with deformed sidewalls such that the concrete and grout lock in place.
   2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
   3. Acceptable manufacturers are Contec, Wilson, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings.

B. Grouting of anchor bolts using plastic sleeves with non-shrink or epoxy grout, where specified, shall be in accordance with Section 03 60 00.

C. The threaded end of anchor bolts and all-thread rods shall be long enough to project through the entire depth of the nut and if too long, shall be cut off at ½-inch beyond top of nut and ground smooth.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position using templates while the concrete is placed.

B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.03 ADHESIVE ANCHOR BOLTS

A. Note that adhesive anchors shall not be substituted for cast-in-place anchor bolts unless the adhesive anchors have been specified or shown on the Drawings, or approval has been obtained from the Engineer that substitution of adhesive anchors is acceptable for the specific use and location. Use of adhesive anchors shall be subject to the following conditions:
   1. Limit to locations where intermittent or continuous exposure to the following is extremely unlikely:
      a. Acid concentrations higher than 10 percent
      b. Chlorine gas
      c. Machine or diesel oils

2. Limit to applications where exposure to the following is extremely unlikely:
   a. Fire
   b. Concrete or rod temperature above 120 degrees F
3. Overhead applications (such as pipe supports) shall not be allowed unless approved by the Engineer and installation is by an Installer specially certified for overhead applications.
4. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
5. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.
6. Embedment depth shall be as specified or as required by the equipment manufacturer.
7. Follow the anchor system manufacturer's installation instructions.
8. Holes shall have rough surfaces created by using a hammer drill with carbide bit. Core drilled holes are not allowed.
9. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.
10. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions. Anchors shall not be placed in concrete when the temperature is below 25 degrees F.
11. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

3.04 EXPANSION ANCHORS

A. Expansion (wedge type) anchors shall not be substituted for cast-in-place anchor bolts or adhesive anchors unless approved by the Engineer for a specific application. Use of expansion anchors shall be subject to conditions [4 through 9] as specified above for adhesive anchors. Expansion anchors shall not be used in a submerged condition or in mounting of equipment subject to vibration or cyclic motion.

3.05 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHOR INSTALLATION

A. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction and provide beveled washer to match angle of anchor. Drill shall not be slanted more than 10 degrees.

B. Where slanting the drill does not resolve the conflict, notify the Owner's Representative and resolve the conflict to the satisfaction of the Owner's Representative in consultation with the Engineer.

C. Abandoned post-installed anchor holes shall be cleaned and filled with non-shrink grout and struck off flush with adjacent surface.

D. The costs of determining and executing the resolution shall be borne by the Contractor. The determination and execution of the resolution shall not result in additional cost to the Owner.

E. Reinforcing steel in masonry shall not be damaged.

F. In order to avoid or resolve a conflict, locate embedded reinforcing steel using non-destructive methods and/or redesign the attachment.
   1. Redesign shall be done by the Contractor's Professional Engineer currently registered in the state of Texas.
   2. Calculations and details for redesign shall be submitted.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be provided under work of other specification sections.
   2. Cover plates and frames
   3. Pipe sleeves
   4. Bollards
   5. Miscellaneous metal fabrications not covered elsewhere

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01 73 24 Design Requirements for Nonstructural Components and Nonbuilding Structures
   2. Section 05 05 20 Anchor Bolts

1.03 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
Aluminum Design Manual	The Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 360	Specification for Structural Steel Buildings
AISC Steel Construction Manual	American Institute of Steel Construction, Manual of Steel Construction
ANSI A14.3	Standard for Ladders - Fixed - Safety Requirements
ASTM A36	Carbon Structural Steel
ASTM A48	Gray-Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

Reference	Title
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A240	Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276	Stainless Steel Bars and Shapes
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength
ASTM A312	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy-Steel Bolting Materials for Low Temperature Service
ASTM A325	Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A489	Carbon Steel Lifting Eyes
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A554	Welded Stainless Steel Mechanical Tubing
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653	Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
ASTM A780	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
ASTM A786	Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A793	Rolled Floor Plate, Stainless Steel
ASTM A924	Steel Sheet, Metallic-Coated by Hot-Dip Process
ASTM A992	Structural Steel Shapes
ASTM A1011	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B211	Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B429	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM B632	Aluminum-Alloy Rolled Tread Plate
ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM F436	Hardened Steel Washers
ASTM F468	Nonferrous Bolts, Hex Cap Screws, SocketHead Cap Screws and Studs for General Use
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum

Reference	Title
AWS D1.6	Structural Welding Code - Stainless Steel
OSHA 29 CFR 1910.27	Fixed Ladders
OSHA 29 CFR 1926.502	Fall Protection Systems Criteria and Practices
SSPC SP5	White Metal Blast Cleaning
IBC	International Building Code

1.04 DEFINITIONS

A. Galvanize: Hot-dip galvanize per ASTM A123 or ASTM A153, per Section 05 05 14.

1.05 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00
   2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration
   4. Manufacturer's product data.
   5. Detailed Shop Drawings:
      a. Fabrication drawings showing layouts, connections to structural system, and anchoring details.
      b. Erection and installation drawings indicating thickness, type, grade, class of metal, coating system and dimensions.
      c. Construction details, reinforcement, anchorage, and installation with relation to the building construction.
   6. Welding procedures and welder certificates and qualifications.
   7. U-Channel Concrete Inserts: Manufacturer’s product description and allowable load tables.
   8. Passivation method for stainless steel fabrications.
   9. Fall Arrest Anchor Certificate:
      a. Certify fall arrest system is designed to meet OSHA 29 CFR 1926.502 specified performance requirements.
      b. Signed and sealed by a Professional Engineer licensed in the state in which the project is located.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Fabricator shall have a minimum of five years' experience in fabrication of metal specified.

B. Certificates
   1. Certified welding procedures and welding operators in accordance with AWS. Welding operator certificates shall be no more than one-year old and the welder shall have used the welding process to be performed within the last six months.

C. The use of salvaged, reprocessed or scrap materials will not be permitted.

D. Shop Assembly: Items in the shop shall be preassembled to the greatest extent possible, so as to minimize field splicing and assembly of units. Units shall be disassembled only to the extent necessary for shipping and handling limitations. Units shall be clearly marked for reassembly and coordinated installation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Avoid damage during delivery and handling of fabrications.

B. Store off the ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials for miscellaneous metalwork are specified in the following table.

Material	Specification
Steel	
Sheets, plates and shapes (except W shapes)	ASTM A36
W shapes	ASTM A992
Pipe	ASTM A53, Grade B
Square/rectangular tubing	ASTM A500, Grade B
Headed Anchor Studs	ASTM A108
Carbon steel bolts	ASTM A307, Grade A
High strength bolts	ASTM A325 (Type 1)
Nuts	ASTM A563
Washers	ASTM F436
Stainless Steel	
Sheet and Plates	ASTM A240, Type 316 or 316L
Shapes, bars, and similar items	ASTM A276, Type 316 or 316L

Material	Specification
Pipe	ASTM A312, Type 316 or 316L
Headed Anchor Studs	ASTM A276, Type 316L
Bolts	ASTM F593, Type 316
Nuts	ASTM F594, Type 316
Aluminum	
Sheets and plates	ASTM B209, Type 6061-T6
Bars, flats and similar items	ASTM B211 or B221, Type 6061-T6
Shapes	ASTM B308, Type 6061-T6
Round tubing and pipe	ASTM B241, Type 6061-T6
Square and rectangular tubing	ASTM B221, Type 6063-T52
Pipe	ASTM B211 or B241, Type 6061-T6
Bolts, Stainless Steel	ASTM F593, Type 316
Nuts, Stainless Steel	ASTM F594, Type 316
Checker Plate	
Steel	ASTM A786
Stainless steel	ASTM A793, Type 304
Aluminum	ASTM B632, Type 6061-T6
Other steel items	
Iron castings	ASTM A48
Eyebolts	ASTM A489
Threaded rods	ASTM A36

2.02 FABRICATION

A. General

1. Conform to AISC or Aluminum Association standards as applicable. Where Code defined loads apply, also conform to IBC requirements.
2. Shop and field welding shall conform to the requirements of AISC, the Aluminum Design Manual, and applicable AWS procedures and specifications as required by the material being welded.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt, tight, flush, and hairline. Remove burrs and weld splatter. Ease exposed edges to small uniform radius.
4. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.
5. Fabrication, including cutting, drilling, punching, threading and tapping required for fabrications or adjacent work, shall be performed prior to galvanizing.

B. Seat Angle Frames

1. Provide recessed seat angle frames for grating and floor plates. Miter corners to ensure accurate fit. Match depth of recess with grating or floor plate thickness. Anchor frames in concrete with headed studs. Steel angle support frames shall be stainless steel, ASTM A276, Type 316, unless indicated otherwise.

C. Iron Castings

1. Castings shall be as specified on the Drawings. Castings weighing less than 100 pounds shall be galvanized after machining. Castings weighing greater than 100 pounds shall be galvanized where specified.

D. Cover Plates and Frames

Fabricate aluminum cover plates weighing not more than 80 pounds per cover with a raised pattern nonslip top surface conforming to ASTM B632. Reinforce to sustain a live load of 100 pounds per square foot (foot traffic only) or as indicated on the Drawings. Frames shall be stainless steel angles and plates, with stainless steel

headed anchors welded to frame for anchoring to concrete. Miter and weld corners and butt joint straight runs. Provide flush drop handles for removal. Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld connections and grind top surface smooth. Provide 1/8 inch clearance at edges.

E. Pipe Sleeves

1. Unless otherwise indicated on the Drawings, fabricate pipe sleeves from schedule 40 steel pipe with 3/16 inch thick by 3 feet wide seep ring continuously seal welded to the outside of the pipe. Galvanize after fabrication in accordance with ASTM A123.

F. Bollards

1. Provide minimum 6 inch standard weight steel pipe or as indicated on the Drawings. Pipe to be in accordance with ASTM A53. Anchor posts in concrete and fill solidly with concrete of a minimum compressive strength of 2500 psi. Coat galvanized pipe above grade in accordance with Section 09 90 00. Top coat cover color shall be safety yellow.

G. Other Miscellaneous Steel Metalwork

1. Other miscellaneous steel metalwork including embedded and non-embedded steel metalwork, hangers and inserts shall be as specified or shown on the Drawings, and shall be galvanized after fabrication unless otherwise noted.

2.03 FINISHES

A. Shop Painting

1. Prepare and coat surfaces in accordance with Section 09 90 00.
2. Steel to be embedded in concrete shall be free of dirt and grease.

B. Stainless Steel Passivation

1. Stainless steel to be cleaned, descaled, and passivated after fabrication in accordance with ASTM A380. Passivate to remove iron compounds from the surface of the stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify measurements at the site. Include field dimensions in shop drawings.

B. Examine and accept existing conditions before beginning work.

3.02 PREPARATION

A. Make provisions for erection loads with temporary bracing. Keep work in alignment.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install items plumb, level and square, accurately fitted, and free from distortion or defects. Install rigid, substantial, and neat in appearance.

B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.

D. Protect encased or embedded dissimilar metals (both metals must be encased or embedded) from galvanic corrosion by means of pressure tapes, coatings or isolators.

E. Place metalwork to be embedded in concrete accurately and hold in correct position while the concrete is placed or, if indicated, form recesses or blockouts in the concrete. Thoroughly clean the surfaces of metalwork in contact with or embedded in concrete.

F. Seat angles, supports and guides: Set seat angles for grating and supports for floor plates so that they maintain the grating and floor plates flush with the floor.

G. Ladder Safety Post: Comply with manufacturer’s installation instructions.

H. Pipe Sleeves: Provide where pipes pass through concrete or masonry. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls. Provide a center flange for water stoppage on sleeves in exterior or water bearing walls. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

I. U-Channel Concrete Inserts: Provide as indicated for pipe supports and where otherwise specified or shown on Drawings.

J. Safety Nosings: Unless otherwise specified, safety stair nosing shall be installed on concrete stairs. Nosing shall be secured to concrete with suitable anchors at 15 inches on center and not more than 4 inches from the ends. 1/8 inch thick rubber tape shall be provided at both ends and cut to fit shape of nosing prior to concrete placement.

K. Concrete: Pan-filled stairs to be constructed in accordance with Section 03 30 00. Finish concrete with a “nonslip” finish with “very flat” tolerance as specified in ACI 301.

L. Fastening to Construction-In-Place: Provide anchorage devices and fasteners where necessary for fastening fabricated items to construction-in-place. Design anchorage devices in accordance with Section 01 73 24. Anchor bolts to be in accordance with Section 05 05 20.

M. Set steel stair baseplates on wedges, or shims. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

N. Railing: Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing required by design loads and as limited on Drawings. Plumb posts in each direction.

3.04 REPAIR/RESTORATION

A. Painted
   1. After installation, clean and touch up damaged areas with the same materials used for the shop coat.

3.05 FIELD QUALITY CONTROL

A. Electrolytic Protection

B. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.

C. Stainless Steel
   1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
   2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
   3. Remove contamination in accordance with requirements of ASTM A380.
   4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.

END OF SECTION

SECTION 05 59 20

STEEL CASINGS

PART 1 GENERAL

1.01 SUMMARY

A. This section provides specifications for steel casing pipe for tunneling.

B. Furnish all designs, tools, equipment, materials, and supplies and perform all labor required to complete the Work as indicated on the Contract Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
   1. Geotechnical Report
   2. Section 01 33 00, Submittal Procedures
   3. Section 31 73 13, Annular Space Grouting
   4. Section 31 73 29, Cement Tunnel Grouting
   5. Section 33 05 23, Trenchless Utility Installation

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. This Section incorporates by reference the latest revision of the following document. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed document, the requirements of this Section shall prevail.
   1. AASHTO: LRFD Bridge Design Specifications.
   2. ASTM A36 – Standard Specification for Carbon Structural Steel.
   3. ASTM A515 – Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Services.
   4. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   5. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   6. American Petroleum Institute (API) Standard 1104 Section 6 – Welding for Pipelines and Related Facilities

1.04 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00 Submittal Procedures and as specified herein.

B. Submittals shall be coordinated with all relevant submittals, assembled and submitted as a single, comprehensive submittal.

C. Where calculations are required to be submitted, they shall be signed and sealed by a Professional Civil Engineer registered in the State of Texas. Calculations shall clearly identify all parameters used, state all assumptions made in the calculation, and identify all sources of information.

D. All shop drawings shall be legible with dimensions accurately shown and clearly marked in Imperial units.

E. Pre-Construction Submittals:
   1. Calculations demonstrating that the casing pipe has been designed to support the maximum anticipated construction and operational loads including maximum anticipated jacking loads and AASHTO HL-93 loads, and Cooper E80 Railroad loads for railroad crossings. Increase casing thickness, if necessary, to withstand the anticipated stresses with a minimum factor of safety of 2.0. Coordinate calculations with Section 33 05 23 and Geotechnical Reports.
   2. Submit manufacturer's mill specification sheet listing diameter, thickness, and class of steel used in making the casing, and the mill certification.
   3. Submit shop drawing of casing showing grout and lubrication ports.
   4. Submit shop drawing showing lay length and joint detail.
   5. Submit manufacturer's written handling instructions.
   6. If different casing diameter is used than that indicated on the Contract Drawings, submit written justification, including availability of tunneling equipment for the alternate diameter.
   7. Welder qualifications in accordance with API Standard 1104 Section 6 if welded casing pipe is submitted.

PART 2 PRODUCTS

2.01 CASING PIPE

A. Provide casing with minimum outside diameter and plate thickness as shown on the Contract Drawings, unless the Contractor elects to adjust the excavated diameter to fit their means and methods, subject to acceptance by the Engineer.

B. Provide casing that is specifically manufactured for jacking with a smooth outer wall and is manufactured to the following dimensional criteria:
   1. Outside Diameter +/- 0.1%
   2. Exterior Roundness +/- 0.5%
   3. End Squareness +/- 1/8 in
   4. Straightness +/- 1/8 in per 10 feet of length
   5. Pipe Length +/- 1/4 in

C. Comply with ASTM A36, ASTM A515, Grade 60, ASTM A53, ASTM A572, grade 42.

D. All casing segments shall be joined by continuous, full circumference, full penetration butt welds.

2.02 LUBRICATION AND CONTRACT GROUTING PORTS

A. Provide at least one (1) lubrication/contact grout port per 10 feet of casing pipe. Rotate consecutive ports to ensure complete lubrication and contact grouting. Refer to Section 33 05 23, Trenchless Utility Installation for lubrication and Section 31 73 29, Cement Tunnel Grouting for contact grouting.

B. Length of coupling shall be sized to allow for installation of carrier pipe. See Contract Drawings for additional requirements.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

DIVISION 31 EARTHWORK

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: This section specifies site preparation which consists of clearing, grubbing and demolition.

B. Existing Conditions: The Contractor shall determine the actual condition of the site as it affects this portion of work.

C. Protection: Site preparation shall not damage structures, landscaping or vegetation adjacent to the site. The Contractor shall repair, or replace any damaged property.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

A. Unless otherwise specified, the Contractor shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger than 6 inches in any dimension, broken or old concrete and pavement, debris, and structures where the completion of the work require their removal.

B. Material that is removed and is not to be incorporated in the work shall be disposed of off the site.

3.02 DEMOLITION AND REMOVAL

A. Structures: Demolition and removal of structures consist of removal of abandoned superstructures, foundation walls, footings, slabs and any other structures. Excavations caused by existing foundations shall be cleared of waste, debris and loose soil, and refilled as specified.

B. Pavement: When portions of asphalt pavements and concrete pads are to be removed and later construction is to be connected, edges shall be saw cut, on a neat line at right angles to the curb face.

C. Salvage: The Owner has the right to salvage any items scheduled for removal. The Contractor shall notify the Construction Manager 5 days prior to any salvage or demolition work to determine the disposition of items to be removed. The Construction Manager will mark items to be salvaged. Such items shall be properly disconnected, removed from their foundations, cleaned, and stored at a location on the plant site as specified.

3.03 UTILITY INTERFERENCE

A. Where existing utilities interfere with the prosecution of the work, the Contractor shall relocate them in accordance with the General Conditions of the Contract Documents.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. This section specifies earthwork which consists of excavation, filling, grading, and disposal of excess material.

B. Definitions:
   1. Compaction: The degree of compaction is specified as percent compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content.
   2. Excavation Slope: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.
   3. Embankment Slope: Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.

1.02 QUALITY ASSURANCE

A. References:
   1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM C136	Standard Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in. (457-mm) Drop
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3017	Test Method for Moisture Content of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)

B. Tests:

1. The Construction Manager will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall remove surface material at locations designated by the Construction Manager and provide such assistance as necessary for sampling and testing. The Construction Manager may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications. Payment for inspection trenches shall be as specified in the General Conditions of the Contract Documents.
2. Tests will be made by the Construction Manager in accordance with the following:

Test	Standard Procedure
Moisture content	ASTM D3017
Gradation	ASTM C136
Density in-place	ASTM D1556
Moisture-density relationships	ASTM D1557

1.03 SUBMITTALS

A. Samples of fill materials to be used shall be submitted 2 weeks in advance of use. Samples shall consist of 0.5 cubic feet of each type of material.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Type A:

1. Type A material shall be a clean gravel-sand mixture free from organic matter and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
3/8 inch	70-100
No. 4	55-100
No. 10	35-95
No. 20	20-80
No. 40	0-55
No. 100	0-2

B. Type B:

1. Type B material shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value determined in accordance with ASTM D2419 of not less than 20 and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3 inch	100
No. 4	35-100

No. 30	20-100

2. The coefficient of uniformity shall be 3 or greater.
3. The material may be an imported quarry waste, clean natural sand or gravel, select trench excavation or a mixture thereof.

C. Type C:

1. Type C material shall be unclassified material which is free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 6 inches. If the material excavated from the site meets these requirements, it may be classified as Type C.

D. Type D:

1. Type D material shall be granular material commonly known as pea gravel and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1/4 inch	100
No. 8	0-5

E. Type E:

1. Type E material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	100
3/4 inch	30-75
1/2 inch	15-55
1/4 inch	0-5

2. Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65

F. Type F:

1. Type F material shall be crushed rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	87-100
3/4 inch	45-90
No. 4	20-50
No. 30	6-29
No. 200	0-12

2. Type F material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

G. Type G:

1. Type G material shall be pervious backfill. Pervious backfill material shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
2 inch	100
No. 50	0-100
No. 100	0-8
No. 200	0-4

H. Type H:

1. Type H material shall be 6-inch riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
10 pounds	100
5 pounds	80-100
2 pounds	45-80
1 pound	15-45
1/2 pound	5-15
Below 1/2 pound	0-5

2. Specific gravity shall be between 2.5 and 2.82.

I. Type I:

1. Type I material shall be 12-inch riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
160 pounds	100
100 pounds	80-100
50 pounds	45-80
20 pounds	15-45
5 pounds	5-15
1 pound	0-5

2. Specific gravity shall be between 2.5 and 2.82.

J. Type J:

1. Type J material shall be unclassified material and may be obtained from excavation on site. The material may contain extraneous material such as demolition waste, unsuitable material excavated from beneath structures, and clearing and grubbing debris up to 50 percent by volume. Extraneous material shall be thoroughly mixed and the maximum size of organic particles shall be 6 inches.

PART 3 EXECUTION

3.01 GENERAL

A. Control of Water:

1. The Contractor shall keep excavations reasonably free from water during construction. The static water level shall be drawn down a minimum of 1 foot below

the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance. The Contractor shall have on hand pumping equipment and machinery in good working condition for emergencies and shall have workmen available for its operation. Dewatering systems shall operate continuously until backfill has been completed to 1 foot above the normal static groundwater level.

2. Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions. Dewatering systems shall not remove natural soils. The Contractor shall control surface runoff to prevent entry or collection of water in excavations.
3. Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.

B. Overexcavation:
   1. Where the undisturbed condition of natural soils is inadequate for support of the planned construction, the Construction Manager will direct the Contractor to overexcavate to adequate supporting soils. The excavated space shall be filled to the specified elevation with backfill. The overexcavated space under footings may be filled with concrete. The quantity and placement of such material will be paid for as extra work.

C. Surplus Material:
   1. Unless otherwise specified, surplus excavated material shall be disposed of off site in accordance with applicable ordinances and environmental requirements.
   2. If the quantity of surplus material is specified, the quantity specified is approximate. The Contractor shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor.
   3. Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure except for those areas designated to be preconsolidated. For these areas, the depth of stockpiled material shall be as specified. The Contractor shall maintain stability of the soil adjacent to any excavation.

D. Borrow Material:
   1. If the quantity of acceptable material from excavation is not sufficient to construct the embankments required by the work, the quantity of material needed to complete the embankments shall consist of imported borrow conforming to specified requirements.

E. Hauling:
   1. When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

F. Haul Roads:

1. The Contractor shall construct haul roads required to transport materials on site. Alignment of haul roads shall be selected to avoid interference with plant operations. Haul roads shall be removed after completion of embankment construction.

G. Finish Grading:
   1. Finished surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.
   2. Finished grade shall be as specified by the contours plus or minus 0.10 foot except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness of topsoil can be applied to attain the finished grade.
   3. When the work is an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.
   4. If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than 2-1/2 inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

H. Control Of Erosion:
   1. The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

3.02 CLASSIFICATION OF FILL

A. Fill material shall be placed in horizontal layers and compacted with power-operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A. Unless otherwise specified, fill classes shall be used where specified in Table A under general application.

Table A, Fill Classifications

Material type	Maximum uncompressed layer depth, inches	Minimum relative compaction, percent	General application
A	8	95	Bedding for pipe (Pipe Embedment Zone)
Class III Fill	8	90	Subsequent backfill above pipe embedment zone to 36" below pavement surface.
Class III Fill	8	95	Subsequent backfill above pipe embedment zone within 36" of pavement surface.
Structural Fill	8	95	Structure fill
Select Fill	8	95	Structure backfill abutting structure
Select Fill	8	95	Fill under flat work: curbs, sidewalks, driveways, handicap ramps.
Base Course	8	100	Concrete pavement fill
E	8	95	Gravel Sump: Plug valve, butterfly valve

Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

a. Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

b. Material shall not be used for bedding or initial backfill for plastic pipe.

c. Fill material shall be grouted as specified in paragraph 3.08.

d. Asphalt and concrete slabs from demolition may be placed at the bottom of the fill side by side to form a continuous pad. Clearing and grubbing is not required unless shrubs are taller than 3 feet. Mucking of the subgrade and keying or benching of adjoining embankments is not required.

3.03 EARTHWORK FOR STRUCTURES

A. Structure Excavation:

1. The bottom shall not be more than 0.15 foot above or below the lines and grades specified. If the elevation of structure excavation is not specified, the excavation shall be not more than 0.15 foot above or below the elevation specified for fill material below the structure. Slopes shall vary no more than 0.5 foot from specified grade unless the excavation is in rock where the maximum variation shall be 2 feet.
2. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill. The cost of such work shall be borne by the Contractor.
3. Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

B. Foundation Treatment:

1. Rock foundations for concrete or masonry footings shall be excavated to sound material. The rock shall be roughly leveled or cut to steps and shall be roughened. Seams in the rock shall be grouted under pressure as directed by the Construction Manager and paid for as extra work.
2. When footings are to be supported on piles, excavations shall be completed to the bottom of the footings before any piles are drilled or driven therein. When swell or subsidence results from driving piles, the Contractor shall excavate, or backfill the footing area to the grade of the bottom of the footing with suitable material as specified. If material under footings is such that it would mix into the concrete during footing placement or would not support the weight of the fluid concrete, the Contractor shall replace the material with suitable material, install soffit forms or otherwise provide a suitable platform on which to cast the footing as directed by the Construction Manager. This shall be paid for as extra work.
3. Whenever any structure excavation is substantially completed to grade, the Contractor shall notify the Construction Manager who will make an inspection of the foundation. No concrete or masonry shall be placed until the foundation has been inspected by the Construction Manager. The Contractor shall, if directed by the Construction Manager, dig test pits and make test borings and foundation bearing tests. If the material tested is undisturbed soil, the cost thereof will be paid for as extra work. If the material tested is backfill material, the cost thereof will be paid as specified in the General Conditions of the Contract Documents.

C. Structure Backfill:

1. Unless otherwise specified, structure backfill shall be Class B1.
2. After completion of construction below the elevation of the final grade, and prior to backfilling, forms shall be removed and the excavation shall be cleaned of debris.
3. Structure backfill shall not be placed until the subgrade portions of the structure have been inspected by the Construction Manager. No backfill material shall be deposited against concrete structures until the concrete has developed a strength of not less than 2500 pounds per square inch in compression, or until the concrete has been in place for 28 days, whichever occurs first.
4. Backfill material shall be placed in uniform layers and shall be brought up uniformly on all sides of the structure. When compaction is done by ponding and jetting, thickness of uncompacted layers shall not exceed 4 feet.
5. Compaction of structure backfill may be performed by ponding and jetting if the backfill material is of such character that it will be self-draining when compacted and that foundation materials will not be damaged by the applied water and no damage from hydrostatic pressure will result to the structure. Ponding and jetting shall not be used within 4 feet of finished grade and shall be performed in such a manner that water will not be impounded.
6. Unless otherwise specified, backfill around and above pipelines within the excavation line of any structure shall be the same as that specified for structures.

3.04 EARTHWORK FOR PIPELINES AND CONDUITS

A. General:
   1. Earthwork for pipelines and conduits is specified in Table A; in the standard details; and in the following paragraphs.

B. Pipeline Soil Support below Embedment Zone :
   1. The bottom of the trench shall be carried to the specified lines and grades with proper allowance for pipe thickness and for bedding as specified.
   2. The suitable subgrade soils shall be scarified at the cut excavation that shall support embedment backfill material and the pipe should be stripped of all vegetation, organic matter, clay soil lumps, topsoil, construction/pavement debris and/or any foreign matter. The exposed subgrade should be scarified just prior to embedment material placement to a minimum depth of 8 inches and recompacted to a minimum of 95 percent of maximum dry density as determined by ASTM D-1557. The moisture content of the subgrade should be maintained within ±3 percent of the optimum moisture content until permanently covered.
   3. In the event soils classified as CH, CL, MH, ML, OH, OL and PT under the USCS in all cases are encountered these soils shall be over-excavated and removed to at least 12 inches below the bottom of the specified pipe invert. These soils shall be replaced with approved Select Fill backfill soil materials.

C. Pipeline Embedment Zone (Pipe Zone) Backfill:
   1. The pipe embedment zone or pipe zone materials that shall be in contact with the new pipe should meet the requirements of a ASTM D2321 Class I angular crushed stone or rock. The backfilled materials should be placed in loose lifts not to exceed 8 inches and compacted to a minimum of 95 percent of maximum dry density as determined by ASTM D-1557. The moisture content of the backfill should be

maintained at ±2 percent of the optimum moisture content until permanently covered.

2. The pipe zone is defined as the area extending from the bottom of the trench to 12 inches above the top of the pipe and extending to the undisturbed trench walls on both sides of the pipe as shown on the plans.
3. Bedding material shall be placed in the bottom of the trench, leveled and compacted. Bell holes shall be excavated at each pipe joint to permit proper inspection and uniform bearing of pipe on bedding material.
4. After the pipe has been laid to alignment and grade, unless otherwise specified, additional bedding material shall be placed in layers the full width of the trench and compacted up to the specified level. Bedding shall be placed simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. The material shall be carefully placed and compacted around the pipe to ensure that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Contractor shall use particular care in placing material on the underside of the pipe to prevent lateral movement during backfilling.

D. Subsequent Backfill:

a. General: Backfill material, placement and compaction above the pipe zone shall be as specified. Backfill above the pipe zone shall not commence until pipe zone backfill has been inspected and accepted by the Contracting Officer.

b. The backfill soil materials above the embedment zone shall be placed in maximum 8-inch thick uniform loose lifts and shall meet the requirements of Class III Fill material as specified in this specification. The backfill materials shall be moisture conditioned to ±3 percent of optimum moisture content and compacted to a minimum of 90 percent of maximum density as determined by ASTM D 1557 laboratory compaction procedures. The trench backfill materials shall be placed to 36 inches below the specified finished pavement section and/or ground subgrade elevation. The suitable fill materials below 36 inches of the finished grade elevations shall achieve a minimum compaction of 95 percent as per ASTM D 1557 or as required by the project specifications.

1) the Class C1 backfill area.

3.05 SUBGRADE FOR PAVEMENT

A. The prepared subgrade shall be scarified to a depth of at least 12 inches and recompacted to at least 95 percent of the maximum density.

3.06 EARTHWORK FOR FLAT SITE WORK

A. Flat site work such as sidewalks, walkways, ramps etc. shall be supported on a minimum of 12 inches of compacted Select Fill. The suitable Select Fill shall be placed in loose lifts not exceedeing 8 inches compacted to a minimum of 95 percent of maximum dry density determined in accordance with ASTM D 1557. The moisture content of these soils shall be maintained at ±3 percent of optimum moisture content until covered.

3.07 EARTHWORK FOR CONCRETE CURBS

B. A minimum of 12 inches of compacted suitable Select Fill soils shall be placed below the curb structures. The suitable Select Fill soils shall be placed in loose lifts not exceedeing

8 inches compacted to a minimum of 95 percent of maximum dry density determined in accordance with ASTM D 1557. The moisture content of these soils shall be maintained at ±3 percent of optimum moisture content until covered.

C. The existing subgrade soils within the project limits that shall support compacted suitable Select Fill below curb structures shall be cleared of all vegetation, organic matter, topsoil, construction debris and/or any foreign matter. The cleared subgrade soils shall be scarified to a minimum depth of 8 inches and re-compacted to 95 percent of maximum dry density determined in accordance with ASTM D 1557 and maintained within ±3 percent of optimum moisture content until permanently covered. Weak or compressible soil zones identified during compaction operations shall be removed and replaced with properly compacted suitable Select Fill to a minimum depth of 8 inches or as required to appropriately bridge over these soils, whichever is deeper.

D. The contractor shall also control or appropriately moisture condition the subgrade soils during earthwork operations to mitigate potential subgrade pumping.

3.08 SITE FILL

A. Unless otherwise specified, site fill shall be Class C2 fill. If the existing slope in an area to be filled is greater than 5:1, the Contractor shall bench the area prior to filling.

END OF SECTION

SECTION 31 23 01

FLOWABLE AND NON-FLOWABLE FILL

PART 1 GENERAL

1.01 DESCRIPTION

A. Fill construction shall consist of filling shallow evacuations, or utility trench conduit pipe zones with Flowable Fill, a flowable mixture of Portland cement, concrete aggregates, and water. It shall be identified by a unique design mix number as defined by the supplier.

B. A 2 sack flowable fill is defined as 2 sack Portland cement mix with aggregate and water that flows when exiting the cement truck.

C. A 2 sack non-flowable fill is defined as 2 sack Portland cement mix with aggregate and water that is moist and will hold its composition when a grab sample is taken.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1981; Rev. 1985) Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
ACI 305	(1977; Rev 1982) Hot Weather Concrete.
ACI 318	(1989) Building Code Requirements for Reinforced Concrete.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1988) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1986) Concrete Aggregates.
ASTM C 94	(1986) Ready-Mixed Concrete.
ASTM C 109	(1993) Compressive Strength of Hydraulic Mortars (Using 2-inch or 50 mm Cube Specimens.)
ASTM C 136	(1993) Sieve Analysis of Fine and Coarse Aggregates.
ASTM C 143	(1978) Slump of Portland Cement Concrete.
ASTM C 150	(1986) Portland Cement.
ASTM C 172	(1982) Sampling Freshly Mixed Concrete.
ASTM C 192	(1988) making and Curing Concrete Test Specimens in the Laboratory.

ASTM C 618	(1991) Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
ASTM C 558	(1982; R 1990) Test Methods for Moisture Density Relations of Soil Cement Mixtures.
ASTM C 4832	19(88) Test Method for Preparation and Testing of Soil Cement Slurry Test Cylinders.

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB-100	(8th Rev 1986) Concrete Plant Standards.
NRMCA TMMB-01	(Jan. 1, 1982; 11th Rev) Truck Mixer and Agitator Standards.

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 Submittals.

A. SD-11, MIX DESIGNS (CONTRACTOR AND JOB):

At least 30 days prior to commencing Flowable Fill placing operations, the Contractor shall submit the result of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of the flowable fill. Aggregate weight shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce Flowable Fill material of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the flowable fill is satisfactory.

B. SD-70, TEST REPORTS:

Certified copies of laboratory test reports, including all test data, shall be submitted for aggregates and cement. These tests shall be by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

C. SD-76, CERTIFICATION OF COMPLIANCE:

Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports attesting that the material meet the requirements of the specification under which it is furnished. No cement or pozzolan shall be used until notice of acceptance has been given by the Engineer. Cement and pozzolan may be subjected to quality testing by the Owner. Samples may be obtained at the mill, at transfer points, or at the project site.

1.04 GENERAL REQUIREMENTS

A. CEMENT CONTENT:

The Portland cement content shall be 188 lbs. per cubic yard ("two sack flowable fill" as referenced on the contract drawing) for areas shown on the contract drawings as requiring

two sack flowable fill or as determined by Engineer.

The Portland cement content shall be 188 lbs. per cubic yards ("two sack non-flowable fill as referenced in the contract drawings) for the installation of the pipe or as directed by Engineer.

B. POZZOLAN CONTENT:

Pozzolan shall not be used for areas requiring "two sack flowable fill". The pozzolan content shall be 94 lbs. per cubic yard for areas requiring "one sack flowable fill".

C. SLUMP:

Slump shall be proportioned to provide a slump of not less than 7 and not greater than 9 inches for flowable fill.

Slump shall be proportioned to provide a slump of not less than 0 and no greater than 1 inch for non-flowable fill.

D. AGGREGATES:

The aggregates shall be combined to provide a mixture of coarse (¾" maximum) and fine aggregate having a coarse aggregate to total aggregate ratio of 20 to 25 percent per cubic yard.

1.05 PROPORTIONS OF MIX

A. MIXTURE PROPORTIONING:

The determination of the Flowable and non-Flowable Fill mix design shall be the responsibility of the Contractor. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions and consistencies suitable for the work shall be made based on methodology described in ACI 211.1. Trial mixtures shall be designed for maximum permitted slump. The temperature, unit weight, slump, yield, moisture content, and dry unit weight of compressive strength test specimens of the Flowable and non-Flowable Fill shall be reported. For each trial batch, at least two cylinders for each test age shall be made and cured in accordance with ASTM C 192. Test specimens shall be cured in a fog room (water tank curing will not be permitted). They shall be tested at 7 and 28 days in accordance with ASTM C 558

B. COMPRESSIVE STRENGTH:

Compressive Strength test specimens shall be tested in accordance with ASTM D 4832. The use of neoprene caps is acceptable.

C. AGGREGATES AND CEMENT:

An optimum moisture density relationship for the combined aggregates and cement, proportioned by weight as defined by the proposed blends of the aggregates and cement, shall be determined for the design mix in accordance with ASTM D 558.

1.06 STORAGE OF MATERIALS

Cement shall be stored in weather-tight buildings, bins, or silos, which will exclude moisture and contaminants. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates.

PART 2 PRODUCTS

2.01 ADMIXTURES

Water-reducing or retarding admixtures shall not be used.

2.02 CEMENTITIOUS MATERIALS

A. CEMENT:

B. ASTM C 150, Type I or II, low alkali. The alkali contents shall not exceed 0.6 percent. Cementitious materials shall each be of one type and from one source.

C. POZZOLAN:

D. ASTM C 618, Class C, except the pozzolanic activity index with lime at 7 days maximum, shall be 900 psi. Pozzolanic materials shall each be of one type and from one source.

2.03 AGGREGATES

Aggregates shall conform to the following:

A. FINE AGGREGATE:

ASTM C 33.

B. NORMAL WEIGHT AGGREGATE:

ASTM C 33. Coarse aggregate shall be will graded from fine to coarse within prescribed limits. Maximum nominal coarse aggregate size shall be ¾ inches, size 67 or size 6.

2.04 WATER

Water shall be potable of potable quality. However, non-potable water may also be used if it produces mortar cubes having 7 and 28 day strengths of at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water containing chloride salts shall not be used.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

Surfaces to receive Flowable Fill shall be clean and free from frost, ice, mud, and standing water.

3.02 BATCHING, MIXING AND TRANSPORTING CONCRETE

Flowable and non-Flowable Fill Material shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and non-agitating units shall comply with NRMCA TMMB-01, Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-01. Batch tickets shall be provided with each truck of Flowable and non-Flowable Fill delivered to the job site. Batch tickets shall reflect all proportions of material and information relative to the mix design utilized, and shall be provided to the Government Representative prior to placement of material.

3.03 SAMPLING AND TESTING

Sampling and Testing is the responsibility of the Contractor and shall be performed by an approved testing agency.

A. AGGREGATES:

Aggregate for fill shall be sampled and tested in accordance with ASTM C 136. Gradation tests shall be performed on the first day and every other day thereafter during construction.

B. SAMPLING OF FLOWABLE AND NON-FLOWABLE FILL:

Samples of fill material shall be sampled in accordance with ASPM C 172. Samples for unit weight and compressive strength shall be taken at a minimum of one per 100 CY or fraction thereof placed for each day's placement. A minimum of three (3) compressive strength test specimens shall be molded from a single load of material for each 100 CY or fraction thereof placed, for each day's placement. One compression strength specimen shall be tested for compressive strength at 7 days and two (2) specimens shall be tested for compressive strength at 28 days.

3.04 CONVEYING FLOWABLE AND NON-FLOWABLE FILL

Flowable fill shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph "FILL PLACEMENT" by methods which will prevent segregation or loss of ingredients.

Non-flowable fill shall be conveyed from a dump truck to the pipe as rapidly as possible and within the time interval specified in paragraph "FILL PLACEMENT" by methods which will prevent segregation or loss of ingredients.

A. CHUTES:

When flowable fill cannot be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.

3.05 FILL PLACEMENT

Flowable fill shall be transported in truck mixers and be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregator or the introduction of the cement to the aggregates. When the Flowable fill temperature exceeds 85 degrees F, the time shall be

reduced to 45 minutes.

Non-flowable fill shall be transported in dump trucks and discharged within 1 hour of being mixed.

Placement of one sack non-flowable fill and two sack flowable fill shall be in the locations shown on the drawings. Contractor must submit method of compaction on non-flowable fill prior to installation.

A. PLACING OPERATION:

Flowable and non-flowable fill shall be handled from mixer or dump truck to forms/excavation in a continuous manner until the approved unit of operation is completed. There shall be no vertical drop greater than 8 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the Flowable Fill shall be regulated so that it will be effectively consolidated in horizontal layers not more than four (4) feet thick. Flowable Fill shall be protected from flooding for at least 12 hours after placement. Flowable Fill shall not be placed when the ambient temperature is below 40 degrees F., or when the temperature of the Flowable Fill shall be allowed to cure for a minimum of 48 hours.

B. CONSOLIDATION:

Fill shall be consolidated after placement as required by the Engineer. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the Flowable Fill; a spare vibrator shall be kept at the jobsite during all placing operations. The vibrators shall have a frequency of not less than 8,000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the flowable fill mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent recently vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if present. Vibrator shall be held stationary until the Flowable Fill is consolidated and then withdrawn slowly. Excessive vibration of Flowable Fill resulting in segregation and flotation of coarse aggregate shall not be tolerated.

C. COLD WEATHER REQUIREMENTS:

Special protection measures, approved by the Engineer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where Flowable Fill is to be placed and temperature of surfaces to receive flowable Fill shall be not less than 40 degrees F. The temperature of the Flowable Fill when placed shall be not less than 50 degrees F. or more than 75 degrees F. Heating of the mixing water or aggregates shall be required to regulate the placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps.

Salt, chemicals or other materials shall not be incorporated in the Flowable Fill to prevent freezing.

D. WARM WEATHER REQUIREMENTS:

Fill shall be placed in accordance with ACI 305R. During periods of warm weather, the

following precautions shall be taken to prevent the formation of plastic-shrinkage cracks resulting from excessive loss moisture from the concrete

1. All Fill shall be delivered to the forms/excavation at the Temperature below 90 degrees F.
2. Flowable and non-flowable fill shall be placed as rapidly as practicable.

END OF SECTION

SECTION 31 23 19

CONTROL OF WATER

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies the definition, responsibilities, and execution for control of water.

B. Existing Conditions: Unless otherwise specified or approved in writing by the Engineer, all pipelines shall be constructed in excavations free of standing or flowing water. Control of water shall consist of the design, furnishing, installation, operation, maintenance, and removal of a dewatering system(s) to achieve proper completion of all work performed under this contract.

C. Protection: The Contractor shall furnish, install, operate, maintain, and remove any and all machinery, appliances, and equipment necessary to keep excavations free from water during construction, and shall dewater and dispose of the water so as not to cause damage to any public or private property, environmental degradation (such as sedimentation of natural waters), or to cause a nuisance or a menace to the public. The Contractor shall at all times have on hand at the job site sufficient pumping equipment and machinery in good working condition for all ordinary emergencies; including power outage and flooding, and shall have available at all times competent workers for the continuous and successful operation of the dewatering, recharge, and monitoring systems. These systems shall not be shut down between shifts, on holidays, weekends, or during work stoppage without written permission from the Engineer. The Contractor shall repair or replace any damaged property.

D. Geotechnical data provided as reference information.

1.2 DESIGN REQUIREMENTS

The dewatering system shall be designed by a licensed professional engineer, geotechnical engineer or professional geologist who is familiar with the hydrogeologic conditions of the area. The dewatering system shall be carefully designed to ensure that “piping” or “boiling” (i.e., quick-sand condition) does not occur at the bottom of the excavation trenches. In addition, groundwater or perched water draw down rates and reestablishment rates shall be carefully considered by the dewatering system designer and dewatering contractor and potential impact to surrounding structures. The designer shall also consider if there is a need to re-inject removed subsurface water during dewatering operations. As a means to monitor potential ground movements, an array of settlement monitoring devices shall be placed within a circular varying radial distance of the construction site to monitor potential ground

movements. Piezometer wells shall also be installed to monitor groundwater or water seepage levels and flow direction. The general contractor shall establish a contingency plan for potential observed movements within nearby adjacent structures and/or submitted adjacent property owner claims of settlement and damage.

It is possible to encounter perched water zones where relatively high permeability soils overlay low permeability soils. Capillary moisture may also be observed above the reported groundwater or perched water depths. This may be associated with the capillary rise of moisture through the soils above the observed water seepage depths. In the event that perched water is encountered at shallower depths during construction at this site, the water seepage shall be appropriately removed. If an “artesian” condition is encountered it may be bridged with suitable Controlled Low Strength Materials (CLSM) or approved gravel rock. The proposed CLSM or gravel rock shall be approved by the Engineer through a submittal process. Workers shall be prohibited from working in excavations where water has accumulated or is accumulating.

The following are some general minimum requirements that shall be included and considered in the preparation of a dewatering plan for this project, but not limited to these sole requirements.

A. The general contractor shall design, provide, and operate dewatering system to include sufficient trenches, sumps, pumps, hose, piping, well points, deep wells, and similar facilities, necessary to depress and maintain groundwater level 2 feet below the base of each excavation during all stages of construction operations for new pipeline and related appurtenances or as required by the general contractors retained design professional.

B. Design and operate dewatering system to avoid settlement and damage to existing structures and underground facilities.

C. Groundwater table shall be lowered in advance of excavation for a sufficient period of time to allow dewatering of fine grain soils.

D. Maintain groundwater level at excavations two (2) feet below lowest subgrade excavation until the structure or underground facility, as applicable, has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural groundwater.

E. Operate dewatering system, continuously, 24 hours per day, seven days per week. Provide standby pumping facilities and personnel to main the continued effectiveness of the system. Do not discontinue dewatering operations without first obtaining the general contractors engineer’s acceptance for such discontinuation.

F. If, in the Engineer’s opinion, the water levels are not being lowered or maintained as required, provide additional or alternate temporary dewatering devices as necessary, at no additional cost to owner.

G. Where portions of dewatering system are located in the area of permanent construction,

submit to and obtain general contractors design engineer's acceptance of details of proposed methods of constructing the work at such location. Control of ground water shall continue until the permanent construction provides sufficient dead load to withstand hydrostatic uplift of the normal groundwater, until concrete or applicable structures have attained sufficient strength to withstand earth and hydrostatic loads.

H. Perform pumping of water from excavations in a manner that prevents carrying away of unsolidified concrete materials, and that avoids damaging the subgrade.

I. Before discontinuing dewatering operations or permanently allowing the gradual rise of groundwater levels, prepare computations to demonstrate that structures affected by the water level rise are protected by fill or other means to sustain uplift.

J. The general contractor's dewatering system shall discharge to suitable locations acceptable to the Engineer, storm sewer system owner(s) and owners of other properties potentially affected by water discharge, including owners adjacent to and downstream of dewatering system discharge. Operation of the dewatering system and disposal of water shall be in accordance with Laws and Regulations. The need for reinjection of water shall also be considered in the design of the dewatering plan.

K. Convey water from excavations in closed conduits. Do not use trench excavations as temporary drainage ditches.

L. Dispose of water removed from excavations in a manner that does not endanger health and safety, property, the work, and other portions of the project at all times.

1.3 GEOTECHNICAL REFERENCE DATA

A. No perched or groundwater was observed in this area.

1.1 SUBMITTALS

Within 15 calendar days from the date of Notice to Proceed, the Contractor shall submit for review and approval a dewatering plan and design data showing methods and equipment it proposes to utilize in dewatering, including relief of hydrostatic head, and in maintaining the excavation in a dewatered and in a hydrostatically relieved condition. The Contractor shall first submit the plan to the Engineer for review and comment. As a minimum, the following shall be provided in accordance with these specifications:

A. Drawings indicating the location and depth of berms, discharge permits (names of ditches, drains, etc.), all deep wells, well points, monitor wells, recharge wells, cutoff walls, and discharge lines.

B. Capacities of pumps, prime movers, and standby equipment.

C. Design calculations proving adequacy of system and selected equipment.

D. Detailed description of the dewatering schedule, operation, maintenance, and abandonment procedures.

E. Documentation in support of filter grain size determination.

F. Qualifications of the firm proposed to perform control of water for the project.

1. Contractor's written confirmation of the settlement monitoring station elevations.

2. Description of dewatering system failure alarm system.

3. Water Quality Testing per Parameters set forth by EPWater Storm Water Section. Testing shall be performed by a Testing Laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP) and/or the American Association for Laboratory Accreditation (AALA). Copies of test reports shall be provided to the Engineer monthly.

The Contractor shall be solely responsible for proper design, installation, proper operation, maintenance, and any failure of any component of the dewatering system for this contract.

If any contaminants are found in the groundwater, the Contractor shall cease all construction activities and notify the Engineer. Contractor shall submit a pretreatment plan to remove any contamination found to be more than maximum contaminate levels (MCL) for the specific contaminate. Contractor will test for contaminants listed in Table 3 prior to beginning any dewatering activities. After initial testing, Contractor shall test all parameters in Table 3 until dewatering operations are terminated. Monthly test results will be submitted to Engineer and EPWater.

TABLE 3 - WATER QUALITY PARAMETERS

Parameters	Units	Minimum Testing Detection Limits*	Maximum Contaminant Level
Benzene	mg/L	0.001	0.01
BOD_5	mg/L	1.0	30
COD	mg/L	1.0	120
Chloride	mg/L	1.0	860
Hex Chromium	mg/L	0.5	1.0
Iron	mg/L	0.5	1.0
Nitrate as N	mg/L	1.0	10
Nitrite as N	mg/L	0.5	1.0
Oil and Grease	mg/L	1.0	15
pH	S.U.	0.1	6.0 to 9.0
Total Arsenic	mg/L	0.01	0.16854
Total Cadmium	mg/L	0.001	0.0159
Total Chromium	mg/L	0.001	0.1
Total Lead	mg/L	0.001	0.100
Total Phosphorus	mg/L	0.001	2.0
Total Zinc	mg/L	0.001	0.117
Total Suspended Solids (TSS)	mg/L	1.0	100

Electrical Conductivity (EC)	millimhos/cm 2	100	5000
*Note: Laboratory shall specify the applicable testing method.			

PART 2 GENERAL

NOT USED

PART 3 -EXECUTION

3.1 DISCHARGE POINTS

The Contractor shall dispose of excess water at the location(s) specified and coordinated with Plant staff and Engineer.

Contractor shall adhere to the dewatering plan submitted and approved.

The Contractor shall also arrange for satisfactory discharge of the water by means of pipes, ditches or channels to an adequate drain so that no nuisance will be created. The Contractor will not be permitted to discharge any groundwater into existing sewer manholes.

All water must be metered. The Contractor shall furnish, maintain the meters, and submit the daily meter readings to the Engineer on a bi-weekly basis.

3.2 WATER SUPPLY FOR SYSTEM INSTALLATION AND ELECTRICAL SERVICE

The Contractor shall be responsible for acquiring a water supply with which to install the dewatering systems (i.e., drilling and jetting). Backflow prevention devices will be required if potable water is used.

The Contractor shall bear the cost of the water utilized in the dewatering operation.

The electrical service used for dewatering shall be supplied by the Contractor and shall be separate from all other Contractor electrical requirements and dedicated solely to the operation of the dewatering systems.

3.3 DEWATERING SYSTEM PROTECTION

The Contractor shall be responsible for taking all reasonable precautions necessary to insure continuous, successful operation of the system. This includes adequate marking of all well, pump, and pipeline locations. Wherever dewatering wells, vacuum headers, or discharge lines shall be crossed for access and egress, steel ramps shall be used to protect the system from vehicular and pedestrian traffic. All ramps shall be capable of supporting the heaviest equipment on-site and shall provide at least one foot of clearance between the dewatering system element and the underside of the ramp. All vehicular access points across the dewatering system shall be clearly identified with brightly colored or flagged poles on each side of the access point. All ramped pipelines shall be valved on both sides of the ramp. Routings affecting normal plant operations, including regular vehicular traffic patterns within,

into, and out of the plant site, must be approved before installation.

3.4 FILTER MATERIAL

Filter material shall be provided for all dewatering wells to protect existing formation soils from removal of fines caused by dewatering operations. The filter material shall be clean, rounded, washed select silica sand or gravel free from silt, clay, and other deleterious material. The filter material sizes shall be determined by the Contractor. The filter material shall be designed to maximize the flow of water into the well and minimize the amount of fine-grained material removed from the formation. The filter grain size shall be determined by taking 70 percent retained grain size of the producing formation to filter and multiply it by 4, 5, or 6. This is the 70 percent retained grain size of the filter material to be used. The uniformity coefficient (the size of sieve that retains 40 percent of the sample divided by the size that retains 90 percent) shall not be greater than 2.5. The gradation of the filter material shall form a smooth and gradual grain size distribution curve when plotted. The Contractor shall be prepared to alter (at no extra cost) the sizes of filter material as necessary in accordance with the grain size distribution of the materials encountered during installation of the dewatering system. The Contractor shall submit documentation in support of the filter grain size determination. Sufficient filter material shall be finished by the Contractor for initial packing of the well and such additional filter material as the well may take during development. The Contractor shall furnish a certificate of filter material quality and gradation prior to having it delivered to the site.

Approval by the Engineer of the Contractor's selection of filter material in no way relieves the Contractor of its responsibility for designing and installing wells or wellpoints which adequately protect foundation soils from fines removal.

3.5 WELL DEVELOPMENT

All wells shall be developed after installation to remove all fines from jetting, drilling, and construction. Development discharge must be disposed of separately from dewatering discharged. The Contractor shall develop the wells until the sand content of the discharge water does not exceed 10 parts per million (ppm)

3.6 RECHARGE WELLS

Where recharge zones are necessary to prevent settlement of adjacent structures as a result of dewatering activities, recharge wells together with monitoring wells shall be provided. Recharge wells shall be periodically redeveloped as necessary to restore their efficiency. The well screen shall be selected with a slot size suitable for the filter. The screen shall have ample open area to provide a reserve against clogging. If periodic acid treatment is anticipated, the screen shall be of corrosion- resistant material. A seal of concrete or grout shall be provided to prevent water from short-circuiting along the casing.

3.7 FORMATION PROTECTION

The contractor shall design, construct, operate, and maintain the dewatering system in a

manner protecting against settlement of natural or engineered soils and structures due to dewatering operations for any reason, including fines removal.

3.8 STANDBY EQUIPMENT

The Contractor shall maintain sufficient equipment and materials on-site to insure continuous and successful operation of the dewatering and monitoring systems.

One hundred percent standby electrical generating capacity shall be required if submersible/turbine pumps are used.

The mechanical systems shall be provided with a monitoring and alarm system that notifies the Contractor 24 hours a day of a system failure.

Each diesel or electrically powered centrifugal pump shall be manifolded to a standby diesel pump of equal or greater performance capability. Standby pumps shall be fueled and operational at all times. All standby centrifugal pumps and generators shall be tested daily to insure their immediate availability.

The Contractor shall maintain on-site a minimum of 30 feet of each size and type of header or discharge pipe used in the system. A sufficient number of valves, tees, elbows, connection, tools, recorder charts, and parts or other system hardware shall be maintained On-site to insure immediate repair or modification of any part of the system as necessary.

3.9 MONITORING SYSTEMS

The Contractor shall design and install monitoring wells necessary to adequately monitor ground water levels. The Contractor shall be responsible for numbering and obtaining location coordinates and ground surface elevations for all monitor wells. Measuring points on wells shall be permanently marked and elevations surveyed. All monitoring information shall be reported to the C Engineer daily.

To comply with the requirements of the discharge permit, the Contractor shall provide discharge monitoring points to obtain samples for laboratory analysis to check for water quality limitations imposed by the permit. The Contractor shall record pumping rates at dewatering wells, pump times, and flows. The Contractor shall be responsible for providing the necessary Method of Measurement and physical means to determine those flows. The Contractor shall provide a daily log, which shall include the number of wells operating and the pumping duration time for each well. The Contractor shall be responsible for taking and recording flow measurements. The daily log shall be submitted weekly to the Engineer.

Data Recorded	Method of Measurement	Frequency of Measurement
Pumping Rate at Each Dewatering Well	Flow Meter	Daily if Changes Occur
Pumping Time	Hours	Daily

Total Dissolved Solids (TDS)	Approved Laboratory	Twice per Month
Flow	Rate x Time	Continuous

It is the responsibility of the Contractor to dispose of the pumped water in accordance with the conditions of any discharge permit.

Inline McCrometer flow meters or equivalent shall be required to insure that all water pumped from excavations is metered. Meters shall show gallons per minute and total flow passing through the meter. All meters shall be installed to manufacturer's specifications and calibration documentation shall be submitted. All meters shall be maintained in working order. If repairs to a meter are required, dewatering will cease until the repaired or a replacement meter is installed. Meter shall be installed in pipe to be flowing full through the meter at all times.

The Contractor shall monitor settlement per the approved Settlement Monitoring Plan developed per Section 02 32 23, Geotechnical Monitoring During Construction. The contractor shall establish the location and elevations of settlement monitoring stations throughout the project site prior to the commencement of dewatering operations, and it will periodically check the elevations of these stations to monitor for settlement. After establishment of the settlement monitoring stations, and prior to commencing dewatering operations, the Contractor shall conduct an independent survey of the settlement monitoring stations and submit written confirmation that it agrees with the elevations established by the Engineer. The Contractor shall check the settlement monitors daily and submit the results to the Engineer daily. If settlement is detected, the Contractor shall stop work immediately and notify the Engineer. The Contractor shall prepare and submit a work plan that indicates measures to be taken to prevent any further settlement. Work shall not proceed until the work plan has been approved by the Engineer. Approval of an action plan by the Engineer shall not relieve the Contractor of its responsibility to effectively prevent the reoccurrence of settlement taking place.

3.10 DAMAGES

The Contractor shall be responsible for and shall repair without cost to the Owner any damage to existing on- and off-site facilities, including other wells, work in place, other Contractors' equipment; and the excavation, including damage to the bottom due to heave and including removal of material and pumping out of the excavated area, that may result from the Contractor's dewatering operations, including any damages that may result from any mechanical or electrical failure of the dewatering system.

3.11 MAINTAINING EXCAVATION IN DEWATERED CONDITION

System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of the same capacity and quantity as specified in the paragraph entitle "Standby Equipment;" and any other work required to maintain the systems. Dewatering shall be a continuous operation and interruptions due to outages or any other reason shall not be permitted. The Contractor shall be responsible for all

damages to accepted work in the excavation area and for damages to any other area caused by the Contractor's failure to maintain and operate the system as specified above.

3.12 AVAILABLE SOIL TEST DATA

The Geotechnical Study's boring logs only illustrate the approximate location of the groundwater table during the time the borings were performed. Soils investigation data is available for review at the Engineer's office. Use of this information in no way relieves the Contractor from its responsibility for design, construction, and operations of a properly functioning dewatering system. Groundwater levels during construction may vary significantly from those encountered during the geotechnical investigation. Groundwater levels can be affected by farmland irrigation practices and seasonal weather changes; therefore, it is the Contractor's responsibility to determine the groundwater levels in the construction areas in order to determine the extent of dewatering which will be necessary. The Contractor shall perform additional testing as required, including soil sampling and test pumping, in order to assure itself of being able to provide a properly functioning dewatering system.

3.13 SYSTEM REMOVAL

Upon written authorization of the Engineer the Contractor shall remove from the site all dewatering system elements with the exception of those monitor wells as designated by the Engineer. The Contractor shall assume ownership and responsibility for the disposal of all dewatering pumps, pipes, and other assorted system hardware. The Contractor shall remove and abandon all wells in accordance applicable codes and regulations. The contractor shall be or employ the services of a licensed water well contractor for the well abandonment.

Abandonment shall include at a minimum: pressure injection of a bentonite/cement grout slurry into the void spaces of the filter material and removal of the well casings. After removing the well casings, the holes shall be topped off with a bentonite/grout and gravel mixture. The Contractor shall ensure that the bentonite or grout penetrates all of the voids in the filter pack. After abandonment the Contractor shall landscape each abandoned well site to match the surrounding environment (e.g., grass, pavement concrete, unclassified fill, etc.).

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 41 00

SHORING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. This section specifies requirements for sheeting, shoring, and bracing of trenches greater than 5 feet in depth.

B. Design Requirements:
   1. The Contractor shall design sheeting, shoring, and bracing in accordance with the most up to date OSHA Regulation on Trenching. The sheeting, shoring and bracing shall be designed by both a Structural Engineer and Geotechnical Engineer liscensed in the state of Texas.
   2. Horizontal strutting below the barrel of a pipe and the use of pipe as support are not acceptable.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
OSHA	State Construction Safety Orders
--	Texas State Labor Code

PART 2 PRODUCTS

2.01 GENERAL

A. The Contractor shall submit as product data to the Engineer information required by and with the most up to date OSHA Regulation on Trenching. Information shall be provided in accordance with Section 01 33 00 of this project manual.

B. Plans must be designed and sealed by a professional structural or geotechnical engineer registered in the State of Texas. The Contractor is responsible for obtaining borings and soil analysis as required for the design and preparation of the trench excavation plan and trench safety system. The trench excavation plan and the trench safety system are to be designed in conformance with OSHA standards and regulations.

C. Detailed excavation support drawings and method of installation and removal of all sheeting, sheet piling, shoring, and bracing, together with underpinning, signed and sealed by the licensed professional engineer.

D. Submittal shall include trench cross-sections prepared by the licensed professional engineer which include pipe, width and depth of trench, trench box, sheet piling, and/or shoring proposed. Max trench width shall be in accordance with widths specified on plans, and as required to protect existing structures and utilities. Trench Cross-sections shall be included for each varying condition. The submittal shall include the stationing where each cross-section shall apply.

PART 3 EXECUTION

1.02 GENERAL

A. The construction of sheeting, shoring, and bracing shall not disturb the state of soil adjacent to the trench and below the excavation bottom.

B. Trench sheeting below the top of a pipe shall be left in place.

1.03 SEQUENCE

A. Trench excavation shall not be started until the design for trench support has been accepted by the Owner.

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 sufficiently 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.

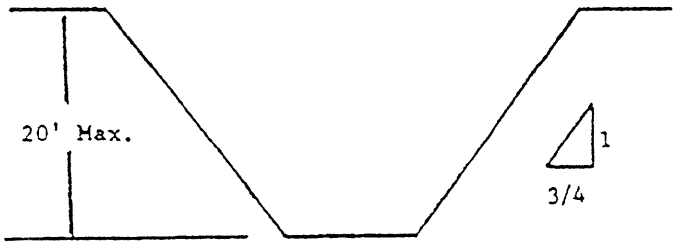
Figure B–1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

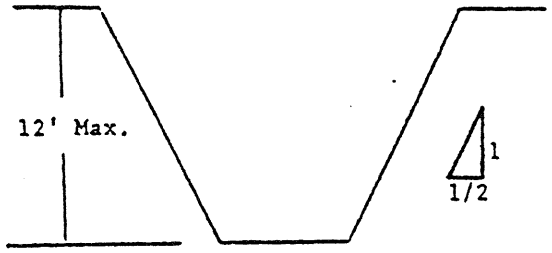
B–1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



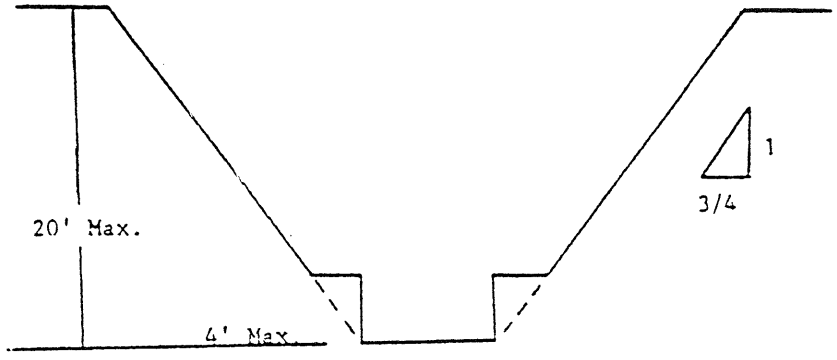
SIMPLE SLOPE—GENERAL

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.

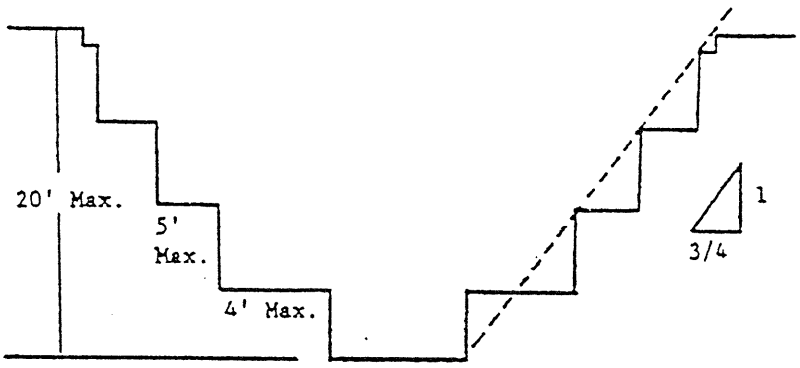


SIMPLE SLOPE—SHORT TERM

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:

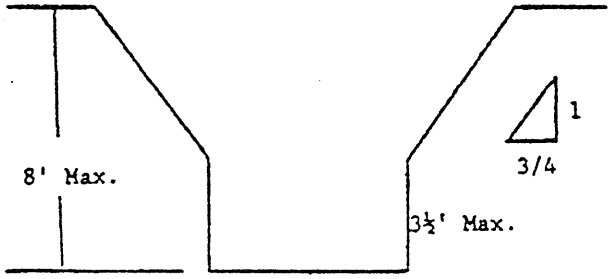


SIMPLE BENCH



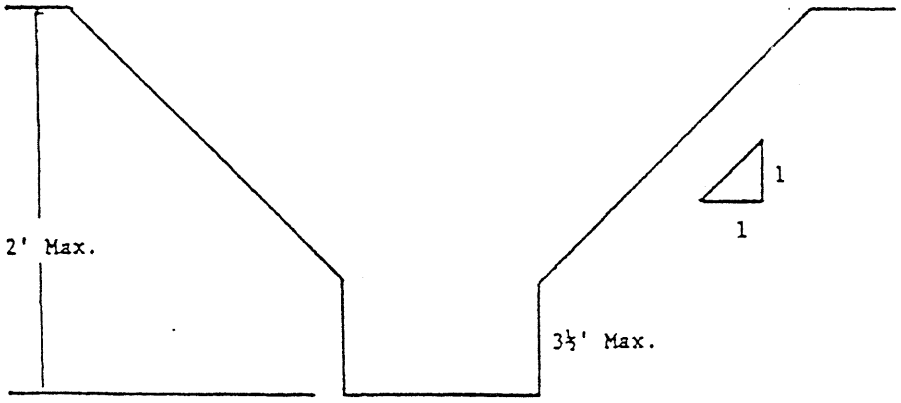
MULTIPLE BENCH

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.



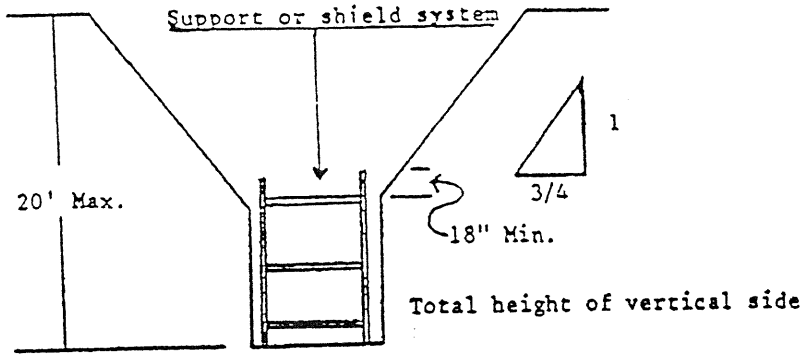
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

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.

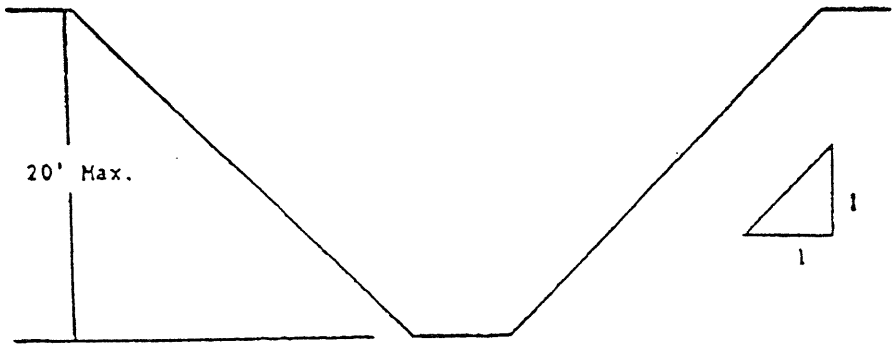


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

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).

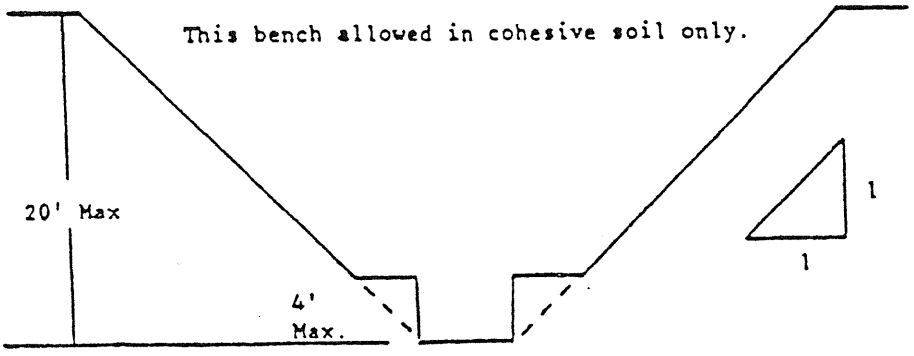
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

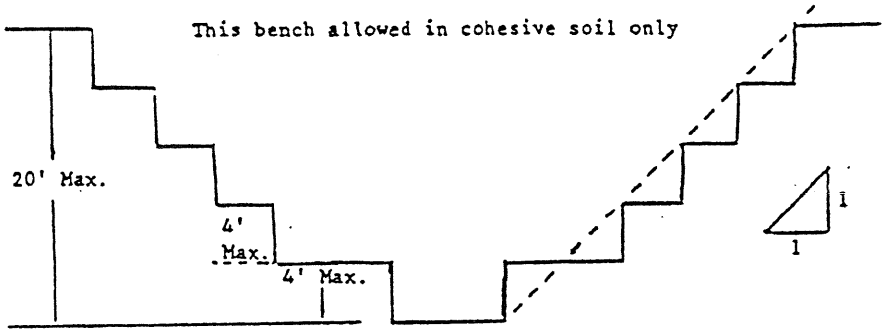


SIMPLE SLOPE

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:

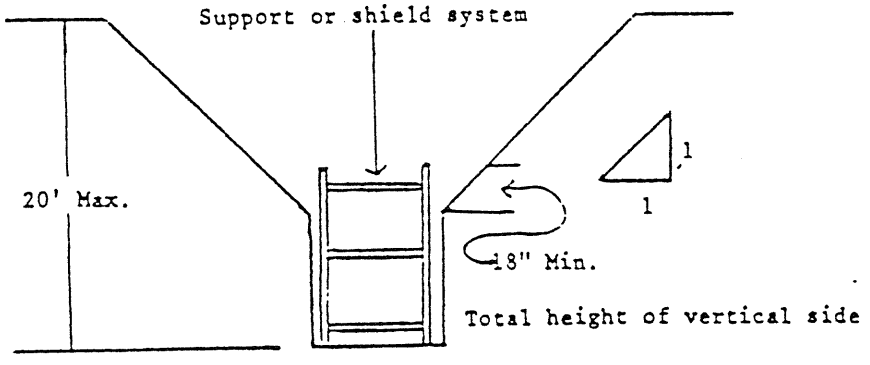


SINGLE BENCH



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.

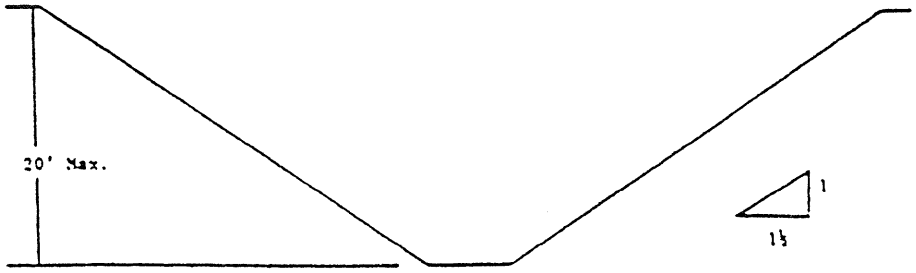


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

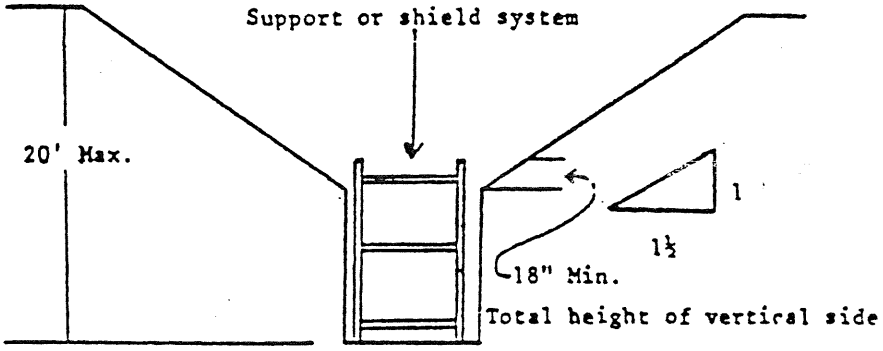
B-1.3 Excavations Made in Type C Soil

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.

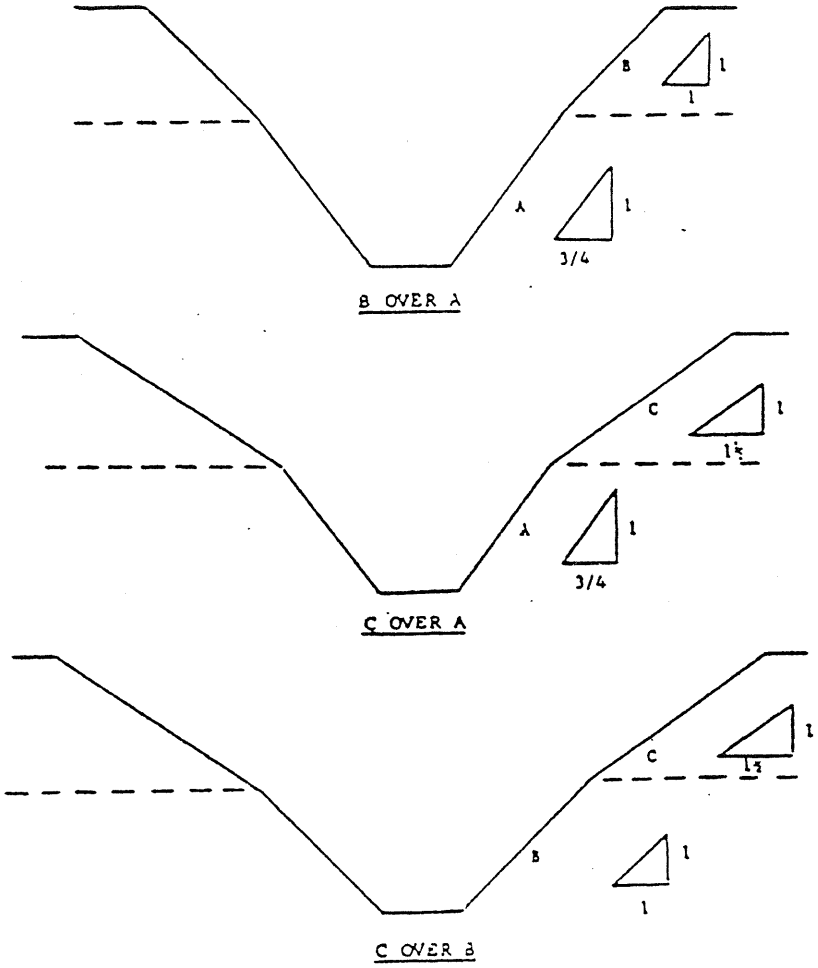


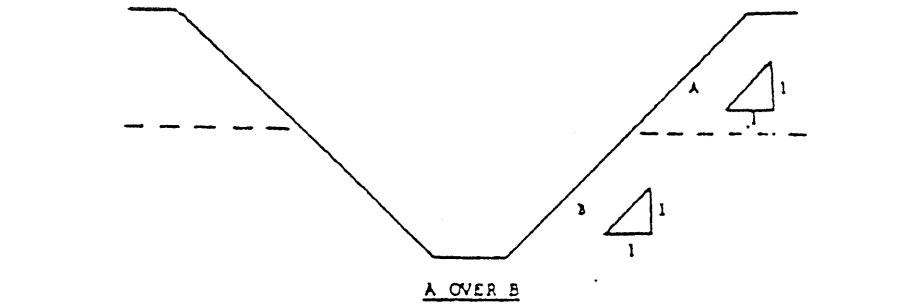
VERTICAL SIDED LOWER PORTION

3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

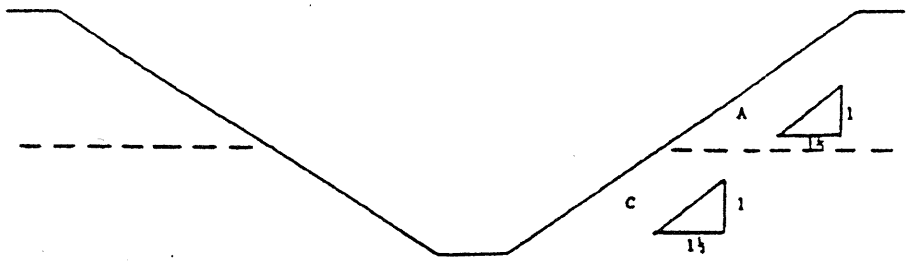
B-1.4 Excavations Made in Layered Soils

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.

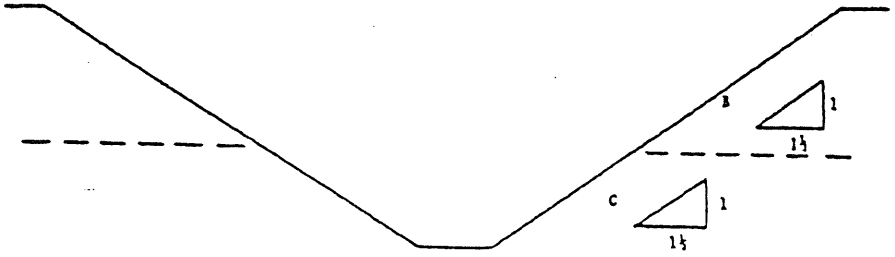

B
1
1
A
1
3/4
B OVER A
C
1
1½
A
1
3/4
C OVER A
C
1
1½
B
1
1
C OVER B



A OVER B



A OVER C



B OVER C

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 cave-ins 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 $P_a = 45 \times H + 72$ 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	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

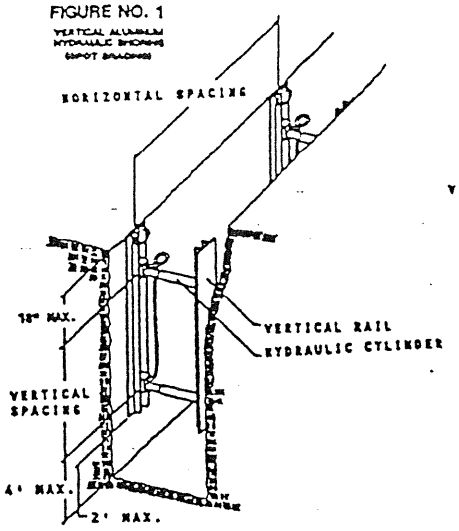


FIGURE NO. 2

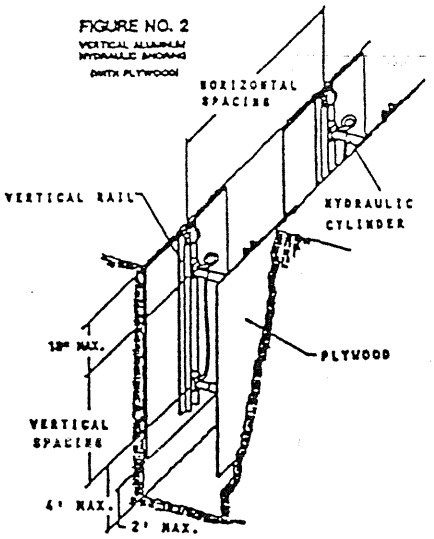


FIGURE NO. 3

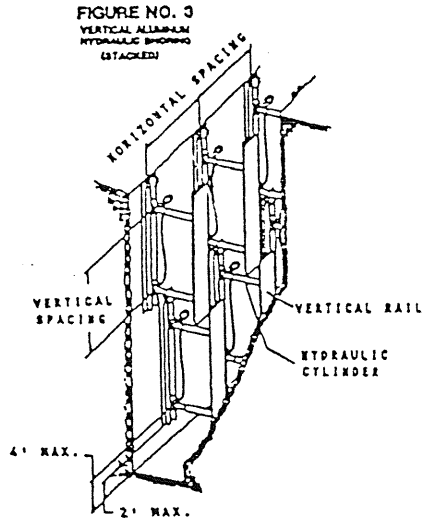


FIGURE NO. 4

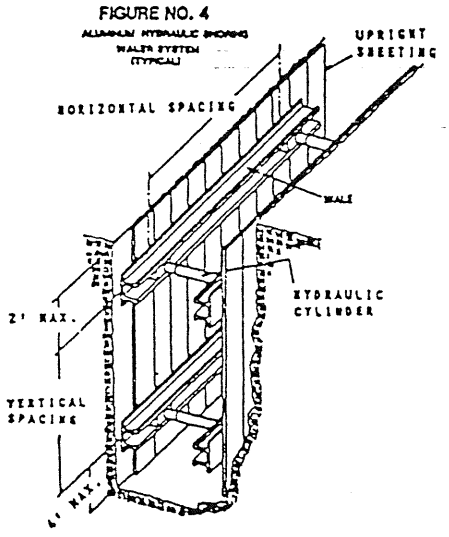


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

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 (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		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 (IN^3)	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

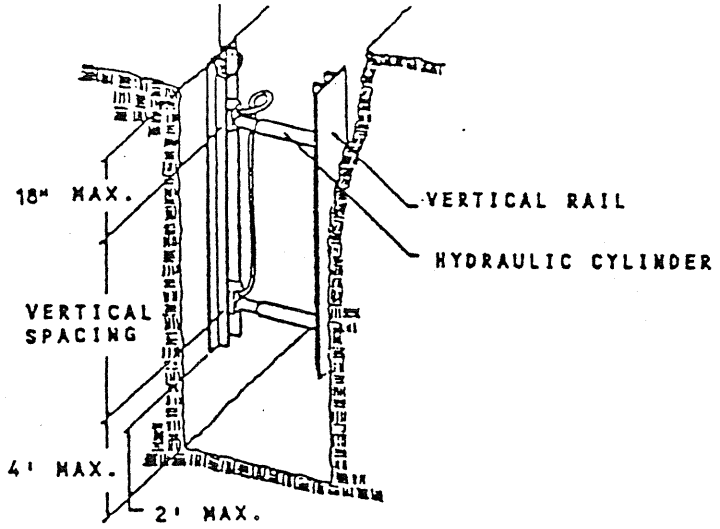


Figure 2. Pneumatic/hydraulic Shoring

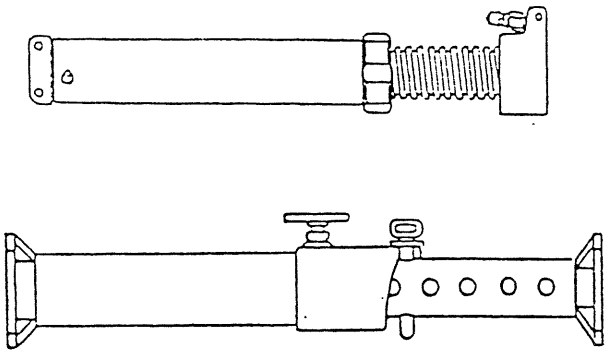


Figure 3. Trench Jacks (Screw Jacks)

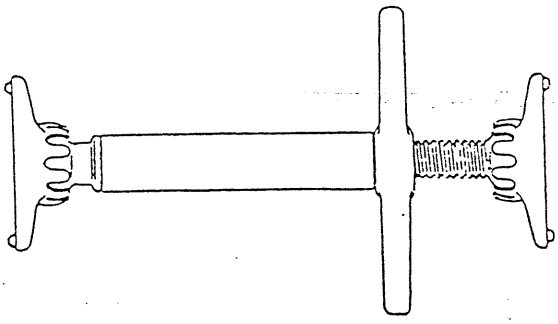
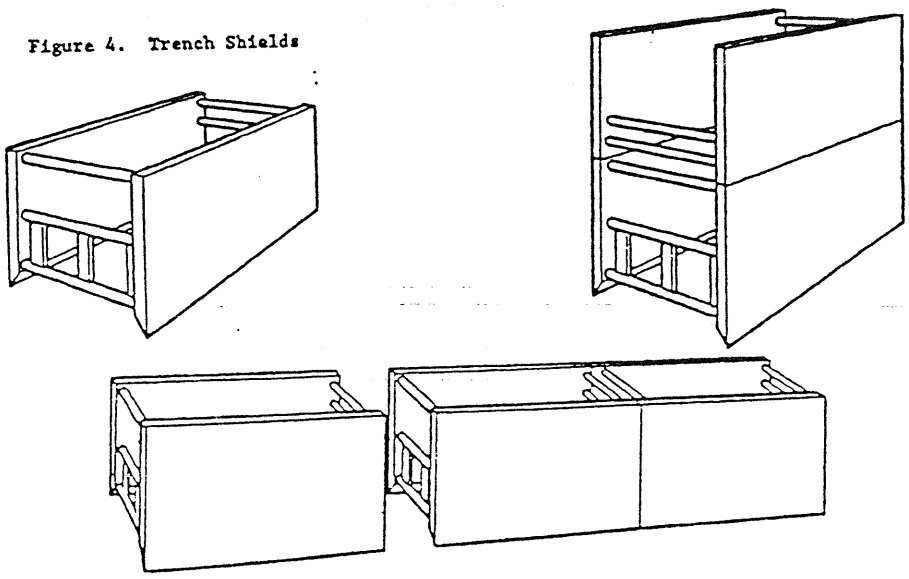


Figure 4. Trench Shields



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).

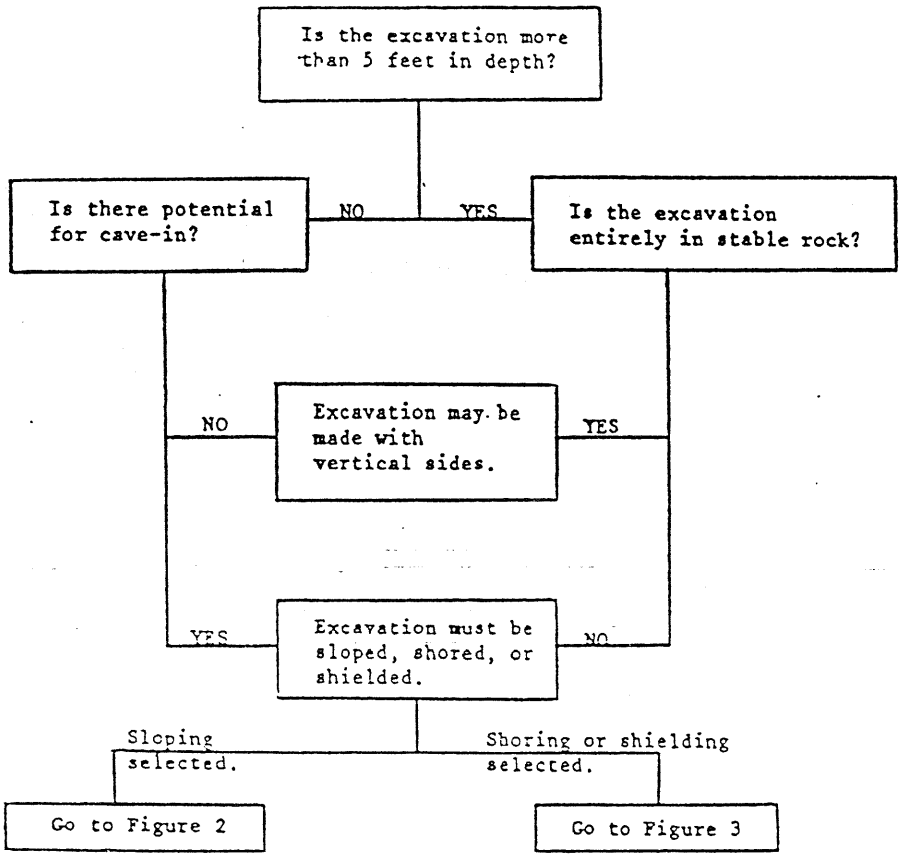


FIGURE 1 - PRELIMINARY DECISIONS

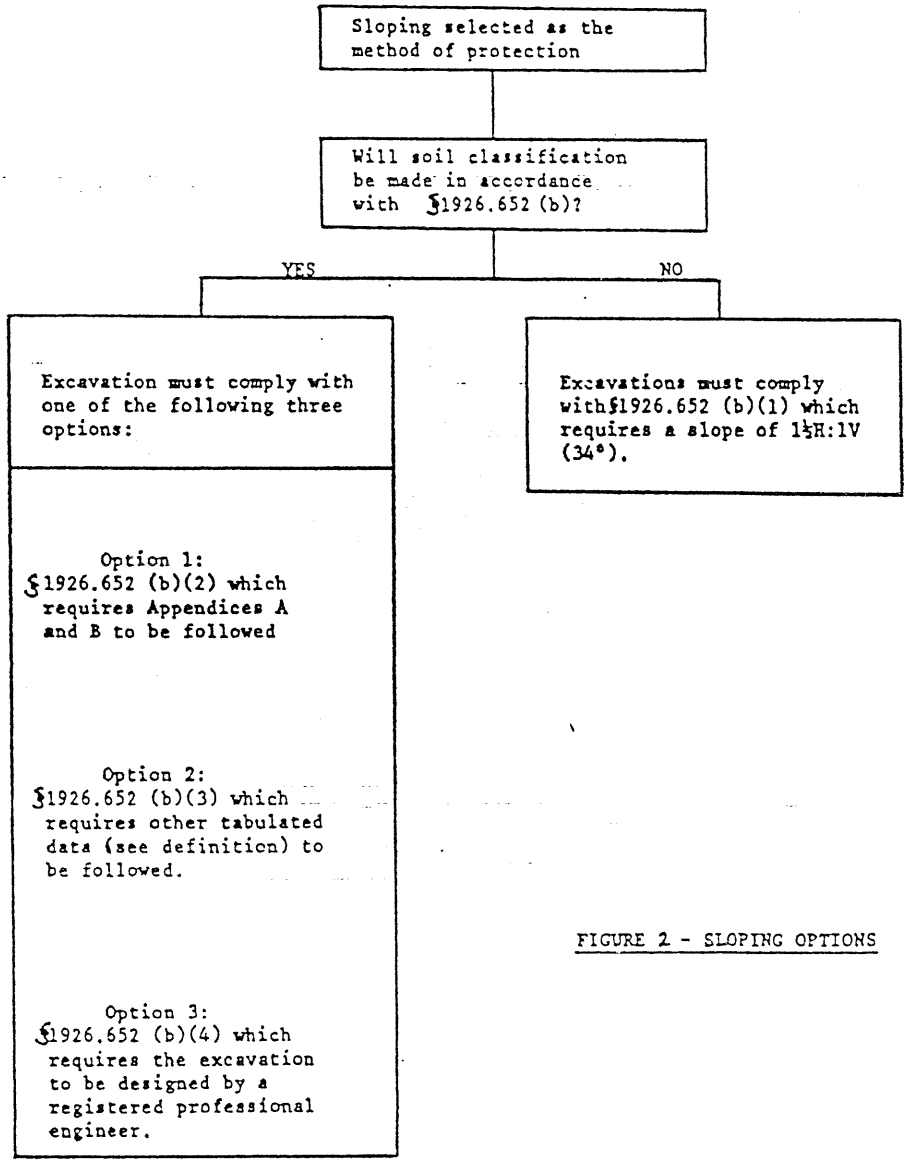


FIGURE 2 - SLOPING OPTIONS

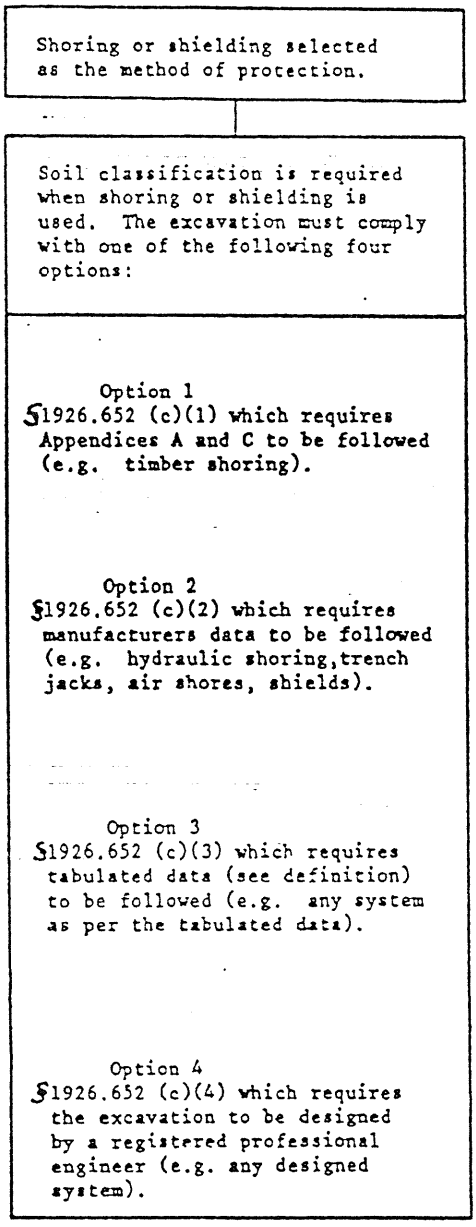


FIGURE 3 - SHORING AND SHIELDING OPTIONS

SECTION 31 73 13

ANNULAR SPACE GROUTING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section presents the requirements for continuous annular space grouting of the carrier pipe after placement within the jacked casing. The annular space void between the jacked casing and carrier pipe shall be completely grouted to support the carrier pipe and provide long-term stability.

1.02 RELATED SECTIONS

A. The Work of the following sections is related to the Work described in this section. Other sections, not referenced below, may also be related to the proper performance of this work. It is the CONTRACTOR's responsibility to perform all the work required by the Contract Documents:
   1. Section 01 33 00, Submittal Procedures
   2. Section 33 05 23, Trenchless Utility Installation
   3. Section 05 59 20, Steel Casing

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. This Section incorporates by reference the latest revision of the following document. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed document, the requirements of this Section shall prevail.
   1. Industrial Standards

ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (or 50-mm) Cube Specimens)
ASTM C138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C150	Portland Cement
ASTM C403	Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C494	Chemical Admixtures for Concrete
ASTM C495	Test Method for Compressive Strength of Lightweight Insulating Concrete
ASTM C939	Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

ASTM E329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ANSI B40	Pressure Gauges and Gauge Attachments

1.04 SUBMITTALS

A. CONTRACTOR shall submit an Annular Space Grouting Plan in accordance Section 01 33 00, Submittal Procedures.

1. The following data:
    a. Proposed grouting mix
    b. Proposed densities and viscosities
    c. Initial set time of the grout
    d. Anticipated hydration temperature
    e. Proposed grouting method
    f. Maximum injection pressures
    g. 24-hour and 28-day minimum compressive strength
    h. Proposed grout stage volumes
    i. Bulkhead designs
    j. Grouting and vent location plans
    k. Buoyant force calculations
    l. Flow control
    m. Provisions for service connections
    n. Pressure gauge certification
    o. Grout head pressure calculations and buckling calculations for the carrier pipe
    p. Plan to stabilize pipe against buoyant forces while grout is setting
    q. Grouting injection locations
2. Recommendations of carrier pipe manufacturer, on manufacturer letterhead, stating the recommendations for grout mix, grout low-hydration temperature, grouting pressure, and installation requirements, including the number of grouting lifts.
3. Certified Test Reports: Before delivery of materials or grout, submit certified reports of the tests specified herein. Accompany the certified reports on previously tested materials with the manufacturer's certified statement that the previously tested material is of the same type, quality, manufacture, and make as that proposed for use in this Contract. Certified test reports are required for the following:
    a. Cement
    b. Additives
4. The Contractor shall submit qualifying experience for subcontractor performing the contact grouting including a minimum of two projects. At least one of the projects shall have been completed within the 12 months prior to this Contract. Submit the following documentation for each of the projects:
    a. Date, title, and location of each project.
    b. Description of each project, including type and size of pipe, depth of pipe, number of tunnel segments in each project, type of equipment used.

c. The name and address of the owner, name and current telephone number of the owner's representative, original and final contract amounts, and a description of all claims or litigation.

d. Submit qualifying experience for the grouting subcontractor's superintendent and grouting machine operator. Each shall have a minimum of 5 years of experience grouting trenchless pipeline installation projects, and shall have worked on a minimum of two projects.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grout for this Section shall be Portland cement and/or additives or other light-weight material including cellular concretes that minimizes the buoyant forces on the carrier pipe.

1. Compressive Strength:
   a. A typical penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C403.
   b. A typical compressive strength of 300 psi in 28 days when tested in accordance with ASTM C495 or ASTM C109.
2. Acceptable Manufacturer (Grout Mix Series) include:
   a. Pacific International Grout Company LDB 662
   b. Masterflow 713; or approved equal.
3. Mix Designs: To completely fill the annular space, develop one or more mixes based on the following requirements:
   a. Size of the annular void.
   b. Material of carrier pipe.
   c. Distance grout must travel between injection points.
   d. Sufficient strength and durability to prevent movement of the carrier pipe.
   e. Provision of adequate retardation.
   f. Low hydration temperature.
   g. Provide less than 1 percent shrinkage by volume.
4. Density: Design a grout mix with a density to prevent floating of the carrier pipe and to meet the requirements of the approved grouting procedure.
5. Viscosity: The apparent viscosity shall not exceed 25 seconds in accordance with ASTM C939 for sand grouts. Viscosity shall be determined by similar methods for cellular concretes.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. The design and installation of the grout shall meet all the requirements of manufacturer of the carrier pipeline to maintain the integrity of the carrier pipeline including, but limited to, grout curing temperature limits.

B. Block carrier pipe as shown on Plans. Placement of grout shall not cause floatation of the carrier pipe during grouting.

C. The grouting pressure and number of grouting lifts shall be as recommended by the carrier pipe manufacturer and shall not cause damage or deflection to the carrier pipe. The grout installer shall perform independent calculations based on grout mix properties to demonstrate that the proposed number of lifts will not cause floatation.

D. Grout, cap or bulkhead the open end of the annular space between the carrier pipe and the jacked casing at casing ends.

3.02 PREPARATION

A. After sliplining and blocking the carrier pipe and prior to grouting, capping, and/or bulk heading of the ends, supply appropriate venting. Submit plans for venting, including the proposed number and location of vents relative to pipe diameter and stiffness.

B. Perform capping, bulk heading and pressure testing.

C. Hold the carrier pipe at the required elevation and slope as indicated on the Plans. The placement of the carrier pipe shall be accepted by the Engineer prior to start of grouting.

D. The grouting shall be injected into the annular space in lifts. The number of lifts and requirements for the grout placement shall be as specified by the carrier pipe manufacturer and verified by the grout installer.

3.03 GROUTING EQUIPMENT

A. Mix the materials in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation.

B. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions any time during the grouting procedure.

3.04 INJECTION PROCEDURE AND PRESSURE

A. The gauged pumping pressure shall not exceed the carrier pipe manufacturer's approved recommendations.

B. Pumping equipment shall be of a size sufficient to inject grout at a velocity and pressure relative to the size of the annular space.

C. Place gauges to monitor grout pressure immediately adjacent to each injection port:
   1. The gauge shall conform to an accuracy of no more than 0.5 percent error over the full range of the gauge.
   2. The range of the gauge shall not be more than 100 percent greater than the design grout pressure.
   3. Pressure gauges shall be instrument oil-filled and attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout.
   4. All gauges shall be certified and calibrated in accordance with ANSI B40, Grade 2A.

5. Provide cumulative volumetric gauges and/or other means for continuously monitoring injection of the volumes of grout pumped into each section of pipe annulus. Gauges or monitoring methods shall enable measurement of pumped grout volumes to within 1 cubic foot. Contractor shall perform field bucket calibration test of grout pump to verify accuracy of reading. The test shall be performed in the presence of the Engineer.

3.05 PERFORMANCE REQUIREMENTS

A. Submit the proposed grout mixes, methods, plans and criteria of the grouting operations to maintain the integrity of the carrier pipeline and to prevent deflection, reduction of ovality and pipeline strength, or the creation of sags.

B. Provide sufficient gauges, monitoring devices and tests to determine the effectiveness of the grouting operation and to ensure compliance with the design parameters and carrier pipe manufacturer recommendations.

3.06 TESTING

A. Grout Testing Responsibility:
   1. Provide testing of the materials and methods for each grouting lift.
   2. Submit results to the Engineer.

B. On-site Test Equipment:
   1. Verify density by ASTM C138 or by other methods as accepted by the Engineer.
   2. Check viscosity with a flow cone provided by the CONTRACTOR and test in accordance with ASTM C939. For cellular concrete check viscosity in a manner approved by the Engineer.

C. Test Section:
   1. Perform a test on each type of grout and grout system proposed to be used.
   2. The test section to be grouted shall be proposed by the CONTRACTOR and accepted by the Engineer.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 73 29

CEMENT TUNNEL GROUTING

PART 1 GENERAL

1.01 SUMMARY

A. This section presents the requirements for contact grouting of all voids resulting from over excavation of soil outside the casing pipe during tunneling installations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
   1. Geotechnical Baseline Report and General Soils Evaluation Report (GSER)
   2. Section 01 33 00, Submittal Procedures
   3. Section 31 23 00, Excavation and Fill
   4. Section 31 73 13, Annular Space Grouting
   5. Section 02 32 23, Vibration and Settlement Monitoring
   6. Section 05 59 20, Steel Casings

1.03 QUALITY ASSURANCE

A. The Contractor shall maintain an ongoing Quality Assurance Plan to verify that items related to contact grouting are being performed in accordance with the Contract Documents.

B. Contact Grouting Qualifications: The Contractor or subcontractor performing contact grouting work shall have proof of previous experience including a minimum of two projects of similar size to this tunnel. At least one of the projects shall have been completed within the 12 months prior to this Contract.

1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. This Section incorporates by reference the latest revision of the following document. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed document, the requirements of this Section shall prevail.
   1. Industrial Standards:

ASTM C31	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Specifications for Ready Mix Concrete

ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-Inch or 50-mm Cube Specimens)
ASTM C143	Test Method for Slump of Portland Cement Concrete
ASTM C144	Specification for Aggregate for Masonry Mortar
ASTM C150	Specification for Portland Cement
ANSI B40	Pressure Gauges and Gauge Attachments

1.05 DESIGN CRITERIA

A. All voids between the outside of the casing pipe and the excavation surface shall be filled with contact grout.

1.06 SUBMITTALS

A. The Contractor shall submit a Contact Grouting Plan in accordance with 01 33 00, Submittal Procedures
   1. Submit a detailed contact grouting plan including the following:
   2. A plan detailing the location of grout injection ports and proposed sequence of grouting to meet requirements of 33 05 23, Trenchless Utility Installation and consistent with the proposed installation method.
   3. Materials including grout mix design, unconfined compressive strengths, and set times.
   4. Equipment including mixers, pumps, grout injection hoses and grouting port connections, gauges, etc.
   5. Methods of grouting execution and sequences including injection pressures and methods of controlling grout pressure.
   6. Anticipated grout injection volumes based on tunnel excavated material volume.
   7. Anticipated minimum and maximum grouting pressures at the port collar connection.
   8. Methods of monitoring and evaluating quality assurance including methods of grout sampling and compressive strength testing.
   9. Cleanup and restoration.
   10. Contingency plan for migration of grout to the surface.

B. The Contractor shall submit qualifying experience for subcontractor performing the contact grouting including a minimum of two projects. At least one of the projects shall have been completed within the 12 months prior to this Contract. Submit the following documentation for each of the projects:
   1. Date, title, and location of each project.
   2. Description of each project, including type and size of pipe, depth of pipe, number of tunnel segments in each project, type of equipment used, geologic conditions, groundwater level and description of dewatering system, and description of any unusual difficulties and how they were resolved.

3. The name and address of the owner, name and current telephone number of the owner's representative, original and final contract amounts, and a description of all claims or litigation.
4. Submit qualifying experience for the grouting subcontractor's superintendent and grouting machine operator. Each shall have a minimum of 5 years of experience grouting trenchless pipeline installation projects, and shall have worked on a minimum of two projects.
5. Maintain and submit daily logs of grouting operations, including pressures, volumes, and grout mix pumped, time of pumping, and slump of grout mix.

PART 2 PRODUCTS

2.01 QUALITY ASSURANCE

A. Slump Tests: Perform at least one slump test from each truck load or batch of grout according to ASTM C143.

B. Grout Strength Tests: Prepare samples for 7- and 28-day compressive strength tests according to ASTM C31 for cylinders or ASTM C109 for cubes. Cylinder molds shall be at least 2 inches in diameter and 4 inches long. Grout cubes shall be either 2 inches or 50 millimeters square. Test samples according to ASTM C39 or C109 as applicable. Grout for the cylinders or cubes shall be taken from the nozzle of the grout injection line.

2.02 MATERIALS

A. Cement: Cement shall be Type II or Type V Portland cement conforming to ASTM C150. Type II cement shall meet Table 4 fast set requirements of ASTM C150.

B. Sand: Conform to ASTM C144 except where modified in the following paragraphs.
1. Fineness modulus: Between 1.50 and 2.00.
2. Grading requirements

Sieve Size	Percentage by Passing Weight
No. 8	100
No. 16	95-100
No. 30	60-85
No. 50	20-50
No. 100	10-30
No. 200	0-5

3. Fluidizer: Holds the solid constituents of the grout in colloidal suspension and is compatible with the cement and water used in the grouting program.
   a. Contains an expansive shrinkage compensator.

4. Admixtures: Other admixtures may be used subject to the approval of the ENGINEER to improve the pump-ability, to control set time, to hold sand in suspension, and to prevent segregation and bleeding.
5. Compressive Strength: Minimum strength of 50 psi in 24 hours; maximum strength of 150 psi in 28 days.

2.03 EQUIPMENT

A. Equipment for mixing and injecting grout shall be adequate to satisfactorily mix and agitate the grout and force it into the grout ports in a continuous flow at the desired pressure. Pumps shall be capable of continuously developing a sustained pressure at grout nozzle that shall not exceed the overburden load.

B. Two pressure gages shall be provided; one at the grout pump and one at the collar of each port being grouted. The accuracy of the gages shall be periodically checked with an accurately calibrated pressure gage.

C. Suitable stop valves shall be provided at the collar of each port for use in maintaining pressure as required until the grout has set.

D. The grouting equipment shall be provided with a meter to determine the volume of grout injected. The meter shall be calibrated in cubic feet to the nearest one-tenth of a cubic foot.

E. The grouting equipment shall be maintained in satisfactory operating condition throughout the course of the work to ensure continuous and efficient performance during grouting operations.

F. Grout hoses shall be capable of withstanding the maximum water and grout pressures to be used.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Scope:
1. The Contractor shall gauge the volume of excavation material during installation to help estimate the required contact grout volume. Contact grout shall be used to fill any voids outside the casing pipe created by over excavation during installation. Contact grouting shall be performed as shown on the Plans and as specified herein. An attempt must be made to hook up and pump grout at every grout hole or coupling unless approval is granted by the ENGINEER to skip selected holes.
2. Immediately after completion of the casing installation operations, the Contractor shall inject grout through the grout connections in such a manner as to completely fill all voids outside the pipe resulting from the installation operations. Grout pressure shall be controlled so as to avoid damaging the pipe, to avoid movement of the surrounding ground or improvements, and to avoid migration of grout to ground surface.

B. Grout Mixes: The Contractor shall develop one or more grout mixes designed to completely fill the void space outside the casing pipe and to provide acceptable strength and durability. All grout mix proportions and test results shall be submitted at least 30 days prior to scheduled use for review and acceptance by the ENGINEER.

C. Contact Grout Composition:
   1. Contact grout shall consist of Portland cement and water in the proportions specified herein or as approved by the ENGINEER. Sand may be added to the grout mix in instances of very high grout take as approved by the ENGINEER but in no case shall the grout mix contain less than seven sacks of cement per cubic yard of grout, in accordance with the TxDOT permit. The addition of sand may require additional water or fluidizer to be added to the grout mix.
   2. Grout mix (water/cement) ratios shall be expressed in cubic feet of water per cubic foot of cement (94-pound bag). The water-cement ratio by volume shall be varied to meet the characteristics of the annular space outside the pipe as they develop during the contact grouting operation. The range of water-cement ratios shall be between 1:1 and 0.75:1 by volume.

3.02 MIXING AND INJECTION OF GROUT

A. All materials shall be free of lumps when put into the mixer, and the grout mix shall be constantly agitated. Grout shall flow unimpeded and shall completely fill all voids. Grout not injected after 90 minutes of mixing shall be wasted.

B. Placement of contact grout ports for the casing pipe are provided in Section 33 05 23, Trenchless Utility Installation.

C. The grouting process shall be operated and controlled so that the grout will be delivered uniformly and steadily.

D. Grouting shall progress from grout port to grout port in the sequence indicated on the approved shop drawings.

E. In general, grouting will be considered completed when less than 1 cubic foot of grout of the accepted mix and consistency can be pumped in 15 minutes under the specified maximum pressure. After the grouting is finished, the pressure shall be maintained by means of a stopcock or other suitable device until the grout has set to the extent that it will be retained in the grout port. Replace grout plugs in pipe or casing at the completion of contact grouting.

F. All grouting operations are to be performed in the presence of the ENGINEER. Notify the ENGINEER at least 24 hours in advance of starting grouting operations.

G. Contact grout port fittings shall be sealed with screw type plugs upon completion of grouting, as shown on Plans.

3.03 CLEANUP

A. Take all necessary precautions to protect and preserve the interior surfaces of the casing pipe from damage. Grout spills shall be minimized and contained, and cleanup shall

proceed immediately after grouting. Any damage to the casing pipe caused by or occurring during the grouting operations shall be repaired by a method approved by the ENGINEER.

B. Remove and properly dispose of all waste grout resulting from grouting operations.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 DESCRIPTION

A. Construct a base course for surfacing, pavement, or other base courses composed of crushed stone, and constructed as herein specified in one or more courses in conformance with the typical sections shown on the plans and to the lines and grades as established by the Engineer.

1.01 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

1.02	Reference	1.03	Title
1.04	ASTM D1557	1.05	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop

B. Testing:

1. Testing will be conducted by the Contractors Testing lab to determine compliance with the specified degree of compaction and moisture content.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer may sample and test project materials at any time before compaction throughout the duration of the project to assure specification

compliance. Use the TxDOT standard laboratory test procedure Tex-100-E for material definitions.

B. **Aggregate.** Furnish aggregate of the type and grade shown on the plans and Section 31 23 00 Excavation and Fill, conforming to the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, as specified.

Table 1
Aggregate Material Requirements

Property	Test Method[1]	Grade 1-2	Grade 3
Master gradation sieve size	Tex-110-E	(cumulative % retained)	(cumulative % retained)
2-½ in.		0	0
1-¾ in.		0–10	0–10
⅞ in.		10–35	–
⅜ in.		30–65	–
No. 4		45–75	45–75
No. 40		65–90	50–85
Liquid limit, % max.[2]	Tex-104-E	40	40
Plasticity index, max.[2]	Tex-106-E	10	12
Plasticity index, min.[2]		As Specified	
Wet ball mill, % max.[3]	Tex-116-E	40	40
Wet ball mill, % max. increase passing the No. 40 sieve[3]		20	20

1. TxDOT standard laboratory test procedures
2. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
3. ASTM C131 (Grad. A), Los Angeles Abrasion, can be used in lieu of the wet ball mill procedure. The maximum abrasion allowed to the crushed stone is forty (40) when subjected to the Los Angeles Abrasion test.

1. **Material Tolerances.** The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.

   When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4 sieve.

   The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

2. **Material Types.** Do not use fillers or binders unless approved by the Engineer. Furnish Type A crushed stone.

   a. **Type A.** Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

B. **Water.** Furnish water free of industrial wastes and other objectionable matter.

C. **Material Sources.** Only commercial sources may be used unless otherwise allowed by the

Engineer.

2.02 EQUIPMENT:

A. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide proof rollers in accordance with TxDOT Item 216, “Proof Rolling,” when required.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 feet thick. Stockpiles must have a total height between 10 and 16 feet unless otherwise shown on the plans. After construction and acceptance of the
stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor’s estimates.

Haul approved flexible base in clean trucks. Deliver the required quantity to each 100 foot station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100 foot station, manipulate in accordance with the applicable Items.

B. **Preparation of Subgrade or Existing Base.** Remove existing concrete pavement in accordance to be replaced, when shown on the plans or as directed by the Engineer. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

When shown on the plans or directed, proof roll the roadbed in accordance with TxDOT Item 216, “Proof Rolling,” before pulverizing or scarifying. Correct soft spots as directed.

C. **Placing.** Spread and shape flexible base into a uniform layer with an approved spreader the same day as delivered unless otherwise approved. Construct layers to the thickness shown on the plans. Maximum lift thickness shall be 10 inches of loose material. Maintain the shape of the course. Control dust by sprinkling, as directed. Correct or replace segregated areas as directed, at no additional expense to the City.

Place successive base courses and finish courses using the same construction methods required for the first course.

D. **Compaction.** Compact in courses not to exceed 8 inches compacted depth using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with TxDOT Item 204, "Sprinkling."

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least ½ the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the City.

1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.
2. **Density Control.** Compact to at least 100% of the maximum density determined by ASTM D1557.

   The Contractor will determine roadway density of completed sections in accordance ASTM D1557. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pounds per cubic foot below the specified density.

E. **Finishing.** After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately ¼ inch. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

In areas where surfacing is to be placed, correct grade deviations greater than ¼ inch in 16 feet measured longitudinally or greater than ¼ inch over the entire width of the cross-section. Correct by loosening, adding, or removing material. Reshape and recompact in accordance with the specified compaction.

F. **Curing.** Cure the finished section until the moisture content is at least 3 percentage points below and above optimum or as directed before applying the next successive course or prime coat.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies paving consisting of aggregate base, asphaltic concrete, and associated materials.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Formula. The laboratory mixture design shall be submitted to the Engineer for approval prior to production and placement. The submittal shall provide the laboratory designed mixture target properties and data that demonstrate the contractor's ability to produce the mixture within the tolerances specified in Item herein either through a trial batch or by submittal of previous production data from a City or TxDOT project.

C. Material Certificates: For each paving material, signed by manufacturers.

SUBMITTAL PROCEDURES:

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. Manufacturer shall be a paving-mix manufacturer registered with the TxDOT.

C. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop

D. Testing:
   1. Testing will be conducted by the Contractors Testing lab to determine compliance with the specified degree of compaction and moisture content.

PART 2 PRODUCTS

A. Aggregate Base:
   1. Aggregate base shall be Type A, Grade 1 or 2, conforming to SDHPT Latest Revision, ITEM 247, shall be used for concrete pavement base. Refer to Section 32 11 23 Aggregate Base Course and Section
   2. Base on City of El Paso ROW and TXDOT ROW shall be two-sack flowable fill. Reference Specification Section 31 23 01.
   3. The base courses shall be constructed in the locations indicated on the drawings or as necessary to construct or repair pavement.
   4. Material sources shall be an approved TXDOT-Supplier.
   5. Aggregate base shall be crushed as necessary to meet the requirements hereinafter specified and shall consist of durable stone crushed and/or screened to the required particle size, with or without other approved fine- sized material. The material shall be from approved sources.
   6. Testing of flexible base materials shall be in accordance with the following TXDOT standard laboratory test procedures:

      Preparation for Soil Constants and Sieve Analysis Tex-101-E
      Liquid Limit Tex-104-E
      Plastic Limit Tex-105-E
      Plasticity Index Tex-106-E
      Linear Shrinkage Tex-107-E
      Sieve Analysis Tex-110-E
      Los Angeles Abrasion ASTM C131 (Grade A)
   7. Samples for testing the material shall be made available to the Engineer and taken prior to the compaction operations.

B. Liquid Asphalt:
   1. Liquid asphalt for tack coats shall comply with SDHPT Latest Revision, Item 300.

C. Asphalt Concrete:
   1. Asphalt pavement shall be Item 340, Type C conforming to SDHPT, Latest Revision, for all City of El Paso roadways.

D. Pavement Markings
   1. Painted Pavement Markings:
      a. Parking Lots and EPWater Property: Painted pavement markings shall be used to restripe pavement markings in parking lots and EPWater property. Painted

pavement markings shall comply requirements in Section 32 17 23 Pavement Markings.

2. Thermoplastic Pavement Markings
    a. City or TXDOT Right of Way: Thermoplastic pavement markings shall be used to replace pavement markings within City or TXDOT Right of Way. Thermoplastic pavement markings shall comply requirements in Section 32 17 23 Pavement Markings.

PART 3 EXECUTION

3.01 GENERAL

A. Construction shall conform to the details, dimensions and grades specified. Maximum variations in finished grade of paving shall be plus or minus 0.05 feet.

3.02 AGGREGATE BASE PLACEMENT

A. Subgrade:
    1. Contractor shall prepare subgrade by scarifying and compacting existing material a minimum of 8". in accordance with Section 31 23 00-3.06 and as specified on the plans.

B. Aggregate Base:
    1. Aggregate base shall be Type A, Grade 1 or 2, conforming to SDHPT Latest Revision, ITEM 247, for base course under concrete pavement. Base shall be compacted as indicated in 31 23 00 Excavation and Fill.
    2. Provide machinery, tools, and equipment necessary for proper execution of the work.
    3. Provide rollers in accordance with SDHPT Latest Revision, Item 210, Rolling.
    4. Base Course shall be installed in 8" thick layers (maximum) and compacted to 5" compacted layers (compaction to 100% density of modified proctor). Installation shall be performed in accordance with TXDOT-Standard Specification Construction Methods, Item 247.

3.03 ASPHALT CONCRETE PAVEMENT

A. Pre-installation Conditions
    1. Surface shall be clean and free of loose dirt, rock, or any foreign matter.
    2. Proof-roll subbase using heavy, pheumatic-tired rollers to locate areas that are unstable that require further compaction.
    3. Verify that subgrade is dry and in suitable condition to support paving particles.
    4. Areas that fail tire test shall be reworked in sections to allow proper compaction using standard equipment and not isolated sections.

B. Tack Coat:
    1. Clean the surface before placing the tack coat. A tack coat shall be applied to all vertical contact surfaces of existing pavement; to curbs, gutters, and construction joints against which asphalt concrete will be placed; to pavements to be surfaced; and where specified at the approximate rate of 0.05 gallons per square yard. Application shall comply with SDHPT latest edition. Immediately prior to placing

asphalt concrete, additional tack coat shall be applied to areas where the tack coat has been damaged.

2. Immediately prior to construction of asphalt concrete berms, a continuous tack coat shall be applied to the pavement surface. Application of the tack coat shall not cause a slip or weakened plane between the two joined surfaces.

C. Asphalt Concrete:

1. Placement of asphalt concrete pavement shall comply with SDHPT latest edition. Berms shall be shaped and compacted with an extrusion machine. Asphalt shall be compacted to a minimum of 98 percent. Asphalt placement in City of El Paso R.O.W. and TXDOT R.O.W. shall be machine laid.
2. COMPACTION
    a. Begin compaction as soon as placed hot mix paving will bear roller weight without excessive displacement. Complete compaction before mix temperatures cools below 190 degrees F.
    b. Initial rolling immediately after rolling joints and outside edges. Correct lay down and rolling operations to comply with requirements.
    c. Intermediate rolling after initial rolling to achieve specified density. Rolling shall continue until HMAC course has been compacted uniformly to 98% compaction.
    d. Finish rolling after intermediate rolling to remove any tire impressions or imperfections.
    e. Repairs shall require the areas that are defective or contaminated with foreign materials to be removed and replace with fresh, hot-mix asphalt and repeat process accordingly.
    f. Curing shall be protected from any traffic until material has cooled and hardened.
3. TOLERANCES
    a. Thickness: Compact courses to produce a core sample to be tested for thickness.
        1) Base Course (+/-) 0.25 inches (as per core measurements)
        2) Surface Course (+/-) 0.125 inches (as per core measurements)
    b. Surfaces: Compact courses to produce a surface smoothness within the allowable tolerances as determined by using a 16-foot straightedge applied along paved areas:
        1) Base course (+/-) 0.25 inches
        2) Surface Course (+/-) 0.125 inches
        3) Depressions/humps (+/-) 0.125 inches
        4) Crowns (+/-) 0.25 inches
    c. Finish: The finished surfaces of bituminous courses shall not vary from the grade line, elevations, and cross sections shown on the contract drawings by more than ½ inch (12.70 mm). The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching will not be permitted.

D. Pavement Markings:

1. Painted Pavement Markings shall be placed on parking lots and EPWater property.
2. Placement shall comply with Section 32 17 23 Pavement Markings.

E. Thermoplastic Pavement Markings:
   1. Thermoplastic Pavement Markings shall be placed on roadways within City and TXDOT right of way.
   2. Placement shall comply with Section 32 17 23.23 Thermoplastic Pavement Markings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 12 36

ASPHALT FOG SEAL COAT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for placing an asphalt Fog Seal upon an existing asphalt pavement surface.

1.2 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

A. Texas Department of Transportation most current Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (TxDOT).

1. Item 300 - Asphalts, Oils and Emulsions
2. Item 325 – Fog Seal
3. Item 316 - Surface Treatments
4. Item 320 – Equipment for Asphalt Concrete Pavement

B. American Society for Testing and Materials Standards (ASTM)

1. D 8-02 – Standard Terminology Relating to Materials for Road Pavements
2. D 698 - Moisture Density Relations of Soil Using 5.5 Pound Rammer and 12 Inch Drop.

C. Texas Department of Transportation Test Procedures

1. TEX 207-F – Determining Density of Compacted Bituminous Mixtures
2. TEX 227-F – Theoretical Maximum Specific Gravity of Bituminous Mixtures

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 17 23 Pavement Markings

B. Section 32 17 23.33 Thermoplastic Pavement Markings

C. Section 32 12 16 Asphaltic Concrete Paving

1.4 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by TxDOT.

1.7 PROJECT CONDITIONS

A. Construct fog seal per the following conditions:

1. Road surface shall be dry.
2. Suspend fog seal operations when rain is expected before the fog seal emulsion can set.
3. Minimum surface temperature of 60 deg F and rising.
4. Application of fog seal shall be only during daylight hours.
5. Temperatures below 40F are not anticipated for at least 24 hours after application.
6. Sustained winds are less than or equal to 10 miles (16 kilometers) per hour; and
7. Application is completed at least 2 hours before sunset.

PART 2 - PRODUCTS

2.1 ASPHALTIC MATERIALS

A. Asphaltic material shall conform to the applicable requirements of Item 300, TXDOT. Asphalt Emulsion shall be AC-5.

2.2 FOG SEAL

A. Emulsion Material: The material shall confirm to SS-1 conforming to SDHPT Latest Revision, TXDOT Item #300, Asphalts, Oils, and Emulsions, table 7.

2.3 EQUIPMENT

A. All equipment necessary to perform the work within the scope of this Section shall conform to requirements of TxDOT Item 316, Article 316.3.

2.4 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Engineer.

1. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Potholes and other structural failure of the surface shall be repaired prior to placing the fog coat.

B. The surface shall be swept clean of all debris, dirt, loose gravel and other loose articles. If necessary, the surface can be washed, but the surface must be dry before the seal coat is applied.

3.2 FOG SEAL APPLICATION

A. Verify the application rate of the emulsified asphalt by dividing the volume of emulsified asphalt used by the area fog sealed each day. Allowable variation is +/- 5% of the application rate adjusted from the design quantity. Provide material certification and quality control test results for each batch of emulsified asphalt used on the project. Include the supplier name, plant location, emulsion grade, and batch number on all reports.

B. Placement shall comply with SDHPT latest edition, Item 315.

C. Provide all equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils, and emulsions.

D. Apply the mixture when the air temperature is at or above 60 °F , or above 50°F and rising. Measure air temperature in the shade away from artificial heat.

E. Rate: Apply emulsion at a rate of 0.25 gallons per square yard.

F. Furnish and distribute clean, fine sand on the surface to blot excess when an excessive quantity of asphalt is applied.

G. Maintain ingress and egress as directed by applying sand to freshly sealed areas.

H. Allow mixture to cure for 48 hours.

I. Test surface to insure surface is dry and not tacky. Apply paint for striping and open for traffic after paint has dried.

3.3 SITE PROTECTION

A. During applications, protect adjacent buildings, structures, vehicles, manhole covers, inlet grates, and trees to prevent being spattered or marred.

3.4 TRAFFIC CONTROL

A. Protect freshly placed coating from damage by traffic. Provide sufficient warning signs and barricades to prevent traffic over freshly treated surfaces. Protect treated areas from traffic for at least 24 hours after final application of coatings, or for such time as necessary to prevent picking up. Provide warning signs and barricades for proper traffic control, in accordance with MUTCD.

END OF SECTION

32 17 23

PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 This guide specification covers the requirements for painting markings on EPWater roads and parking areas. Thermoplastic markings shall be used within City and TXDOT Right-of-Ways as specified in Section 32 17 23.33 Thermoplastic Pavement Markings.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

B. American Society for Testing and Materials (ASTM)

C. Federal Specifications (FS)

D. Joint fillers and sealers are specified in Division-7.

1.3 SUBMITTALS

A. Lists of proposed products and equipment to be used, including descriptive data, notifications of proposed Contractor actions as specified in this Section.

B. Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

1.4 DELIVERY AND STORAGE

A. All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.5 EQUIPMENT

A. All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads will display low speed traffic markings and traffic warning lights.

1. Paint Application Equipment: The equipment to apply paint to pavements shall be a self- propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph and shall be capable of applying the stripe widths indicated, at

the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The paint applicator shall have paint reservoirs or tanks or sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with a quick-action valves conveniently located and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to insure freedom from residue and foreign matter that may cause malfunction of the spry guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

2. Sandblasting Equipment: Sandblasting equipment shall include an air compressor, hoses and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing no less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used and shall be equipped with traps that will maintain the compressed air free of oil and water.
3. Waterblast Equipment: the water pressure shall be specified at 2600 psi and 60 degrees C (140 degrees F) in order to adequately clean the surfaces to be marked.
4. Traffic Controls: Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for altering approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.6 HAND-OPERATED, PUSH-TYPE MACHINES

A. All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and praying nozzles and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

PART 2 – PRODUCTS

2.1 PAINT

A. The paint shall be homogeneous, easily stirred to smooth consistency and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paint for roads and streets shall conform to color as indicated. Painted markings shall comply with DMS-8200 Traffic Paint (TXDOT).

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. Surface to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance existing paint markings and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushers, sandblasting, approved chemicals, or mechanical abrasion as required. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has stopped due to rain.

B. Cleaning existing pavement markings: In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings that are in good condition that interfere with or conflict with the newly applied marking patterns shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.2 APPLICATION

A. All pavement markings and patterns shall be placed as per pre-construction layout and/or as shown on the plans.

1. Paint shall be applied to clean, dry surfaces and only when air and pavement temperatures are above 40 degrees F and below 94 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified herein. The Contractor shall provide guidelines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

2. Rate of Application: Reflective markings. Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet per gallon. Glass spheres shall be applied uniformly to the wet paint on road and street pavement at a rate of 6 plus or minus 0.5 pounds of glass

spheres per gallon of paint.

3. Drying: The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

END OF SECTION

SECTION 32 17 23.33

THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This item includes white thermoplastic pavement markings for crosswalks, stop lines, lane lines, and other types of traffic controls.

1.2 RELATED WORK SPECIFIED ELSEWARE

A. Section 32 12 16 Asphalt Paving

B. Section 32 13 13 Concrete Paving

C. Section 32 12 36 Asphalt Fog Seal Coat

1.3 REFERENCES

A. ASTM E 28 - Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus.

B. ASTM G 152 - Standard Practice for Operating Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

C. ASTM G 153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

D. TxDOT Tex-822-B - Determining Refraction Index of Glass Beads.

E. TxDOT Tex-826-B - Water Absorption Test of Beads.

F. TxDOT Tex-839-B - Determining Color in Reflective Material.

G. TxDOT Tex-851-B - Evaluating the Abrasion Resistance of Pavement Marking Material.

1.4 SUBMITTALS

A. Product Data: Submit Manufacturer's literature indicating product specifications and instructions for handling, installation, and curing. Include performance test data sheets for each product.

B. Submit material supplier's certification of compliance with specifications.

C. Chemical Analysis: Submit infrared analysis of Type B resins for each manufacturer

used.

PART 2 P R O D U C T S

2.1 MATERIAL REQUIREMENTS

A. General Requirements: Thermoplastic pavement marking material Type B for use on either asphaltic or Portland cement concrete surfaces. Clearly mark each container to indicate color, weight, type of material, and lot or batch number (consider lot or batch as each individual mix or blend that produces finished product ready for use). Package material in either suitable corrugated containers or thermal degradable plastic bags to avoid sticking during shipment or storage.

B. Thermoplastic markings shall not be slippery when wet, nor exhibit tacky, exposed surface. Cold ductility of material shall permit normal road surface expansion and contraction without chipping or cracking. Markings shall retain their original color, dimensions, and placement under normal traffic conditions at road surface temperatures of 158 F and below.

C. Prime and filler pigments shall pass U.S. Standard sieve No. 230 (0.0024 inch opening) when washed free of resins by solvent washing, and meet following specific requirements for each pigment.

1. Prime Pigments: White pigment shall be Rutile Titanium Dioxide.

2. Filler Pigment: Filler pigment shall be calcium carbonate, 95% purity.

D. Binder

1. Type B - Alkyd: Use binder consisting of mixture of resins, at least one of which is solid at room temperature, and high boiling point plasticizers. At least one-third of binder compositions shall be a maleic-modified glyceryl ester 012 Rosin and shall be no less than 8% by weight of entire material formulation.

F. Glass Traffic Beads: the total silica used in formulation shall be in form of glass traffic beads meeting the following requirements:

1. Manufacture. Use glass traffic beads having the following characteristics:

a. Manufactured from glass;

b. Spherical in shape;

c. Free of sharp angular particles;

d. Free of particles showing milkiness, surface scoring, or surface scratching;

e. Water white in color.

2. Contaminants. Use glass traffic beads having the following characteristics:

a. Containing less than 1/4 of 1% moisture by weight;
b. Free of trash, dirt, etc;
c. Showing no evidence of objectionable static electricity when flowing through regular traffic-bead dispenser.

3. Gradation:

a. Sieve Analysis. Glass traffic beads shall meet following gradation requirements:

Openings U.S. Standard Sieves Percent
Passing No. 20 95 - 100
No. 30 80 - 95
No. 50 15 - 35
No. 100 0 - 4

b. Irregular Particles: Glass traffic beads, retained on screen used to determine gradation requirements, shall not contain more than 30% (by weight) irregular particles.

4. Index of Refraction: Glass traffic beads, when tested by TxDOT Tex-822-B, using liquid immersion method at 25 C (77 F) shall show index of refraction within range of 1.50 to 1.53.

5. Wetting. Use glass traffic beads capable of being readily wet with water when tested in accordance with TxDOT Tex-826-B.

6. Stability. Use glass traffic beads showing no tendency toward decomposition, surface etching, change in retro reflective characteristics, or change in color after:

a. One hour exposure to concentrated hydrochloric acid at 25 C (77 F);
b. Twenty-four-hour exposure to weak alkali;
c. One hundred hours of Weather-O-Meter exposure, in accordance with ASTM G 152 and ASTM G 153.

2.2 FINISHED PRODUCT REQUIREMENTS

A. Physical Characteristics. Finished thermoplastic pavement markings material shall be free flowing granular material, unless otherwise shown on Drawings. Material shall remain in free flowing state in storage at temperatures of 100 F or less. Materials shall be readily sprayed through nozzles commonly used on thermoplastic spray equipment at temperatures between 205 and 218 C (401 to 425 F).

B. Toxicity. At temperatures up to and including 230 C (446 F), materials shall not give off fumes which are toxic and otherwise injurious to persons, animals, or property.

C. Material shall not break down or deteriorate when held at 205 C (401 F) for 4 hours.

D. Temperature versus viscosity characteristics of material in plastic state shall remain constant throughout up to four reheatings at 205 C (401 F) and from batch to batch.

E. Material shall not be adversely altered by contact with sodium chloride, calcium chloride, or other similar chemicals on, or used on, roadway surface; by contact with oil content of pavement materials, or by contact from oil dropping from traffic.

F. Softening Point. After heating thermoplastic materials for two hours at 204 C (400 F) Type B Alkyd material shall have softening point greater than 90 C (194 F) when tested in accordance with ASTM E 28-58T - Ball and Ring Method.

G. Color. CIE chromaticity coordinates of materials, when determined in accordance with TxDOT Tex-839-B, shall fall within area having following corner points and shall meet following luminosity requirements.

CIE CHROMATICITY COORDINATE CORNER POINTS

	Point 1		Point 2		Point 3		Point 4		
Color	X	Y	X	Y	X	Y	X	Y	
	Luminosity White								
{tc \12 "White}	0.290 - 0.315		0.310 - 0.295		0.350 - 0.340		0.330 - .360		Min 65

Material shall meet above specified color requirements, before and after 70 hours of exposure in Weather-O-Meter (Atlas, Sunshine Type) fitted with 18 - 102 (18 minutes of sunshine and rain and 102 minutes of sunshine) cyclic gear. Prepare panels for testing with material as supplied.

H. Abrasion. Thermoplastic pavement marking materials shall have loss between 4.0 and 12.0 grams when tested for abrasion in accordance with TxDOT Tex-851-B. Test according to steps 1 through 8 of procedure utilizing following test parameters:

Test distance: 5
inches Blast
pressure: 40 psi
Sample angle: 10 degrees and 122 gram blast
media Blast Media: 1200 grams

I. Uniformity. Manufacture material so that, when sampled in accordance with TxDOT Manual of Testing Procedures, 100-gram sample will be representative of batch or lot of material.

J. When applied 1/8 inch thick, setting time shall not exceed characteristic straight-line curve, lower limit of which is four minutes at 59 F road surface temperatures, and upper limit of which is ten minutes at 90 F road surface temperature. Both temperatures are to be measured at maximum relative humidity of 90%.

2.3 FORMULAE

K. Type B - Alkyd Thermoplastic Marking:

Pounds

Binder 18 - 23
Titanium Dioxide 12 - 15
Calcium Carbonate 20 - 42
Glass Traffic Beads 30 - 45
TOTAL 100

PART 3 EXECUTION

3.1 GENERAL

A. Spray apply pavement marking or extrude hot to pavement surface unless application method is specified on Drawings.

B. Provide continuous mixing and agitation of material. Provide clean, square, marking ends. Do not use pans, aprons, or similar appliances which dye overruns.

C. Provide thermometer capable of measuring temperature of pavement marking material.

D. Use automatic bead dispenser attached to pavement marking equipment in manner that beads are dispensed uniformly and almost instantly upon marking as marking is being applied to road surface. Rate of application shall be sufficient to achieve retro-directive reflective characteristics specified. Provide automatic cut-off control for bead dispenser, synchronized with cut-off of pavement marking equipment.

E. Place markings in accordance with approved traffic control plan so that minimal interruption to traffic flow is achieved. Protect newly-installed pavement markings from damage by traffic.

F. Apply pavement markings onto clean, dry pavement having road surface temperature above 60 F for Portland cement concrete surface and above 50 F for asphaltic surface. When pavement marking application is by spray and operations cease for five or more minutes, flush spray head by spraying pavement marking material into pan or similar container until material is proper temperature for application.

G. Use markings that are completely reflectorized internally and externally.

H. Use crew experienced in work of installing pavement markings and supply all equipment and materials necessary for placement of pavement markings.

I. Apply material within temperature limits recommended by manufacturer.

J. Prior to placement of thermoplastic material, properly prepare pavement with primer.

3.2 LAYOUT

A. Place pavement markings in proper alignment with guidelines established on roadway. Do not deviate from alignment established greater than two inches. Do not deviate in alignment of marking being placed greater than one inch per 200 feet of marking and do not deviate abruption.

B. Place additional markings required to achieve alignment specified throughout both

straight and horizontally curved sections of roadway. Additional markings placed on roadway for alignment purposes shall be temporary in nature and shall not establish permanent marking on roadway. Materials used for alignment markings and equipment used to place markings shall be approved by Engineer.

3.3 SURFACE PREPARATION

A. Clean pavement by sandblasting and prepare in accordance with recommendations of thermoplastic material manufacturer and to satisfaction of Engineer, prior to placement of markings. Surface scarification can be used with prior approval of Engineer.

B. Use cleaning methods approved by Engineer that completely remove contaminants, loose materials, and conditions deleterious to proper adhesion. Do not clean Portland cement concrete surfaces by grinding.

C. Prepare Portland cement concrete surfaces further after cleaning by completely sealing with epoxy or methyl methacrylate sealer, as recommended by thermoplastic material manufacturer. Placed sealer sufficiently in advance of thermoplastic to allow release of all solvents.

D. Prime asphaltic surfaces with sealer, as recommended by thermoplastic material manufacturer based on surface conditions. Include adhesive or adhesion promoter when asphaltic surfaces exhibit polished aggregate.

3.4 INSTALLATION

A. Install in widths of 4, 6, 8, or 12 inches, to match existing, or shaped otherwise as shown on Drawings. Tolerances in width shall not exceed 1/8 inch. Tolerance shall not exceed 1/4 inch in case of undulation in pavement.

B. Material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing materials.

C. Maintain uniform thickness of each pavement marking. Minimum thickness of markings, as measured above plane formed by pavement surface, shall not be less than 1/8 inch (125 mils), unless shown otherwise on Drawings. Maximum thickness shall be 3/16 inch. Supply device, approved by Engineer, to measure thickness of applied extruded markings.

3.5 TESTING

A. Maintain uniform cross section, density, quality, and thickness for markings. Markings shall be uniform throughout their thickness. Use applied markings that are 95% free of holes and voids, and free of blisters for minimum of 60 days after application.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies galvanized chain link fence comprising fences, swing gates, sliding gates and appurtenances.

1.02 QUALITY ASSURANCE

A. Factory Testing:
   1. Wire fabric and barbed wire shall be tested for zinc coating weight by the method specified in ASTM A90. Ferrous metal, except the fabric, shall be tested for zinc coating uniformity by the method specified in ASTM A239; zinc coating shall withstand six 1-minute dips.

B. References:
   1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A90	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless
ASTM A121	Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A239	Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
ASTM A392	Zinc-Coated Steel Chain-Link Fence Fabric

PART 2 PRODUCTS

2.01 MATERIALS

A. Chain Link Fabric:
   1. Chain link fabric shall be 2-inch mesh [9]-gage wire, hot-dip galvanized after fabrication. Height of fabric shall be [6 feet 0 inch (plus or minus 3/4 inch)]. Fabric shall conform with the requirements of ASTM A392 and shall have a [Class 2] zinc coating.

B. Top And Bottom Tension Wire:
   1. Top and bottom tension wires shall be at least 7-gage galvanized coil spring steel.

C. Barbed Wire:
   1. Barbed wire shall be double strand 12 1/2-gage galvanized steel with 14-gage barbs in 4-point pattern on 5-inch centers and shall have a Class 3 galvanized coating per ASTM A121.
   2. Pipe used shall be ASTM A53, Schedule 40 steel pipe. Posts, rails, braces and frames shall be hot-dip galvanized per ASTM A53, A123 or A153, whichever is applicable. Galvanizing shall apply at least 2.0 ounces of zinc per square foot of surface.
   3. Line posts shall be either "H" columns weighing not less than 2.7 pounds per foot or 2-3/8-inch outside diameter pipe weighing 3.65 pounds per foot. Corner and end posts shall be minimum 2-7/8-inch outside diameter pipe weighing a minimum of 5.79 pounds per foot. Braces and top rails where specified, shall be 1 5/8-inch outside diameter pipe weighing 2.27 pounds per foot. Swing gate frames shall be made of minimum 2-inch outside diameter pipe. Slide gate frames consist of 2-1/2" O.D. horizontal rails, 2" O.D. vertical bracing, and 1-5/8" diagonal bracing with all welded construction. Gate posts shall be 6-5/8-inch outside diameter weighing 19.0 pounds per foot.

D. Truss Rods And Miscellaneous Fittings:
   1. Truss rods shall be fabricated of 3/8-inch diameter steel rods and shall have turnbuckles or similar means of adjustment. Extension arms for barbed wire shall be steel or malleable iron. Gate hinges, drop bar locking devices, caps, gate stops and miscellaneous bolts, bands, and other appurtenances shall be consistent in quality and strength to the rest of the fence. Fittings used shall be hot-dip galvanized iron or steel with a minimum coating of at least 2.0 ounces of zinc per square foot of surface in accordance with ASTM A123 or A153, whichever is applicable.

E. Concrete:
   1. Concrete for post foundations shall be Class C as specified in Section 03 30 00.

2.02 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00:
   1. Manufacturer's product information designating specific materials provided.
   2. Results of the factory testing specified in paragraph 1.02 Factory Testing.

3. The layout of the chain link fence as it is to be provided illustrating fence height, post sizes, bracing configurations, and accessories.

PART 3 EXECUTION

3.01 FENCE

A. Line posts shall be equally spaced between corners, end posts, and gate posts at a spacing not exceeding 10 feet. The base top shall be at least 1 inch above grade and sloped for drainage. Posts shall be set vertical, shall be accurately aligned, and shall have their tops level or at a constant slope between changes in grade. Tubular posts shall be fitted with extension arms for barbed wire, post top to permit passage of top rail or rainproof malleable iron caps as applicable.

B. Corner, end, and gate posts shall be braced to the nearest line post. Corner and end posts shall be diagonally braced. Bracing for gate posts shall be horizontal braces with truss rods. Line posts shall be braced horizontally and trussed in both directions with truss rods at 1000-foot minimum intervals. Top rails, where specified, shall be in lengths not less than 18 feet and shall be fitted with couplings for connecting lengths into continuous runs. Couplings shall be not less than 6 inches long and allow for expansion and contraction of the rail.

C. Chain link fabric shall be taut and shall be attached to posts, rails, and wires with galvanized fabric bands or tie wires at a maximum spacing of 12 inches on posts and 18 inches on the rails and tension wires. Stretcher bars shall be provided at ends of fabric. The bottom tension wire shall be stretched tight and shall be located 2 inches maximum above finished grade and on a straight grade between posts by excavating the high points of ground, and in no case shall depressions be filled.

D. Unless otherwise specified, three strands of barbed wire attached to extension arms shall be provided along the fence top. Extension arms shall overhang the outside of the fence at a 45-degree angle. The topmost strand of barbed wire shall be 12 inches above the top of the fabric.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 91 13

SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Components of planting mediums.
2. Testing and certification of components.
3. Mixing of planting mediums.
4. Transporting of mediums.
5. Soil and soil amendments products including all imported landscape soil as required to make-up deficiencies in quantity of stockpiled native topsoil available on site.

1.02 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

D. Topsoil: Soil with organic content suitable for sustaining the growth of a soil stabilizing groundcover such as turf. Topsoil is spread over prepared subgrade.

1. Stockpiled Native Topsoil: Topsoil stripped from the site prior to rough grading work to be spread and amended as specified (When available). No onsite soil may be used as topsoil unless approved by Engineer. Soil cut from non-organic layers will not be considered for use as topsoil.
2. Imported Landscape Topsoil: Off-site topsoil imported and stockpiled to be spread and amended as specified.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated, furnish manufacturer's literature, certifications, sources, samples, and laboratory analytical data.

Organic amendments.
Topsoil.
Sand.

Mulch.
Plant bed mix.
Fertilizer.
Soil amendments.
Pre-emergent herbicide.

1.04 QUALITY ASSURANCE

A. Testing: Soil testing laboratory shall be approved by Engineer. Soils laboratory shall be capable of providing all tests outlined in this section and shall provide recommendations and rates of applications per 1000 sq. ft. for soil amendments, soil chemistry, and soil placement.

1. All costs for testing shall be paid for by Contractor.
2. Materials to be Tested:

    a. Stockpiled Native topsoil - 3 samples minimum from at least 3 different locations within the stockpile.
    b. Imported Landscape soils - 3 samples minimum from at least 3 different locations within the stockpile.

3. Agricultural Test Reports: Stockpiled Native Topsoil, Imported Landscape Soils, and Subgrade Soil shall be tested as follows:

    a. Fertility (as expressed in measures of pH, salinity, nitrates, ammonium, phosphate, potassium, calcium, and magnesium).
    b. Agricultural Suitability (sodium absorption ratio, sodium acetate and extractable calcium).
    c. Particle Size: Classify the soil by USDA standards including particle size and organic content notations. Lab reports to conform to material specification description for sieve sizes.
    d. Heavy metals (cadmium, lead, arsenic, aluminum).
    e. Soils lab may require additional tests due to field conditions.

4. Fertility Considerations: In the event of nutrient inadequacies, provisions shall be made to add required materials in soils to overcome inadequacies prior to planting.
5. Imported Landscape Topsoil: Test for herbicide contamination.
6. Certificates: Certify strict compliance with accepted soil mixes and amendments, including rate of application.

PART 2 - PRODUCTS

2.01 NATIVE LANDSCAPE TOPSOIL

A. Stockpiled Native Topsoil

1. Quantity: Approximate quantity of stockpiled native topsoil will not be known until demolition and rough grading have been completed under Civil Work.
2. Stockpiling: Stockpile stripped topsoil onsite.
3. Composition: Fertile, friable, well-drained soil, of uniform quality, free of stones over 1-inch diameter, sticks, oils, chemicals, plaster, concrete and other deleterious materials.
4. Analysis: Obtain an agricultural suitability analysis of the proposed topsoil from an accepted, accredited Testing Agency at Contractor's cost.
5. Test Results: Request Testing Agency to send one (1) copy of test results directly to Engineer and one (1) copy to the Engineer. Imported topsoil shall be amended per soils analysis report.

2.02 IMPORTED TOPSOIL

A. Grading:

Sieve Size	**Percent Passing Sieve**
25.4 mm (1")	95-100
9 Sl mm (3/8")	85-100
53 Micron (270 mesh)	10-30

B. Chemistry - Suitability Considerations:

1. Salinity: Saturation Extract Conductivity (ECe x 103 @ 25 degrees C.) less than 4.0.
2. Sodium: Sodium Absorption Ratio (SAR) less than 9.0.
3. Boron: Saturation Extract Concentration less than 1.0 PPM.
4. Reaction: pH of Saturated Paste: 6.0- 7.5.

C. Pests: The population of any single species of plant pathogenic nematode shall be fewer than 500 per pint of soil.

D. Fertility Considerations: Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium, and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials to overcome inadequacies prior to planting.

E. Source of above shall be approved and conformity of material shall be laboratory verified for each 100 cubic yards of material delivered to the site.

F. Composition: Fertile, friable, well drained soil, of uniform quality, free of stones over 1 in. diameter, sticks, oils, chemicals, plaster, concrete and other deleterious materials.

2.03 PINE BARK MULCH

A. Finely ground decomposed pine bark.

B. White wood or filler material is not allowed.

C. Submit sample for approval.

2.04 SAND

A. Grading: Clean bank sand free of deleterious materials and clumps larger than 1 inch in diameter.

B. Planting Bed Mix/Tree Backfill: Sharp sand.

2.05 CHEMICAL ADDITIVES

A. The following soil components listed shall be applied at rates shown as determined by soil tests. Till additives into existing soil for all grassed areas.

1. Gypsum: Agricultural grade product containing 80 percent minimum calcium sulphate. Apply at a rate of 6lbs./1000 sq. ft.
2. Boil Sulphur: Agricultural grade sulphur containing a minimum of 96 percent sulphur. Apply at a rate of .2 lbs./1000 sq. ft.
3. Apply the following micronutrients at the rates shown:

    a. Zinc: .05 ounces/1000 sq. ft.
    b. Manganese: .05 ounces/1000 sq. ft.
    c. Copper: .05 ounces/1000 sq. ft.

2.06 PLANTING MEDIA

A. Thoroughly mix planting media in the following proportions:

1 part sharp sand
1 part topsoil
1 part pine bark mulch

B. The ratio of mix components may be altered during Contract period to meet site conditions found different in various Project areas.

1. Chemical additives – determined by soil tests.
2. Maintain pH at 6.5 to 7.5.

PART 3 - EXECUTION

3.01 SOIL MOISTURE CONTENT

A. Do not work soil when the following conditions occur:

1. Moisture content is so great that excessive compaction will occur.
2. When it is so dry that dust will form in air or where clods will not break readily.
3. When it is frozen.

B. Apply water if necessary to bring soil to optimum moisture content for tilling and planting.

3.02 CLEARING AND CULTIVATION

A. Clearing: Clear all planting areas of stones 1-1/2 in. diameter and larger, weeds, debris and other extraneous materials prior to soil preparation work.

B. Cultivation of Subgrade:

1. Verification:

a. Verify that subgrades for installation of stockpiled native topsoil and imported landscape soil have been established under rough grading and have been approved by the Engineer. Do not spread landscape soil prior to acceptance of subgrade work.
b. Depth: Verify that subgrades are 4-inch minimum below finished grades, + 1 inch. Report all variations.

2. Cultivation: Rip or cultivate rough grade in all lawn and planting areas to a depth of 4 inches immediately prior to spreading stockpiled native topsoil or imported landscape soil.

3.03 SPREADING, DEPTH, AND AMENDING OF IMPORTED LANDSCAPE SOIL

A. Sequence: Existing soil subgrade cultivation and amending to be approved prior to spreading stockpiled native topsoil or imported landscape soils.

B. Install stockpiled topsoil in low areas to bring the rough grade to within plus or minus 1 foot.

C. Place in lifts of 3 inches maximum where necessary.

3.04 MIXING

A. Till soil amendments into existing soil for grassed areas with the use of mechanical tiller to a depth of 4 inches.

B. Mix soil base, amendments, and chemical additives by mechanical means. Do not mix additives with excavated material at the plant pit site.

C. Mechanical means should thoroughly mix all amendments with soil or soil-less base.

D. Soil and sand bases shall be completely pulverized and free of lumps or aggregated material. Moisture content of base materials shall not be such that chemical granular or pelletized additives become dissolved before thorough mixing.

E. Mix media in quantities of not less than 50 cubic yards or mix total quantity required if less than 100 cubic yards. Contractor shall be responsible for continuity between batches.

F. The Contractor shall keep in storage, at his own expense, sufficient quantities of mix to repair any settling or to adjust grades throughout the warranty period.

3.05 FIELD QUALITY CONTROL

A. Engineer reserves the right to take and have a Soils Testing Laboratory analyze soil samples at the site.

B. Immediately remove rejected materials from site. Replacements are subject to all specified requirements.

C. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the Drawings or Specifications, obstructions on the site, or prior work done by another party, which Contractor feels precludes establishing proper drainage shall be brought to the attention of Engineer in writing for correction or relief of said responsibility.

END OF SECTION

SECTION 32 91 19

LANDSCAPE GRADING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes prevention of excessive weed growth in lawns.

B. Related Sections:
   1. Section 32 91 13 – Soil Preparation.
   2. Section 32 93 13 – Trees, Shrubs, and Groundcover

1.02 DEFINITIONS

A. Finished Grading: Placing and grading of additional soil that may be required to bring the grade to the required grades for lawns, shrubbery, and groundcover beds.

B. Additional Fill Materials: Topsoil as specified herein unless otherwise specified.

1.03 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-preparation operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Engineer and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
   3. Minimize use of heavy machinery where practicable.

1.04 QUALITY ASSURANCE

A. Qualifications: Work shall be performed by personnel trained and experienced in the work and shall be done under the direct supervision of a superintendent on Contractor's staff.

B. Workmanship: Perform work in conformance with recognized acceptable practices. Where job requirements require deviation from those practices, obtain approval from Engineer before processing.

1.05 EXISTING CONDITIONS

A. Protection of Existing Utilities:

   1. Existence and location of underground items are not guaranteed. Investigate and field

verify before starting work. Excavation and backfill in the vicinity of existing items of work shall be carried out with extreme caution.

2. Contractor shall be held responsible for any damage and for maintenance and protection of existing utilities.
3. Indicate on record drawings where there is conflict between field conditions and drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Topsoil shall be free from herbicides and insecticides which might adversely affect subsequent growth of turf or plantings, or which might otherwise contain materials toxic to humans and pets.

B. Sand: Required product shall be "Bank Sand". Submit sample for approval. Sand is not permitted for fine grading purposes if depth exceeds 3/4 inches to achieve finished grade.

2.02 EQUIPMENT

A. Machinery: Machinery shall be approved by Engineer. Contractor shall provide equipment and machinery sufficient for proper execution of Work.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Engineer.

3.02 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

3.03 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Engineer or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two weeks in advance of proposed utility interruptions to allow conformance with Utility Department Outage Notification protocol.

3.04 FINISH GRADING

A. In areas to receive lawns, till, disc, or otherwise scarify soil removing all clods, stones, and related material one inch or larger. Place and spread any additional material that may be required.

B. Landscape areas shall have 2% minimum slope for good drainage. Contractor shall be responsible for minor adjustments to finished subgrade if deemed required by Engineer.

C. Hand rake surface, removing all clods and undesirable material greater than one-half inch from ground surface. Fill all low spots and cut irregularities to the acceptance of the Engineer.

D. Finish all swales and additional swales that may be required to drain areas where there are existing plant materials during finished grading operations.

E. Prepare to immediately begin grassing operations of the completed and accepted finish grade to prevent excessive weed growth in lawn areas.

3.05 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Engineer's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 93 13

TREES, SHRUBS, AND GROUNDCOVER

PART 1 - GENERAL

1.02 SUMMARY

A. Section Includes:

1. Trees.
2. Shrubs.
3. Ground cover.

1.03 REFERENCES

A. "Grades and Standards", latest edition, Texas Association of Nurserymen Specifications, Austin, Texas 78704.

B. "American Standard for Nursery Stock", American National Standards Institute, Incorporated, (ANSI Z 60).

C. "Standardized Plant Names", 1942 Edition, American Joint Committee on Horticultural Nomenclature

1.04 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

F. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated provide requested copies of manufacturers literature, samples, certifications, and laboratory analytical data:
   1. Trees, shrubs, and groundcovers – Samples and/or photographs.
   2. Mulch – manufacturer's literature and sample.
   3. Tree and shrub planting fertilizer – certification or laboratory analytical data.
   4. Tree paint – manufacturer's literature.

B. Product certificates.

C. Planting Schedule: Indicating anticipated planting dates for exterior plants.

D. Maintenance Instructions: Recommended procedures to be established by Engineer for maintenance of exterior plants during a calendar year.

1.06 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

   1. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

D. Source - Quality Control:
   1. Plants shall be subject to inspection and approval by Engineer at place of growth and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the Work. Submit written request for inspection of plant material at place of growth to Engineer. Written request shall state the place of growth and quantity of plants to be inspected. Engineer reserves right to refuse inspection at this time if a sufficient quantity of plants is not available for inspection. All plant material shall be tagged by the Engineer at the nursery.
   2. All plants inspected at the nursery by the Engineer shall be tagged with serialized self-locking tags. Trees delivered to the site without these tags or with broken tags shall be sufficient reason for rejection.
   3. Substitutions of plant materials will not be permitted unless authorized in writing by Engineer. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract Price. Such proof shall be substantiated and submitted in writing to Engineer at least thirty (30) days prior to start of

Work under this Section. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

E. Inspections: Make written request for inspection after planting operations have been completed. Such inspection is for the purpose of establishing the Maintenance Period.

F. Submit written requests for inspections to the Engineer at least seven (7) days prior to anticipated inspection date.

G. Preinstallation Conference: Generally, on site

1.07 DELIVERY, STORAGE, AND HANDLING

A. Submit plan for transporting plant material to site to Engineer for approval. Plan should include:
   1. Date of pick-up at nursery or place of storage.
   2. Type of vehicle used for shipping.
   3. Method of protecting trees during transit.
   4. Dates in transit.
   5. Date of delivery to site.
   6. Projected date of installation.
   7. Means of storage, watering and shading used between delivery and planting.

B. Engineer suggests the following considerations for the Contractor to evaluate in product handling:
   1. During hot weather and when practical, the Contractor may be required to transport plant materials between sunset and sunrise if transported in an open trailer or unrefrigerated box.
   2. Dug material should be maintained and watered as required at the nursery to guarantee their vitality and health until shipping.
   3. Protect all trunks, stems, branches, and root balls during tree tying, wrapping, and loading operations from damage.
   4. Load balls or containers onto transport vehicle and secure in a manner that protects the structural integrity of the root balls.
   5. The Contractor shall be solely responsible for the safe transportation of plants to the site and their condition upon arrival. Trees damaged, dehydrated, or abused during transit and storage will be rejected.
   6. Plant materials should not be stored on concrete or left exposed to the sun.
   7. Protect the balls and water regularly until planting. If trees are left in storage over the weekend or holiday, provide a means of periodical watering and inspecting root ball protection.

C. Engineer may inspect any phase of this operation and may reject any plant material improperly handled during any phase of this operation.

D. Nothing in this Section shall be interpreted as relieving the Contractor of the responsibility of providing healthy, viable plants, nor shall it have any affect upon the terms of the warranty specified herein.

E. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.

F. Handle planting stock by root ball.

G. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.08 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Engineer upon satisfactory completion of all work including maintenance, but exclusive of replacement of plant materials under the warranty period. Upon Final Acceptance, Engineer will assume responsibility for maintenance of Work.

1.09 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Engineer, or incidents that are beyond Contractor's control.
   b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Substantial Completion:

   a. Trees and Shrubs: One year.
   b. Ground Cover and Plants: Three months.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is

planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period for Trees and Shrubs: 12 months from date of Substantial Completion.
2. Maintenance Period for Ground Covers and Plants: Three months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TREES, SHRUBS, VINES, AND GROUNDCOVER

A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless specifically otherwise authorized by Engineer in writing. Unless specifically noted otherwise, all plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness, and symmetry.

B. Plants shall be sound, healthy, and vigorous, well branched, and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

C. Plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if approved by Engineer. Use of such plants shall not increase Contract price. If larger plants are approved, the ball of earth or container size shall be increased as specified under "Applicable Standards" and subject to the approval of the Engineer.

D. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip.

E. Container stock, when specified, shall have grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Samples must prove no root-bound conditions exist. No container plants that have cracked or broken balls of earth, when taken from container, shall be planted except upon special approval by Engineer. Container stock shall not be pruned before delivery. Field grown plants recently transplanted into containers will not be accepted.

F. Nursery grown B&B material (when allowable) shall be pruned and thinned at the place of growth immediately prior to digging as required for packaging and safe moving. Method of pruning shall be as approved in the field by the Engineer. Do not remove self- locking tags during this pruning prior to delivery to site.

2.02 COMMERCIAL FERTILIZERS

A. Shrub/Groundcover Fertilizers: Agri-Form 20-10-5, 21 gram tablets.

B. Tree planting fertilizer: Davey Arbor Green Organic Liquid Soil injected at 115 PSI. Apply at mfg. recommended rates.

C. Top-dress Fertilizer: Complete fertilizer, 50 percent of the nitrogen to be derived from organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone, or tankage. Potash shall be derived from potassium sulfate containing 60 percent potash.

2.03 PRE-EMERGENCE WEED CONTROL

A. In areas of Woody Ornamental Plants, Eptam or Eptam -5-G as manufactured by Greenlight Products Company, or approved equal.

2.04 STAKING MATERIALS

A. Use staking materials necessary to meet requirements of specifications, subject to approval. Suggested materials:
   1. Tree Stakes: Green, Eight (8') feet long steel T-Post weighing 1.33 pounds per foot.
   2. Ties: Black rubber 3/4-inch hose with 3/16-inch wall thickness
   3. Tree Guying Material: #10 gage galvanized multi-strand cable.
   4. Cable Clamps: Size needed to hold two strands together.

2.05 MULCH

A. Shredded Hardwood bark.

2.06 INSECTICIDE

A. Ortho "Lindane Borer and Leaf Miner Spray" by Ortho, Consumer Products Division, Chevron Chemical Company, San Francisco, California 94119, or "Borer Killer" by Greenlight Company, San Antonio, Texas 78217.

2.07 WATERING TUBES

A. Gray, perforated SDR PVC drainage pipe, 4 inches in diameter.

PART 3 - EXECUTION

3.01 LAYOUT AND EXCAVATION OF PLANTING AREAS:

A. Layout plants in locations shown on Drawings. Use wire stakes color-coded for each species of plant material. Stake location of each tree and major shrub and outline of shrub and groundcover beds.

B. Engineer will check location of plants in the field and shall adjust to exact position before planting begins.

C. Subsoil shall not be worked when moisture content is so great that excessive compaction

should occur, nor when it is so dry that clods will not break readily. Water shall be applied, if necessary, to bring soil to an optimum moisture content for tilling and planting.

D. Excavate entire planting beds to a depth of 8 inches.

3.02 DRAINAGE, DETRIMENTAL SOILS, AND OBSTRUCTIONS:

A. Test drainage of plant beds and pits by filling with water twice in succession. Conditions permitting the retention of water in planting beds for more than twenty-four (24) hours or percolation of less than one inch per hour shall be brought to the attention of the Engineer.

B. Notify the Engineer in writing of all soil or drainage conditions Contractor considers detrimental to growth of plant material.

C. If rock, hardpan, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits and beds, alternate locations may be selected by Engineer. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than 6 inches below the required pit or bed depth. Proceed with work after approval.

3.03 PREPARING PLANT MATERIALS FOR PLANTING:

A. Canned stock shall be removed carefully after cans have been cut on two sides with approved cutter. Do not use spade to cut cans. Do not lift or handle container plants by tops, Stems, or trunks at any time.

B. Do not bind or handle any plant with wire or rope at any time so as to damage bark or break branches. Lift and handle plants only from bottom of ball.

3.04 INSTALLATION OF BED PLANTED MATERIALS:

A. Fill all shrub and groundcover beds with plant bed mix to finished grade (compacted).

B. Excavate in planting mix for individual plant and install as required. Set plant plumb and brace rigidly in position until planting soil mix has been tamped solidly around the ball and roots.

C. When plant pits have been backfilled approximately two-thirds (2/3) full, place Agriform tablets evenly distributed in plant pits according to the following schedule:

1-gallon equivalent - 1 tablet
5-gallon equivalent - 2 tablets

D. Water thoroughly, saturating root ball, before installing remainder of the planting soil to top of pit, eliminating all air pockets. Top of root ball shall be 2 inches above finished grade.

E. Smooth planting areas to conform to specified grades after full settlement has occurred. Contractor shall bear final responsibility for proper surface drainage of planted areas.

F. Water all plants immediately again after planting.

G. Apply pre-emergent weed control material over entire area to receive mulch.

H. Mulch all shrub and groundcover beds as detailed on Drawings.

3.05 SURFACE DRAINAGE OF PLANTING AREAS

A. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the Drawings or Specifications, obstructions on the site, or prior work done by another party which Contractor feels precludes establishing proper drainage, shall be brought to the attention of Engineer in writing for correction or relief of said responsibility.

3.06 PRUNING

A. Prune containerized plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Prune by removing entangled branching and by removing crotches. Avoid removing branch tips wherever possible. Pruning to be done under supervision of the Engineer.

B. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools.

C. Paint cuts over 3/4-inch diameter with tree paint, covering all exposed, living tissue.

3.07 STAKING

A. Contractor shall stake trees and shall be responsible for material remaining plumb and straight for all given conditions through the guarantee period. Tree support shall be done as outlined on the following tables.

B. Staking shall be completed immediately after planting. Plants shall stand plumb after staking.

C. Stake all trees in accordance with the following table:

Tree	No. of Stakes	Stake Size
30 Gal. and B&B	2	7 ft. T-Post
65 Gal. to 100 Gal.	3	8 ft. T-Post

D. Machine moved trees do not require staking or guying.

E. Locate first stake on prevailing windward side of tree and as close to the main trunk as is practical, avoiding root injury. Stakes shall be driven at least 18 inches into firm ground.

F. Tie tree to stake using approved tree tie. Tie shall be located midway within tree crown or at a location approximately two-thirds (2/3) of the overall height of the tree. Locate tie just above major side branch in order to deter slippage of tie.

G. Locate second stake opposite first. Secure with one tie opposite upper tie at first stake.

H. Where used, stakes shall be equally spaced around the tree and placed equal distances from the trunk.

I. Auxiliary stem stakes shipped with trees shall be removed after shipping.

3.08 CLEANING

A. Clean all areas as required for complete and acceptable inspection.

3.09 INSPECTIONS:

A. Make written request for inspection after planting operations are completed.

B. Submit requests for inspections to the Engineer at least two (2) days prior to anticipated inspection date.

3.10 PLANT MAINTENANCE

A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

C. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 33 UTILITIES

THIS PAGE LEFT INTENTIONALLY BLANK

GSECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 REQUIREMENTS

A. See Conditions of the Contract and Division 1, General Requirements, which contain information and requirements that apply to the work specified herein and are mandatory for this project

1.02 SCOPE

A. Description:
   1. This Section covers the work necessary for the construction of precast concrete manholeson opencutsewers.

B. Requirements And Responsibilities:
   1. The Contractor shall be required to construct the Manholescomplete, as specified and shown on the Plans.
   2. The Contractor shall be responsible for installing required facilities and equipment in the precast concrete manholesin accordance with the intent of these Contract Documents, referring to all of the Plan, Specifications, and show drawings for other trades for details of support, attachments, embedments, finishes and other construction which affects the work covered under this Section.
   3. The Contractor shall furnish all labor, materials, supplies and equipment required to perform the work specified in this section, including but not limited to the construction of the manholes and concrete structures, the installation and testing of all required equipment, and any flow diversions or bypass pumping required to complete the work.

1.03 REFERENCES

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

Reference	Title
ASTM A48-83	Gray Iron Castings
ASTM C478	Precast - Reinforced Concrete Manhole Sections
ASTM C891	Installation of Underground Precast Concrete Utility Structures

1.04 QUALITY ASSURANCE

A. Standardization:

1. Materials, supplies and equipment provided by the Contractor shall be the standard products of manufacturers. The standard products of manufacturers, other than those specified, will be accepted when it is demonstrated to the Engineerthat they are equal in composition, durability, quality and usefulness for the purposes intended. Requests for substitution shall be in accordance with Section 01 74 23, and shall include directions for applicable and descriptive literature on the safe storage, handling and disposal of the product.

1.05 SUBMITTALS DURING CONSTRUCTION

A. Submittals during construction shall be made in accordance with Section 01 33 00 in Division 1, General Requirements. In addition, the following specific information shall be provided:
   1. Shop drawings and catalog cuts for all required equipment and appurtenances .
   2. Details of precast concrete units.

PART 2 PRODUCTS

2.01 GENERAL

A. Manholes on sanitary sewers shall be constructed with precast concrete base and risers, with eccentric cone and manhole tops as specified and shown on the Plans.

2.02 SITE PREPARATION

A. Products and materials needed for site preparation prior to the construction of manholes and cleanouts shall conform to those specified in Section 31 10 00.

2.03 CLEARING AND GRUBBING

A. Clearing and grubbing required for the construction of manholes and cleanouts, shall conform to Section 31 11 00.

2.04 SHORING, SHEATHING AND BRACING OF EXCAVATIONS

A. Shoring, sheathing and bracing required for the construction of manholes and cleanouts shall conform to those requirements as specified in Section 31 41 00.

2.05 EXCAVATION

A. Excavation for manholes and cleanouts on open-cut construction is specified in Section 31 23 00.

2.06 BACKFILL

A. Conform to the applicable provisions of Section 31 23 00 .

2.07 FOUNDATION STABILIZATION MATERIAL

A. Conform to Section 31 23 00.

2.08 BASE MATERIAL FOR MANHOLES

A. Base material for manholeson open-cut sewers shall conform to Bedding Material in Section 31 23 00

2.09 CONCRETE

A. Conform to Section 03 30 00.

2.10 REINFORCING STEEL

A. Conform to Section 03 20 00.

2.11 WATERSTOPS

A. Conform to Section 03 30 00.

2.12 FORMS

A. Conform to Section 03 11 00.

2.13 GROUT

A. Conform to Section 03 60 00.

2.14 MORTAR FOR BRICK

A. Conform to Section 03 30 00.

B. Mortar to be used for joints for brick manhole tops, pipe bulkheads, as specified in Section , Gravity Sewers, for plastering and backplastering, or for any other specified used, shall meet the requirements of Type "M" mortar of the material specification of ASTM C270. Mortar shall consist of a mixture of mason sand, water, and cemetitious materials.

C. Consistency shall be such that excess mortar will be forced out of the joints. Mortar mixed for longer than 30 minutes shall not be used.

2.15 PRECAST MANHOLE SECTIONS

A. Precast reinforced concrete manhole bases, risers and tops shall meet the requirements of ASTM C 478 and the following detailed requirements, which shall govern when they differ from the ASTM Standards. Precast manhole tops shall be the eccentric cone type. Flat-top slabs may be used only when shown on the Plans or otherwise approved by the Construction Manager.

B. Precast reinforced concrete manhole bases, risers and tops shall have a minimum wall thickness of 5 inches for 48-inch diameter manholes, 6 inches for 60-inch diameter manholes, 7 inches for 72-inch diameter manholes, and 9 inches for 96-inch diameter manholes.

C. Prior to the delivery of any size of precast manhole section on the jobsite, yard tests will be conducted at the point of manufacture. The precast sections to be tested will be selected at random by the Engineer from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C 14.

D. Precast, reinforced, concrete manhole bases, risers and tops shall be tested in accordance with ASTM C 497 by an approved testing laboratory, for concrete compression tests on cores drilled from 5 percent of the lot. When manhole sections are made on a sewer pipe machine, the number of compression tests on cores may be reduced to 1 percent of the order with a minimum of two cores per lot.

E. For manhole section testing frequency, a lot shall be defined as all manhole risers and tops manufactured by the same process in one plant over a period not to exceed 2 weeks.

F. Each manufacturer shall provide a suitable core-drilling machine conforming to ASTM C 497, on his premises, and an operator to take test cores as directed by the testing laboratory personnel.

G. Precast, reinforced, concrete manhole bases, risers and tops shall be subject to rejection for failure to conform to any of the Specification requirements. In addition, individual sections of manhole risers and tops may be rejected for any of the following reasons:
   1. Fracture or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
   2. Defects that indicate imperfect proportioning, mixing, or molding.
   3. Surface defects indicating honeycombed or open texture.
   4. Damaged ends, where such damage would, in the Engineer's opinion, prevent making a satisfactory joint.
   5. Manhole steps out of line, or not properly spaced.
   6. The internal diameter of the manhole section varying more than 1 percent from the nominal diameter.
   7. Any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more, regardless of the position in the section wall.

2.16 PRECAST MANHOLE JOINTS

A. Precast, reinforced concrete manhole sections used for sewer manholes shall be jointed with rubber gaskets meeting the following requirements of ASTM.

Depth of Manhole	ASTM Standard
0 to 30 feet	C443

2.17 MANHOLE TOPS

A. Manhole tops for sanitary sewer shall consist of an eccentric cone constructed of concrete brick, a manhole extension constructed of concrete brick and a manhole header constructed of either concrete brick or precast concrete adjusting grade rings, and as shown on the Plans.

2.18 CONCRETE BRICK

A. Conform to ASTM C 139

2.19 PRECAST CONCRETE GRADE RINGS

A. Concrete used to fabricate grade rings shall contain a proportion of cement in the mixture not less that 564 pounds per cubic yard of concrete except that a maximum of 64 pounds of Portland cement may be replaced with a minimum of 100 pounds of flyash. The mixture shall contain 6 percent (plus/minus 1.5 percent) entrained air. The minimum compressive strength shall be 5,500 psi at 28 days. the maximum water absorption shall not exceed 6 percent by weight. If the grade ring is steam cured, it shall not be reduced in temperature more than 40 degrees F per hour until it is within 20 degrees F of the outside temperature. The units shall be maintained at a temperature above 32 degrees F during the first 6 days after curing. The rings shall have an approved identification mark or color code.

2.20 MANHOLE EXTENSIONS AND MANHOLE HEADERS CONSTRUCTED FROM PRECAST CONCRETE ADJUSTING GRADE RINGS

A. Precast concrete adjusting grade rings used for manhole headers shall meet the requirements of ASTM C 478. Precast concrete adjusting grade rings used for manhole headers shall comprise a total height of 6 inches when stacked vertically and shall contain a minimum of one No. 2 reinforcing rod centered within each ring. Where necessary, rings shall be grooved to receive manhole steps.

B. In general, manhole extensions and headers will be used on all manholes in roads or streets or in other locations where a subsequent change in existing grade may be likely. Extensions and headers will be limited to a maximum combined height of 16 inches. Finish grade for manhole covers shall conform to finished ground or street surface unless otherwise directed by the Engineer.

2.21 DROP CONNECTION PIPE AND FITTINGS

A. The drop pipe and ell for drop assemblies shall be Class 3 concrete conforming to ASTM C 14 or polyvinyl chloride (PVC) conforming to ASTM D 3034. Tees shall be of the same material as the entering pipe. Type of joint shall be resilient type factory fabricated and conform to ASTM D 3212 for PVC pipe.

2.22 STEEL STRAPPING

A. Steel strapping for use with drop assemblies shall be 1/8-inch by 1-inch mild steel strap conforming to ASTM A 36.

2.23 MASONRY ANCHORS

A. Masonry anchors shall be snap-off type or flush type for use with cadmium plated bolts. Nondrilling anchors shall be flush type for use with a bolt or stud type with projecting threaded stud as manufactured by ITT Phillips Drill Division, Michigan City, IN; Hilti HDI Drop-in anchors, Hilti, Inc., Stamford, CT; or approved equal.

2.24 PIPE STUBOUTS FOR FUTURE SEWER CONNECTIONS

A. Pipe stubouts shall be the same type as approved for use in lateral, main sewer construction. Strength classifications shall be same class as in adjacent trenches. Where there are two different classes of pipe at a manhole, the higher strength pipe will govern strength classification.

2.25 WATERPROOFING

A. Elastomeric Waterproofing Sealer (NOT USED):
   1. Elastomeric waterproofing membrane shall be a single component, bitumen-modified, moisture-curing polyurethane similar to TREMproof 60 as manufactured by Tremco, 10701 Shaker Blvd., Cleveland, Ohio 44104; Duramem V500 as manufactured by Pecora Corporation, 2601 Oakland Avenue, Garland, Texas 75040; Thiodeck C.F. as manufactured by Toch/Carboline Company, 350 Hanley Industrial Court, St. Louis, Missouri 63144; or equal.

B. Manhole Liners:
   1. Conform to Section 33 05 13.16.

PART 3 EXECUTION

3.01 MANHOLE SIZE

A. Manhole size shall be as specified on the Plans,

3.02 SITE PREPARATION

A. Site preparation required for the construction of manholes, cleanouts and concrete structures shall conform to Section 31 10 00.

3.03 SHORING, SHEATHING AND BRACING OF EXCAVATIONS

A. Shoring, sheathing and bracing required for the construction of manholes, cleanouts and concrete structures shall conform to those requirements as specified in Section 31 23 00.

3.04 EXCAVATION AND BACKFILL FOR MANHOLES

A. Excavation and backfill for manholes and cleanouts on open-cut sewers shall conform to the applicable provisions of Section 31 23 00.

B. If the excavation for manholes base is stable soil has, without the concurrence of the Engineer, been carried below the required bottom of the manhole base the excess depth shall be filled, at no additional cost to the Owner, with base material as specified.

3.05 REMOVAL OF WATER

A. Conform to Section 31 23 19.

3.06 BASE MATERIAL FOR MANHOLES

A. Conform to Section 31 23 00.

B. Backfill around manholes and cleanouts on open-cut sewers shall conform to the class specified for trench backfill, Section 31 23 00.

C. Should the contractor elect to use a sealing slab to prevent uplift due to external water pressure, the slab thickness shall be sufficient to withstand full external water pressure with the excavation dry. If a sealing slab is used, no mud slab will be required.

3.07 PRECAST MANHOLES

A. Manhole Invert
   1. Construct manhole inverts in conformance with manhole details shown on the Plans, and with smooth transitions to insure an unobstructed flow through the manhole. Remove all sharp edges or rough sections which tend to obstruct flow. Where a full section of pipe is laid through a manhole, break out the top section and cover exposed edge of pipe completely with mortar. Trowel all mortar surfaces smooth.
   2. The trough of a manhole for pipe sewers shall be the same diameter as the larger of the adjoining sewers. The pipe may be laid through the manhole, and the upper half of the pipe shall be removed after the manhole is built. The pipe shall be supported on brick or solid concrete blocks for the placement of the concrete base. The concrete shall be extended under the pipe to the face of a pipe joint and where the pipe rests on undisturbed soil. This extended portion of the manhole base shall rest on undisturbed soil.

B. Precast Manhole Base:
   1. Set precast manhole base unit level on compacted base material or concrete work slab as specified in Section 31 23 00.

C. Placing Precast Manhole Riser Sections:
   1. Conform to the requirements of jointing rubber gasketed concrete sewer pipe in Section 33 05 13.16.

3.08 MANHOLE RISER TOLERANCE

A. Departure from and return to true vertical from the established manhole center shall not exceed 1/2 inch per 10 vertical feet or 2 inches for the total manhole depth, whichever is less.

3.09 REINFORCING STEEL

A. Conform to Section 03 20 00.

3.10 PIPE TO MANHOLE CONNECTIONS

A. Provide joints in reinforced concrete, nonreinforced concrete and clay pipe sewers not more than 1 foot from the outside face of manhole walls. Provide joints in flexible pipe sewers within 1 to 3 feet from manhole walls. Pipes entering and leaving the base of the manhole shall be finished with a bentonite waterstop as shown on the Plans, and shall

be laid on concrete backfill. Place 3,000 psi concrete from the manhole base to the springline of the pipe, from the manhole wall to undisturbed earth. Place 4,000 psi concrete collar and base extension support from the manhole base to 12 inches above the inside face of the pipe at the crown, as shown on the Plans, forming a collar around the pipe with a minimum total pipewall-concrete thickness of 12 inches. This collar shall extend from the manhole wall exterior face to the pipe joint as shown on the Plans.

B. Where pipe enters the manhole above the manhole base, it shall be supported with compacted Special Backfill Beneath Utilities as specified in Section 31 23 00. The backfill shall extend from the manhole wall to undisturbed earth.

C. Grout around pipes in manhole walls or base to provide a watertight seal. Where flexible pipe is used, the annular space between the pipe and manhole wall shall be filled with a mastic sealant supplied by the pipe manufacturer.

3.11 PIPE STUBOUTS FOR FUTURE SEWER CONNECTIONS

A. Install stubouts from manholes for future sewer connections as shown on the Plans. Maximum length shall satisfy the requirements of Pipe To Manhole Connections. Install temporary watertight plugs in all manhole stubouts, as specified for Pipe Bulkheads in Section 40 05 01.

3.12 MANHOLE FRAMES AND COVERS

A. Install frames and covers on top of manholes grade rings to prevent all infiltration of surface or ground water into manholes. Frames shall be set in a bed of mortar with the mortar carried over the flange of the frame. Set frames so tops of covers are flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.

3.13 WATERTIGHT MANHOLE FRAMES AND COVERS

A. Watertight manhole frames and covers shall be fastened to the manhole top section as shown on the Plans.

3.14 DROP ASSEMBLIES

A. Construct drop assemblies at locations indicated and as shown on the Plans.

B. Firmly support all drop pipe and fittings to prevent movement when concrete is being placed.

3.15 ELASTOMERIC WATERPROOFING SEALER

A. Elastomeric waterproofing sealer shall be applied to all gravity sewer manholes. Thoroughly sandblast the section of the manhole frame over which the sealer is to be applied, the manhole header, extension and cone and the top 12 inches of the manhole riser. All surfaces shall be free of dust, oil, rust, loose materials and other contaminants. Take necessary precautions to prevent rebound from the sandblasting operation to enter the sewer system. If the mortar between grade rings or brick courses is removed to a depth greater than 1/4 inch by the sandblasting, the joints shall be refilled with mortar as specified herein. All new masonry work shall be cured a minimum of 24 hours prior to applying the waterproofing sealer.

B. Apply the 4-inch wide bond breaker tape completely around the manhole circumference and centered over the mortar joint between the manhole frame and the manhole extension. Immediately before applying the sealer, wipe all surfaces with a cleaner and immediately prime. The cleaner and primer shall be furnished by the sealer manufacturer. Apply the sealer with a trowel, roller or by spraying to achieve a thickness of not less than 100 wet mils. Do not apply the sealer when the ambient temperature is below 40 degrees F. The sealer shall extend from 9 inches below the bottom of the manhole cone and be carried over the top and onto the flange of the frame a minimum of 5 inches.

C. Allow the sealer to cure a minimum of 24 hours before backfilling when the ambient temperature is above 70 degrees F, and 48 hours when the ambient temperature is below 70 degrees F. Immediately before backfilling, loosely wrap two layers of 4 mil plastic sheet over the sealed area to prevent direct contact between the sealer and the backfill material.

3.16 BACKFILL OF MANHOLES ON OPENCUT SEWERS

A. Conform to Section 31 23 00 .

3.17 GROUT

A. Conform to Section 03 60 00.

3.18 CONNECTION TO EXISTING MANHOLES

A. Connect sewers to existing manholes at locations indicated. Provide all diversion facilities and perform all work necessary to maintain sewage flow in existing sewers during connection. Break out existing manhole bases or grout as necessary and re-grout to provide smooth flow through existing manholes.

3.19 CONNECTION TO EXISTING MANHOLES

A. Connect new sewers to Existing manhole at locations indicated Provide all diversion facilities and perform all work necessary to maintain sewage flow in existing sewers during connection. Break out existing manhole bases or grout as necessary and re-grout to provide smooth flow through existing manholes.

END OF SECTION

SECTION 33 05 13.16

PRECAST MANHOLES, FRAMES AND COVERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to install precast concrete manholes, grade rings, frames and covers, and appurtenances as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Shop drawings, product data, materials of construction, and details of installation shall be submitted in accordance with Section 01 33 00. Submittals shall include the following:
   1. Design calculations, sealed by a Professional Engineer licensed in the State of Texas, indicating adequate strength to resist the vertical and lateral loadings including “H-20" wheel loadings, and buoyancy forces.
   2. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings with notarized certificate indicating compliance with ASTM C478.
   3. Concrete mix design.
   4. Detail of pipe connection(s) to manhole.
   5. Manhole frame and cover style and finish with notarized certificate indicating compliance with ASTM A48, Class 30.
   6. Method of repair for minor damage to precast concrete sections.

B. Design data for precast concrete structures: sectional plan(s) and elevations showing dimensions, reinforcing steel placement, manhole covers, steps, baffle plates, and accessories.

C. Test reports for precast concrete structures: concrete test cylinder reports from an approved testing laboratory certifying conformance with specifications.

D. Manufacturers Installation (or Application) Instructions

E. Operation and Maintenance Data

1.03 REFERENCE STANDARDS

A. New and replacement manholes shall be constructed and installed per the Contract Drawings.

B. Occupational Safety and Health Administration (OSHA).

1.04 QUALITY ASSURANCE

A. All material shall be new and unused.

B. Materials' quality, manufacturing process and finished sections are subject to inspection and approval by OWNER or other OWNER'S representative. Inspection may be made at place of manufacture, at work site following delivery, or both.

C. Materials will be examined for compliance with ASTM specifications, these Specifications and approved manufacturer's drawings. Additional inspection criteria shall include: appearance, dimensions(s), blisters, cracks and soundness.

D. Materials shall be rejected for failure to meet any Specification requirement. Rejection may occur at place of manufacture, at work site, or following installation. Mark for identification rejected materials and remove from work site immediately. Rejected materials shall be replaced at no cost to Engineer.

E. Repair minor damage to precast concrete sections by approved method, if repair is authorized by Engineer.

1.05 WARRANTY

A. All materials supplied under this section shall be warranted for a period of 2-years by the manufacturer and the CONTRACTOR. Warranty period shall commence upon formal acceptance of the project by the Engineer.

B. The materials shall be warranted to be free from defects in workmanship, design and materials. If the materials should fail during the warranty period, it shall be replaced or restored to service at no expense to the Engineer.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

PART 2 PRODUCTS

2.01 GENERAL

A. Reference to a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and manufacturer's service.

C. Provide lifting lugs or holes in each precast section for proper handling.

2.02 PRECAST CONCRETE MANHOLE SECTIONS

A. Precast concrete base sections, riser sections, transition top sections, flat slab tops and grade rings shall conform to ASTM C478, EPWater and meet the following requirements:
   1. Bottom slab thickness shall equal the riser wall thickness or flat slab top thickness, whichever is greater.
   2. Unless otherwise specified, top section shall be eccentric cone where cover over pipe exceeds 4 feet; top section shall be flat slab where cover over top of pipe is 4 feet or less, or where shown.

3. Base, riser and transition top sections shall have tongue and groove joints.
4. Sections shall be cured by an approved method.
5. Ship precast concrete only after concrete has attained 3,000 psi compressive strength.
6. Design precast concrete base, riser, transition top, flat slab top and grade ring for a minimum H-20 loading plus earth load. Calculate earth load with a unit weight of 130 pcf. Calculate buoyancy forces based on groundwater depth 1-foot below the ground surface.
7. Mark date of manufacture, name and trademark of manufacturer on the inside of each precast section.
8. Construct and install precast concrete base as shown on the Drawings.
9. Portland cement shall be ASTM C150, Type II.

2.03 MANHOLE FRAME AND COVER

A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30, and the City of El Paso.

B. Manhole covers shall be comply with El Paso Water Utilities and City of El Paso design requirements.

2.04 JOINTING PRECAST MANHOLE SECTIONS AND STRUCTURES

A. Seal tongue and groove joints of precast manhole and structure sections with either rubber "O"-ring gasket or preformed flexible joint sealant. "O"-ring gasket shall conform to ASTM C443. Preformed flexible joint sealant shall be Kent Seal No. 2 as manufactured by Hamilton-Kent; Ram-Nek as manufactured by K.T. Snyder Company or equal.

B. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

2.05 PIPE CONNECTIONS TO MANHOLE

A. Connect pipe to manhole in the following ways:
   1. Precast manhole connections shall be watertight in accordance with ASTM C-923.
   2. Flexible Sleeve
      a. Integrally cast sleeve in precast manhole section or install sleeve in a formed or cored opening. Fasten pipe in sleeve with stainless steel clamp(s). Coat stainless steel clamp(s) with bitumous material to protect from corrosion. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve; Kor-N-Seal connector; PSX Press-Seal Gasket or equal.
   3. Compression Gasket

a. Integrally cast compression gasket in precast manhole section. Insert pipe into compression gasket. Compression gasket shall be A-Lok, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. All excavation, temporary shaft supports, sheeting and shoring, foundation cushion, concrete and grout required to support the walls of shafts and necessary to construct the manholes as shown on the Contract Drawings shall be provided.

B. All sheeting and shoring inclusive of liner plates shall be cut off 2 feet below ground surface and left in place, the cost of which shall be included in the bid.

C. Excavated surplus materials shall be disposed of by the contractor as described in Section 31 23 00 of the specifications and the cost of which shall be included in the various lump sum prices stipulated in the bid.

3.02 PRECAST MANHOLES

A. Precast concrete manhole riser sections shall be installed plumb and true on the precast concrete base sections as shown on the Contract Drawing. Before placing the O-ring gasket in the spigot groove, the gasket and all bearing surfaces of the tongue and groove shall be wiped clean, and a lubricant as recommended by the manufacturer shall be applied to the gasket and the inside bell surface. Care shall be taken when lowering any precast unit into the trench that no dirt gets on the gasket or into the joint. Top sections of precast manholes shall be flat slab-type or eccentric cone sections cast to the proper dimensions to receive the manhole casting shown on the Contract Drawings.

B. All manhole riser section joints more than 20 feet below the manhole rim shall be provided with an exterior joint collar and be installed according to the manufacturer's recommendations. After removing the protective paper, the band shall be placed around the manhole riser, mastic side to the riser and spanning the joint. The steel straps shall be secured with the proper tools. The closing flap shall cover all remaining exposed strap.

C. The top of the wall of all manholes shall be properly leveled off with mortar so as to form a flat surface upon which the manhole rim is to rest, and manholes shall be carried to such height above the sewer as shown, as necessary to meet grade or as ordered, but shall not be left in a depression to act as an area drain.

D. When there is not enough room for a full length of precast concrete riser section to be installed under the manhole frame, precast reinforced concrete grade rings and mortar shall be used for sanitary manholes. The use of brick masonry on sanitary manholes is prohibited.

E. In order to allow for a future adjustment of roadway grade or widening of existing roadway, shorter lengths of riser sections when used should be installed immediately below the cone section. Also, a minimum of one precast concrete grade ring will be required on top of the cone or flat slab top section to effect the proper elevation for the manhole rim. The total height of precast concrete grade rings and mortar shall not exceed 12 inches.

F. Precast bottom sections with integral bases when used shall be set plumb on a firm foundation in the trench. Height of the bottom section shall be provided to admit the various pipes at the elevations shown on the drawings and still contain sufficient material for structural integrity across the top of these openings. Pipe openings shall be cast into the unit at the time of manufacture. All pipe connections to precast concrete manholes shall be made with resilient connectors conforming to ASTM C923.

G. Cast-in-place non-reinforced concrete manhole bottom sections shall be built in accordance with the dimensions indicated on the Contract Drawings. Forming and finishing shall be done per the El Paso Water Standard Specifications.

H. Manholes shall have steps (rungs) built into the precast and cast-in-place concrete manhole sections and shall be securely embedded in the precast concrete manhole wall at the time of manufacture. Steps shall be placed as shown on the Contract Drawings. The CONTRACTOR shall arrange the various components that will become part of the manhole so that the vertical step spacing is consistent and the frame and cover is situated as oriented in plan on the Contract Drawings.

I. The manhole frames shall be properly set in place in a full bed of mortar and so adjusted as to make the top of the rim a few inches higher than the surrounding ground so as not to act as a surface drain, or flush with paved surfaces.

3.03 CLEANING

A. Thoroughly clean all new manholes of all silt, debris and foreign matter of any kind, prior to final inspections.

3.04 LEAKAGE TESTING

A. Manholes shall be tested after completion of installation and backfill. Each manhole shall be tested for leakage, separate and independnat of the collection system pipes, by hydrostatic exfiltration testing or vacuum testing in accordance with the latest version of Chapter 217 – Desing Criteria for Domestic Wastewater Systems of the Texas Commission on Environmental Quality.

B. HYDROSTATIC TESTING:

Hydrostatic testing shall be conducted by utilizing approved plugs to seal all wastewater pipes coming into a manhole with an internal pipe plug, fill the manhole with water to the top of the cone, and maintain the test for at least one hour.

The maximum leakage for hydrostatic testing or any alternative test methods is 0.025 gallons per foot diameter per foot of manhole depth per hour. Test for concrete manholes may use a 24-hour wetting period before testing to allow saturation of the concrete.

C. VACUUM TESTING:

Plug all lift holes and exterior joints with a non-shrink grout and plug all pipes entering a manhole. No grout must be placed in horizontal joints before testing. Stub-outs, manhole boots, and pipe plugs must be secured to prevent movement while a vacuum is drawn.

Use a minimum 60 inch/lb torque wrench to tighten the external clamps that secure a test cover to the top of a manhole. A test head must be placed at the inside of the top of a cone section, and the seal inflated in accordance with the manufacturer's recommendations. There must be a vacuum of 10 inches of mercury inside a manhole to perform a valid test. A test does not begin until after the vacuum pump is off. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury.

D. ACCEPTANCE:

Manholes will be accepted with relation to vacuum test requirements, if they meet the criteria above. Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material of which the manhole is constructed. The manhole shall be retested as described above until a successful test is attained. After a successful test, the temporary plugs will be removed. To ensure that the plugs have been removed, Contractor shall only do so in the presence of the Inspector.

E. REPAIRS TO EXISTING MANHOLES:

Any existing manhole which fails to pass the vacuum test shall be closely examined by the Engineer and the Contractor to determine if the manhole can be repaired. Thereafter, the Contractor shall either repair or remove and replace the manhole as directed. The manhole shall then be retested and coated with approved coating. The Engineer may elect to simply remove and replace the existing manhole with a new one.

3.05 HOLIDAY TESTING:

Inspect each sanitary sewer manhole using high-voltage holiday detection equipment. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper, or other hand tooling method. After abrading and cleaning, additional protective coating material shall be applied to the repair area. All touch-up repair procedures shall follow the protective coating manufacturer's recommendations.

END OF SECTION

SECTION 33 05 23

TRENCHLESS UTILITY INSTALLATION

GENERAL

1.01 SUMMARY

A. This section specifies the construction requirements for tunneling of jacked casing pipe where shown elsewhere in the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work:
   1. Section 02 32 23, Geotechnical Monitoring During Construction (Vibration and Settlement Monitoring)
   2. Section 05 59 20, Steel Casings
   3. Section 26 42 00, Cathodic Protection
   4. Section 31 73 13, Annular Space Grouting
   5. Section 31 73 29, Cement Tunnel Grouting

B. The approximate locations of launch and receiving pits are shown on the Plans for reference only. Final launch and receiving pits shall be verified in the field and sized appropriately based on Contractor's means and methods and site limitations, and be contained within the approved limits of construction.

1.03 QUALITY ASSURANCE

A. The Contractor shall maintain an ongoing Quality Assurance Plan to verify that items related to tunneling work are being performed in accordance with the Contract Documents.

B. The Contractor shall meet the requirements for surveying in accordance with this specification and Section 01 32 23, Survey and Layout Data.

C. The Contractor shall meet the requirements for settlement monitoring in accordance with Section 02 32 23, Geotechnical Monitoring During Construction (Vibration and Settlement Monitoring).

D. The Contractor shall meet requirements for dewatering and shoring in accordance with Section 01 35 29 Health and Safety Requirements, Section 31 23 00 Excavation and Fill., Section 31 23 19 Control of Water.

1.04 DESIGN REQUIREMENTS

A. Contractor shall perform settlement monitoring in accordance with Section 02 32 23, Geotechnical Monitoring During Construction.

B. Installation Method:

1. Casing shall be installed by guided auger boring, guided boring machine, tunnel boring methods or micro tunnel methods.
2. Table 1 indicates the available boring methods based on the crossing location.

Table 1. Available Boring Methods						
Crossing Location	Auger Boring	Guided Auger Boring	Guided Boring Machine	Tunnel Boring	Micro Tunnel	Line and Grade Deviation (in)
Delta D. / Shelter Pl.	X	X	-	X	X	8

3. Contractor shall exercise care to ensure casing is within line and grade distance indicated in Table 1 of the coordinates shown (X, Y, Z) on plans.
4. Each casing pipe to contain a minimum of one lubrication/grout port at a spacing not to exceed 10 feet along the pipe and as specified in Section 05 59 20, Steel Casings. Lubrication port locations shall be rotated around the pipe circumference for successive pipe sections. Contractor shall determine and provide the necessary number of lubrication/grout ports required to lubricate the casing during tunneling and fill the voids outside the casing pipe installation that are due to over excavation by the tunneling activities.

1.05 PERFORMANCE REQUIREMENTS

A. Casing Pipe Alignment: Deviations in line and grade of the casing pipe shall only be allowed to the extent that the carrier pipe can be shifted within the casing pipe to compensate for the deviation and maintain line and grade indicated on the Plans.

B. Tunnel Work: Safety regulations and the requirements of the Contractor's tunnel safety plan shall be adhered to at all times.

C. Schedule
   1. Plan tunneling operations and frequency of lubrication to reduce induced friction along the pipe and to minimize the risk of the casing pipe getting stuck during construction.
   2. Modify the tunneling operation, as needed, to successfully complete drive on schedule within the allowable permitted operations period.
   3. Contractor to have full set of plans, specifications, and the geotechnical information on site at all times.

1.06 SUBMITTALS

A. Submittals shall be made in accordance with the General Requirements and as specified herein. Tunneling and related activities, including excavation of shafts, shall not commence until all submittals related to tunneling work have been reviewed and accepted.

B. Tunneling equipment, procedures, calculations and other information required for the Contractor's tunneling submittals shall be assembled into a single comprehensive submittal. The Contractor shall allow for a 20-calendar day period for the Engineer's review of the submittal package.

C. The Contractor shall coordinate with the Engineer for the timing of transport of tunneling and associated equipment to the site for staging.

D. Submittals shall be coordinated between activities of the Contractor and all subcontractors.

E. Quality Assurance Plan Quality Assurance Plan: The Contractor shall submit a Tunneling Quality Assurance Plan including all documents to substantiate quality assurance items described in Paragraph 1.3 of this specification.

F. Tunnel and Pipeline Installation System Plan
   1. The system plan shall include:
      a. Proposed tunneling system.
      b. Proposed location and configuration of launch and exit shafts for each tunnel location.
   2. Detailed tunneling schedule showing the sequence of the tunneling and the anticipated jacking schedule, including mobilization/demobilization, groundwater control (if applicable) at jacking and reception pits, pit excavation and support, working slab, thrust reaction force construction, jacking equipment setup, ground stabilization, entry ring installations, tunneling, retrieval of machine, support and installation of carrier pipe, annular space grouting of carrier pipe, shaft backfill.
   3. Shop drawings showing general tunneling operation setup, including location of the power and control units, slurry processing equipment, and the tunnel spoils handling system.
   4. Detailed drawings of the tunnel launch pit layout to include, but not be limited to:
      a. Pipe rail layout.
      b. Pipe launch and exit seal detail, including seal diameter, seal rubber thickness, and plate travel distance.
   5. Detailed drawings of shaft layout.
   6. Provide the location where the spoils will be permanently stored and provide documentation indicating that the disposal area is in compliance with state regulations.
   7. Tunnel spoils disposal plan including:
      a. Chemical feed options and polymers used (if any) to aide settling, including manufacturer's literature and MSDS for additives.
      b. Agreements with selected liquid and muck disposal areas, including contact names, companies and locations, and phone numbers.
      c. Details for monitoring and controlling actual volume of soil removed.
   8. Grade and alignment control system details and drawings.
   9. Noise levels to be anticipated by the various elements and equipment utilized in the Contractor's operation.

10. Casing spacers and end seals.

G. Calculations
   1. The required calculations shall be prepared, stamped, dated and signed by a currently registered structural or geotechnical professional engineer in the State of Texas
   2. Identify the maximum jacking resistance for the complete casing anticipated for each drive. At a minimum, the calculations for the maximum frictional resistance, earth loads, superimposed live loads, jacking forces, buoyancy, handling loads, and the maximum face pressure is required to determine maximum jacking load for the jacking reaction frame and IJSs, if required. The reaction frame needs to be designed for the maximum jacking capacity to be experienced plus a safety factor of 2.0.
   3. Detailed calculations and plan of thrust restraint for jacking reaction frame.
   4. Calculations showing the casing joints and casing to Tunneling Method equipment connection can withstand with a factor of safety of 2.0, the maximum jacking capacity of the jacking system the pipe will experience.
   5. Casing pipe handling details.
   6. Line and grade calculations and layout for casing pipe installation.
   7. Casing pipe thickness to prevent deflection or buckling.

H. Reports and Records
   1. Submit geotechnical monitoring measurements in accordance with Section 02 32 23, Geotechnical Monitoring During Construction.
   2. Certified survey notes and shift reports including copies of field notes used to establish all lines and grades.
   3. Settlement Monitoring Records
   4. All information required by this specification.
   5. Reporting of all information does not relieve the Contractor of its responsibility.
   6. Maintenance of the system.
   7. Daily jacking records to include, but are not limited to:
      a. Date, starting and finishing time for each pipe segment.
      b. Installed pipe segment number and corresponding cumulative tunnel length.
      c. Rate of advance on a continuous basis.
      d. Auger speed (rpm) and torque.
      e. Use of any cutting or high-pressure nozzles.
      f. Problems encountered with machine, description of any unusual conditions or special actions taken, etc.
      g. Description of the soil conditions encountered.
   8. Daily records are to be submitted for review to the on-site Engineer's representative by the Contractor by 10:00 a.m. on the day following the shift for which the data or records were taken.
   9. Hourly records to include, but not limited to:
      a. Slurry properties and quantities.
      b. MTBM face pressure.

c. Hourly records are to be submitted to the on-site Engineer's representative for review on the hour during each hour of the tunneling operation.

10. The Contractor shall maintain manual records of observations made at intervals every five feet or as conditions change. Automatic data acquisition system shall record the same information on intervals of one minute or less.

I. Perform work in a manner to maximize safety and avoid exposure of workers and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards and Contractor's safety procedures. Specify specific items required for the emergency plan that are not covered in the general safety plan.

J. Tunnel Construction Safety Plan

1. A site-specific safety plan needs to be submitted that at a minimum meets State and Federal OSHA Safety Standards for Construction Work and includes a section for the tunneling safety plan.
2. The Contractor shall submit a safety and training plan for the tunnels. The plan shall include, but not be limited to:
   a. Method used for meeting all applicable safety requirements.
   b. Hazard communications.
   c. Rescue equipment required to be on site.
   d. Confined space entry procedures.
   e. Fall protection.
   f. Tunneling work shall not start without an acceptable safety plan in place.
   g. The safety plan shall be posted on site throughout construction of the tunnel.
   h. Submit in accordance with the General Requirements as part of the Health and Safety Plan.

K. Tunnel Contingency Plan

1. Step by step description of the planned operation including an itemized list of materials and equipment required to be available on site to complete the work. The Plan shall provide description and details illustrating steps and time sequence. The plan shall include required contacts and procedures for utility coordination and relocation, required dewatering, descriptions of methods to provide safe access and prevent flowing ground, and contacts and procedures to comply with local permitting requirements. Provide calculations necessary to support proposed plan(s). Shoring designs that are a part of the Contractor's contingency plans shall be stamped by a structural engineer registered in the State of Texas. The plan shall include procedures for:
   a. Removal of impediments and obstructions
   b. Tunnel drive seizes and cannot be advanced
2. Settlement, subsidence, or heave beyond the allowable limits as indicated in Section 02 32 23, Geotechnical Monitoring During Construction.
3. Over excavation and creation of a void. Excavated volumes exceed pipe volume installed.
4. Submit details to repair cracked, damaged or otherwise broken casing pipe sections or defective joints.

5. Presence of contaminated ground:
    a. Noticeable hydrocarbon smell is detected in the MTBM, shield, or shaft.
    b. Contaminated water or soil is encountered. Include procedure for disposal.
6. Line and grade cannot be maintained or alignment tolerance is exceeded.
7. Pipe has been damaged or has been found to be out if compliance with specifications before, during or after installation.

L. Daily tunneling progress reports specified in paragraph entitled “Submittals” of this specification.

PRODUCTS

2.01 CASING PIPE

A. Install casing pipe that meets the material type and operation characteristics specified in Section 05 59 20, Steel Casings, and to the diameter and minimum thickness specified on the plans.

B. Casing pipe installation shall not result in surface or utility heave or settlement beyond the allowable limits as indicated in Section 02 32 23 Geotechnical Monitoring During Construction (Vibration and Settlement Monitoring).

2.02 CARRIER PIPE

A. Carrier pipe shall be of the types and sizes shown in the contract documents and shall conform to the requirements of these specifications. If PVC pipe is to be utilized as carrier pipe, installation shall conform to Specification 40 05 20, Plastic Pipe, and shall be fully restrained in casing.

2.03 CASING SPACERS/INSULATORS

A. Casing spacers shall be spaced so that each spacer is located 12 inches from each side of the pipe joint, so that there is a maximum spacing of eight (8) feet between insulators, and so that one full insulator is located within six (6) inches of each end of the casing.

B. Casing spacers shall be manufactured with a minimum of 14-gauge steel band and where required, 10-gauge risers. The band, risers and connecting studs shall be welded and cleaned and the factor before the application of a fluidized be fusion bonded PVC coating between 10 to 16 mils thick. The insulators shall have a flexible PVC inner liner of 0.09-inch thickness with a durometer “A” 85-90 hardness. Runners shall be high pressured molded glass reinforced polymer with a minimum compressive strength of 18,000 PSI per ASTM D-638. Casing Insulator for fusible PVC C905 pipe shall be Model C12G-2 as manufactured Pipeline Seal and Insulator, Inc., or Equal.

C. Each AWWA C905 PVC pipe bell joint within the casing shall be restrained and supported with a Uni-Flange Series UFRCS1390 restrained casing spacer or Equal. A casing spacer shall also be provided between each joint and shall be Uni-Flange Series UFRCS1300 or Equal.

D. Manufacturers and supplier shall certify the insulators being furnished will support the weight of the approved carrier pipe when it is full of water.

E. The bottom of the casing shall be prepared to ease installation of the carrier pipe by lubricating the bottom 50% with a soap compound or other methods approved by the Engineer.

2.04 CASING END SEALS

A. Both ends of each casing shall be sealed.

B. Seals shall be custom made per each application with a minimum 1/8" thick synthetic rubber.

C. Banding clamps shall be 304 stainless steel with worm screws.

D. End seals shall be Model C Pull-On as manufactured by Pipeline Seal and Insulator, Inc., or Equal.

EXECUTION

3.01 GENERAL

A. No work shall commence on the tunneling phase until the design and construction procedure has been accepted in writing by the Engineer. The Contractor shall be solely responsible for the performance of the equipment and methods selected for this phase. The Engineer's review signifies only that the construction process is compatible with the overall objectives of the project.

B. The tunneling operation shall be in accordance with the system plan prepared and submitted to the Engineer.

C. Stockpiling of excavated materials around the launch and exit shafts will not be permitted without the acceptance of the Engineer. Do not stockpile excavated materials within a distance equal to the depth of the shaft.

D. Monitor settlement in accordance with Section 02 32 23, Geotechnical Monitoring During Construction.

E. All tunneling staff including, but not limited to, Subcontractors, shall attend the daily work meeting during the tunnel installation.

3.02 PIT OR SHAFT CONSTRUCTION

A. Pit or shaft construction shall be in accordance with Section 31 23 00, Excavation and Fill.

B. Shored and dewatered to safeguard personnel and existing substructures, and surface improvements and to prevent ground movement. The shoring at pits or shaft shall be designed together with dewatering to minimize infiltration to the shafts or pits. The maximum allowable leakage factor shall not exceed 20

gallons per minute (gpm). If the shoring leakage factor exceeds 20 gpm, the Contractor shall implement mitigation measures to reduce the infiltration.

C. If groundwater is encountered during construction, the Contractor shall control the flow sufficiently to protect personnel, excavation, pipe and equipment, and avoid flowing soil conditions.

3.03 INSTALLATION OF CASING

A. The casing for the carrier pipe shall be new welded steel pipe which complies with Section 05 59 20, Steel Casings.

B. Installation of the casing and the excavation and removal of material within the casing shall proceed simultaneously.

C. The completed casing shall be free of dents, bends, weld protrusions, or other obstructions to allow the smooth sliding of the carrier pipe through the casing. The final position of the casing shall not vary from the line and grade shown on the plans, or established by the Engineer, by more than 1 foot.

3.04 INSTALLATION OF CARRIER PIPE IN CASING PIPE

A. After the casing has been installed and accepted by the Engineer the carrier pipe shall be pushed through by exerting pressure on the barrel of the pipe in such manner that the pipe joints are always in compression.

B. Care shall be taken while installing the carrier pipe in the casing to ensure that the carrier pipe is not damaged. Any damage to the carrier pipe in the casing shall be repaired as prescribed by the pipe manufacturer recommendation before proceeding with installation of the carrier pipe.

C. The carrier pipe shall be installed in the casing in accordance with the recommendations of the pipe manufacturers and as specified herein. During the entire installation the carrier pipe shall be level and centered in the casing.

D. The annular spacing between the casing and the carrier pipe shall be filled in with air blown sand unless otherwise noted on the drawings. Contractor shall furnish the necessary sand, air compressor, hoses, pressure gauges, valves, and fittings for the filling operation. Place a bulkhead for retaining the sand in the annular space between the casing and the carrier pipe at each end of the casing. At the start of the operation, extend the sand discharge pipe from the placing equipment, through the inside of the casing, and to the bulkhead at the remote end of the casing. The method used to place the sand shall be such to ensure complete filling of the annular space. During placement, position the sand discharge pipe so that its discharge end shall be kept well buried in the sand at all times after the sand has been built up over the crown of the pipe at the remote end of the section being filled. Install a riser pipe suitable for a vent in the casing adjacent at the bulkhead near end of the casing as indicated on the plans. The sand shall be blown inside the annular space until all of the annular space is completely filled from each end of the casing. Contractor shall provide washed sand meeting the following gradation.

U.S. standard sieve size	Percent by weight passing
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-65
No. 50	10-35
No. 100	0-10
No. 200	0-3

E. After installation of the carrier pipe in the casing, the annular space between the carrier pipe and casing shall be filled with grout as indicated on the drawings. The Contractor shall submit an Annular Space Grouting Plan in accordance Section 01 33 00.

3.05 CASING PIPE ENDS

A. Both ends of each casing shall be sealed with rubber end seals.

B. The annular space at ends of casing pipe shall be bulk headed with a minimum 12-inch thick solid masonry with a 1-inch fiberboard cushion between the masonry and carrier pipe.

3.06 ENGINEER'S INSPECTION AND ACCEPTANCE

A. After the Contractor completes the installation of the casing and contact grouting and prior to installation of the carrier pipe and annular space grout, the Contractor shall request inspection by the Engineer for the structural integrity of the joints and review of the horizontal and vertical alignment to confirm that the installation was performed in accordance with the Contract Document.

B. If any pipe is defective or the pipe is out of alignment beyond allowable limits, the Contractor shall be responsible for developing and submitting an acceptable repair procedure in accordance with the pipe manufacturer, Contract Documents, and to the satisfaction of the Engineer at no additional cost or construction schedule to perform the required repair Work.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 39 13

SANITARY UTILITY SEWERAGE MANHOLES, FRAMES, AND COVERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies manhole frames and covers.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A48	Gray-Iron Castings

1.03 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Manufacturer's catalog data. Data shall include a written Certification of Materials from the supplier on the supplier's letterhead which contains the following information:
    a. Signature of supplier's representative
    b. Statement "these castings are rated heavy duty and are suitable for AASHTO H-20 wheel loading conditions. These castings have passed 40,000 lb. proof load testing per American Association of State Highways and Transportation Officials (AASHTO) M-306.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Manhole frames and covers shall be East Jordan Iron Works Model 1480A with a Bolted Sealed Cover, or Equal modified to provide the specified features.

2.02 MATERIALS

A. The materials for manhole frames and covers shall be cast iron in accordance with ASTM A48, Class 30.

2.03 FABRICATION

A. Unless otherwise specified, manhole frames and covers shall be the heavy-duty type designed for H-20 highway loading, shall have a 24-inch clear frame opening and a minimum frame height of 4-1/2 inches and shall be equipped with a continuous-ring type gasket designed to minimize surface water inflow. Cover pattern shall be checkered pattern design and shall have concealed or closed pick holes with sufficient dimensions to allow for removal without special equipment. Bearing and wedging surfaces shall be machined to ensure a tight fit and to prevent rocking. Frames shall be provided with four 1-inch diameter holes for anchor bolts. The use of salvaged or scrap materials will not be permitted.

B. Covers shall be provided with a continuous, machined groove on either the underside bearing lip or the outer wedging edge of the cover. A groove on the bearing lip shall be fitted with a glued, continuous, low compression, set gasket; a groove on the outside edge shall be fitted with a neoprene O-ring seal.

C. Locking type, nongasketed frames and covers shall be provided where specified. Locking covers shall have two locking wedges in the frame. Covers shall have two fingers which engage the locking wedges when the cover is positioned in the frame and turned.

D. Locking type, gasketed (water tight) frames and covers shall be watertight and provided where specified. Frames shall have a neoprene or buna-n o-ring gasket.

PART 3 EXECUTION

3.01 MANHOLE COVERS

A. Manhole frames and covers shall be set flush with the surrounding surfaces unless otherwise specified.

B. Manhole Ring Encasement: All manhole rings shall be encased with 4,000 psi reinforced concrete as shown in the contract documents.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 40 PROCESS INTEGRATION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 40 05 01

PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the general requirements for design, selection, and supply of pipe materials, fittings, appurtenances, for process systems.

B. Use the general requirements specified in this section with the more specific requirements listed in the Piping System Schedules (Section 40 05 02) and other referenced sections. Except where referenced specification sections specify alternate provisions, the requirements of this Section apply to all piping systems listed in Section 40 05 02.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 50 00 – Construction Facilities

C. Section 03 30 00 – Cast-in-Place Concrete

D. Section 31 23 00 – Excavation and Fill

E. Section 40 05 02 – Piping System Schedules

F. Section 40 05 06.16 – Piping Connections

G. Section 40 05 45 – Piping System Identification

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.

Reference	Title
ANSI B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ANSI B31.1	Power Piping
ANSI B31.3	Process Piping
ANSI B31.9	Building Services Piping
ANSI Z223.1	National Fuel Gas Code
ANSI/ISA-S70.01	Quality Standard for Instrument Air
ASME B1.1	Unified Inch Screw Threads
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Requirements
ASTM F37	Sealability of Gasket Materials

Reference	Title
ASTM F104	Nonmetallic Gasket Materials
ASTM F152	Tension Testing of Nonmetallic Gasket Materials
AWWA C651	Disinfecting Water Mains
CAN/CGA B149.6	Code for Digester Gas and Landfill Gas Installations
EJMA	Expansion Joint Manufacturer's Association
UPC	Uniform Plumbing Code

1.04 DEFINITIONS

A. Terminology used in this Section conforms to the following definitions:
   1. Maximum pressure: The greatest continual pressure at which the piping system is designed to operate.
   2. Test pressure: The hydrostatic, air, or gas pressure used to determine system compliance.
   3. Take down coupling: Pipe couplings that facilitate disassembly of piping systems without damage or demolition of piping system components.
   4. Embedded/Encased piping: Piping enveloped in reinforced concrete, typically under structures and under roadways, where specified on the drawings.

1.05 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00.
   2. Qualifications of the Design Professional charged with inspection and certification of pipe hangers and supports and related scope of work; provide educational background, proof of registration, and proof of insurance and previous experience in performing this type of work. No further submittals under this or any related section will be considered until the Design Professional's qualifications have been reviewed and accepted by the Engineer .
   3. A copy of this specification section, along with Sections 01 73 24, 40 05 07, 40 05 07.13 and 40 05 07.16, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   4. For each piping system (refer to Piping System Schedules in Section 40 05 02.00 through 40 05 02.43), submit document listing pipe, fittings, linings, coatings, valves, couplings, bolts, gaskets, restraints, and other items provided for each applicable pipe size and category.

5. Welding: Prior to commencing any welding of steel or stainless steel pipe, supports, and/or structural attachments, provide a written description of welding techniques, including, but not limited to, materials, methods, and quality control. Identify differences in shop and field techniques. Indicate in the submittal that the welding technique has been reviewed for each piping service and certify that the technique is acceptable for the intended service condition (piping service defined in Section 40 05 02).

B. Informational Submittals:
   1. Procedures: Section 01 33 00
   2. Pre-Construction Data:
      a. Product Samples: Where specified or when directed by the Engineer , provide mill test results or product samples.
      b. Prior to the commencement of welding, submit current and complete documentation of the welder's qualifications.
      c. Safety plans for pneumatic pressure testing.
   3. Post-Construction Data: Inspection reports, authored, final report shall be submitted to the Engineer.

1.06 QUALITY ASSURANCE

A. Review the drawings prior to installation of piping, conduit services, and fixtures. Identify any conflicts and cooperate with the Engineer to determine the adjustments necessary to resolve conflicts.

B. Confirm the routing of each section of pipeline with other services prior to commencement of installation. Advise the Engineer of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict and confirm with the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01 50 00 for Shipment and Storage.

B. Deliver pipe, fittings, and specials to site using loading methods which do not damage pipe or linings, or coatings.

C. Piping materials delivered to site will be clearly marked to indicate size, type, class/schedule and coatings.

D. Until ready for incorporation in the work, store on site as recommended by the piping materials manufacturer to prevent damage, undue stresses, or weathering.

E. Store materials at least 8 inches above ground. Provide sufficient supports to prevent undue bending.

F. Protect non-UV light inhibited plastic from sunlight.

G. Maintain refrigerant piping factory seals until ready for incorporation into the Work.

H. Cover openings in piping, and temporarily seal to protect from contamination.

I. Protect materials and equipment from damage due to environmental conditions. Use protective cover, and protect from surface water by elevating above floor or surrounding grade.

J. Protect unfinished work at end of each workday from damage, contamination and moisture by use of plugs, caps or covers.

K. Protect piping and valves from damage pending performance of system tests.

L. Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe, linings, and coatings.

M. Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings or linings.

N. Prevent entry of foreign matter during handling, assembling, and installation. Use compressed air, wire brush, solvent and other acceptable means to remove all foreign matter from inside of pipe prior to installation. Remove residual scale, dirt and other foreign matter from interior of piping before final connections are made.

1.08 COORDINATION

A. Refer to Section 40 05 45 for process piping identification requirements.

B. Pipe Sleeves: Coordinate placement of sleeves and penetrations in cast-in-place concrete with raceway, duct, and pipe penetrations prior to concrete placement. Coordinate placement of sleeves and wall penetration prior to construction of masonry building elements.

PART 2 PRODUCTS

2.01 PIPE MATERIALS - GENERAL

A. All pipe materials to be new, free from defects and conforming to the requirements and standards identified in the Piping System Schedules and related sections.

B. New and existing piping is designated by process service rather than pipe material. Existing pipe material types may not be the same as material types specified for new piping. Investigate connections to existing piping and provide suitable connections, including electrical isolation, as necessary.

C. Fittings and Coupling Compatibility: To assure uniformity and compatibility of piping components, furnish fittings and couplings for grooved-end or shouldered-end piping systems from the same manufacturer.

2.02 PIPE AND VALVE COMPATIBILITY

A. Coordinate the selection of pipe materials, linings, and end connections so that valves operate properly over their entire range (e.g., sufficient disk clearance for butterfly

valves). Support wafer style valves or spectacle flanges between flanges of equal inside diameter.

2.03 JOINTS – GENERAL

A. Provide joints for disassembly within 3.0 ft of any connection to equipment, on both sides of structural penetrations, and within 2.0 ft of all threaded end valves.

B. Unless otherwise specified on the drawings or in equipment specifications, adapt all equipment connections to a flanged connection compatible with the connected piping system.

C. Flexible Joints at Structural Joint Crossings: Provide a flexible joint (or joints) on all piping crossing structural joints.

2.04 FLANGES AND OTHER COUPLINGS

A. Pipe connections are specified in each Piping System

B. General requirements for flanges are as follows:
   1. Where raised-face and flat flanges are provided for connection, reface the raised-face flanges. Flange face to be flush with flat-faced companion flanges on flat-faced valve or equipment flanges.
   2. Provide flat-faced flanges on each side of butterfly valves.
   3. For steel piping, provide weld neck flanges on both sides of wafer or lug body valves.

C. Slip-on flanges that are attached to a pipe by means of set screws and gaskets (uni-flange, etc.) are not acceptable.

2.05 FITTINGS – GENERAL

A. Fittings are specified in the Piping System Schedules.

B. Provide eccentric reducers in horizontal lines with the flat side on top, unless specified otherwise on the drawings (e.g., flow meters in horizontal runs requiring submergence).

C. Provide concentric reducers in vertical lines, unless otherwise specified on the drawings.

D. Provide reducers upstream and downstream of flow measurement devices to adapt line size to the specified flow measurement device dimension. Coordinate with the specific instrument requirements.

E. Provide long radius (greater than or equal to 1.5 x nominal diameter) elbows unless otherwise specified on the drawings.

2.06 GASKET MATERIALS

A. For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets. Conform to ANSI B16.21.

B. Refer to the Piping System Schedule for the specified gasket material. Material designations used in the detailed pipe specification sheets are as follows:
   1. EPDM: ethylene-propylene-diene-terpolymer 70 durometer
   2. Neoprene: neoprene (black) 70 durometer
   3. Nitrile: nitrile (Buna N)
   4. SBR: Styrene-butadiene (red)
   5. Natural rubber: natural rubber
   6. Compressed synthetic fibers (Kevlar): ASTM F104 (F712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37)
   7. Compressed synthetic fibers (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F152), 0.1 mL/h Leakage Fuel A (ASTM F37)
   8. Gylon - Type 1: Garlock Style 3500: 1.35 MPa (ASTM F152), 0.22 mL/h Leakage Fuel A (ASTM F37)
   9. Gylon - Type 2: Garlock Style 3510: 1.35 MPa (ASTM F152), 0.04 mL/h Leakage Fuel A (ASTM F37)
   10. CPE - Chlorinated Polyethylene
   11. Spiral-wound: Flexitallic SS316L, graphite impregnated per ASME B16.20
   12. PTFE bonded EPDM, full-face gaskets
   13. Viton/FKM – Fluoroelastomer, 75 Durometer

2.07 DISSIMILAR METAL CONNECTIONS

A. Where dissimilar metals are to be connected, provide dielectric fittings and/or isolating flanges, including bolt sleeves and washers, according to Section 40 05 06.

2.08 CATHODIC PROTECTION

A. Provide anode cathodic protection of steel casings where specified on the drawings.

2.09 STRUCTURAL ELEMENT PENETRATIONS

A. Penetrations through structural elements are referenced to a custom detail or Standard Detail. Where a penetration detail is not specified, conform to the Standard Detail relevant to the type of structure, exposure, and type of pipe.

B. Provide pipe sleeves capable of supporting the loads applied during placement of concrete or during block work erection.

2.10 PIPE MARKERS, DETECABLE WARNING TAPE, AND TRACER WIRE

A. Pipe marker, detectable warning tape, and tracer wire materials per Section 40 05 45.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to installation, inspect, and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

B. Pothole existing pipe at connections to new pipe to confirm material and joints prior to submittal of pipe layout drawings.

C. The Drawings are, in part, diagrammatic, make all minor modifications to suit installed equipment and structural element locations and elevations and coordinate with electrical construction.

D. Provide details of connections to new and existing equipment, piping, and structures in piping layout drawing submittals. Unless otherwise specified on Drawings, piping fitting angles and vertical and horizontal pipe locations shall be determined by Contractor.

E. Piping arrangements indicated on the drawings have been estimated from the approximate configuration of the type of equipment listed in the equipment specifications. If the equipment to be provided does not have the same configuration, modify the piping arrangement as necessary. Include any piping modifications in shop drawings submitted prior to fabrication or installation.

3.02 PIPE SUPPORT, ANCHORAGE, AND SEISMIC BRACING

A. Support piping with anchor brackets, guides, saddles, or hangers. Provide supports on each run at each change of direction.

3.03 JOINT AND COUPLING OPTIONS

A. Provide pipe connection (joint and coupling) options as specified in the Piping System Schedule.

B. If a Piping System Schedule lists several connection options, then any of the listed options may be used for a particular pipe material, but the selected option shall be used consistently. For example, if flanged or grooved connections are specified and grooved are represented on the Drawings, then flanged may be installed in lieu of the grooved couplings specified on the drawings.

C. Connecting straight runs of pipe by welding is acceptable only where the individual Piping System Schedule allows welding as a connection option.

D. Where connections other than those indicated on the Piping System Schedule are specified on the Drawings, locate the connection specified on the drawing at the specific location indicated on the drawing.

E. Provide rigid, non-rotating connections at all valves and equipment.

3.04 SLEEVES

A. Unless otherwise noted in the specified pipe penetration details or otherwise approved by the Engineer , provide sleeves where piping passes through a wall, floor, or ceiling.

B. Locate and place sleeves prior to construction of cast-in-place elements and prior to the construction of concrete and masonry building elements.

3.05 PIPE JOINTS AND CONNECTIONS

A. Field cuts for glass-lined pipe are not permitted.

B. Cut pipe with appropriate tool and deburr.

C. Make joints tight. Test and remake leaking joints with new materials. Do not use thread cement or caulking to remake joints.

D. Do not use sharp toothed wrench in making up brass pipe, or chrome plated items.

E. Provide thread forms and length in accordance with ASME standards. Use lubricant or sealant on male threads suitable for proposed pipe service.

F. Clean joints before soldering. Use flux and alloy appropriate for specified operating temperature and pressure.

G. Welding procedures, welder certification/qualification, and weld testing per ASME Section IX, Boiler and Pressure Vessel Code. Make welds per the specified standard when ASME B31.1 or ASME B31.3 are specified for a Piping System in the Piping System Schedules (Sections 40 05 02.00 through 40 05 02.99.

H. Coat gasket with gasket manufacturer's recommended lubricant between flange faces.

3.06 TAKEDOWN COUPLINGS

A. Takedown Couplings: Provide takedown couplings at the locations specified on the Drawings in accordance with this Section.

B. Provide takedown couplings at changes in piping direction and where specified in the Drawings on straight runs of pipe.

C. Provide screw unions, flanged or grooved end coupling type joints as takedown couplings.

D. Use flanged or grooved end joints on pipelines 1.5-inch diameter and larger.

E. Where piping passes through walls provide takedown couplings within 40 inches of the wall.

F. Provide a union or flanged connection within 24 inches of each threaded end valve.

3.07 INSTALLATION OF BURIED PIPE AND PIPE BELOW STRUCTURES

A. Trenching and backfill for buried pipe: conform to Section 31 23 00.

B. Pipe laying and bedding: conform to Section 31 23 00.

C. Restrain all plugs, caps, tees and bends in buried pressure piping systems by means of restrained joints as specified in the respective Piping System Schedule.

D. In accordance with Section 40 05 06.16, and where specified on the Drawings, provide flexibility per specified details where buried pipe passes under, through, or is connected to structures. Provide restrained joint connections or provide restraints across each un-restrained joints.

E. Install pipe in straight alignment. Do not exceed 3/8-inch variance over 30 ft from the true alignment in any direction.

F. Slope gravity lines uniformly from point of origin to discharge.

G. Ensure the pipe alignment stays true during and after placement of concrete encasement.

H. Ensure that the method used to prevent pipe uplift during placement of concrete encasement results in an invert and crown true to intended grade.

I. Maintain circular cross section of pipe.

J. Provide lean concrete below the underside of the slab or footing for backfill over pipe laid below structures when pipe is less than 6 inches below the underside of the slab or footing, unless specified otherwise. Place concrete in accordance with Section 03 30 00.

K. Provide Heat-Shrinkable Cross-Linked Polyolefin Coating or Tape Wrap coating on all flanged, grooved, and welded joints that are buried or below structures.

L. Use anti-seize compound with all stainless steel nuts and bolts.

M. Provide detectable warning tape for all buried pipe. Provide tracer (locate) wire as specified in Section 40 05 45.

3.08 EXPOSED INSTALLATION

A. Fabricate and install domestic hot and cold water piping, sanitary piping and storm drainage piping in accordance with the Plumbing Code.

B. Provide pipe system layout in accordance with the following criteria:
   1. Drawings show general layout of piping. Exact dimensions determined by Contractor.
   2. Maintain minimum clear areas through tunnels and principal access aisles as specified in this Section.
   3. Expanding or swaging of tubing to fit IPS (Iron Pipe Size) fitting sockets is not permitted.
   4. Use reducing fittings where change in pipe size occurs.
   5. Use couplings only where pipe runs are longer than standard supplied pipe lengths.
   6. Make exposed polished or enameled connections to fixtures or equipment with special care to avoid damage to finished surfaces.
   7. Make changes in direction only with fittings.
   8. Install piping with not less than minimum slope to ensure adequate drainage and venting.
   9. Maintain clear areas around equipment to allow adequate access for maintenance as specified in this Section.

10. Ensure valve operators are accessible from floor level. Provide chain wheel operators for valves with centerline elevations of 7 feet or above.
11. Ensure piping ancillaries and in-pipe instrumentation is installed in accessible locations which do not create problems for traffic in the clear areas.

C. Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage.

D. Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag or stress.

E. Install expansion joints where specified on the Drawings or where required by the Design Professional, to allow for piping expansion and contraction.

F. Install expansion loops or bends where specified, or required by the Design Professional, to allow for proper pipe expansion. Construct expansion loops with long radius welded bends.

G. Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.

H. Accurately cut all piping for fabrication to field measurements.

I. Install pipes in straight alignment and parallel to wall. Do not exceed 3/8-in variance over 30 ft from the true alignment, in any direction.

J. Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. Unless stipulated by the Design Professional to address significant thermal strain, and accepted by the Engineer , the "springing" of pipe and fittings to ensure alignment is not permitted. Undo and subsequently remake all pipework connections where so instructed by the Engineer to ensure that unintended springing does not occur. Take care not to damage equipment, valves, or flanges.

K. Slope instrument air piping to condensate traps.

L. Do not cut or weaken the building structure to facilitate installation of piping.

M. In parallel pipe runs, offset flanges and/or grooved joint fittings by a minimum of 8 inches longitudinally to allow for proper access.

N. In vertical pipe runs of pipe diameter greater than 10 inches, provide 8-inch long spool piece on lower side of each valve.

O. Do not install water piping over electric switchboards, transformers, cable tray or electric motor starters.

P. Provide pipe markers for all exposed pipe.

3.09 THREADED JOINTS

A. Conform to the requirement of ANSI B31.1.

B. Ream the end of all pipes to remove all burrs and cuttings when fabricating threaded joints.

C. Clean out pipe and repair linings and coatings prior to joining.

D. Apply Teflon tape to male threads and join pipe. Use both Teflon tape and Teflon sealing compound on stainless steel pipe threads. Do not apply extra tape to make up for slack in the joint.

3.10 FLANGED JOINTS

A. Maintain consistent flange bolt hole positions along the entire length or run of the pipe.

B. For pipe installed with a horizontal axis, position flange bolt holes so that the vertical centerline of the flange face bisects the arc between flange bolt holes ("Two-Holed").

C. For pipe installed with a vertical axis, position flange bolt holes so that the horizontal centerline of the flange face bisects the arc between flange bolt holes and is perpendicular to the closest structural wall ("Two-Holed").

D. Clean flanges and gaskets prior to connection.

E. Lubricate gaskets with gasket manufacturer's recommended lubricant and apply anti-seize compound to all bolts.

F. Bring flanges into close parallel and lateral alignment.

G. Tighten bolts progressively. Proceed from side to side of the flange.

H. Use proper length bolts for each size flange on flanged connections. Washers may not be used to take up excess bolt length. Provide approximately two full threads bolt projection beyond nuts. Bolts with excessive length of exposed threads will not be permitted. All-thread rod is not acceptable for bolting flanges.

I. When joining steel to cast iron flanges, take care to avoid damage to the cast iron flange. Ensure both flanges are flat-faced and use full face gaskets.

J. Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place strain on the equipment.

K. Allow a minimum of 6 inches' clearance to face or 8 inches to edge of flange to wall, floor, or ceiling unless otherwise specified.

3.11 INSULATION

A. Insulate piping systems in accordance with the Piping System Schedules (Sections 40 05 02.00 through 40 05 02.99) and Section 40 42 00.

3.12 FLEXIBLE HOSE CONNECTORS

A. Accurately align pipelines to receive flexible connectors before installing the connectors. Do not stretch, compress, misalign or offset the connectors.

B. Align and install each flexible connector in accordance with the manufacturer's instructions.

C. Support, anchor and guide the piping so that the flexible hose connectors are not required to absorb any axial compression or elongation.

D. Do not torque or twist the flexible connectors.

E. Check bolt tightness and tighten where necessary, a maximum of one week after commissioning and periodically thereafter.

3.13 EXPANSION JOINTS

A. Accurately align pipelines to receive expansion joints before installing the joint. Do not stretch, compress or offset the joint to fit the piping. Install expansion joints in accordance with manufacturer's instructions prior to releasing preload.

B. Align and install each expansion joint in accordance with EJMA standards and with the manufacturer's written instruction; properly guide and anchor all expansion joints. No lateral movement is permitted on compensator type expansion joints.

C. On rubber expansion joints, check bolt tightness, and tighten where necessary one week after Commissioning is completed.

3.14 REPAIR/RESTORATION

A. Repair pipe with damaged shop-applied protective linings in accordance in accordance with specified standard (e.g. AWWA C210) or accordance with the lining manufacturer's directions, if no standard is cited.

B. Damaged glass lining cannot be repaired. Replace piping with damaged glass lining.

C. Patching inserts, overlays, or pounding out of dents is not be permitted.

D. Repair pipe with damaged protective coatings and holdback areas for welding and other field fabrication, as follows:
   1. For shop-applied coatings, not subject to Section 09 90 00 requirements, in accordance with specified standard (e.g. AWWA C210) or in accordance with the coating manufacturer's directions, if no standard is cited.
   2. For coatings applied pursuant to Section 09 90 00 requirements, apply repair coatings in conformance with the applicable Section 09 90 00 coating system, including thickness and stipulated preparation of the lowest full thickness coating layer (i.e. exposed metal would require full profile preparation and specified multi-layer coating restoration).
   3. Prepare areas to be repaired not less than 2-inches beyond damaged areas and feather repair coating into adjacent areas.
   4. Repair to provide equivalent protection to undamaged coatings and a uniform appearance when judged from 4 feet away.

E. Other requirements may be stipulated in related piping sections.

3.15 FIELD QUALITY CONTROL

A. Inspections:
   1. Inspect and provide reports as specified in Section 40 05 07, Section 40 05 07.13, and Section 40 05 07.16.
   2. Submit the Design Professional's final report before beneficial occupancy by the Engineer.

3.16 TESTING

A. Provide 24 hours notice prior to testing.

B. Do not insulate or conceal work until piping systems are tested and have met all required criteria.

C. Complete any required weld tests.

D. Supply all water, air, and inert gases required for pressure testing.

E. Supply all pumps, compressors, gauges, etc. required for testing.

F. Install air threadolets, air relief valves, and line fitting valves as necessary to complete testing. Remove after testing and plug threadolets.

G. Cap or plug all lines which are normally open ended. Remove on completion of testing.

H. Provide all temporary thrust restraints necessary for testing. Remove upon completion of testing.

I. Test all underground lines prior to backfilling. Do not place concrete encasement until lines are tested and have met all required criteria.

J. Test all existing piping where it connects to new piping to the first valve in the existing piping. Repair any failures in existing piping which occur as a result of the test after informing the Engineer of such failure.

K. Isolate all pumps and low pressure equipment and appurtenances during testing so as not to place any excess pressure or thrust forces on the equipment.

L. Where defective material or equipment is identified, repair or replace using new material.

M. Flush and drain liquid pipes after pressure tests. Purge all gas pipes after pressure tests using inert gas.

N. Dispose of flushing water in manner approved by the Engineer , which causes no damage to buildings or siteworks.

3.17 HYDROSTATIC PRESSURE TESTING OF LIQUID LINES

A. Hydrostatically test all lines normally used for the conveyance of potable water and reclaimed water using water as the test medium. Refer to Section 40 05 12 Pressure Testing Of Piping.

B. Test pressures and durations as specified in the Piping System Schedules.

3.18 CLEANING AND FLUSHING

A. After installation and prior to testing, perform initial cleaning of process and utility lines. Clean piping greater than 6 inches and less than 24 inches by passing a tightly fitting cleaning ball or swab through the pipeline, unless specified otherwise. Lines greater than 24 inches may be cleaned manually or with a cleaning ball or swab. Give lines an initial flush or purge.

B. Flush liquid systems after testing, with clean water. Maintain flushing for a minimum period of 15 minutes and until no debris is collected in the screens.

3.19 SEWER AND SIPHON TELEVISION INSPECTION

A. The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising and a NASSCO-(PACP) standard video, recorded in MPEG-1 format and written to DVD video, of sewer siphons, sewer mains and manholes utilizing a color, closed-circuit television inspection unit to determine their condition.

B. GENERAL: After completion of the work specified in the contract documents, the newly constructed or rehabilitated sanitary sewer mains shall be televised immediately upon cleaning. Televising shall be observed by the Engineer and contractor, as the camera is run through the system. Any abnormalities such as, but not limited to, misaligned joints, cracked/defected pipe, rolled gaskets, shall be repaired by the Contractor solely at his expense. Sections requiring repair shall be re-televised to verify condition of repair. No additional compensation shall be provided for all needed repairs, re-cleaning, or re-televising efforts.

C. Execution: The Contractor shall provide a DVD and log of the televised system for review and approval by the Inspector. If the Contractor provides a DVD of such poor quality that it cannot be properly evaluated, the Contractor shall re-televise as necessary and provide a DVD of good quality at no additional cost. If the Contractor cannot provide a DVD of such good quality that can be reviewed by the Engineer, the Engineer may elect to televise the line at the Contractor's expense.

D. The television unit shall also have the capability of displaying in color, on DVD, pipe inspection observations such as pipe defects, sags, points of root intrusion, offset joints, service connection locations, and any other relevant physical attributes. Each DVD shall be permanently labeled with the following:
   1. Project name / Contract#
   2. Date of television inspection;
   3. Station to station location and size of sanitary sewer;
   4. Street/easement location;

5. Name of Contractor;
6. Date DVD submitted;
7. DVD number;
8. Engineer representative.

E. The Contractor shall provide a line diagram area sketch and written log for each completed segment of DVD sewer main describing the section being televised, flow and camera direction, position of service connections, description and location of failures, pipe condition, weather conditions, and other significant observations.

F. The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole. A camera with rotating and panning lens capabilities is required. The camera height shall be centered in the conduit being televised. The speed of the camera through the conduit shall not exceed 40 feet per minute. The produced video shall also have an inclinometer that displays the slope of the sewer main being televised.

G. The Contractor shall be required to have all materials, equipment, and labor force necessary to complete all videotaping on the job site prior to isolating the sewer manhole segment and beginning videotaping operations.

H. Television inspection shall be done one section between two manholes at a time. Also the flow in the section being televised shall be bypassed if the line is in service and the flow exceeds 25% of the internal pipe diameter. When the depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, the flow can be reduced to allowable levels by performing bypass pumping, as approved by the Inspector.

I. The Contractor shall not be allowed to float the camera. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction. At that time, and prior to proceeding, the Contractor shall contact the Inspector. If the length of sewer main cannot be televised because of obstructions, the Contractor shall clean the system as is necessary. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended, payment shall be made based on the actual televised length, and the remaining televising of the sewer line shall be continued upon successful correction of the blockage by the

J. Contractor at his expense. No additional payment shall be made for additional setups required due to obstructions encountered during televising.

K. The Contractor is solely responsible for any damage of sewer mains as a direct result of televising operations. Any repair shall also be the responsibility of the Contractor.

L. The method(s) used for securing passage of the camera are at the discretion of the Contractor, and as approved by the Inspector.

M. No separate and/or additional payment will be made for any excavation, man entry, or any other method which may be required to retrieve video equipment that may have been hung up, destroyed, and/or lost during the operation.

3.20 DISINFECTION

A. Flush and disinfect lines intended for potable water service after testing in accordance with AWWA C651, see Specification 40 05 13 Disinfection Of Piping .

3.21 GRAVITY COLLECTION SYSTEM LOW PRESSURE TEST

A. Low pressure test shall be performed on gravity sewer and siphon piping per TCEQ regulations and as modified in 40 05 11 Sanitary Sewer Pipe Low Pressure And Deflection Testing.

3.22 DEFLECTION TESTING FOR FLEXIBLE PIPE

A. Deflection testing of flexible pipe shall be performed on gravity sewer and siphon piping per TCEQ regulations and as modified in 40 05 11 Sanitary Sewer Pipe Low Pressure And Deflection Testing.

END OF SECTION

SECTION 40 05 02

PIPING SYSTEM SCHEDULES

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies a Piping System Schedule for each Process Service. Each Piping System Schedule specifies piping system materials for groups of similar process piping services.

B. The table in paragraph 1.01C lists process services and the corresponding Piping System Schedule that specifies piping system material requirements for the associated process piping service. See Part 4 for Piping System Schedules that define materials for piping services.

C. Piping System Schedule assignments are listed in the following table:

Process Service Identifier	Process Service	Piping System Schedule	Fluid Category	Pipe Marker Background Color
RS	Raw Sewage	40 05 02.43	Wastewater	Green
1W	Potable Water	40 05 02.23	Water	Blue

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.

Reference	Title
ASME B1.20.1	Pipe Threads, General Purpose
ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250
ASME B16.3	Malleable Iron Threaded Fittings Class 150 and 300
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.11	Forged Steel Fittings, Socket Welding and Threaded
ASME B16.12	Cast Iron Threaded Drainage Fittings
ASME B16.18	Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASME B31.9	Building Services Piping

Reference	Title
ASME B32	Solder Metal
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B1.1	Unified Inch Screw Threads
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Requirements
ASTM A47	Malleable Iron Castings
ASTM A53	Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	Forgings, Carbon Steel, for Piping Components
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A126	Grey-Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A135	Electric-Resistance-Welded Steel Pipe
ASTM A139	Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over)
ASTM A167	Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate
ASTM A181/181M	Forgings, Carbon Steel, for General Purpose Piping
ASTM A182/182M	Forged or Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/193M	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service High Pressure Service and Other Special Purpose Applications
ASTM A194/194M	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service or High Temperature Service, or Both
ASTM A197	Cupola Malleable Iron
ASTM A234/A234M	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A307	Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A312/312M	Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A320/320M	Alloy Steel Bolting Materials for Low-Temperature Service
ASTM A403/A403M	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A409/A409M	Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service
ASTM A480/A480M	General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A480/A480M	General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A536	Ductile Iron Castings
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A774/A774M	As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
ASTM A778	Welded, Unannealed Austenitic Stainless Steel Tubular Products
ASTM A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High- Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B75	Seamless Copper Tube
ASTM B88	Seamless Copper Water Tube

Reference	Title
ASTM B584	Copper Alloy Sand Castings for General Applications
ASTM C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C361	Reinforced Concrete Low-Head Pressure Pipe
ASTM C443	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	Circular Precast Reinforced Concrete Manhole Sections
ASTM D638	Test Method for Tensile Properties of Plastics
ASTM D792	Test Method for Specific Gravity and Density of Plastics by Displacement
ASTM D1248	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2466	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2996	Filament-Wound Reinforced Thermosetting Resin Pipe
ASTM D3034	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
ASTM D3261	Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings
ASTM D3350	Polyethylene Plastics Pipe and Fittings Materials
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM D4174	Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems
ASTM D4894	Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials
ASTM D4895	Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced from Dispersion
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
AWWA C104	Cement–Mortar Lining for Ductile-Iron Pipe and Fittings
AWWA C105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110	Ductile-Iron and Grey-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
AWWA C111	Rubber-Gasket Joints for Ductile-Iron and Grey-Iron Pipe and Fittings
AWWA C115	Flanged Ductile-Iron and Grey-Iron Pipe with Threaded Flanges
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids
AWWA C153	Ductile-Iron Compact Fittings
AWWA C200	Steel Water Pipe, 6 Inches and Larger

Reference	Title
AWWA C203	Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inches through 144 Inches
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services - Sizes 4 Inch Through 144 Inch
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
AWWA C210	Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA C222	Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
AWWA C301	Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
AWWA C303	Reinforced Concrete Pressure Pipe - Steel Cylinder Type, Pretensioned, for Water and Other Liquids
AWWA C600	Installation of Ductile-Iron Water Mains and their Appurtenances
AWWA C606	Grooved and Shouldered Joints
AWWA C651	Disinfecting Water Mains
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water
AWWA M11	Steel Pipe - A Guide for Design and Installation
CISPI 301	Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings
EJMA STDS	Standards of Expansion Joint Manufacturers' Association, Edition No. 6
FSA	Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division
FEDSPEC, L-C-530B(1)	Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
MIL-H-13528B	Hydrochloric Acid, Inhibited, Rust Removing
MIL-S-8660C	Silicone Compound
MIL-STD-810C	Environmental Test Methods
MSS SP-25	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-43	Wrought Stainless Steel Butt Welding Fittings
MSS SP-97	Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends
MSS SP-114	Corrosion Resistant Pipe Fittings Threaded and Socket Welding Class 150 and 1000
NSF/ANSI 61:	Drinking Water System Components – Health Effects
SSPC	Society for Protective Coatings
SAE J1227	Assessing Cleanliness of Hydraulic Fluid Power Components and Systems

1.03 DEFINITIONS

A. Terminology used in this Section conforms to the following definitions:

B. Pipe Connections and Joints:

1. BABS – Bell and Ball Spigot
2. BAS – Bell and Spigot
3. BFW – Butt Fusion Weld
4. BSS – Bolted Split Sleeve Coupling
5. BW – Butt Weld
6. BSW – Butt-Strap Weld
7. CGRV – Cut (or Cast) Grooved End Coupling
8. CPLG – Coupling
9. CPO – Compression Type Push-On
10. CPRSN – Compression
11. DLW – Double Lap Weld (Bell and Spigot)
12. EFSW - Electro-Fusion Socket Weld
13. FLG – Flanged
14. FLRD – Flared
15. FP – Full Penetration
16. FSW – Fusion Socket Weld
17. HAS – Hub and Spigot, Compression (Cast Iron Soil Pipe)
18. HBLS - Shielded Hubless (Cast Iron Soil Pipe)
19. HGRV – HDPE Groove Coupling
20. HLF CPLG – Half Coupling
21. HPEG – HDPE Plain End with Gripping Teeth
22. HXGT - HDPE by Grooved End Transition
23. LR ELL – Long Radius Elbow
24. MJ – Mechanical Joint
25. PGRV - Proprietary Groove Coupling
26. PO – Push-on
27. RBAS – Restrained (Lap Welded) Bell and Spigot with O-ring rubber gasket
28. RGRV – Rolled Grooved End Coupling
29. RJC – Ring Joint Coupling
30. RMJ – Restrained Mechanical Joint
31. RPO – Restrained Push-On joint
32. SLV – Solvent Weld
33. SLDR – Solder or Brazing
34. SLW – Single Lap Weld (Bell and Spigot)
35. SR ELL – Short Radius Elbow
36. SW – Socket Weld
37. THD – Threaded
38. UN – Union

C. Flanges:
1. FF – Full Face
2. LF – Loose Flange

3. LJ – Lap Joint
4. LWN – Long Weld Neck
5. RF – Raised Face
6. SO – Slip-On
7. THD – Threaded
8. WN – Weld Neck

D. Materials:
1. DI – Ductile Iron
2. RCP – Reinforced Concrete Pipe
3. RCP-LHP – Reinforced Concrete Low Head Pressure Pipe
4. SS – Stainless Steel
5. SV – Service (Cast Iron Soil Pipe available with SV rating or XH, extra heavy, rating)

E. Welding:
1. FP – Full Penetration
2. SML – Seamless
3. WLD – Welded

F. Other:
1. CFT - Cured Film Thickness
2. DFT – Dry Film Thickness
3. Dim – Dimensions
4. M or E Pipe – Matches or exceeds rating of connecting pipe
5. Thk – Thickness
6. Sch – Schedule
7. Std – Standard
8. STD – Standard Weight or Standard

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe size (nominal diameter) and the Process Service Identifier for the contents of the pipeline are specified in pipe line labels on the drawings.

B. Provide piping system materials and components per the Piping System Schedule assigned for the specified process service and pipe size.

C. The Rating column in the Piping System Schedule specifies the minimum acceptable pressure rating or wall thickness for the component of the piping system.

PART 3 NOT USED

PART 4 SCHEDULES

4.01 PIPESPEC SYSTEM SHEETS/DETAILED PIPING SPECIFICATION SHEETS.

A. Piping System Schedules follow this Section. Piping System Schedules are assigned a Section number in the range from 40 05 02.00 through 40 05 02.43.

END OF SECTION

Test Conditions

Pressure (psig)	Duration (min.)	Medium
Gravity Sewer		
Section 40 05 11	Low Pressure Air Test	Air
Siphon Pipe 24" and larger		
20 Design 30 Operating Section 40 05 11	Low Pressure Air Test	Air
12" Reclaimed Water Main		
200 psi Section 40 05 12	120	Water

General Requirements

1. Full-Faced flanges mated with raised face flanges are not permitted.
2. Mating flanges for pipe shall be of the same Standard, Class and Series. Mating flanges at valves and equipment shall have specified rating and matching drilling pattern.
3. Pipe Threads per ASME B1.20.1.
4. Match metal alloy/grade/type for any metal welded to pipe or fittings. (e.g. Do not weld carbon steel to stainless steel; weld Type 316L to Type 316L pipe material.)

Buried (Includes Embedded and Encased)

Component	Line Size, in	Rating	Conn./Joints	Material	Spec Section	Notes
Pipe Air Release Vent & Blowoff Valve	3 thru 8	SCH. 40	Flanged	Steel: ASTM A53, Gr B, Type E or Type S, Dim. Per ASME B36.10 Lining: Liquid Epoxy, factory applied. Provide magnetic tracer tape. External Coating: 80 MILS Polyethylene Tape Coating or 2 coats of Epoxy coating at locations specified on plans.	40 05 24	
Pipe Gravity Sewer	4 thru 15	SDR35	Bell & Spigot	PVC: Minimum pipe stiffness = 46 psig, ASTM D3034 Color of pipe shall be Green. Provide magnetic tracer tape. Conn: bell and spigot with O-ring rubber gasket joint, ASTM F477 Ftgs: none	40 05 20	1

Schedule 40 05 02.43 – Pressurized and Gravity Wastewater Systems

Process Service	Pumped Drainage	Raw Sewage	Septage.	Tank Drain	
Process Service Identifier		RS			

Pipe Reclaimed Water Main	12	DR14	Bell & Spigot	**PVC**: AWWA C900 DR14 Color of pipe shall be Purple. Provide magnetic tracer tape. Conn; bell and spigot with O-ring rubber gasket joint. Flanged adapters for valves. Ftgs; Ductile iron fittings, coating, and lining see 24". Restrained joint fittings at all bends, tees and ductile iron fittings. Minimum shall be one pipe joint on either side of bend min.	40 05 20	2
Pipe Gravity Sewer	18	PS 46	Bell & Spigot	**PVC:** Minimum pipe stiffness = 46 psig, ASTM F679 Color of pipe shall be Green. Provide magnetic tracer tape. Conn: bell and spigot with O-ring rubber gasket joint, ASTM F477 Ftgs: none	40 05 20	1

Schedule 40 05 02.43 – Pressurized and Gravity Wastewater Systems

Process Service	Pumped Drainage	Raw Sewage	Septage.	Tank Drain	
Process Service Identifier		RS			

Pipe Siphon	24 and larger	100 psig DR41	Bell & Spigot	PVC: AWWA C905 DR41 Color of pipe shall be Green. Provide magnetic tracer tape. Conn; bell and spigot with O-ring rubber gasket joint. Restrain joints inside all steel casings with split serrated bell joint restraint. Ftgs; Ductile iron fittings, line and coat per 24" ductile iron pipe requirements in this specification. All fittings shall include joint restraint devices. Manhole and structure connections as specified on the drawings. Joint Restraint: All bends, valves, and other fittings shall include joint restraint devices, mechanical wedge style joint restraint. Refer to joint restraint table on plans. Minimum shall be one pipe joint on either side of bend min. or as recommended by pipe manufacturer.	40 05 20	1
Pipe Siphon	24 and larger	100 psig DR41	Fusible	Fusible PVC Pipe: AWWA C905 DR41 Provide magnetic tracer tape. Fusion Joints: Fusible polyvinylchloride pipe lengths field assembled with butt fused joints. Conn: Connections to pvc pipe shall utilize a sleeve type mechanical pipe coupling. Restrain coupling with EBAA Iron Series 3800 or government approved equal.	40 05 31	1

Schedule 40 05 02.43 – Pressurized and Gravity Wastewater Systems

Process Service	Pumped Drainage	Raw Sewage	Septage.	Tank Drain	
Process Service Identifier		RS			

Pipe Fittings	24 and larger	Class 150 24” thru 36” Class 200 12” Reclaimed, 36” at Casing Locations	CGRV	Ductile Iron; AWWA C151 with epoxy lining. Provide magnetic tracer tape. Conn; grooved end, push-on rubber gasket joint. Flanged adapters for valves. Restrain all joints. Ftgs; ductile iron; coating, lining, and ends to match pipe. Restrained joint at all bends. Joint Restraint: All bends, valves, and other fittings shall include joint restraint devices, mechanical wedge style joint restraint. Minimum shall be one pipe joint on either side of bend min. or as recommended by pipe manufacturer. Joints shall be restrained with wedge style bell and spigot joint restraint. Structure connections as specified on the drawings. Lining: Ceramic Epoxy. 40 mils Pipe Coating: Asphaltic (Manufacturer’s Standard (AWWA C151) Factory Applied with Polyethylene Encasement (AWWA C105, Field Installed)	40 05 19	
Valves	36 and larger		Flanged	Air Release Valves for Sewer; Air Release Valves designated as Air Release, Air Vacuum (ARV), Combination Air Valve (CAV) and Air Vacuum Valve (AVV) shall be provided at points shown in drawings. Flanged 2 - inch thru 8 - inch. 40 05 78.23 Tap: Stainless steel tapping sleeves	40 05 60	
Valves	2” thru 8”		Flanged	Plug: AWWA C517, Full Port, Glass lined. 40 05 62.01, shall be provided at location shown on plans External coating: per specification	40 05 60	

Schedule 40 05 02.43 – Pressurized and Gravity Wastewater Systems

Process Service	Pumped Drainage	Raw Sewage	Septage.	Tank Drain	
Process Service Identifier		RS			

Valves	12” or smaller		Flanged	Plug: AWWA C509, Resilient seat gate valves; Mueller, M&H, Pratt or equal; AWWA C509 External coating: per specification	40 05 60	
Valves	30” and larger		Flanged	Plug: AWWA C517, Full Port, Glass lined, eccentric. 40 05 62.02, shall be provided at location shown on plans External coating: per specification	40 05 60	1

Keyed Notes

1. Deflection Testing and Leakage Testing see Section 40 05 11 Sanitary Sewer Pipe Air and Deflection Testing.
2. Hydrostatic Pressure Test see Section 40 05 12 Pressure Testing of Piping

END OF SECTION

SECTION 40 05 06.13

JOINT GASKETS

PART 1 GENERAL

1.01 DESCRIPTION

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.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reence	Title
ASTM D395	Rubber Property--Compression Set, Test for
ASTM D412	Rubber Properties in Tension, Test for
ASTM D471	Rubber Property--Effect of Liquids, Test for
ASTM D573	Rubber--Deterioration in an Air Oven, Test for
ASTM D1149	Rubber Deterioration--Surface Ozone Cracking in a Chamber (Flat Specimens), Test for
ASTM D2240	Rubber Property--Durometer Hardness, Test for

B. Testing:

1. 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 paragraph 2.02 shall be provided as product data.

PART 2 PRODUCTS

2.01 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.

2.02 PHYSICAL REQUIREMENTS

A. The compound shall meet the following physical requirements when tested in accordance with the specified ASTM standards.

B. Tensile (ASTM D412):
   1. The tensile strength shall be 1500 psi minimum and the ultimate elongation shall be 350 percent minimum.

C. Hardness (ASTM D2240, TYPE A DUROMETER):
   1. The compound shall have a hardness in the range of 35 to 50 for concrete spigots and 50 to 65 for steel spigots.

D. Compression Set (ASTM D395):
   1. The compression set shall not exceed 20 percent when compressed for 22 hours at 70 degrees C.
   2. The test specimens shall be circular discs cut from the gaskets. Test specimens shall be 0.500 ($\pm$ 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 $\pm$ 0.010 inches in diameter.

E. Aging (ASTM D573):
   1. 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.

F. Effect Of Liquids (ASTM D471):
   1. The maximum volume change in oil and in water shall be as follows:
      a. Oil: 100 percent in ASTM oil No. 3.
      b. Water: 15 percent.
   2. The test specimens shall have a thickness of 0.080 $\pm$0.005 inches and shall be circular discs cut from the gasket.

G. Ozone Cracking (ASTM D1149):
   1. 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/l ozone at 40 degrees C.

2.03 PRODUCT DATA

A. In accordance with Section 01 33 00, the Contractor shall provide certified copies of test reports specified in paragraph 1.02 Testing.

PART 3 EXECUTION

3.01 INSTALLATION

A. The gaskets shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 40 05 06.16

PIPING CONNECTIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the following methods of connecting metallic piping: flanges, threading, mechanical couplings, equipment connection fittings, dielectric unions, and welding.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI Bl.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI Bl.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI B31.1	Power Piping
ANSI B31.3	Chemical Plant and Petroleum Refinery Piping
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators Qualifications
ASTM B98	Copper-Silicon Alloy Rod, Bar and Shapes
ASTM F37	Standard Test Methods for Sealability of Gasket Materials
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F152	Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

Reference	Title
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service-Size 4 in. through 144 in.
AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
AWWA C550	Protective Epoxy Coatings for Valves and Hydrants
AWWA C606	Grooved and Shouldered Joints
AWWA M11	Steel Pipe-A Guide for Design and Installation
NSF 61	Drinking Water System Components - Health Effects

1.03 SUBMITTALS

A. Submit the material listed in the detailed specification in accordance with Section 01 33 00:

1.

PART 2 PRODUCTS

2.01 FLANGE ASSEMBLIES

A. Flanges:

1. General: Flanges shall either be flat flanges or convoluted ring flanges as specified in the following paragraphs.
2. Flat 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.
3. Convoluted Ring Flanges: Convoluted ring flanges shall be ductile iron, forged steel or cast stainless steel, designed to bear on hubs welded to the pipe and shall be as manufactured by Improved Piping Products. The Engineer knows of no equal. The flange joints shall be rated for not less than 150 percent of the test pressures listed in Section 40 05 01 and shall conform to the requirements of ANSI B 16.5 and AWWA C207. The flange manufacturer shall be prepared to demonstrate, by certified pressure test that the flanges will meet these requirements.

B. Gaskets:

1. Gasket material shall be as specified in paragraph 2.03.
2. 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:

1. Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI Bl.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5.
2. Unless otherwise specified, bolts shall be carbon steel machined bolts with hot pressed hexagon nuts. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

2.02 MECHANICAL COUPLINGS

A. Sleeve-Type Couplings:

1. Unless otherwise specified, sleeve-type mechanical pipe couplings shall be Smith-Blair Type 411, Dresser Style 38, or Approved Equal, with the stop removed from the middle ring. Reducing couplings shall be Smith-Blair Type 415, Dresser Style 62, or equal. Sleeve-type flanged coupling adapters shall be Smith-Blair Type 913, Dresser Style 128, or equal. Insulating couplings shall be Smith-Blair Type 416, Dresser Style 39, or equal.
2. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, markingF593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04, or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.
3. Gaskets shall be as specified in paragraph 2.03 and AWWA C111.

B. Plain End Couplings:

1. 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.
2. Gaskets shall be as specified in paragraph 2.03 and AWWA C606.

C. Grooved End Couplings:

1. Grooved end flexible-type couplings shall be Gustin-Bacon 100, Victaulic Style 77, or Approved Equal. Grooved end rigid-type couplings shall be Gustin-Bacon 120 Rigi-Grip, Victaulic Style 07 Zero-Flex, or Approved 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.

2. Unless otherwise specified, bolts and nuts shall comply with AWWA C606. Bolts for submerged service shall be Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.
3. Gaskets shall be as specified in paragraph 2.03 and AWWA C 606.

D. Equipment Connection Fittings

1. Equipment connection fittings shall provide both lateral and angular misalignment adjustment between equipment connection flanges and the connection to field piping systems by providing individually adjustable flexible joints at each connection. In addition, equipment connection fittings shall provide full pressure thrust restraint between the field piping connection and equipment connection flanges.
2. Equipment connection fittings shall consist of two flanged coupling adapters, a plain end section of pipe and thrust restraint rods and associated fittings designed to transmit thrust without transmitting shear to the thrust restraint rods and without compromising provisions for accommodating angular and parallel misalignment. Materials and features shall conform to the requirements established in this paragraph. Standard “dismantling joints” incorporate only one flanged coupling adapter and are not acceptable substitutes. Equipment connection fittings shall be Romac ECF Series, or Baker Coupling Company, Los Angeles or equal, modified as specified to provide the required features.
3. Equipment connection fittings shall each consist of a single sleeve of plain end piping conforming to the requirements of the specified piping system of sufficient length to span the gap between the connection at the equipment and the connection at the field piping with gasketed flange adapters at each end. Thrust restraint shall be provided by means of all threaded rod spanning between flanges and male rod nuts and female washers that are rounded to provide a ball-joint type self aligning feature. All threaded restraint rod shall project through flange and mating flange coupling adapter bolt holes or through holes in restraint lug plates that extend above the flanges and are secured to the flanges with a minimum of two flange bolts. Where the all threaded rods project through flange bolt holes, ball joint type nut and washer combinations and lock washers shall be provided at each face, each end. Where restraint lug plates are employed, ball joint type nuts and washers shall be provided only on the outside faces of the plates and the nuts shall have a self locking feature that prevents nut movement due to vibration or other operational or environmental causes. Double nutting with non-locking nuts shall not be an acceptable method of providing the self locking feature. Thrust rod diameter and material shall be selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings to accommodate piping misalignment without transmitting any shear to the thrust rods and also to permit full development of thrust restraint at all thrust rod tension take-ups. Design of equipment connection fittings shall conform to AWWA C219.

4. Thrust rods, restraint lug plates, nuts, washers and lock washers shall be Type 316 stainless steel, all selected to develop full rated piping system pressure thrust forces. Equipment connection fittings for pump applications shall have thrust rod number and diameter selected such that thrust rod stretch under piping system operating pressure does not exceed 2 mils. Calculations shall be submitted. Dry film molybdenum di-sulfide anti-galling compound shall be factory applied to ends of thrust rods, covering all threads subject to nut travel and tightening. Gaskets shall be as specified in paragraph 2.03. Flange gaskets shall be full face type. Follower gaskets shall be compression wedge type.
5. Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All metal portions of equipment connection fittings, with the exception of 316 stainless steel components, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61.

E. Dismantling Joints:
1. Dismantling joints may be used as takedown couplings in accordance with paragraph 3.03. Dismantling joints shall fully restrained double flange fittings consisting of a flange coupling adapter and flanged spool piece that allows for longitudinal adjustment. Thrust restraint shall be provided by means of all threaded rod spanning between flanges and secured to the flanges with a minimum of two flange bolts. Design of equipment connection fittings shall conform to AWWA C219. Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All metal portions of equipment connection fittings, with the exception of 316 stainless steel components, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61. Dismantling joints shall be Romac DJ-400, Smith Blair 975, Crane-Viking Johnson Dismantling Joint or Approved Equal.

F. Sleeve Band Couplings:
1. Sleeve band couplings shall be Victaulic Depend-O-Lock or Approved Equal. Unless otherwise noted, couplings for liquid service shall be Model F x F Type 2 fully restrained, shouldered high deflection couplings with standard width band. Couplings shall comply with AWWA C-219. Sleeve band couplings are acceptable wherever sleeve type couplings are used (paragraph 2.02 Sleeve Type Coupling).

G. Flexijoint Couplings:
1. Where specified Flexijoint couplings shall be Flanged Romac Flexijoint couplings or Approved Equal. The Flexijoint is a flexible, ductile iron joint that can accommodate expansion, contraction, rotation and bending and is rated at 350 psi working pressure. The joint can accommodate 15 to 20 degree deflection depending on size. Body shall be ductile iron, lock rings Type 410 stainless steel, and ring gasket, casing, ball and cover shall be EPDM molded watertight construction. All metal portions of Flexijoint coupling including the stainless steel lock rings shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61. For buried installations, install with polyethylene baggy cover in accordance with the manufacturer's instructions.

2.03 GASKETS

A. Gaskets designated in Section 40 05 01 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 (ASTM F152), 0.2 ML/HR LEAKAGE FUEL A (ASTM F37).
5. Compressed gasketing consisting of organic fibers (Kevlar) and SBR binder; ASTM F104 (F712400), 2500 PSI (ASTM F152), 0.1 ml/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: noncreeping tetrafluoroethylene (TFE) with insert filler.
10. PTFE bonded EPDM: PTFE bonded to EPDM in full-face gasket having concentric-convex molded rings; Garlock Stress Saver 370 or equal.

2.04 THREAD

A. Pipe thread dimensions and size limits shall conform to ANSI BI.20.1.

2.05 DIELECTRIC UNIONS

A. Dielectric unions shall be EPCO, Capitol Manufacturing, or equal.

2.06 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.

2.07 PRODUCT DATA

A. In accordance with Section 01 33 00, 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

3.01 PIPE CUTTING, THREADING AND JOINTING

A. Pipe cutting, threading and jointing shall conform to the requirements of ANSI B31.1.

3.02 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 05

01. Welds shall be made in accordance with the requirements of ANSI B31.3 for piping System 20 specified in Section 40 05 01.

B. Welds for piping systems not specified above shall be made in accordance with AWWA C206.

3.03 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.

B. A union or flanged connection shall be provided within 2 feet of each threaded end valve.

3.04 FLEXIBILITY

A. Unless otherwise specified, piping passing from concrete to earth shall be provided with two pipe couplings or flexible joints (or a single Flexijoint) as specified on the buried pipe within 2 feet of the structure for 2-inch through 6-inch diameter pipe; within 3 feet of the structure for 8-inch through 24-inch diameter pipe; and within one and one-half pipe diameters of the structure for larger pipe. Where required for resistance to pressure, mechanical couplings shall be restrained in accordance with Chapter 13 of AWWA M11, including Tables 13-4, 13-5 and 13-5A, and Figure 13-20.

3.05 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 paragraph 2.05 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.

3.06 EQUIPMENT CONNECTION FITTINGS

A. Where shown, equipment connection fittings shall be provided between field piping systems and equipment inlet and outlet connections.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 40 05 11

SANITARY SEWER PIPE LOW PRESSURE AIR AND DEFLECTION TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes the requirements and procedures for leakage and infiltration testing of gravity sewer systems.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Piping Systems: 40 05 01

B. Piping System Schedules: 40 05 02

C. Plastic Pipe: 40 05 20

D. Fusible Polyvinylchloride Pipe 40 05 31

1.03 SUBMITTALS

A. The Contractor shall submit a testing plan which includes: the testing methods, testing procedures and equipment.

1.04 CLEANING

A. Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, and 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.

1.05 FLUSHING

A. Prior to testing, all pipelines shall be flushed or blown out as appropriate. The Contractor shall test all pipelines either in sections or as a unit. The test shall be conducted in accordance with the applicable local state administrative code. The Contractor shall be responsible for ascertaining that all test plugs/bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe.

PART 2 MATERIALS

The Contractor shall furnish all equipment and materials required for testing.

PART 3 EXECUTION

3.01 LOW PRESSURE AIR TEST

A. Prior to testing, the section of the pipeline to be tested shall be filled at a rate which will not cause any surges. After the section of pipeline has been filled, the gravity sewer shall be placed under pressure in accordance with TCEQ 217.57(a)(1) Testing Requirements for Installation of Gravity Collection System Pipes: Low Pressure Air Test.

B. A pipe must be pressurized to 3.5 pounds per square inch (psi) greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop from 3.5 psi gauge to 2.5 psi gauge is computed from the following equation:

$$T = (0.085 \times D \times K) / Q$$

Where:
T = time for pressure to drop 1.0 psi gauge in seconds
K = 0.000419xDxL, but not less than 1.0
D = average inside pipe diameter in inches
L = length of same pipe size being tested, in feet
Q = rate of loss, 0.0015 cubic feet per minute per square foot internal surface

Since a K value of less than 1.0 may not be used, the minimum testing time for each pipe diameter is shown in the following table:

Pipe Diameter (inches)	Minimum Time (seconds)	Maximum Length for Minimum Time (feet)	Time for Longer Length (seconds/foot)
4	227	597	0.380
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1020	133	7.693
21	1190	114	10.471
24	1360	100	13.676
27	1530	88	17.309
30	1700	80	21.369
33	1870	72	25.856
36	2040	66	30.771

Note: Test time starts after the required 60 seconds of stabilization time has transpired.

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, Then the test shall continue for the entire test duration as outlined above or until failure.

Mains with a 27-inch average inside diameter and larger must be air tested at each joint. A visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to the test pressure specified in Specification 40 05 02.43 Pressurized and Gravity Wastewater Systems, Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 1.0 psi gauge shall be 10 seconds.

3.02 DEFLECTION TESTING

A. Deflection tests shall be performed on all flexible pipe. This test shall be conducted after the final backfill has been in place at least 30 days. A rigid mandrel shall be used to measure deflection for all pipelines. The test and methods shall be conducted in accordance to TCEQ, Texas Administrative Code, Title 30, Section 217, Sewage Collection System, most current edition. No pipe will exceed a deflection of 5%. If a pipe should fail to pass the deflection test, the problem must be corrected, and a second test must be conducted after the final backfill has been in place an additional 30 days. The tests must be performed without mechanical pulling devices. The Engineer should recognize that this is a maximum deflection criterion for all pipes and a deflection test less than 5% may be more appropriate for specific types and sizes of pipe.

B. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) not less than 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

C. Mandrel Design: The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

D. Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 40 05 12

PRESSURE TESTING OF PIPING

PART 1 GENERAL

1.01 GENERAL DESCRIPTION

A. This section specifies the hydrostatic and leakage testing of pressure piping for water transmission mains.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Disinfection of Piping: 40 05 13

B. Piping System: 40 05 01

C. Ductile Iron Pipe: 40 05 19

D. Steel Pipe: 40 05 24

E. Plastic Pipe: 40 05 31

1.03 SUBMITTALS

A. Submit pressure testing plan to include: test segments, testing sequence (stationing), bulkhead locations, testing equipment and protocol, testing pressures, pipe attachment details, and methods to prevent excessive pipe wall stresses.

B. Submit six (5) copies of the test records to the Engineer upon completion of the testing.

1.04 TEST PRESSURES

A. Test pressures for all sizes and types of piping as installed by this project shall be per Section 40 05 02.23 and 40 05 02.43.

1.05 TESTING RECORDS

Provide records of each piping installation during the testing. These records shall include:

A. Date of test.

B. Identification of pipeline, or pipeline section, tested or retested.

C. Identification of pipeline material.

D. Identification of pipe specification.

E. Test fluid.

F. Test pressure.

G. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

H. Certification by Contractor that the leakage rate measured conformed to the specifications.

PART 2 MATERIALS

2.01 VENTS AND DRAINS FOR ABOVEGROUND PIPING

A. Install vents on the high points of aboveground piping, whether shown in the drawings or not. Install drains on low points of aboveground piping, whether shown in the drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4-inch for piping 3 inches and larger and 1/2-inch for piping smaller than 3 inches. Valves shall be as specified, unless otherwise shown in the drawings.

2.02 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

A. Provide temporary manual air-release valves for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

2.03 TEST BULKHEADS

A. Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

2.04 TESTING FLUID

A. For potable water pipelines, obtain and use only potable water for hydrostatic testing.

B. Submit request for use of water from waterlines of Engineer 48 hours in advance.

2.05 TESTING EQUIPMENT

A. Provide pressure gauges, pipes, bulkheads, pumps, compressors, meters, and other appurtenances to perform the hydrostatic testing.

PART 3 EXECUTION

3.01 TESTING PREPARATION

A. Pipes shall be in place, backfilled, and anchored before commencing pressure testing.

B. Conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. Perform the final pressure test, however, after completely backfilling and compacting the trench.

D. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

E. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing. Drain the pipes after they have been tested.

3.02 CLEANING

A. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 fps for water testing. Flush pipes for time period as given by the formula

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)
L = pipe length (feet).

B. For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

3.03 TESTING AND DISINFECTION SEQUENCE FOR POTABLE WATER PIPING

A. Perform required chlorination after hydrostatic testing, except when pipeline being tested is connected to a potable waterline.

B. Locate and install test bulkheads, valves, connections to existing pipelines, and other appurtenances in a manner to provide an air gap separation between existing potable water pipelines and the pipeline being tested. Disinfect water and pipeline being tested before hydrostatic testing when connected to a potable waterline.

3.04 LENGTH OF TEST SECTION FOR BURIED PIPING

A. The maximum length of test section for buried pipe of 12 inches or smaller in diameter is 3,500 feet; for buried pipe larger than 12 inches, between valves or as approved by the Engineer. Provide intermediate test bulkheads where the pipeline length exceeds these limits.

3.05 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

A. Maximum rate of filling shall not cause water velocity in pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

3.06 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

A. Prior to testing new pipelines which are to be connected to existing pipelines, isolate the new line from the existing line by means of test bulkheads, spectacle flanges, or blind flanges. After the new line has been successfully tested, remove test bulkheads or flanges and connect to the existing piping.

3.07 HYDROSTATIC TESTING OF ABOVEGROUND OR EXPOSED PIPING

A. Open vents at high points of the piping system to purge air while the pipe is being filled with water. Venting during system filling may also be provided by temporarily loosening flanges. Subject the piping system to the required psi test pressure per Section 15050. Maintain the test pressure for a minimum of two hours. Examine joints, fittings, valves and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

3.08 HYDROSTATIC TESTING OF BURIED PIPING

A. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

B. Apply and maintain the test pressure by means of a positive displacement hydraulic force pump.

C. Maintain the test pressure for the following duration by restoring it whenever it falls an amount of 5 psi:

Pipe Diameter (inches)	Hours
18 and less	1
20 to 48	2

D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage volume is defined by the formula

$$L = \frac{HND(P)^{1/2}}{C}$$

in which:

L = allowable leakage (gallons)
H = specified test period (hours)
N = number of rubber-gasketed joints in the pipe tested
D = diameter of the pipe (inches)
P = specified test pressure (psig)
C = 7,400

E. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.

F. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

3.09 REPETITION OF TEST

A. If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

3.10 BULKHEAD AND TEST FACILITY REMOVAL

A. After a satisfactory test, remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 40 05 19

DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies ductile iron pipe and fittings.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 50 00 – Construction Facilities

C. Section 40 05 01 – Piping Systems

D. Section 40 05 02 – Piping System Schedules

E. Section 40 05 06.16 – Mechanical Pipe Couplings

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ASME B16.5	Pipe Flanges and Flanged Fittings
ASTM C150	Portland Cement
ASTM A716	Standard Specification for Ductile Iron Culvert Pipe
AWWA C104	Cement-Mortar Lining for Ductile- Iron and Gray-Iron Pipe
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber-Gasket Joints for Ductile- Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
AWWA C116	Protective Fusion-Bonded-Epoxy Coating for the Interior and Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings.
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast
AWWA C153	Ductile-Iron Compact Fittings
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances.

Reference	Title
AWWA C606	Grooved and Shouldered Type Joints
ISO 8179-1	Ductile Iron Pipes – Externa Zinc-based Coating - Part 1: Metallic Zinc with Finishing Layer

1.04 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00
   2. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer is the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   3. For pipes 20 inches and greater submit shop drawings.
      a. Manufacturer's pipe design calculations.
      b. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Engineer.
      c. Calculations and limits of thrust restraint.
      d. Class and length of joint.
   4. Manufacturer's product data, catalog cuts, dimensions and materials. Indicate each Piping System Schedule where the product will be used.

B. Informational Submittals:
   1. Procedures: Section 01 33 00
   2. Certifications indicated in the following documents:
      a. ASTM A716, sworn statement of inspection and certification.
      b. AWWA C110, certification of inspection and testing.
      c. AWWA C111, record of specified tests.
      d. AWWA C115, affidavit of compliance.

e. AWWA C151, manufacturer's statement and affidavit of compliance.
f. AWWA C606, affidavit of compliance.
g. Ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.
h. Pipe joints have been tested and meet requirements of ANSI A 21.11.
i. Compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01 50 00 for shipment and storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. All pipe system materials to be new, free from defects and conforming to the requirements and standards identified in Section 40 05 02 and related sections.

B. Pipe.
1. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections.

2.02 PIPE LINING

A. Provide pipe and fittings with lining as specified in Piping System Schedules. Requirements for each lining type are specified in this Section.
1. Cement Mortar Lining.
a. Factory applied.
b. Line pipe and fittings with cement mortar as specified in AWWA C104.
c. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkalis
d. Patch field welds, cuts, connections, and damaged lining in accordance with AWWA C104.
2. Ceramic Epoxy
a. Factory applied.
b. Line pipe and fittings with amine cured novolac epoxy containing at least 20 percent ceramic quartz pigment.
c. 40 mils minimum thickness.
d. Candidate Manufacturers:
1) Protecto 401
2) Or Approved Equal

2.03 PIPE COATING

A. Provide pipe with coating as specified in Piping System Specification Sheets in Section 40 05 02. Requirements for each coating type are specified in this Section.

1. Asphaltic Coating
    a. Factory applied.
    b. Coat pipe and fittings with 1 mil, minimum, of asphaltic material as specified in AWWA C151.
2. Polyethylene Encasement.
    a. Field installed.
    b. Encase pipe and fittings in polyethylene wrap as specified in AWWA C105.
    c. Polyethylene tubing shall be Anti-microbial, Low Density Polyethylene (LDPE) or High Density Polyethylene (HDPE):
        1) LDPE: 8-mil linear low density polyethylene film meeting the requirements of AWWA C105, impregnated with ½ percent NM-100 anti-microbial compound. Fulton Enterprises Biofilm, or Or Approved Equal.
        2) HDPE: 4-mil high-density, cross-laminated polyethylene film meeting the requirements of AWWA C105.
    d. Seam/Joint Tape – Acceptable manufacturer:
        1) Polyken No. 900 (polyethylene).
        2) Scotchwrap No. 50 (polyvinyl).
        3) Or Approved Equal.
3. V-Bio Enhanced Polyethylene Encasement
    a. Field installed
    b. Encase pipe and fittings in polyethylene tubing as specified in AWWA C105.
    c. Three layer, co-extruded, linear low density polyethylene wrap.
    d. 8 mils minimum wrap thickness
    e. Inner surface of polyethylene wrap infused with anti-microbial biocide and corrosion inhibitor.
    f. Candidate Manufacturers:
        1) V-Bio
        2) Or Approved Equal
4. Epoxy Primer.
    a. Factory or shop applied.
    b. Coat pipe and fittings with Amide or Polyamide cured epoxy, 4 to 6 mils DFT
5. Uncoated
    a. Provide pipe and fittings with a bare metal (no coating) exterior.

2.04 JOINTS, AND COUPLINGS

A. Push-On (PO) Joint (Unrestrained)
    1. Rubber ring compression gasket, push-on type joints conforming to AWWA C111.
    2. 5 degree deflection at rated operating pressure for joints on 4-inch through 30-inch pipe.
    3. Candidate manufacturers:
        a. American Cast Iron Pipe Company Fastite
        b. U.S. Pipe Tyton Joint

c. Or Approved Equal

B. Restrained Push-On (RPO) Joint
   1. Restrained, rubber ring compression gasket, push-on joints conforming to AWWA C111
   2. Restrained by the interference of metallic rings, bolts, locking segments or other interlocking components with flanges, lugs, beads, grooves or retainer rings that are integrally cast into or welded onto both ends of the joint. Restrained joints with gripping wedges, or gripping gaskets, radial pads, or other devices that penetrate, grip, or embed in the pipe material to resist axial thrust loads are not acceptable.
   3. Candidate manufacturers:
      a. American Cast Iron Pipe Company, Flex-Ring or Lok-Ring
      b. U.S. Pipe, TR Flex or HP LOK
      c. Or Approved Equal

C. Mechanical Joint (MJ)
   1. Mechanical Joints per AWWA C110 and AWWA C111.

D. Restrained Mechanical Joint (RMJ)
   1. Restrained by tie-rods/bolts tying the gasket gland to a second retainer/follower gland behind a welded ring on the spigot end of the joint. Restrained joints with gripping wedges, or gripping gaskets, radial pads, or other devices that penetrate, grip, or embed in the pipe material to resist axial thrust loads are not acceptable.
   2. Fully restrained mechanical joints for above or below ground service conforming to AWWA C110 and AWWA C111.
   3. Candidate manufacturers:
      a. American Cast Iron Pipe Company, Mechanical Joint Coupled Joint
      b. U.S. Pipe, MJ HARNESS-LOK
      c. Or Approved Equal

E. Grooved couplings (CGRV) and fittings.
   1. When pipe wall thickness does not meet the minimum requirements of AWWA C606 for rolled or cut groove joints, provide shouldered ends per the requirements of AWWA C606.
   2. Candidate manufacturers.
      1) Victaulic
      2) Gruvlok
      3) Or Approved equal.
   3. Grooved end flanged coupling adapters candidate manufacturers:
      a. Victaulic Style 341
      b. Or Approved Equal
   4. Grooved end transition couplings to steel pipe candidate manufacturers:
      a. Victaulic Style 307
      b. Or Approved Equal

F. Bell and Ball Spigot Flexible (BABS) Joint.

1. Boltless type with retainer lock to prevent rotation after assembly
2. Up to 15 degrees of deflection at operating pressure
3. Candidate manufacturers.
    a. Flex-Lok Joint by American Cast Iron Pipe
    b. USIFlex by US Pipe
    c. Or Approved equal.

G. Sleeve/Transition Coupling.
1. When connecting new ductile iron piping to existing piping, field verify outside diameters of existing pipe prior to connection. See drawings for location and installation requirements. Transition coupling shall be restrained.
2. Candidate Manufacturers.
    a. Romac, "501"
    b. JCM, "212"
    c. Smith-Blair, "461"
    d. Or Approved Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
1. Follow piping routes specified on the drawings as closely as possible. Submit proposed deviations in accordance with Section 01 33 00.
2. Install pipe in accordance with AWWA C600.
3. Make connections to existing structures and manholes so that the finished work will conform as nearly as practicable to the requirements specified for new manholes, including necessary concrete work, cutting and shaping. Shape concrete mortar within any structure and manhole as specified.

B. Insulating Sections: Where a metallic nonferrous pipe/appurtenance connects to ferrous pipe/appurtenance or when connecting new metallic piping to existing metallic piping, provide an insulating section per Section 40 05 06.16.

C. Anchorage: Provide as specified on the Drawings.

3.02 REPAIR/RESTORATION

A. Per Section 40 05 01.

3.03 COMPONENT TEST PHASE

A. Buried Piping: Test hydrostatic pressure in accordance with Section 5 of AWWA C600, using the test pressures and allowable leakage specified in Section 40 05 01.

B. Exposed and Concrete Encased Piping: Conduct hydrostatic pressure tests in accordance with Section 40 05 01.

3.04 POLYETHYLENE ENCASEMENT

A. Install polyethylene as specified in AWWA C105 and within this Section.

B. Potable Water Pipe: Single wrap, 4-mil high density polyethylene.

C. Wrapping:
   1. Wrap buried pipe, fittings, valves, and couplings.
   2. Prior to the placing of concrete, wrap fittings that require concrete backing.
   3. Wrap the polyethylene tube seams and overlaps and hold in place by means of a 2-inch-wide plastic backed adhesive tape.
   4. The tape shall be such that the adhesive shall bond securely to both metal surfaces and polyethylene film.
   5. Bedding and initial backfill for polyethylene wrapped pipe shall be a well-graded granular material to avoid cutting or damaging the polyethylene tube during placement and backfilling.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 40 05 20

POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies:
   1. Polyvinyl chloride (PVC solid wall) pressure pipe for water distribution, in nominal diameters 6 inches through 12 inches.
   2. Polyvinyl chloride pressure pipe for force mains in nominal diameters 6 inches through 12 inches.
   3. Polyvinyl chloride pressure pipe for siphons in nominal diameters 24 through 36 inches.
   4. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 6 inches through 18 inches.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 66 00 – Product Storage and Handling Requirements

C. Section 40 05 01 – Piping Systems

D. Section 40 05 02 – Piping System Schedules

E. Section 40 05 06.16 – Piping Connections

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM D618	Methods of Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D883	Definitions of Terms Relating to Plastics
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D2122	Method of Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2412	Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading
ASTM D2444	Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by means of a tub
ASTM D2855	Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

Reference	Title
ASTM D3212	Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals
ASTM F402	Practice for Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
ASTM F412	Definitions of Terms Relating to Plastic Piping Systems
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F679	Poly (Vinyl & Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F794-7	Standard Specification for PVC Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F794-7	
ASTM F1057	Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique
ASTM F1803-97	Standard Specification for PVC Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter
AWWA C605	Underground Installation of PVC pressure pipe and fittings for water
	PVC Water Transmission Pipe (diameters 14 to 36 inches)
AWWA C905	Recommended Specification for Thermoplastic Pipe Joints, Pressure and Non-Pressure Applications
UNI-B-1	
UNI-B-5	Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe
UNI-B-6	Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe
ASTM D395	Rubber Property--Compression Set, Test for
ASTM D312	Joints for Drain and Sewer Pipes Using Flexible Elastomeric Seals
ASTM D412	Rubber Properties in Tension, Test for
ASTM D471	Rubber Property--Effect of Liquids, Test for
ASTM D573	Rubber--Deterioration in an Air Oven, Test for
ASTM D1149	Rubber Deterioration--Surface Ozone Cracking in a Chamber (Flat Specimens), Test for
ASTM D2240	Rubber Property--Durometer Hardness, Test for

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00
2. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer is the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Manufacturer's product data, catalog cuts, dimensions and materials. Indicate each Piping System Schedule where the product will be used.

B. Informational Submittals:
   1. Procedures: Section 01 33 00
   2. Certifications indicated in the following documents:
      a. Manufacturer's certificates of compliance with the specified standards and Contractor's layout drawings. Each such certification shall be signed by an authorized agent of the manufacturer. AWWA C110, certification of inspection and testing.
      b. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.
      c. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01 66 00 for shipment and storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. All pipe system materials to be new, free from defects and conforming to the requirements and standards identified in Section 40 05 02 and related sections.

B. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

C. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

D. Joint Restraint:
   1. AWWA C900 Pipe
      a. Restrained joints are required for all fittings, bends, valves and tees.
      b. PVC Pipe at Mechanical Joint: Mechanical Joint Wedge Restraint, Series 2000SV MEGALUG or Approved Equal. Match pressure rating.
      c. PVC Bell and Spigot Joints: Bell Restraint Harness, Series 1600 by EBAA Iron Sales or Approved Equal. Match pressure rating.
   2. AWWA C905 Pipe
      a. Restrained joints are required for all fittings, bends, valves and tees.

b. PVC Pipe at Mechanical Joint: Mechanical Joint Wedge Restraint, Series 2200 MEGALUG or Approved Equal. Match pressure rating.

c. PVC Bell and Spigot Joints: Bell Restraint Harness, Series 2800 by EBAA Iron Sales or Approved Equal. Match pressure rating.

d. PVC Joint at Fusible PVC Joint: Restrained Coupling.

E. Gaskets:

1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory- installed gaskets to make joints flexible and watertight.
2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

2.02 WATER SERVICE PIPE

A. Pipe 6 inch through 12 inch: AWWA C 900, Class 235, DR 18; AWWA C 900, Class 305, DR 14 as specified; nominal 20-foot lengths; cast-iron equivalent outside diameters, and conforming to minimum working pressure rating specified in Section 40 05 02.23 Pressurized and Gravity Wastewater Systems.

B. Pipe shall conform to the following dimensionality and general characteristics table:

C. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Engineer.

D. Hydrostatically test pressure rated pipe in accordance with Section 40 05 12 Pressure Testing of Pipeline.

2.03 SEWER SIPHON PIPE

A. Pipe 24 inch through 36 inch: AWWA C 905, Class 10, DR 41 as specified; nominal 20-foot lengths; cast-iron equivalent outside diameters and conforming to minimum working pressure rating specified in Section 40 05 02.23 Pressurized and Gravity Wastewater Systems.

B. Pipe shall conform to the following dimensionality and general characteristics table:

Usage	AWWA Designation	Nominal Diameter (in.)	DR	Color	Pressure Class (psi)	STD Length (ft)
Low Pressure Sewer	AWWA C905	30	41	Green	100	20

C. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Engineer.

D. Fittings: Provide approved ductile iron fittings as per Section 40 05 19 Ductile Iron Pipe, and 40 05 02.43 Pressurized and Gravity Wastewater Systems.

E. Low pressure air test at and deflection testing per Section 40 05 11 Sanitary Sewer Pipe Low Pressure Air And Deflection Testing.

2.04 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe shall be in accordance with provisions in following table:

Usage	ASTM Designation	Nominal Diameter (in.)	SDR	Color	Pipe Stiffness (psi)	STD Length (ft)
Gravity Sewer	ASTM D3034 ASTM F477	6 to 15	35	Green	46	20
Gravity Sewer	ASTM F679 ASTM3212 ASTM F477	18	-	Green	46	20

B. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTMD 2444.

C. Bends and Fittings: ANSI A 21.10, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating.

D. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Engineer. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or - 3.6 degrees F and 50 percent relative humidity plus or - 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

E. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance withTest Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

F. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

G. Low pressure air test at and deflection testing per Section 40 05 11 Sanitary Sewer Pipe Low Pressure Air And Deflection Testing.

2.05 JOINTS, AND COUPLINGS

A. All joints shall show no sign of leakage when tested in accordance with ASTM D3212 or the non-pressure applications of UNI-B-1. All surfaces of the joint, upon which the gasket may bear, shall be smooth and free of imperfections, ridges, fractures or cracks that could adversely affect seal ability.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Follow piping routes specified on the drawings as closely as possible. Submit proposed deviations in accordance with Section 01 33 00.
2. The pipe and fittings shall be essentially uniform in color, capacity, density and other properties. The inside and outside surfaces shall be semimatte or glossy in appearance and free of chalking, sticky or tacky material. The pipe walls shall be free of cracks, holes, blisters, voids, foreign inclusions or other defects that are visible to the naked eye and that may affect the wall integrity.
3. Unless otherwise specified, PVC pipe 15 inches in diameter and greater shall be joined by means of gasketed push on joints.
4. Make connections to existing structures and manholes so that the finished work will conform as nearly as practicable to the requirements specified for new manholes, including necessary concrete work, cutting and shaping. Shape concrete mortar within any structure and manhole as specified.

B. Anchorage: Provide as specified on the construction documents.

C. Over Homing: The contractor shall monitor, control, and eliminate installation practices involving “over homing” each joint of pipe, spigot to bell, as the pipe laying progresses. The recommended practice (AWWA M23) is to use hand or bar with block methods of pushing one joint into another. Construction machinery should be used only at the direction of the manufacturer. A circumferential reference mark is placed on the pipe’s spigot end by the manufacturer to indicate the correct depth of spigot penetration into the pipe’s gasket joint. If undue resistance to insertion of the pipe end is encountered, or if the reference mark does not position properly, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat (“fish mouthed”), inspect components, repair or replace damaged items, clean the components, and repeat the assembly steps. Ensure that pipe lengths are in concentric alignment. If gasket is not out of position, verify proper location of the reference mark. Relocate the reference mark if it is out of position. Few fittings allow as much spigot insertion length as do pipe bells and couplings.

END OF SECTION

SECTION 40 05 24

STEEL PIPE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies steel pipe and fittings.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 50 00 – Temporary Construction Facilities and Controls

C. Section 40 05 01 – Piping Systems

D. Section 40 05 02 – Piping System Schedules

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASME B16.3	Malleable Iron Threaded Fittings, Class 150 and 300
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	Forged Steel Fittings, Socket-Welding and Threaded
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A47	Ferritic Malleable Iron Castings
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105/A105M	Forgings, Carbon Steel, for Piping Components
ASTM A106	Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A197	Cupola Malleable Iron
ASTM A234/A234M	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A283/A283M	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A1011/A1011M	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

Reference	Title
ASTM A572/A572M	High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
AWWA C200	Steel Water Pipe 6 Inches (150 mm) and Larger
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe, DN100 mm and Larger, Shop Applied
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services--Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipe
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA C218	Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings
AWWA C222	Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
AWWA C606	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Joints
AWWA M11	Steel Pipe, a Guide for Design and Installation
SSPC-SP10	Near-White Blast Cleaning.

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00
2. A copy of this specification section, addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations.
3. Manufacturers' product data, catalog cuts, installation details, and dimensions. Indicate each piping system that will use each steel pipe product or installation detail described in the Manufacturers' product data, catalog cuts, and installation details.
4. Pipe wall thickness calculations for pipe fabricated per AWWA C200. Demonstrate the maximum permissible internal design pressure in the pipe based on the wall/shell thickness specified in the Piping System Schedule for the associated Process Service and pipe size and the support and/or bedding conditions specified on the Drawings. Steel pipe design calculations conform to AWWA M11.
5. Pipe wall thickness and reinforcement calculations for fittings fabricated per AWWA C208. Demonstrate that the maximum permissible internal design pressure for fabricated fittings matches or exceeds the maximum permissible internal design pressure in the connecting pipe for the support and/or bedding conditions specified on the Drawings. Fabricated steel pipe fitting design calculations conform to AWWA M11.
6. Calculations for any pipe and fittings that are not fabricated per one of the components standards listed in the specified ASME B31 code.

7. Affidavits of Compliance with the provisions of AWWA C200, ASTM A53, or ASTM A106, as applicable for the specified pipe materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01 50 00 for Shipment and Storage.

B. Deliver pipe and fittings with stulling end protectors in place. Do not remove stulling or end protectors until materials are about to be installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. All pipe system materials to be new, free from defects and conforming to the requirements and standards identified in the Piping System Schedules.

2.02 PIPE LINING

A. Provide pipe with lining as specified in Piping System Schedules in Sections 40 05 02.00 through 40 05 02.43. Requirements for each lining type are specified in this Section. Apply linings for steel pipe at the factory or shop. Unless specifically prohibited in this Section, repair of steel pipe linings damaged after the pipe has left the factory or fabrication shop may be performed at the project site.
   1. Epoxy Lining.
      a. Line pipe and fittings with a liquid epoxy as specified in AWWA C210.
      b. Do not incorporate coal tar products into the liquid epoxy.
      c. Apply to a minimum thickness of 16 mils in not less than two coats.
      d. Patch field welds, connections and damaged lining in accordance with AWWA C210.
   2. Cement Mortar Lining.
      a. Line pipe and fittings with cement mortar as specified in AWWA C205.
      b. Fittings and specials larger than24 inches, not fabricated from centrifugally lined straight sections, require 2 inch by 4 inch by 13 gage self-furring wire mesh reinforcement for hand applied lining.
      c. Patch field welds, connections and damaged lining in accordance with AWWA C205.
   3. High Temperature Service Epoxy Lining.
      a. Steel pipe and fittings: epoxy lined with not less than 15 mils of epoxy suitable for temperatures to 750 degrees F.
      b. Prepare surfaces in accordance with SSPC SP 10 Near White Blast Cleaning, and apply lining as recommended by the manufacturer.
      c. Patch field welds, connections and damaged lining per coating manufacturer's recommendations.
      d. Candidate manufactures:
         1) Dampney, Thurmalox 225 HD.
         2) PPG, Hi Temp 1027.

3) Or approved equal.

4. Glass Lining.
   a. Factory or Shop applied.
   b. Grind all internal welds smooth and grind out any voids or slag holes. Re-weld to fill ground out voids and slag holes and grindsmooth.
   c. Line pipe and fittings with glass lining, 10 mils minimum thickness, using a dual layer coating system of vitreous material.
   d. Provide continuous coverage glass lining 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.
   e. Damaged glass lining cannot be repaired. Damaged glass lined pipe must be replaced.
   f. Candidate manufacturers:
      1) Ferrock, MEH 32.
      2) Vitco SG 14.
      3) Or approved equal.
5. Polyurethane Lining.
   a. Line pipe and fittings with polyurethane as specified in AWWA C222.
   b. Patch field welds, connections and damaged lining in accordance with AWWA C222.
   c. Candidate manufacturers:
      1) Lifelast Durashield 210.
      2) Or approved equal.

2.03 PIPE COATING

A. Provide pipe with coating as specified in Piping System Schedules in Sections 40 05 02.00 through 4 05 02.99. Requirements for each coating type are specified in this Section. Apply coatings to steel pipe at the factory or fabrication shop. Unless specifically prohibited in this Section, repair of steel pipe coatings damaged after the pipe has left the factory or fabrication shop may be performed at the project site.

B.

1. Epoxy Coating.
   a. Coat pipe and fittings with a liquid epoxy as specified in AWWA C210.
   b. Do not incorporate coal tar products into the liquid epoxy.
   c. Apply coating to a minimum thickness of 16 mils in not less than two coats.
   d. Patch field welds, connections and damaged coating in accordance with AWWA C210.
2. Polyethylene Tape Coating.
   a. Coat and wrap pipe and fittings with prefabricated multilayer cold applied polyethylene tape coating in accordance with AWWA C209 and AWWA C214.
   b. Apply coating in a continuous step operation in conformance with AWWA C214, Section 3.
   c. The total coating thickness: not less than 50 mils for pipe 24-inch and smaller and not less than 80 mils for pipe 30-inch and larger.

d. Patch field welds, connections and damaged in accordance with AWWA C209 and AWWA C214.

3. Polyurethane Coating.
   a. Coat pipe and fittings with polyurethane as specified in AWWA C222.
   b. Patch field welds, connections and damaged coating in accordance with AWWA C222.
   c. Candidate manufacturers:
      1) Lifelast Durashield 210.
      2) Or approved equal.
4. Three Coat Zinc/Epoxy/Urethane Coating.
   a. Coat pipe and fittings with a three coat system as specified in AWWA C218.
   b. Patch field welds, connections and damaged coating in accordance with AWWA C218.
5. Cement Mortar Coating.
   a. Coat pipe and fittings with cement mortar as specified in AWWA C205.
   b. Patch field welds, connections and damaged coating in accordance with AWWA C205.

2.04 FUSION BONDED EPOXY COATING AND LINING.

1. Line and coat per AWWA C213.
2. NSF 61 certified for potable water applications.
3. Application Method: fluidized bed method, attaining 12 mils minimum dry film thickness.
4. Surface Preparation: in accordance with SSPC SP 10 Near White Blast Cleaning.
5. Patch field welds, connections and damaged areas according to the manufacturer's instructions with 3M Scotchkote 306 and AWWA C213.
6. Candidate manufacturers:
   a. 3M Scotchkote 206N.
   b. Or approved equal.

2.05 FITTINGS

A. Steel fittings: Provide straight tapered reducers for fabricated fittings. Fabricated flanged and flued reducers and bushing type abrupt reducers are not permitted.

2.06 JOINT TYPES

A. BAS – Bell and Spigot
   1. Bell end and spigot end formed into the ends of the pipe cylinder.
   2. Swedged bell and roll formed groove that retains an O-ring gasket in the spigot end.
   3. Insertion of the spigot compresses the O-ring against the inner wall of the flared bell end to form a watertight seal.

B. CPO – Compression Type Push-On (Carnegie O-ring Gasket Joint)
   1. Prefabricated bell end and spigot end are welded to the ends of the pipe cylinder.

2. Carnegie spigot ring with formed groove that retains an O-ring gasket.
3. Weld on bell ring.
4. Insertion of the spigot compresses the O-ring against the inner wall of the bell ring to form a watertight seal.

2.07 WELD JOINT TYPES

A. BW – Butt Weld Joint
   1. Unmodified pipe cylinder ends butted end to end and joined by welding.

B. BSW – Butt-Strap Joint
   1. Unmodified pipe cylinder ends with an end gap and an exterior strap spanning the end gap.
   2. Pipe cylinders joined to strap with circumferential fillet welds on the exterior of the pipe cylinder.

C. SLW – Single Lap Weld (Inside or Outside)
   1. Bell end formed into end of pipe cylinder.
   2. Unmodified end of pipe cylinder for Spigot end.
   3. Single circumferential fillet weld to join lapped bell end to spigot end.

D. DLW – Double Lap Weld
   1. Bell end formed into end of pipe cylinder.
   2. Unmodified end of pipe cylinder for Spigot end.
   3. Two circumferential fillet welds join lapped bell end to spigot end. One weld on the exterior of the pipe and the other on the pipe interior.

E. SW – Socket Weld
   1. Fittings, valves, and couplings include a recess or socket for insertion of plain end pipe.
   2. A single circumferential fillet weld joins the pipe and coupling or fitting.

2.08 COUPLINGS

A. Grooved Coupling, cut or cast groove (CGRV) and rolled groove (RGRV):
   1. Installed with rolled, cast, or cut groove dimensions per AWWA C606.
   2. Flexible or Rigid Couplings as specified in the Piping System Schedules.
   3. Candidate manufacturers.
      a. Victaulic
      b. Gruvlok
      c. Or approved equal.

B. Proprietary Grooved Coupling (PGRV):
   1. Groove dimensions per coupling manufacturer's requirements.
   2. Flexible or Rigid Couplings as specified in the Piping System Schedules.
   3. When pipe wall thickness does not meet the minimum requirements for the specified groove joint(s), provide shoulder ends or ring adapters welded to pipe ends.

4. Candidate manufacturers.
    a. Victaulic AGS
    b. Or approved equal.

C. Ring Joint Coupling (RJC):
1. Circumferential coupling segments bolted together to engage shouldered end or ring adpapters. Groove dimensions per coupling manufacturer's requirements.
2. Flexible or Rigid Couplings as specified in the Piping System Schedules.
3. When pipe wall thickness does not meet the minimum requirements for the specified groove joint(s), provide shoulder ends or ring adapters welded to pipe ends.
4. Candidate manufacturers.
    a. Victaulic Vic-Ring
    b. Or approved equal.

D. Bolted split sleeve couplings (BSS):
1. AWWA C227 compliant sleeve with single or double arch cross section of the same material with a body thickness equal to or greater than that of connecting pipe wall thickness.
2. Candidate manufacturers.
    a. Victaulic, Style 231 through 234.
    b. Or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.
1. Use couplings and prefabrication of pipe systems at the factory to minimize field welding to the greatest extent possible. Field welds conform to specified field welding requirements.
2. Install pipe in accordance with AWWA M11, Chapter 16.

B. Weather conditions.
1. Perform welding only when the surfaces are completely free of any moisture.
2. Do not weld the pipe during periods of high winds or rain unless the areas to be welded are properly shielded.

C. Field welding.
1. Except where the Piping System Schedule specifies compliance with ASME Pressure Piping Codes (ASME B31.1, ASME B31.3, etc.) make field welds per AWWA C206 using shielded metal arc, gas shielded arc, or submerged arc welding methods. Make welds per the specified Pressure Piping Code when these codes are specified for the Piping System in the Piping System Schedule.
2. Provide double-groove (double-vee) circumferential welds for butt welds on 30 inch diameter and larger joints. Provide single-groove (single-vee) circumferential welds for butt welds on joints less than 30 inch diameter. If backing rings are used,

completely remove them after welding is complete and deburr, grind, and clean the area per AWWA C206.

3. Apply pipe lining and coatings at field joints as specified in this Section.

D. Coating.

1. Field coat buried mechanical couplings and valves as specified in Section 40 05 01.

E. Anchorage.

1. Provide concrete thrust blocks only where specified on the drawings.
2. Submit calculations and drawings for proposed alternative thrust restraint or pipe anchorage.

F. Provide weld neck flanges on both sides of wafer, lug body, or flanged valves.

3.02 REPAIR/RESTORATION

A. Per Section 40 05 01.

3.03 COMPONENT TEST PHASE

A. Per Section 40 05 01.

END OF SECTION

SECTION 40 05 45

PIPING SYSTEM IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the supply and installation of permanent identification labels and markers for piping systems.

B. Requirements for the supply and installation of permanent identification tags for valves are specified in Section 40 05 60.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01 33 00 – Submittal Procedures
   2. Section 01 45 00 – Area Exposure Designations
   3. Section 40 05 02 – Piping System Schedules
   4. Section 40 05 60 – Valves

1.03 REFERENCES

A. References:
   1. This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
   2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, has been discontinued or has been replaced.

Reference	Title
ASME A13.1	Scheme for the Identification of Piping Systems
ANSI Z535.1	Safety Colors/APWA Uniform Color Code for Marking Underground Utilities

1.04 DEFINITIONS

A. Terminology used in this Section conforms to the following definitions:
   1. Embedded/Encased piping: Piping enveloped in concrete, typically under structures or under roadways.

2. Exposed: All area exposures specified in Section 01 45 00 other than buried, submerged, or encased/embedded.
3. Buried: Below grade walls or roofs; locations covered and in contact with earth/soil.

1.05 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00.
   2. Provide a full line product brochure showing available Piping System Marker and Detectable Warning Tape standard text and color options. Submit all text and colors proposed for use.
   3. Provide manufacturer's recommended installation instructions for Detectable Warning Tape.
   4. Provide product brochures and data sheets for tracer wire and splice kits. Submit all wire insulation colors proposed for use.
   5. Submit proposed tracer wire access box(es) for test leads. Submit electrical continuity test results upon completion.
   6. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

B. Informational Submittals:
   1. Procedures: Section 01 33 00
   2. Electrical continuity test results.
   3. Sample of each piping identification plastic marker used.
   4. Sample of each detectable warning tape used.

PART 2 PRODUCTS

2.01 PIPING SYSTEM MARKERS FOR EXPOSED PIPE

A. Identify material contained in exposed piping systems using a colored plastic marker legend system conforming to ASME A13.1.
B. For exposed piping, provide pre-coiled mechanically attached type colored markers that are easily removable. Adhesive type markers are not acceptable.
   1. Resistant to petroleum based oils and grease and meet criteria for humidity, solar radiation, rain, salt, fog, leakage and fungus specified by MIL-STD-810.
   2. Withstand a continuous operating temperature range of -40 to 250 degrees.
   3. Manufactured and applied in one continuous length of plastic including directional arrows. Markers comprised of letters and directional arrows individually applied to the maker are not acceptable. Legends and arrows printed on polyester subsurface and over laminated with Tedlar.
   4. Text size per ASME A13.1.
   5. Marking Services Style MS-995, Brady Style B-689, or approved equal.

C. Each piping system marker to be color coded for identification and labelled with the Process Service Identifier and directional flow arrows indicating the direction of flow in the pipe. Piping System marker background colors are specified in Section 40 05 02 for each process service. Except for piping system markers with an orange, yellow or white background color, provide white text and directional arrows for all piping system markers. Provide black text and directional arrows for pipe markers with an orange, yellow or white background.

2.02 DETECTABLE WARNING TAPE AND TRACER WIRE FOR BURIED PIPE

A. Provide Detectable Warning Tape for all buried piping:
   1. Detectable Warning Tape shall be 6 inches wide, colored per ANSI Z535.1 (APWA Uniform Color Code for Marking Underground Utilities) and made of inert plastic material suitable for direct burial with solid aluminum foil core. Minimum 5 mil laminate thickness. Tin or nickel plated clips for joining sections of tape, as provided by the tape manufacturer.
   2. Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or approved equal.
   3. Print two messages on buried Detectable Warning Tape. The first message reads **"CAUTION CAUTION CAUTION _____ PIPE BURIED BELOW"** with bold letters approximately 2 inches high. Fill the blank with the Process Service name. The second message reads **"CALL____"** with letters approximately 3/4 inch high. Both messages printed at maximum intervals of 2 feet. Fill the blank with phone number provided by the Construction Manager.

B. Install tracer (locate) wire along the buried portion of pipe alignments for the following piping services: [Edit as required for the project. Examples: LSG, CD, ML, NG, POL]
   1. Direct burial rated, 12 gauge solid copper, 600-volt UF tracer wire with heavy-duty PVC insulation. Tracer wire insulation color-coded to match each utility service as designated in ANSI Z535.1 (APWA Uniform Color Code for Marking Underground Utilities).
   2. SPLICES: Silicone-filled UL-Listed product specifically designed for waterproof direct bury splicing of tracer wire. 3M DBR-6; or approve equal.
   3. WIRE ACCESS BOXES: Cast iron valve box top piece frame and cover set within a concrete ring cast flush with grade, as appropriate for the location in which it will be installed and for the traffic loading it may be subject to, and in accordance with the applicable elements of the Standard Detail for valve box installations. Mark lids in raised or recessed lettering with the word “Test”. Submit all wire access boxes proposed for use to the Construction Manager for review.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPING SYSTEM MARKERS

A. Provide piping system markers and direction arrows at locations conforming to ASME A13.1 and at the following locations:
   1. Apply intermittent markings on straight pipe runs, close to all valves, fittings, and adjacent to all changes in direction.
   2. Where pipes pass through walls, partitions, and floors, apply markings on both sides of walls, partitions, and floors.
   3. At point of entry and leaving each pipe chase and/or confined space, and piping accessible at each access opening.

4. Adjacent to valves and where valves are in series at intervals of no more than 6 feet.
5. At least once in each room and at maximum spacing of 40 feet. Exception: gas piping to be identified at 6-ft intervals in ceiling plenums.
6. Spacing for markings not less than 1 foot.
7. At the beginning and end points of each run; and, at each piece of equipment in each run.

B. Visibility
1. Place identification on the bottom of the piping system for pipe systems located near ceiling or above the normal line of sight.
2. Place identification on the side of the piping systems for pipe systems located at the normal line of sight or below.
3. Place identification at approximate line of sight for vertical pipe systems.

3.02 INSTALLATION OF DETECTABLE WARNING TAPE

A. Install a continuous ribbon of Detectable Warning Tape as specified for ALL buried piping.

B. Multiple pipes less than 4 inches in diameter installed in a common trench may be provided with a single ribbon of tape per trench. If the total width of such utilities within the common trench exceeds 3 feet, provide two parallel ribbons of tape spaced equally.

C. Provide a separate detectable warning tape for each pipe that is 4 inches or greater in size.

D. Install the tape in accordance with manufacturer recommendations.

E. At end-to-end and branch connections, provide electrical continuity connectors for detectable tape to mechanically and electrically connect ends together as recommended by the manufacturer.

F. Provide a single line of tape 2.5 feet above the centerline of buried pipe. For pipelines buried 8 feet or greater below finished grade, provide a second line of tape 12 inches below finished grade, above and parallel to each buried pipe. Spread tape flat with message side up before backfilling.

3.03 INSTALLATION OF TRACER WIRE

A. Tracer wire shall be a continuous, fully functioning, and tested system to include all appurtenances including splices and wire access boxes at grade.

B. Tracer wire laid along the top of the pipe prior to backfilling. Secure in place with tape every 20 feet. Where the pipe is encased or provided with concrete collars or cut-off walls, lay the wire on top of the encasement (do not encase the wire). Do not pull the wire taut; leave sufficient slack to allow for pipe movement and future repairs.

C. Splice tracer wire using the specified silicone-filled splice kits in accordance with manufacturer recommendations. Ensure the silicone fully encapsulates un-insulated wire ends and are made watertight.

D. Pull tracer wire up into all valve boxes, cleanout access boxes, and into all utility cabinets and meter boxes installed on the pipeline. For each wire end, provide an 18-inch long length of extra wire (coiled and tucked out of the way in an accessible location) for connection to utility locating equipment.

E. Where the pipeline enters structures, vaults, tanks, or buildings, provide a wire access box at grade adjacent to the structure or building for termination of the tracer wire. Provide an 18-inch long length of extra wire (coiled and tucked into the box) for connection to utility locating equipment. Also provide boxes at each pipeline branch, cross or tee, and at intermediate spacing along the pipeline not to exceed 1,000 feet (except where pipeline valves with valve boxes provide the required wire access at those locations and intervals).

F. Upon completion and backfill of the pipeline, test and demonstrate electrical continuity of each segment of tracer wire. Submit test results to the Owner indicating the location of the tested segment. Use conductive testing method; inductive test methods are not acceptable. Repair all faulty work at no additional cost to the Owner until the system is functional and approved.

3.04 FIELD QUALITY CONTROL

A. Comply with manufacturer's handling and installation instructions.

B. Provide continuity testing of tracer wire as specified herein.

END OF SECTION

SECTION 40 05 59.14

FRP STOP LOGS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies fiberglass composite stop logs and stainless steel guides for isolation of flow streams in a wastewater treatment plant. The Contractor shall furnish and install complete stop log systems to operate as herein specified and as shown on the drawings. Storage rack for stop log storage shall be coordinated with EPWater (wall mounted or floor mounted) and shall be furnished and installed in accordance with manufacturer recommendations.

The Contractor shall assign unit responsibility in accordance with paragraph 11000-1.02C to the stop log manufacturer for all equipment specified in this section including, but not necessarily limited to, frames, logs, and lifters.

B. TYPE: Stop logs shall be rectangular design and manufactured of rectangular frame embedments fabricated from fiberglass skins with a polyester concrete core. Stop logs shall be removable sections having water seals along at least one contact surface of each adjoining section.

C. The stop log and lift systems provided under this section shall be designed for outdoor open-channel operation in the environmental conditions described in specification Section 01 11 80.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01 78 23 – Operation and Maintenance Manual
   2. Section 01 11 80 – Environmental Conditions
   3. Section 05 50 00 – Metal Fabrications

1.03 REFERENCES

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

ASTM A276	Stainless Steel Bars
ASTM D256	Izod Impact Strength
ASTM D570	Water Absorption Rate
ASTM D638	Tensile Strength
ASTM D695	Compressive Properties of Rigid Plastic
ASTM D696	Coefficient of Linear Expansion
ASTM D790	Flexural Properties
ASTM D2583	Indentation Hardness
ASTM D2563-0	Visual Defects
ASTM D2584	Resin, Glass & Filler Content

1.04 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00
   2. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from specification requirements. Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote with a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal will be sufficient cause for rejection of the entire submittal with no further consideration.
   3. Catalog cuts and/or shop drawings for each stop logs, materials of construction, dimensions, end connection configuration, pressure rating, and operating temperature range.
   4. Product date: include specifications and engineering data including dimensions, materials, sizes, weights, and performance data.
   5. Shop drawings: Include fabrication, assembly, and installation details.
   6. Manufacturer's installation instructions.
   7. Design calculations: Submit calculations and design data to substantiate conformance with requirements specified in the specifications, including stop log load and deflection criteria.
   8. Factory Acceptance Test results and/or Certified Statement of Proof-of-Design testing results when specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Procedures: Section 01 66 00.

B. Deliver Stop Logs and associated components to site in accordance with Section 01 66 00 and using loading methods which do not damage any Stop Log components or coatings.

C. Store on site until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

1.06

A. Where a warranty duration is specified, provide a special warranty valid for the specified duration.

B. Where no special warranty requirements are specified, provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stop Log and Guides
   1. Material shall be the latest design of a manufacturer engaged in the production of material of this type.
   2. Stop Logs and frames shall be by one manufacturer.
   3. Stop Logs shall be as manufactured by Glass-Steel, Inc, Plasti-Fab, or equal.

2.02 MATERIALS

Stop Logs shall be constructed of fiberglass skins with a polyester concrete core. Each Stop Log shall be reinforced and sized to withstand the maximum seating head with a deflection of less than L/500 pf the span. Each Stop Log shall be flat and level with a crown less than ¼" in any direction. Maximum allowable leakage shall be 0.20 gal. per minute per foot of wetted perimeter in accordance with AWWA criteria. Each Stop Log shall have two lifting pins as designed by the manufacturer for the proposed application and compatible with the Stop Log Lifter.

A. Guides: Guides shall be 316 SS and shall extend to the top of the concrete (top of Junction Box B)

B. Stop Logs: Fiberglass reinforced polyester skins with a polyester polymer concrete integral core.
   1. Tensile Strength of the skins 13,500psi max.
   2. Tensile Strength of the core 8,000psi min.
   3. Flexural Modulus of the log 1.0 x 106psi
   4. Water absorption: Less than 0.38 percent in (14) days.
   5. Thickness of skins 1/8"min.
   6. Ultraviolet stabilized and nontoxic.

C. Lifting lugs: 316SS (if proposing galvanized, contractor shall request a substitution from the Engineer)

D. Seals: Neoprene rubber.

E. Anchor Bolts: 316SS

2.03 COMPONENTS

A. Stop Logs
   1. Construct each stop log individually to the exact dimensions specified.
   2. The surface shall be free of exposed reinforcements.
   3. Use polymer concrete to attain the necessary stiffness to meet the deflection requirements.

B. Seals

1. Equip stop logs with elastomeric bottom seals (sponge neoprene) to seal between the logs.
2. Equip the guides with integral J-bulb seal on each inside face to seal against stop logs.

C. Guides
1. Style guides surface mouting.
2. Equip guides to be bolted to the head wall with SS Anchors sized for the loads involved.
3. Guides shall have a slot suitable for mating with the stop log.
4. Extend guides from invert of opening to top of concrete.

D. STOP LOG LIFTER
1. One stop log lifter shall be provided. The stop log lifter shall be portable and sized to accommodate the Stop Logs provided. The lifter shall be capable of being lowered into the channels, guided by the stop log frame grooves, and easily install or remove the logs under the design heads. Latching and unlatching the logs shall be easily accomplished by personnel at the working floor elevation above the stop logs.
2. The lifter shall be provided with a lifting eye to permit the lowering and raising of the lifter with a chain or cable. Each lifter shall be provided with stainless steel lifting chain or cable suitable for lifting the logs under the specified operating and pressure head conditions.

PART 3 EXECUTION

3.01 INSTALLATION

The Contractor shall install the stop logs and stop log frames in the general arrangement shown on the drawings and as specified. The Contractor shall install and test each installation in strict conformance with the manufacturer's written recommendations. Installation shall be performed by mechanics skilled in work of this kind.

END OF SECTION

SECTION 40 05 60

VALVES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the supply, installation and testing of valves. Materials and performance requirements for valves are specified in Detailed Valve Specifications. Detailed Valve Specifications are provided in Sections 40 05 61.01 through 40 05 89.99.

B. Determining Valve Type:
   1. Drawings specify valve types (gate, plug, butterfly, check, globe, etc.) used in each pipeline. Process fluids that will be conveyed in pipelines are identified by the Process Service Identifiers shown on the Drawings.
   2. Piping System Schedules (Sections 40 05 02.01 through 40 05 02.99) specify piping system materials and components, including valve requirements, based on the Process Service Identifier specified on the Drawings for the pipeline or piping system. Piping System Schedules reference Detailed Valve Specifications that specify requirements for each valve type used in the pipeline or piping system.
   3. Provide valves conforming to the Detailed Valve Specifications listed in the Piping System Schedule for the valve/line size, process service, and valve type specified on the Drawings. Example: The Drawings specify a ball valve on a 1-inch line. The Piping System Schedule for the process service specified on the Drawings refers to Section 40 05 63.01 for 1/2 through 2 1/2 inch ball valves. For this example, provide the subject ball valve per the requirements specified in 40 05 63.01.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01 78 23 – Operation and Maintenance Manual
   2. Section 40 05 02 – Detailed Piping Specification Sheets

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents

shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI 16.10	Face-to-Face and End-to-End Dimensions of Valves
ANSI B1.20.1	Pipe Threads, General Purpose
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.34	Valves—Flanged, Threaded, and Welding End
API 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats
ASTM A48	Gray Iron Castings
ASTM A108	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216/A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A276	Stainless and Heat Resisting Steel Bars and Shapes
ASTM A351	Castings, Austenitic, for Pressure-Containing Parts
ASTM A516	Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A536	Ductile Iron Castings
ASTM A571	Austenitic Ductile Iron Castings
ASTM A995/A995M-13	Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts
ASTM B124	Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM B148	Aluminum-Bronze Sand Castings
ASTM C283	Resistance of Porcelain Enameled Utensils to Boiling Acid
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D5162	Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C504	Rubber-Seated Butterfly Valves
AWWA C507	Standard for Ball Valves
AWWA C508	Swing Check Valves for Waterworks Service, 2 – 24 Inches NPS
AWWA C517	Resilient-Seated Cast Iron Eccentric Plug Valves
AWWA C550	Protective Interior Coatings for Valves and Hydrants
MSS SP-70	Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
MSS SP-81	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
MSS SP-110	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
NSF 61	Drinking Water System Components - Health Effects
UL 429	Electrically Operated Valves
UL 1002	Electrically Operated Valves for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G

1.04 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01 33 00
   2. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from specification requirements. Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote with a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal will be sufficient cause for rejection of the entire submittal with no further consideration.
   3. Catalog cuts and/or shop drawings for each type of valve indicating the valve type (Detailed Valve Specification Section Number), materials of construction, dimensions, operating torque, valve end connection configuration, pressure rating, and operating temperature range.
   4. An amended Detailed Valve Specification for all valve types provided for this contract. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
   5. Factory Acceptance Test results and/or Certified Statement of Proof-of-Design testing results when specified in Detailed Valve Specifications.
   6. Action Submittal Items listed on Detailed Valve Specifications

B. Informational Submittals:
   1. Affidavits and registration numbers as specified.
   2. Operating and Maintenance data for incorporation in operation and maintenance manual, as specified in Section 01 78 23. Include complete description of operation together with detailed drawings, a complete list of replacement and repair parts, and parts manufacturer's identifying numbers.
   3. Informational Submittal Items listed on Detailed Valve Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01 66 00.

B. Deliver valves to site in accordance with Section 01 66 00 and using loading methods which do not damage any valve components or coatings.

C. Tag loose valves as specified in Section 01 66 00, stating size, type, coatings and mating parts shipped loose or separate.

D. Store on site until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

1.06 WARRANTY

A. Where a warranty duration is specified by the Detailed Valve Specification, provide a special warranty valid for the specified duration.

B. Where no special warranty requirements are specified in the Detailed Valve Specification, provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 VALVE CONFIGURATION REQUIREMENTS

A. General
   1. Provide valves of the same type, size range and service from a single manufacturer.
   2. Provide new, unused valves for the work.
   3. Provide valve materials free from defects or flaws, with true alignment and bores.
   4. Provide valves that open by turning the valve shaft to rotate counter-clockwise unless otherwise specified in the Detailed Valve Specification Section.

B. Provide padlockable lockout feature on all valves.

C. Manual Operators
   1. For hand wheels, clearly show the direction of opening in raised lettering and symbols.
   2. The maximum rim pull on a hand wheel is not to exceed 65 lb. when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater force to operate, provide a torque reduction gearbox operator. Unless different operators are scheduled or specified on the Drawings, conform to the following minimum requirements.
   3. Provide 6 (total) eight-point operating wrenches for use on all valves with square nut operators.
   4. Quarter turn lever operators are to be perpendicular to the pipe runs when the valves are closed.
   5. Provide butterfly valves with 10 position latching levers except where used to balance air flows. Where used to balance air flows provide infinite position, screw down levers.
   6. The maximum pull at the end of the lever arm is not to exceed 65 lb. when one side of the valve is at test pressure and other side is at atmospheric pressure. Where greater force would be required to operate the valve with a lever, provide a torque reduction gearbox operator.
   7. Provide grease lubricated, worm gear type operators for torque reduction gearbox operators. Gearbox operators equipped with a hand wheel and a visual indicator of the valve position. Provide gear operators with adjustable mechanical stop-limiting devices to prevent over travel of the disc/ball/plug in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Where gearbox operators are intended for direct bury or submergence, seal units with long life lubricant.

8. For manual valves on lines 3 inches and greater, mounted over 7.0 feet above the operating floor, provide chain wheel gear operators. Design chain wheel operators so that a force of 30 lb. is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. Provide chain pulley that positively engages the chain links. The chain will extend from the valve operator to an operating height of 4 feet above the floor or as directed by the Owner. The exact dimensions will be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.
9. Where manual operators are installed over 7.0 feet above the operating floor and the Drawings specify a vertical valve shaft, revise the gear operator and/or chain wheel position to provide a horizontal chain wheel shaft. Retain the valve orientation specified on the Drawings.
10. Provide ductile iron chain wheels. Provide galvanized steel operating chains.

D. Valve Stem Extensions and Wrench Nuts
   1. Provide valve stem extensions where additional clearance is required for pipe insulation or where valve operation without the extension is difficult; and in manholes.
   2. Where angle valve stem extensions are employed, they will be angle geared. Universal joint types are not permitted.
   3. Wrench nuts shall comply with AWWA C500. A minimum of two operating keys, but no less than one key per every ten valves, shall be provided for operation of wrench nut operated valves.

E. Operator Appurtenances
   1. 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. Valve boxes extending to finished surfaces shall be provided for buried valves.
   2. Floor Boxes: Floor boxes shall be hot-dip galvanized. Where the operating nut is in the concrete slab, the floor box shall be bronze bushed. Where the operating nut is below slab, the opening in the bottom of the box shall be sufficient for passage of the operating key. 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.
   3. 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."

2.02 VALVE IDENTIFICATION TAGS

A. Provide valve identification tags for all valves with an identification tag number on the drawings (Mechanical and PI&D drawings).

B. Match tag numbers shown on the drawings.

C. Type 316 stainless steel tags, minimum 2.5-inches x 0.75 inches, with 0.1875 inch numbers and letters. Complete tag number shall be embossed on the tag. Tags shall be attached using stainless steel wire.

PART 3 EXECUTION

3.01 PREPARATION

A. The valve and piping arrangement indicated on the Drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the piping to allow for discrepancies between the valve dimensions shown and those supplied for the Work.

B. Prior to installation of valves, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for hydraulic, pneumatic, and electric power actuators.

C. Where conflicts are identified, inform the Owner.

3.02 INSTALLATION

A. Install valves in conjunction with the piping specified in the Piping System Schedules (Sections 40 05 02.01 through 40 05 02.99), and with control valves and their appurtenances specified in Section 40 06 20.13.

B. In horizontal pipe runs, other than in locations where space does not permit, install all valves (except for butterfly valves, eccentric plug valves, and trunnion ball valves) with a vertical operating shaft with the actuator at the top. In no case install a valve with the operator below the valve.

C. Unless otherwise specified on the drawings, install butterfly valves, eccentric plug valves, and trunnion ball valves with the shaft in a horizontal orientation. Install eccentric plug valves with the plug above the valve shaft centreline when the valve is full open.

D. When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.

E. Support valves in position using temporary supports until valves are fixed in place.

F. Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.

G. Where valves are installed in plastic pipelines (PVC, CPVC, HDPE, polypropylene etc.) greater than 4-inch diameter, support valves independent of the piping and brace valves against operating loads and torque to prevent transmission of stresses to the adjacent pipework.

H. Install gate valves in the closed position.

I. Install valves which are bubble tight in one direction to provide bubble tight seal of flow in normal direction of flow unless otherwise noted or directed by the Owner.

J. Unless otherwise specified, install single seated valves with the seat downstream. Install valves at tank connections with seat away from tank. Install valves on pump discharge and suction lines with seat end towards the pump.

K. Install all valves in accordance with the manufacturer's recommendations.

L. Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tape wrap.

M. 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.

3.03 FIELD QUALITY CONTROL

A. Field or Site Tests and Inspections per Detailed Valve Specifications.

B. Pressure test all valves in conjunction with the pipes in which the valves are installed at test pressures specified in the applicable Piping System Schedule.

END OF SECTION

SECTION 40 05 61.17

KNIFE GATE VALVES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies iron-body knife gate valves.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
ASME/ANSI B16.10	Face-to-Face and End-to-End Dimensions of Valves
ASME/ANSI B 16.5	Pipe Flanges and Flanged Fittings
ASME/ANSI B16.47	Large Diameter Steel Flanges
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
ASTM A193/A193M	Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A240/A240M	Standard Specification for Chromium and Chromium nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276/A276M	Standard Specification for Stainless Steel Bars and Shapes
ASTM A312/A312M	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM B271/B271M	Standard Specification for Copper Base Alloy Centrifugal Castings
ASTM F593.17	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F1941	Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings

Reference	Title
AWWA C500	Gate Valves for Water and Sewerage Systems
AWWA C520-19	Knife Gate Valves, Sizes 2 in. through 96 in.

B. Design Criteria:
   1. 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 tests at the test pressure.

1.03 SUBMITTALS

A. Submittal material, to be provided in accordance with Section 01 33 00, shall include the following:
   1. Catalog information for each size to be furnished
   2. A copy of this specification Section and the referencing Section and all other applicable specification Sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each Paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a Paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified Paragraph. The remaining portions of the Paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   3. Certified performance information produced by an independent testing laboratory acceptable to the Engineer, current to within five years from the date of the submittal, specific to the construction details for the model proposed, confirming performance not less than that required by this specification. The test methodology may use mathematical modeling techniques to affirm specific model size performance so long as the test performance for specific size valve(s) has been spot-checked by bench tests of the valve size in question and the results show modeling performance within ± 5 percent of bench test results. The performance confirmation shall be dated, signed by the author of responsible for the test information, notarized as true and correct.
   4. Submit manufacturer's product data for proposed valves.
   5. Affidavits of compliance, as required by AWWA C500.
   6. Hydrostatic test results.
   7. Installation requirements
   8. O&M instruction manuals per Section 01 78 23.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. DeZurik, Wey Series W0, ITT C67 or Equal.

2.02 MATERIALS

A. Materials of construction shall be as follows:

Component	Material
Body:	
Larger than 3 inches	Cast iron, ASTM A126, Class B
Valve Gate:	
Larger than 3 inches	316 Stainless Steel
Bonnet	Fully enclosed bonnet for burial service, carbon steel
Stem	Chrome Steel with 45,000 psi bronze drive nut
Yoke bearings	Bronze, 45,000 psi
Fasteners	300 series stainless steel

B. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

2.03 MANUFACTURE

A. General:

1. The valve shall be furnished with a resilient seat which seals around the edge, not the face of the gate and shall be replaceable and mechanically retained. The body seal groove is machined with sufficient tolerances to prevent body seat creeping (dimpling and/or spaced blind holes in body seat area are not allowed).
2. The valve shall have a secondary metal seat to provide gate support and withstand the full pressure in either direction.
3. The dual top gate seals shall be fully enclosed and shall be re-packable with the valve in service under fully rated pressure and without the removal of packing gland or follower. This seal shall be capable of resealing by means of injection of packing material into the seal through external ports located at a minimum of four locations to insure even and packing material distribution. The top seals shall be protected by glass filled scraper blades. The scraper blades shall be pressed into the gate by means of mechanically retained rubber backing cord.
4. The leading edge of the gate shall be straight or shall not inscribe more than a 60 degree included angle.
5. The gate shall be guided for the full length of the stroke and supported to withstand full rated shutoff pressure in either direction for the full length of valve stroke. The interior of the valve port shall be contoured to insure self-cleaning, non-jamming cycling in media consistencies up to 15%. The resilient seat in the bottom port area of the valve shall be flush with the port area and shall not form a cavity in which

debris can collect. Valve design cannot allow discharge of process media onto the ground or into any reservoir or bonnet. The design shall not rely on flush ports to clear the gate guides, seat or bonnet area of the valve.

B. End Connections:
   1. Gate valve end connections shall be flanged. 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:
   1. Manual Operators: 2” Drive Nut attached to stem.
   2. Stem shall be non-rising and shall be provided with a bevel gear to allow for horizontal installation as shown on the plans

PART 3 EXECUTION

3.01 INSTALLATION

A. Gate valves shall be installed in the closed position.

END OF SECTION

SECTION 40 05 78.23

AIR/VACUUM VALVES FOR WASTEWATER SERVICE

1.01 DESCRIPTION

A. Scope:
   1. This Section specifies air release valves, air and vacuum relief valves, and combination valves for wastewater service.

B. Types:
   1. General: Valves furnished under this specification shall be tubular in design with direct acting cylindrical hollow and solid float mechanisms designed to function efficiently in the presence of grease, fibers and particulate material commonly present in municipal and domestic wastewaters and wastewater treatment effluents. The design shall incorporate materials and geometry that provides self-flushing of the valve internals on emptying.
      a. Valve designs that employ float guide brackets, levers, springs and ball type floats are specifically prohibited. Valves furnished under this Section shall be fitted with direct vents of flanged for connection to piping connections as indicated. Main venting orifices and outlet connections shall be equal in diameter to the specified pipeline connection.
      b. Air and vacuum valve nomenclature originated with valves used in clean water service which had the three valve types listed in below. Valves for wastewater service as covered in this Section are available in the types listed in below.
   2. Air Release Valves: Wastewater air release valves (ARV) shall have a small venting orifice to vent the accumulation of air and other gases with the line or system under pressure. Size and capacity shall be as specified.
   3. Air and Vacuum Valves: Wastewater air and vacuum valves (ARVV) shall have a dual float system with a large venting orifice to permit the release of air as the line is filling or relieve the vacuum as the line is draining or is under negative pressure. As the pipeline approaches the full condition on filling, the large orifices shall be sealed by the primary float and the secondary float shall allow the remaining air to vent at a reduced rate to prevent development of hydraulic transients. Size and capacity shall be as specified.
   4. Combination Air Valves: Wastewater combination air valves (CAV) shall have operating features of both the air and vacuum valve and the air release valve. Size and minimum capacity under both air release and vacuum relief shall be as specified.

1.02 REFERENCES

A. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by

the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A240	Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

1.03 SCHEDULE

A. Valve size shall be as shown on plans. Valve performance shall be as listed in Table 1 below.

Table 1. Performance Data for Manufacturer's Standard CAVs

Valve size, inches	Vent connection[a]	System pressure, PSIG	Pressure relief capacity, minimum, standard cubic feet/min at 0.75 PSI differential[b]	Anti-shock vent capacity, maximum, standard cubic ft/min at 14.5 PSI differential[b]	Vacuum relief capacity, minimum standard cubic feet/min at 5 PSI differential[b]
2	F	30	200	42	430
3	F	30	500	105	1,100
4	F	30	790	190	1,720
6	F	30	1,800	377	3,880
8	F	30	3,190	529	6,900

[a] F= Flange, T = Threaded connection

[b] Capacities shall be documented by an independent testing method acceptable to the Engineer and shall be as listed in a report detailing the testing methodology. The report shall be dated not more than two years prior, shall be specific to the model proposed, shall be signed by the test author and shall be notarized as true and correct.

1.04 SUBMITTALS

A. Submittal material, to be provided in accordance with Section 01 33 00, shall include the following:
   1. Catalog information for each size to be furnished
   2. A copy of this specification Section and the referencing Section and all other applicable specification Sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each Paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a Paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified Paragraph. The remaining portions of the Paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the

specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Certified performance information produced by an independent testing laboratory acceptable to the Engineer, current to within five years from the date of the submittal, specific to the construction details for the model proposed, confirming performance not less than that required by this specification. The test methodology may use mathematical modeling techniques to affirm specific model size performance so long as the test performance for specific size valve(s) has been spot-checked by bench tests of the valve size in question and the results show modeling performance within ± 5 percent of bench test results. The performance confirmation shall be dated, signed by the author of responsible for the test information, notarized as true and correct.
4. Submit manufacturer's product data for proposed valves.
5. Installation requirements
6. O&M instruction manuals per Section 01 78 23.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Wastewater Air/Vacuum Valves shall be as manufactured by Val-Matic, APCO, A.R.I. USA, Inc., GA Industries or Approved Equal.

B. Alternative manufacturers' products will be considered, provided the following information has been submitted and accepted as proof the proposed substitution provides equal or improved performance over that of the specified product and materials. Any submittal requesting substitution shall include the information specified under paragraph 1.04 and the following:
   1. Detailed construction and functional description of operation with bill of materials and detailed graphics showing construction features and step-by-step operation demonstrating compliance with the features and operational characteristics specified in this Section.
   2. Certified performance (air venting and vacuum venting) curves for each size valve to be provided. Performance curves shall be certified and notarized correct by an independent testing laboratory.
   3. Not less than four affidavits of performance signed by general managers or executive officers of the owning agency and notarized. The affidavits of performance shall, as a minimum, document the following:
      a. Side-by-side operation with the specified Vent-Tech or Vent-O-Mat valves in unscreened wastewater service for periods of not less than 6 months.
      b. During the side-by-side periods of operation, the proposed valve and the specified valves shall have been inspected for clogging and function on not less than a weekly basis and shall not have required more maintenance effort than the valves specified in this Section.
      c. The affidavits shall contain unreserved acceptance of the proposed valve as a complete equal to valves specified herein.

2.02 MATERIALS

Component	Material
Body and cover	Stainless Steel, ASTM A351 Grade CF8M
Hardware	Stainless Steel, Type 316
Float	Stainless Steel, Type 316
Seat	EPDM or Viton
Trim	Type 316 SS, ASTM A240
Coating (Internal & External)	Fusion Bonded Expoxy, AWWA C550
Backwash Kit	Rubber hose with quick disconnect couplings on each end

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

2.03 CONSTRUCTION

A. General:
   1. All wastewater air release and vacuum valves shall have tubular elongated bodies and shall be specifically designed for operation on wastewater and wastewater applications. Valve bodies shall be certified for not less than twice the system pressure specified in paragraph 1.03 and shall have over pressure relief features to prevent catastrophic rupture of the valve body. The relief feature shall be incorporated into easily replaced components. The valve size shall be the nominal size of the valve inlet and outlet (piping connection) as herein described. All valve clearances shall be designed for unobstructed flow of air through all passages with a net cross-sectional area at least equal to that of the nominal piping connection. The valve manufacture shall be prepared to document compliance with this requirement in all respects for each component in the valve assembly.

B. Body:
   1. The valve body shall have a fused glass lining or equivalent finish. The valve body shall, be sized to assure the unobstructed annular space between the valve floats and the inner surface of the valve body exceeds the cross-sectional area of the valve's inlet and outlet connections. Valved upper and lower flushing ports (1/2 inch minimum) shall be provided. Materials for flushing ports shall be the same as the body.

C. Air Inlet/Outlet Fitting:

1. The air inlet/outlet fitting shall have a net opening equal in cross-sectional area to the valve size and shall be screened with a high efficiency punched screen to prevent ingression of airborne debris. The connection from the air inlet cap chamber to the valve body shall be a smooth toroidial transition, polished to facilitate movement from the cap to the body with minimal energy losses by gradual acceleration to the connection with the valve body air passages. The underside of the fitting shall be finished smooth to effect an air tight seal with the anti-surge floats. The valve shall form an airtight seal with an internal pressure of no more than 3 psig.

D. Air Outlet/Inlet Fitting:

1. The air outlet/inlet fitting at the connection to the piping shown shall formed to provide a smooth transition to the valve outlet in a manner equal to that described in paragraph 2.03 Air Inlet/Outlet Fitting. The connection to the piping system shall have a cross-sectional area as described in paragraph 2.03 General.

E. Floats:

1. The anti shock float shall have not less than five tubular orifices to evenly distribute pressurized air across the face of the float. Air inlets for the tubular orifices shall be a smooth, rounded transition to reduce shock and discharged moisture as the as the float seats. The main float shall be tubular in construction, fitted with a centering guide on the upper float cap for contacting and centering on the anti-shock float.

2.04 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00:

1. Manufacturer's product data.
2. O&M instructions per Section 01 78 23.
3. Certification NSF 61

PART 3 EXECUTION

3.01 INSTALLATION

A. Wastewater air release and vacuum valves shall be installed in accordance with the manufacturer's recommendations. Isolation valves shall be provided below each air valve, as shown on the Contract Drawings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK