



Develop**Abilene**
DEVELOPMENT CORPORATION OF ABILENE

CONTRACT DOCUMENTS
FOR
POLARIS DR. SEWER LINE EXTENSION
FIVE POINTS BUSINESS PARK

FEBRUARY 2024

Board of Directors

Shea Hall, Chair

Tracy Howle, Vice Chair

Sam Vinson, Secretary/Treasurer

Floyd Miller

Buddy Napier

Misty Mayo, CEO

174 Cypress Street
Abilene, Texas 79602
DevelopAbilene.com

DEVELOPMENT CORPORATION OF ABILENE

PROJECT MANUAL

FOR

POLARIS DR. SEWER LINE EXTENSION
FIVE POINTS BUSINESS PARK

FEBRUARY 2024

Documents included: Bid, Contract, Technical Specifications, and
Construction Drawings

**DEVELOPMENT CORPORATION OF ABILENE
POLARIS DR. SEWER LINE EXPANSION
FIVE POINTS BUSINESS PARK**

TABLE OF CONTENTS

BIDDING DOCUMENTS

Advertisement
Bid Schedule
Bid Bond
Qualifications Statement

CONTRACT DOCUMENTS

DRAFT Agreement
Performance Bond
Payment Bond
Certificate of Insurance
Notice of Award
Notice to Proceed

TECHNICAL SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

010101 – Summary of Work
010201 – Special Technical Specifications and Conditions
010901 – Disinfection of Potable Water Piping and Tanks

DIVISION 2 – EXISTING CONDITIONS

020101 – Site Clearing

DIVISION 3 – CONCRETE

030401 – Manholes
030404 – Polymer Concrete Manholes
030501 – Grout
030901 – General Concrete

DIVISION 31 – EARTHWORK

310301 – Trenching, Backfilling, and Compaction
310401 – Trench Excavation Safety Protection System
310601 – Site Grading and Earthwork

DIVISION 33 – UTILITIES

330101 – General Requirements for Piping Systems
330102 – Field Testing of Piping Systems
330103 – Ductile Iron Pipe
330106 – Polyvinyl Chloride (PVC) Pressure Pipe
330107 – Polyvinyl Chloride (PVC) Sanitary Sewer Pipe
330108 – Pipe Couplings and Expansion Joints

CONSTRUCTION DRAWINGS

Sheet 1 – Cover Sheet
Sheet 2 – Sheet List, Legend, & Vicinity Map
Sheets 3 – Plan and Profile Details
Sheets 10 – Sewer Details
Sheet 13 – Water & Sewer Crossing Details
Sheet 14 – Erosion Control Details

BID DOCUMENTS

ADVERTISEMENT FOR BIDS

DEVELOPMENT CORPORATION OF ABILENE POLARIS DR. SEWER LINE EXTENSION FIVE POINTS BUSINESS PARK ABILENE, TEXAS

General Notice

The Development Corporation of Abilene, Inc. (Owner) is requesting Bids for the construction of the following Project:

POLARIS DR. SEWER LINE EXTENSION

Bids for the construction of the Project will be received at **the Development Corporation of Abilene office**, located at **174 Cypress Street, 3rd Floor, Abilene, Texas 79601**, until **Thursday, March 7, 2024**, at **2:00 p.m.** local time.

The Project includes the following Work: furnishing and installing approximately 1,715 LF of 10" SDR35 PVC sewer line, approximately 640 LF of 8" SDR35 PVC sewer line, approximately 260 LF of 6" SDR35 PVC sewer line, manholes, connections and all associated incidentals along Polaris Dr., located in the Five Points Business Park.

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website:

<https://developabilene.com/bids>

Bidding Documents may be downloaded from the designated website, listed above. The designated website will be updated periodically with addenda, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

The successful bidder, if any, will be the bidder offering the most beneficial bid for the DCOA based on criteria including: (1) proposed construction costs; (2) history of contractor's quality and successful completion of previous projects; (3) contractor's proposed team; (4) past performance on comparable jobs; (5) overall reputation; (6) financial capability compared to size and scope of the project; (7) past relationship with the DCOA; (8) if the contractor is located in the City of Abilene; and/or (9) any other criteria as determined by the DCOA and/or any architect/engineer used for the construction project.

This Advertisement is issued by:

Owner: **Development Corporation of Abilene, Inc.**

By: **Misty Mayo**

Title: **Chief Executive Officer**

Date: **February 8, 2024**

BID FORM FOR CONSTRUCTION CONTRACT

SECTION 1. OWNER

1. This Bid is submitted to: **Development Corporation of Abilene
174 Cypress Street, 3rd Floor
Abilene, Texas 79601**

**Project Name: Polaris Dr. Sewer Line Extension
Project Number: DCOA0224**

2. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

SECTION 2. ATTACHMENTS TO THIS BID

1. The following documents are submitted with and made a condition of this Bid:
 - a. Required Bid Security (Bond);
 - b. List of Proposed Subcontractors (if any);
 - c. Evidence of Authority to do business in the State of Texas;
 - d. Required Bidder Qualification Statement

SECTION 3. BASIS OF BID—LUMP SUM BID AND UNIT PRICES

1. Lump Sum Bids
 - a. Bidder will perform the following Work at the indicated lump sum bid based on the following project plan details.

SECTION 4. BIDDERS ACKNOWLEDGEMENT

1. Receipt of Addenda
 - a. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

2. Bid Acceptance Period
 - a. This Bid will remain subject to acceptance for 60 days after the Bid opening date, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

BID SCHEDULE

Show bid prices in words **and** numerals. Words take precedence over numerals. These Bid prices must include all labor, materials, equipment, insurance, overhead, superintendence, transportation, profit, and incidentals to cover the finished Work called for in the Contract Documents. In case of mathematical error in extensions, written price prevails.

BID SCHEDULE FOR POLARIS DR. SEWER LINE EXTENSION				
BASE BID				
NOTE: Bids shall include all applicable taxes and fees				
ITEM	ESTIMATED QUANTITY	DESCRIPTION AND UNIT PRICES (PRICE TO BE WRITTEN)	UNIT PRICE (NUMBERS)	TOTAL
1	1 LS	Furnish Mobilization, Bonds and Insurance, at _____ Dollars and _____ Cents per lump sum.		\$ _____
2	1 LS	Implement Appropriate Stormwater Pollution Prevention Plan (SWP3) controls and provide any required permit forms and fees, at _____ Dollars and _____ Cents per lump sum.		\$ _____
3	1 LS	Site Clearing, Grubbing, Miscellaneous Demolition, as shown and as specified, for _____ Dollars and _____ Cents per acre.		\$ _____
4	1,715 LF	Furnish and install 10" SDR35 PVC sewer line, manholes, connections, and all associated incidentals as shown and as specified, for _____ Dollars and _____ Cents per linear feet.	\$ _____/LF	\$ _____
5	640 LF	Furnish and install 8" SDR35 PVC sewer line, manholes, connections, and all associated incidentals as shown and as specified, for _____ Dollars and _____ Cents per linear feet.	\$ _____/LF	\$ _____
6	260 LF	Furnish and install 6" SDR35 PVC sewer line, manholes, connections, and all associated incidentals as shown and as specified, for _____ Dollars and _____ Cents per linear feet.	\$ _____/LF	\$ _____
TOTAL BASE BID PRICE (ITEMS 1 THRU 6)				\$ _____

Bidder agrees that the Work will be substantially complete within _____ calendar days after the date when the Contract Times commence to run, and will be completed and ready for final payment within _____ calendar days after the date when the Contract Times commence to run.

BIDDER hereby submits this Bid as set forth above:

Bidder:

(typed or printed name of organization)

By:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

Address for giving notices:

Bidder's Contact:

Name:

(typed or printed)

Title:

(typed or printed)

Phone:

Email:

Address:

Bidder's Contractor License No.: (if applicable)

BID BOND (PENAL SUM FORM)

<p>Bidder</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>
<p>Owner</p> <p>Name: Development Corporation of Abilene, Inc.</p> <p>Address <i>(principal place of business)</i>: 174 Cypress Street, 3rd Floor Abilene, Texas 79601</p>	<p>Bid</p> <p>Project <i>(name and location)</i>: Polaris Dr. Sewer Line Extension, Five Points Business Park, Abilene, Texas</p> <p>Bid Due Date: March 7, 2024</p>
<p>Bond</p> <p>Penal Sum: _____</p> <p>Date of Bond: _____</p>	
<p>Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.</p>	
<p>Bidder</p> <p>_____</p> <p style="text-align: center;"><i>(Full formal name of Bidder)</i></p>	<p>Surety</p> <p>_____</p> <p style="text-align: center;"><i>(Full formal name of Surety) (corporate seal)</i></p>
<p>By: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>	<p>By: _____</p> <p style="text-align: center;"><i>(Signature) (Attach Power of Attorney)</i></p>
<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>	<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p>Attest: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>	<p>Attest: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>
<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>	<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p><i>Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.</i></p>	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

QUALIFICATIONS STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business’s organizational structure:

Form of Business:	<input type="checkbox"/> Sole Proprietorship <input type="checkbox"/> Partnership <input type="checkbox"/> Corporation		
	<input type="checkbox"/> Limited Liability Company <input type="checkbox"/> Joint Venture comprised of the following companies:		
	1.		
	2.		
	3.		
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending			

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business (if applicable):

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—SAFETY

3.01 Provide information regarding Business’s safety organization and safety performance.

Name of Business’s Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

3.02 Provide Worker’s Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 4—INSURANCE

4.01 Provide information regarding Business’s insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):	
Insurance Provider	Type of Policy (Coverage Provided)
Are providers licensed or authorized to issue policies in the Project location? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Does provider have an A.M. Best Rating of A-VII or better? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Mailing Address (principal place of business):	
Physical Address (principal place of business):	
Phone (main):	Phone (claims):

ARTICLE 5—CONSTRUCTION EXPERIENCE

5.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

5.02 Provide information regarding the Business’s previous contracting experience.

Years of experience with projects like the proposed project:		
As a general contractor:		As a joint venturer:
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:		
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been barred from contracting by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been released from a bid in the past 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Defaulted on a project or failed to complete any contract awarded to it? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Refused to construct or refused to provide materials defined in the contract documents or in a change order? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been a party to any currently pending litigation or arbitration? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Provide full details in a separate attachment if the response to any of these questions is ‘Yes’.		

5.03 List all projects currently under contract in Schedule A and provide indicated information.

ARTICLE 6—REQUIRED ATTACHMENTS

6.01 Provide the following information with the Statement of Qualifications:

- A. Schedule A - list of current projects, up to 3.
- B. Schedule B – list team members and company references.
- C. Additional pertinent items.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Designated Representative:
Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization			
Project Owner		Project Name	
General Description of Project			
Project Cost		Date Project	
Project Owner		Project Name	
General Description of Project			
Project Cost		Date Project	
Project Owner		Project Name	
General Description of Project			
Project Cost		Date Project	

Schedule B—Key Individuals & Company References

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Company References Contact Information			
Company Name		Company Name	
Contact & Position		Contact & Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	

CONTRACT DOCUMENTS

CONSTRUCTION AGREEMENT

This Construction Agreement (the “*Agreement*” or “*Contract*”) is made and entered into by and between the Development Corporation of Abilene, Inc. (“*DCOA*”), a Texas non-profit corporation and an economic development corporation formed pursuant to *Tex. Loc. Gov’t Code Section 501.001 et. seq.*, 174 Cypress Street, Suite 301, Abilene, Texas 79601 and [_____], (“*Contractor*”), [a _____], [address] (the DCOA and Contractor are individually referred to herein as a “*Party*” and collectively referred to herein as the “*Parties*”).

WHEREAS, the DCOA is the owner of the following described Property and is seeking the services of a contractor to make certain improvements to the Property. The Property is described as follows: Polaris Dr., Five Points Business Park, Abilene, Texas (the “*Property*”); and

WHEREAS, the improvements that the DCOA is seeking are described in the Project Manual titled “Contract Documents for Polaris Dr. Sewer Line Extension at Five Points Business Park” dated [_____] (the “*Project Manual*”). This Agreement is incorporated within the Project Manual which shall include, but not limited to, (i) the terms and conditions, in addition to this Agreement, contained within the Project Manual and (ii) the Technical Specifications and Construction Drawings contained in the Project Manual are hereby incorporated herein, and Contractor is willing to perform such improvements to the Property according to the terms and conditions that are set forth herein; and

WHEREAS, the DCOA desires to retain Contractor to perform such improvements to the Property according to the terms and conditions that are set forth herein.

NOW, THEREFORE, in consideration of the mutual promises contained in this Agreement, the Parties agree as follows:

ARTICLE 1 IMPROVEMENTS TO BE PERFORMED BY CONTRACTOR

1.01 Scope and Timing of Work. Contractor agrees to perform the construction and/or services required to make the improvements to the Property as specified in the Project Manual (said improvements are sometimes collectively referred to herein as the “*Work*”) and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. Contractor shall use all new materials in connection with the Work, unless stated otherwise in this Agreement. Contractor’s performance of the Work shall conform to the standards prevailing in Taylor County, Texas with respect to the scope, quality, due diligence, and care for like Work. Contractor shall coordinate the performance of the Work with the DCOA’s Chief Executive Officer (“*CEO*”) and any other person that the CEO designates. For purposes of this Agreement, the DCOA’s CEO shall serve as the “*Contracting Officer*” for this Agreement. Contractor shall provide all personnel, labor, tools, materials and services, and pay all cost that are necessary in order for Contractor to complete the Work.

1.02 Commencement of Work. Contractor shall commence the performance of the Work upon the DCOA delivering to Contractor a Notice to Proceed. If Contractor acquires any permits for the Work, Contractor shall provide the DCOA with copies of all permits required pursuant to **Section 1.05** prior to Contractor’s commencement of the Work.

1.03 Completion of Work. Contractor shall begin the Work no later than 10 days from the date that the DCOA delivers to Contractor the Notice to Proceed and Contractor shall complete the Work no later than [] days from the date that the DCOA delivers to Contractor the Notice to Proceed (the “**Required Completion Date**”)¹. Upon the completion of the Work, Contractor agrees to leave the Property in the same or substantially the same condition as the Property was in before the Contractor commenced the Work. All surrounding area where no Work is being performed and the path traveled to construction must be restored to the same or a substantially similar condition as the areas were in before Contractor commenced the Work. Contractor agrees to repair and/or replace any damaged areas as a result of Contractor’s use of the Property. At the time of Contractor’s substantial completion, the Contracting Officer or his/her designee will conduct an inspection of the Work and will execute and deliver to Contractor a punch list specifying items to be completed and/or corrected prior to the Work being completed. Contractor agrees to complete and/or correct the Work in accordance with the terms of **Section 1.04** below.

1.04 Correction of Work. The Work is subject to review and approval by the Contracting Officer or his/her designee whether discovered before or after completion and whether or not fabricated, installed, or completed. The Work shall conform to all existing local and state building codes. Contractor shall coordinate all necessary color, type and style selections with the DCOA’s Contracting Officer or any other person that the Contracting officer designates. In the event that all or part of the Work is not approved and accepted by the Contracting Officer or his/her designee, said Work shall be deemed to be “**Rejected Work**”. Contractor shall correct all of the Work that is determined by the DCOA to be Rejected Work no later than 30 days after the DCOA notifies the Contractor of such Rejected Work. Contractor shall be responsible for the payment of all expenses associated with correcting said Rejected Work, including but not limited to additional testing and inspections, the cost of uncovering and replacement, and compensation for any third party services and expenses incurred by the DCOA as a result of such Rejected Work. In the event that Contractor fails to correct such Rejected Work within such 30 day time period, the DCOA may correct and remedy such Work. In such event, the DCOA may reduce the amount that is payable to Contractor hereunder in an amount equal to the sum that it expends to correct and remedy the Work and/or seek the payment of such sums directly from Contractor. Upon demand from the DCOA, Contractor agrees to pay to the DCOA within 7 days of the date of the demand the sums that the DCOA incurs to remedy any Rejected Work.

1.05 Licenses and Permits, Fees, Notices, and Compliance with Laws.

(a) Contractor shall obtain and maintain all necessary licenses, permits (including building permits), and certificates that it is required to hold or maintain (if any) to perform the Work specified herein, including all licenses required by any statute, ordinance, rule, or regulation. Contractor shall immediately notify the DCOA of any suspension, revocation, or other detrimental action against any of its licenses, permits or certificates that relate to the Work.

¹ Should Contractor fail to complete said Work within the time required, Contractor shall be subject to liquidated damages as specified in **Section 1.06**.

(b) Contractor shall secure and pay for the building permit as well as other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work.

(c) Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

1.06 Liquidated Damages. Contractor and the DCOA recognize that time is of the essence regarding this Agreement and that the DCOA will suffer financial loss if the Work is not completed by the time of the Required Completion Date. The Parties also recognize the expense and difficulties in proving in a legal proceeding the actual loss suffered by the DCOA if the Work is not completed on time. Accordingly, instead of requiring any such proof, the DCOA and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay the DCOA [$\$$ _____]² for each day that expires after the Required Completion Date until the Work is completed. Notwithstanding the foregoing, in the event that the weather prevents the Contractor from performing the Work, the Required Completion Date shall be extended for each day that the weather prevents Contractor from performing the Work, provided that the DCOA concurs (in writing) that the weather prevented the Contractor from performing the Work on such day(s). In this regard, should Contractor be prevented from performing the Work due to the weather, Contractor must so inform the DCOA no later than 3 days after such weather day. The DCOA's concurrence (in writing) with Contractor's claim for an extension due to a weather day and the Contractor providing the notice to the DCOA as set forth above are conditions precedent for the Contractor to claim a weather day(s) under this Section for the purpose of extending the Contractor's obligations to complete the Work within the time period set forth above. The terms and conditions of this Section are in addition to the terms and conditions that are set forth in **Article 4**, and the Parties agree that the terms and conditions of this Section may be enforced independent of the terms and conditions that are set forth in **Article 4**.

1.07 Warranty. Contractor warrants to the DCOA that the materials furnished under this Agreement will be of good quality, that Contractor's Work will be free from defects not inherent in the quality required or permitted, that the Work will conform to the requirements of this Agreement and that the Work will be fit for its ordinary purpose. Work not conforming to the requirements of this Agreement may be considered defective.

1.08 Correction of Work after Completion. In addition to Contractor's warranty obligations as set forth in **Section 1.07** above, if within 1 year after Contractor has completed the Work, any of the Work is found not to be in accordance with the requirements of this Agreement, Contractor shall correct the Work promptly after receipt of written notice from the DCOA to do so, unless the DCOA has previously given Contractor a written acceptance of such condition. If Contractor fails to correct the nonconforming Work within 30 days after written notice from the DCOA, the DCOA may correct the Work and, following completion of the corrected Work, Contractor shall pay the DCOA for the costs and expenses that the DCOA incurs in correcting the Work upon 7 days written notice from the DCOA to the Contractor. Nothing contained in this Section shall be construed to establish a period of limitation with respect to other obligations which

² [(Contract Sum * 15%)/Contract Days]

Contractor might have under this Agreement. Establishment of a 1 year period for correction of the Work relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the obligations to comply with this Agreement may be sought to be enforced by the DCOA, nor the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligation under this Agreement, other than specifically to correct the Work under this Section.

1.09 Subcontractors and Prohibition Against Liens. Contractor may not hire subcontractors to perform the Work unless the DCOA gives its written consent, which it may withhold in its sole and absolute discretion. The Contractor is prohibited from placing a lien on the DCOA's property. This prohibition shall apply to all subcontractors at any tier and all material suppliers.

1.10 List of Subcontractors. Upon request from the DCOA, Contractor shall provide to the DCOA a list of subcontractors and materialmen that have been or may be utilized to perform the Work. At the DCOA's request, Contractor agrees to provide to the DCOA lien waivers from all subcontractors and materialmen who have been utilized to perform the Work.

1.11 Subcontractor Responsibility. Contractor shall be responsible to the DCOA for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its subcontractors. Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in the tasks assigned to them.

1.12 Labor and Materials. Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

1.13 Use of Property. Contractor shall not unreasonably encumber the Property with materials or equipment. Contractor shall keep the Property clean and orderly during the course of the Work and, on a daily basis, remove from the Property all debris and waste material resulting from the Work. Contractor shall not utilize onsite trash receptacles, unless expressly authorized in writing by the DCOA. Upon completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus material from the Property.

1.14 Contractor's Representations and Warranties. Contractor represents and warrants to the DCOA that:

(a) The Contractor has visited the Property, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Work;

(b) The Work will be in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities;

- (c) title to all Work will pass to the DCOA no later than the time of payment;
- (d) all Work for which the Contractor has received payment from the DCOA is free and clear of liens, claims, security interests or other encumbrances adverse to the DCOA's interests; and
- (e) any plans and specifications provided by Contractor will be of good quality and suitable for the Work.

1.15 Contractor's Expertise. Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the DCOA to cooperate and exercise the Contractor's skill and judgment in furthering the interests of the DCOA; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the DCOA's interests.

ARTICLE 2 PAYMENT TO CONTRACTOR

2.01 Payment for the Work. Provided that Contractor performs its obligations as specified herein, the DCOA agrees to pay the Contractor the sum of [\$_____] (the "**Contract Sum**") for the Work that Contractor has agreed to perform as specified in this Agreement. The Contract Sum includes, but is not limited to, the cost of all permits associated with the Work, the cost of the bonds described in **Article 13**, and all charges associated with Contractor making trips to the Property. Unless written Contract modifications or changes are expressly agreed to by the DCOA, there shall be no escalation in the Contract Sum for any reason. Subject to the other terms and conditions of this Agreement, the above-referenced Contract Sum shall be payable by the DCOA to the Contractor as follows:

- (a) 90% of the Contract Sum shall be payable to Contractor upon its completing the Work as represented by the Contractor and verified by the DCOA's Contracting Officer or any other person that the Contracting officer designates.
- (b) 10% of the Contract Sum shall be payable to Contractor 30 days following completion of the Work (said completion as represented by Contractor and verified by the DCOA's Contracting Officer or any other person that the Contracting officer designates).

Contractor shall invoice the DCOA each time that an amount becomes payable under this Agreement. Such invoices should be sent to the DCOA, 174 Cypress Street, Suite 301, Abilene, Texas 79601. The DCOA agrees to pay the Contractor for such Work within 15 days following its receipt of the Contractor's invoice (but only after such Work has been inspected and approved by the DCOA).

Contractor shall not allow a mechanic, contractor, subcontractor, materialman or other person to contract for or in any other manner have or acquire any lien upon any building or work covered by this Contract or the land upon which the same is situated. Notwithstanding the foregoing, in the event that the DCOA receives notice or a claim that a subcontractor, supplier,

materialman or employee of Contractor has not been paid for work or materials provided for the project that is the subject of this Agreement, the DCOA may withhold all payments due to Contractor under this Agreement until such payment issues are resolved to the satisfaction of the DCOA.

Before final acceptance of this project by the DCOA, the Contractor may be required to execute and provide the DCOA with an affidavit that all bills for labor, materials and incidentals incurred by subcontractors, materialmen, mechanics and suppliers under this Agreement have been paid in full, and that there are no claims pending of which Contractor has been notified.

2.02 Method of Payment—Disputed Payments. If the DCOA disputes any items on an invoice that Contractor submits for any reason, including lack of approval or lack of supporting documentation, the DCOA shall temporarily delete the disputed item and pay the remainder of the invoice. The DCOA shall promptly notify the Contractor of the dispute and request remedial action. After the dispute is settled/resolved (and only after the dispute is settled/resolved), the Contractor shall include the disputed item on a subsequent regularly scheduled invoice or on a special invoice for the disputed item only at the agreed upon/determined amount.

2.03 Taxes. The DCOA is exempt from payment of Texas Limited Sales and Use Tax. The Contractor's invoices to the DCOA must not contain assessments of any of these taxes. The DCOA will furnish the DCOA's exemption certificate and federal tax identification number to the Contractor if requested.

ARTICLE 3 DISPUTE RESOLUTION

All claims by the Contractor against the DCOA shall be made in writing and submitted to the Contracting Officer for a written decision. The Contracting Officer shall, within 30 days after receipt of the request, decide the claim or notify the Contractor of the date by which the decision will be made. If the Contractor is not satisfied with the written decision made by the Contracting Officer, both Parties agree to make reasonable efforts to resolve the dispute by negotiation. If such negotiation is not successful, prior to proceeding to litigation, the Parties agree to submit the dispute to non-binding mediation with a mediator who is mutually acceptable to both Parties. If the Parties cannot agree on the selection of a mediator, each Party shall identify a mediator of their preference, and the two preferred mediators shall appoint a third mediator who shall be the person to mediate the dispute. The expenses incurred in retaining a mediator to conduct the mediation shall be equally shared between DCOA and the Contractor.

ARTICLE 4 TERMINATION AND DEFAULT

4.01 Termination for Convenience. The DCOA may terminate this Agreement in whole or in part, whenever the Contracting Officer determines that such termination is in the best interest of the DCOA. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which the performance of the Work under the Contract is terminated, and the effective date upon which such termination becomes effective. If the

performance of the Work is terminated under this Section of the Agreement, either in whole or in part, the DCOA shall be liable to the Contractor only for payment of services rendered before the effective date of the termination.

4.02 Default by Contractor and Termination for Default. The Contracting Officer may issue a written order to the Contractor to stop the Work, or any portion thereof, upon the occurrence of any of the following:

(a) Contractor refuses or fails to prosecute the Work or any separable part thereof in accordance with the terms of this Agreement and/or with the diligence that will assure its completion within the time specified in this Contract, or any extension thereof, or fails to complete said Work within this time;

(b) Contractor refuses or fails to supply enough properly skilled workers or proper materials;

(c) Contractor fails to make a payment to a subcontractor for materials or labor in accordance with the respective agreements between the Contractor and the subcontractors;

(d) Contractor disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

(e) Contractor otherwise breaches a provision of this Agreement.

In that event, the DCOA may, without prejudice to any other remedies, take over the Work and complete it by contract or otherwise, and may take possession of and use any materials and equipment on the Property necessary for completing the Work. The DCOA may further withhold or nullify payments under this Agreement, in whole, or in part, to the extent reasonably necessary to reimburse the DCOA for the reasonable cost of correcting and/or completing the Work and the Contractor shall not be entitled to receive further payment until the DCOA has completed the Work. The Contractor shall be liable for any damage to the DCOA from Contractor's refusal or failure to complete the Work within the specified time, whether or not the Contractor's right to proceed with the Work is terminated. This liability includes any increased cost incurred by the DCOA in completing the Work.

In addition to (and not in lieu of) the foregoing, in the event that Contractor fails to perform its obligations under this Agreement, the DCOA may deliver to the Contractor written notice of such default. If the event of default specified in the notice is not cured by the Contractor within 10 days (or such other date as specified in the notice) after delivery of such written notice to Contractor, then the DCOA may exercise any one or more remedies available as allowed by law or under this Agreement to seek recovery of monetary damages suffered by the DCOA as a result of the default.

4.03 Default by DCOA. In the event that the DCOA fails to perform its obligations under this Agreement, the Contractor shall deliver to the DCOA written notice of such default and an opportunity of at least 30 days for the DCOA to cure the default. Any claim by Contractor that the

DCOA has defaulted under this Agreement is subject to the Dispute Resolution section of this Agreement (**Article 3**).

ARTICLE 5 INDEMNIFICATION

CONTRACTOR AGREES TO AND SHALL DEFEND, INDEMNIFY, AND HOLD THE DCOA, ITS AGENTS, EMPLOYEES, OFFICERS, BOARD MEMBERS, RETAINED CONSULTANTS AND LEGAL REPRESENTATIVES (COLLECTIVELY IN THIS AND THE FOLLOWING TWO PARAGRAPHS, THE “DCOA”) HARMLESS FOR ALL SUITS, CLAIMS, CAUSES OF ACTION, LIABILITIES, FINES, AND EXPENSES (INCLUDING, WITHOUT LIMITATION, ATTORNEYS’ FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS AND INTEREST) FOR LOSS, DAMAGE OR INJURY ARISING OUT OF OR RELATED TO, OR ALLEGED TO ARISE OUT OF OR BE RELATED TO THE PERFORMANCE, CONDITIONS, OR EXISTENCE OF THE WORK AND/OR CONTRACTORS USE OF THE PROPERTY IN ITS PERFORMANCE OF THE WORK (THE “ACTS OR OMISSIONS”), AS WELL AS THE ACTS OR OMISSIONS OF ANY SUBCONTRACTOR, ANY SUPPLIER OR ANY INDIVIDUAL OR ENTITY DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM TO PERFORM OR SUPPLY ANY OF THE WORK, REGARDLESS OF WHETHER OR NOT CAUSED IN PART BY ANY NEGLIGENCE OR OMISSION OF THE DCOA.

IT IS THE EXPRESSED INTENT OF THE PARTIES TO THIS AGREEMENT THAT THE INDEMNITY PROVIDED FOR IN THIS SECTION IS AN INDEMNITY EXTENDED BY CONTRACTOR TO INDEMNIFY AND PROTECT THE DCOA FROM THE CONSEQUENCES OF THE ACTIONS OF THE CONTRACTOR, ANY SUBCONTRACTOR, ANY SUPPLIER OR ANY INDIVIDUAL OR ENTITY DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM, AS WELL AS THE DCOA’S OWN NEGLIGENCE, PROVIDED, HOWEVER, THAT THE INDEMNITY PROVIDED AS TO THE DCOA’S NEGLIGENCE IN THIS SECTION SHALL APPLY ONLY WHEN A COURT OF COMPETENT JURISDICTION ENTERS A FINAL UNAPPEALABLE JUDGMENT ADJUDGING THAT THE NEGLIGENT ACT OF THE DCOA IS A CONTRIBUTORY CAUSE OF THE RESULTING INJURY, DEATH OR DAMAGE AND SHALL HAVE NO APPLICATION WHEN THE NEGLIGENT ACT OF THE DCOA IS THE SOLE CAUSE OF THE RESULTANT INJURY, DEATH, OR DAMAGE UNMIXED WITH THE LEGAL FAULT OF ANOTHER PERSON OR ENTITY.

In this connection, it is expressly agreed that Contractor shall, at its own expense, defend the DCOA (using counsel that is approved by the DCOA) against any and all claims, suits or actions which may be brought against the DCOA, as a result of, or by reason of, or arising out of, or on account of, or in consequence of any act or failure to act the consequences of which Contractor has indemnified the DCOA against, and if Contractor shall fail to do so, the DCOA shall have the right, but not the obligation, to defend the same and to charge all direct and incidental costs of such defense to Contractor including attorney’s fees and court costs. The

indemnity obligations that are set forth herein expressly survive the termination of this Agreement.

Contractor must at all times exercise reasonable precautions on behalf of, and be solely responsible for, the safety of Contractor's employees while in the vicinity where the Work is being done. The DCOA is not liable or responsible for the negligence or intentional acts or omissions of the Contractor or Contractor's employees.

The DCOA assumes no responsibility or liability for damages which are directly or indirectly attributable to any defect, real or alleged, which now exists or which may hereafter arise upon the Property ("**Premise Defects**"). Responsibility for all such Premise Defects is expressly assumed by the Contractor with respect to any damages sustained by Contractor or any of Contractor's subcontractors.

ARTICLE 6 INSURANCE

Contractor shall maintain in effect certain insurance coverage and shall furnish certificates of insurance to the DCOA, in duplicate form, before beginning its performance under this Agreement. All policies except Workers' Compensation must name the DCOA as an additional insured. The required insurance must be issued by a company or companies of sound and adequate financial responsibility. All policies are subject to examination and approval by the DCOA for their adequacy as to content, form of protection and providing company. Contractor shall maintain the following insurance coverages in the following amounts:

- (a) Commercial General Liability insurance: \$1,000,000.00 per occurrence; \$2,000,000.00 aggregate, together with damage to premises and fire damage of \$50,000.00 and medical expenses of any one person of \$5,000.00 with deductible no greater than \$1,000.00.
- (b) Workers' Compensation: Statutory amount meeting the requirements in **Exhibit A**.
- (c) Automobile: Automobile Liability on owned and non-owned motor vehicles used on the site(s) or in connection therewith for a combined single limit for bodily injury and property damage of not less than \$1,000,000.00 per occurrence.

Defense costs are excluded from the face amount of this policy. Aggregate Limits are per 12-month policy period unless otherwise indicated.

If Contractor has employees, Contractor shall obtain and/or maintain workers' compensation insurance coverage throughout the term of this Contract and for at least 6 months after this Agreement expires or terminates. Should Contractor not have employees at the time this Contract is signed and hires employees while performing under this Contract, Contractor shall, prior to said employee(s) first day of employment with Contractor: (i) notify the DCOA of that fact; and (ii) obtain workers' compensation insurance coverage (and provide proof of such coverage to the DCOA). The amount of workers' compensation coverage shall comply with Texas state statutes.

All insurance policies must require on their face, or by endorsement, that the insurance carrier waives any rights of subrogation against the DCOA, and that it shall give 30 days written notice to the DCOA before they may be canceled, materially changed, or nonrenewed. Within the 30 day period, Contractor shall provide other suitable policies in lieu of those about to be cancelled, materially changed, or nonrenewed so as to maintain in effect the required coverage. If the Contractor does not comply with this requirement, the DCOA, at its sole discretion, may: (i) immediately suspend the Contractor from any further performance under this Agreement and begin procedures to terminate for default; or (ii) purchase the required insurance with DCOA funds and deduct the cost of the premiums from amounts due to Contractor under this Agreement.

Within 3 business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Agreement, the Contractor shall provide notice to the DCOA of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the DCOA shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation under this Agreement, including but not limited to the obligations to provide any required coverage.

ARTICLE 7 INTELLECTUAL PROPERTY

7.01 Intellectual Property Fees and Suits. Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringement of any patent rights and shall hold the DCOA harmless from loss on account thereof.

7.02 Use of Plans and Specifications. The DCOA shall be entitled and authorized to use and reproduce any plans and specifications prepared and/or used by Contractor for the Work.

ARTICLE 8 CONSTRUCTION BY DCOA OR BY SEPARATE CONTRACTORS

8.01 Construction by Separate Contractors. The term “*Separate Contractors*” shall mean other contractors retained by the DCOA under separate agreements. The DCOA reserves the right to perform construction or operations related to the Property with the DCOA’s own forces, and with Separate Contractors retained under conditions of a contract substantially similar to those of this Agreement, including those provisions of the conditions of a contract related to insurance and waiver of subrogation.

8.02 Storage of Materials/Equipment. The Contractor shall afford the DCOA and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor’s activities with theirs.

8.03 Cost Reimbursement. The DCOA shall be reimbursed by the Contractor for costs incurred by the DCOA which are payable to a Separate Contractor because of delays, improperly timed activities, or defective construction of the Contractor.

ARTICLE 9 CHANGES IN THE WORK

The DCOA, without invalidating this Contract, may order changes, additions, deletions, or other revisions to the Work, with the Contract Sum and Required Completion Date being adjusted accordingly. Such changes in the Work shall be authorized by a written “*Change Order*” signed by the DCOA and Contractor and adjustments in the Contract Sum and Required Completion Date resulting from a change in the Work shall be determined by the mutual agreement of the Parties.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.01 Safety Precautions and Programs. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. The Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury, or loss to the following:

- (a) employees on the Property and other persons who may be affected thereby;
- (b) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, or a subcontractor; and
- (c) other personal property at the Property or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction.

10.02 Safety Notices and Remedy of Damages. The Contractor shall comply with, and give all notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities related to the safety of persons and property and their protection from damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a subcontractor, or anyone directly or indirectly employed by any of them.

ARTICLE 11 NO INDEBTEDNESS

Contractor agrees that no payments owed by Contractor of any nature whatsoever to the DCOA, including payment in advance for service charges or any sums of any character whatsoever, shall become delinquent or in arrears. The DCOA will not knowingly award contracts for goods or services to any bidder in arrears to the DCOA for any debt, claim, demand, or account whatsoever, including taxes, penalty and interest. Contractor is responsible for ensuring that no indebtedness exists.

**ARTICLE 12
VERIFICATION OF EMPLOYMENT ELIGIBILITY**

Contractor must comply with the Immigration Reform and Control Act (“**IRCA**”) and may not knowingly obtain labor or services of an unauthorized alien. Contractor, not the DCOA, must verify eligibility for employment as required by IRCA.

**ARTICLE 13
PAYMENT AND PERFORMANCE BONDS**

Contractor must furnish a payment bond. Contractor must also furnish a performance bond when this Contract is executed and delivered to the DCOA. Each bond shall be for the full amount of this Contract, must be executed by a corporate surety company authorized to do business in the State of Texas and acceptable to the DCOA.

The DCOA may require additional security if the initial surety becomes insolvent, bankrupt, or otherwise financially unable to protect the DCOA under the terms of this Contract. The DCOA’s requiring new or additional security relieves neither the original surety nor the Contractor of their obligations under this Contract. The DCOA may, without incurring any liability, stop work under this Contract until Contractor furnishes additional security.

**ARTICLE 14
MISCELLANEOUS PROVISIONS**

14.01 Salvage Rights. DCOA shall have the right to retain any materials, rubbish, or other items (“**Salvage Materials**”) that are demolished and/or slated to be removed from the Property by Contractor (“**Salvage Rights**”). To exercise the Salvage Rights, the DCOA shall give the Contractor notice of the Salvage Materials that Contractor intends to salvage and Contractor agrees to use reasonable care in placing the Salvage Materials in a location on the Property that is easily accessible to the DCOA. This Section shall not otherwise alter Contractor’s obligations to keep the Property clean and remove all waste materials and rubbish caused by operations under this Agreement.

14.02 Independent Contractor. Contractor is an independent contractor and shall perform the services provided for in this Agreement in that capacity. The DCOA has no control or supervisory powers over the manner or method of Contractor’s performance under this Agreement. Contractor is solely responsible for the compensation of its personnel, including but not limited to the withholding of income, social security, and other payroll taxes and all workers’ compensation benefits coverage. Contractor acknowledges and agrees that it may not subcontract the services it has agreed to render herein to the DCOA, unless the DCOA provides its express written agreement allowing for such contracting (which it is not required to approve). Nothing contained in this Agreement or in the relationship between DCOA and Contractor shall be deemed to constitute such relationship as a partnership or joint venture, or constitute Contractor as an employee or a partner of DCOA, or create any other relationship between DCOA and Contractor, expressed or implied.

14.03 Time is of the Essence. Timely performance by Contractor is essential to this Agreement.

14.04 Force Majeure. Timely performance by both Parties is essential to this Agreement. However, neither Party is liable for reasonable delays in performing its obligations under this Agreement to the extent that the delay is caused by Force Majeure that directly impacts the DCOA or Contractor. The event of Force Majeure may permit a reasonable delay in performance but does not excuse a Party's obligations to complete performance under this Agreement. As used in this Agreement, "**Force Majeure**" means: fires, interruption of utility services, floods, hurricanes, tornadoes, explosions, war, terrorist acts against the DCOA or Contractor, riots, strikes, court orders, and the acts of superior governmental or military authority, and which the affected Party is unable to prevent by the exercise of reasonable diligence. Force Majeure does not include a weather day that the DCOA has not concurred to in writing under **Section 1.06** above. Force Majeure does not entitle Contractor to extra reimbursable expenses or payment.

14.05 Severability. If any part of this Agreement is for any reason found to be unenforceable, all other parts remain enforceable unless the result materially prejudices either Party.

14.06 Entire Agreement. This Agreement, including the Project Manual, merges the prior negotiations and understandings of the Parties and embodies the entire agreement of the Parties. No other agreements, assurances, conditions, covenants (express or implied), or other terms of any kind, exist between the Parties regarding this Agreement.

14.07 Written Amendment. Unless otherwise specified elsewhere in this Agreement, this Agreement may be amended only by written instrument executed on behalf of the DCOA and Contractor.

14.08 Applicable Laws and Venue. This Agreement is subject to the laws of the State of Texas, the laws of the federal government of the United States, and all rules and regulations of any regulatory body or officer having jurisdiction. Contractor shall comply with all applicable state and federal laws and regulations applicable to this Agreement and the Contractor's services hereunder. Venue for any litigation relating to this Agreement shall be in Taylor County, Texas.

14.09 Notices. All notices required or permitted by this Agreement must be in writing and are deemed delivered on the earlier of the date actually received or the third day following: (1) deposit in a United States Postal Service post office or receptacle; (2) with proper postage (certified mail, return receipt requested); and (3) addressed to the other Party at the address set out in the preamble of this Agreement or at such other address as the receiving Party designates by proper notice to the sending Party.

14.10 Captions. Captions contained in this Agreement are for reference only, and therefore, have no effect in construing this Agreement. The captions are not restrictive of the subject matter of any section in this Agreement.

14.11 Non-Waiver. If either Party fails to require the other to perform a term of this Agreement, that failure does not prevent the Party from later enforcing that term and all other

terms. If either Party waives the other's breach of a term, that waiver does not waive a later breach of this Agreement.

14.12 Retention and Inspection of Records. With regard to the services that the Contractor has agreed to perform hereunder, the Contractor shall retain such records for a period of 4 years after this Agreement terminates and shall keep its books or records relating to such services available for the DCOA's review and copying for at least 4 years after this Agreement terminates. This provision does not affect the applicable statute of limitations.

14.13 Enforcement. Contractor shall provide to the DCOA all documents and records that the DCOA requests to assist in determining Contractor's compliance with this Agreement, with the exception of those documents made confidential by federal or state law or regulation.

14.14 Survival. Contractor shall remain obligated to the DCOA under all clauses of this Agreement that expressly or by their nature extend beyond the expiration or termination of this Agreement, including but not limited to, the indemnity provisions.

14.15 Parties in Interest. This Agreement does not bestow any rights upon any third party, but binds and benefits the DCOA and Contractor only.

14.16 Successors and Assigns. This Agreement binds and benefits the Parties and their legal successors and permitted assigns; however, this provision does not alter the restrictions on assignment and disposal of assets set forth herein. This Agreement does not create any personal liability on the part of any officer or agent of the DCOA.

14.17 Assignment. Contractor shall not assign or delegate its responsibility under this Agreement without the DCOA's prior written consent.

14.18 Remedies Cumulative. Unless otherwise specified elsewhere in this Agreement, the rights and remedies contained in this Agreement are not exclusive, but are cumulative of all rights and remedies, which exist now or in the future. Neither Party may terminate its duties under this Agreement except in accordance with its provisions.

14.19 Not Parties to Agreement. Neither the City of Abilene nor the State of Texas is a Party to this Agreement and neither of such parties are subject to any obligations or liabilities to the DCOA, Contractor, or any other party pertaining to any matter resulting from this Agreement.

14.20 Construction. Each Party agrees that any court interpreting or considering this Agreement shall not apply the presumption that the terms hereof shall be more strictly construed against a Party by reason of the rule or conclusion that a document should be construed more strictly against the Party who prepared it.

14.21 Advice of Counsel. Both Parties acknowledge that this Contract is a legal document and that they have been advised and given the opportunity to seek the advice of legal counsel of their own choosing as to its contents, obligations and effect.

14.22 Counterpart Execution. This Agreement may be executed in several counterparts, each of which shall be fully effective as an original and all of which together shall constitute one

and the same instrument. A signed copy of this Agreement (including an electronically signed copy) transmitted by facsimile, email or other means of electronic transmission shall be deemed to have the same legal effect as delivery of an original executed copy of the Agreement. Each Party agrees that any electronic signatures of the Parties included in this Agreement are intended to authenticate this writing and to have the same force and effect as manual signatures.

14.23 Waiver of Claims for Consequential Damages. The Contractor waives and in no event shall the DCOA be liable under this Agreement to Contractor for consequential, indirect, incidental, special, exemplary, punitive or enhanced damages, or lost profits or revenues, arising out of, relating to, or in connection with any breach of this Agreement.

Executed to be effective as of the date that this Agreement is executed by the DCOA (the “*Effective Date*”).

DCOA
DEVELOPMENT CORPORATION OF
ABILENE, INC.

CONTRACTOR
[COMPANY NAME]

By: _____
Misty Mayo, President and CEO
Date: _____

By: _____
Name: _____
Title: _____

EXHIBIT A

a. Definitions

Certificate of coverage ("certificate") - a copy of a certificate of insurance, a certificate of authority to self-insure issued by the 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 a project, for the duration of the project.

Duration of the project - includes the time from the beginning of the work on the project until the Contractor's/person's work on the project has been completed and accepted by the DCOA.

Persons providing services on the project ("subcontractors" in 406.096) - includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitations, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

- b. The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.
- c. The Contractor must provide a certificate of coverage to the DCOA prior to being awarded the Contract.
- d. If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the DCOA showing that coverage has been extended.
- e. Contractor shall obtain from each person providing services on a project and provide to DCOA:
(1) a certificate of coverage, prior to that person beginning work on the project, so the DCOA will have on file certificates of coverage showing coverage for all persons providing services on the project; and
(2) no later than 7 days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
- f. The Contractor shall retain all required certificates of coverage for the duration of the project and for 1 year thereafter.
- g. The Contractor shall notify the DCOA in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.
- h. The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
- i. The Contractor shall contractually require each person with whom it contracts to provide services on a project to:
(1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;
(2) provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing service on the project, for the duration of the project;
(3) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
(4) obtain from each other person with whom it contracts, and provide to the Contractor:

- (a) a certificate of coverage, prior to the other person beginning work on the project; and
 - (b) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
- (5) retain all required certificates of coverage on file for the duration of the project and for 1 year thereafter;
- (6) notify the DCOA in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing service on the project;
- (7) contractually require each person with whom it contracts, to perform as required by paragraphs (i) (1)- (6), with the certificates of coverage to be provided to the person for whom they are providing services.
- j. By signing this contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the DCOA that all employees of the Contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self- Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.
- k. The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the DCOA to declare the contract void if the Contractor does not remedy the breach within 10 days after receipt of notice of breach from the DCOA.

PERFORMANCE BOND

<p>Contractor</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>
<p>Owner</p> <p>Name: Development Corporation of Abilene, Inc.</p> <p>Mailing address <i>(principal place of business)</i>: 174 Cypress Street, 3rd Floor Abilene, Texas 79601</p>	<p>Contract</p> <p>Description <i>(name and location)</i>: Polaris Dr. Sewer Line Extension, Five Points Business Park, Abilene, Texas</p> <p>Contract Price: _____</p> <p>Effective Date of Contract: _____</p>
<p>Bond</p> <p>Bond Amount: _____</p> <p>Date of Bond: _____ <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form: <input checked="" type="checkbox"/> None <input type="checkbox"/> See Paragraph 16</p>	
<p>Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.</p>	
Contractor as Principal	Surety
_____ <i>(Full formal name of Contractor)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<p><i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
 - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
 - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
 - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
 - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: **None**

PAYMENT BOND

<p>Contractor</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>
<p>Owner</p> <p>Name: Development Corporation of Abilene, Inc.</p> <p>Mailing address (<i>principal place of business</i>): 174 Cypress Street, 3rd Floor Abilene, Texas 79601</p>	<p>Contract</p> <p>Description (<i>name and location</i>): Polaris Dr. Sewer Line Extension, Five Points Business Park, Abilene, Texas</p> <p>Contract Price: _____</p> <p>Effective Date of Contract: _____</p>
<p>Bond</p> <p>Bond Amount: _____</p> <p>Date of Bond: _____ <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form: <input checked="" type="checkbox"/> None <input type="checkbox"/> See Paragraph 18</p>	
<p>Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.</p>	
Contractor as Principal	Surety
_____ <i>(Full formal name of Contractor)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<p><i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
 - 5.1. Claimants who do not have a direct contract with the Contractor
 - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2. Pay or arrange for payment of any undisputed amounts.
 - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
 - 16.1. *Claim*—A written statement by the Claimant including at a minimum:
 - 16.1.1. The name of the Claimant;
 - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
 - 16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
 - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
 - 16.1.7. The total amount of previous payments received by the Claimant; and
 - 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
 - 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
 - 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
 18. Modifications to this Bond are as follows: **None**

CERTIFICATE OF INSURANCE

TO:

Owner _____

 Address _____

Date _____
 Project No _____
 Project Type _____

THIS IS TO CERTIFY THAT _____
 (Name and address of Insured)

is, at the date of this certificate, insured by this Company with respect to the business operations hereinafter described, for the types of Insurance and in accordance with the provisions of the standard policies used by this Company, and further hereinafter described. Exceptions to standard policy noted on reverse side hereof.

TYPE OF INSURANCE

	Policy No.	Effective	Expires	Limits of Liability
Workmen's Compensation				
Public Liability				1 Person \$ _____ 1 Accident \$ _____
Contingent Liability				1 Person \$ _____ 1 Accident \$ _____
Property Damage				
Builder's Risk				
Automobile				
Other				

The foregoing Policies (do) (do not) cover all sub-contractors.

Locations Covered: _____

Descriptions of Operations Covered: _____

The above policies either in the body thereof or by appropriate endorsement provide that they may not be changed or canceled by the insurer in less than five days after the insured has received written notice of such change or cancellation.

Where applicable local laws or regulations require more than five days actual notice of change or cancellation to the assured, the above policies contain such special requirements, wither in the body thereof or by appropriate endorsement thereto attached.

 (Name of Insurer)

By _____

Title _____

NOTICE OF AWARD

Date of Issuance:

Owner: Development Corporation of Abilene, Inc. Owner’s Project No.: DCOA0224

Engineer: Jacob | Martin Engineer’s Project No.:

Project: Polaris Dr. Sewer Line Extension

Bidder:

Bidder’s Address:

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Polaris Dr. Sewer Line Extension

The Contract Price of the awarded Contract is \$_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Sign the Contract that is sent to you through DocuSign.
2. Deliver through DocuSign with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Owner: **Development Corporation of Abilene, Inc.**

By (signature): _____

Name (printed): _____

Title: _____

NOTICE TO PROCEED

Owner: Development Corporation of Abilene, Inc. Owner's Project No.: DCOA0224

Engineer: Jacob | Martin Engineer's Project No.: _____

Contractor: _____ Contractor's Project No.: _____

Project: Polaris Dr. Sewer Line Extension

Effective Date of Contract: _____

Owner hereby notifies Contractor, as of _____, 2024, to commence performance of the Work under Section 1.02 of the Contract.

On that date, Contractor shall start performing its obligations under the Contract. No Work will be done at the Property prior to such date.

In accordance with the Contract:

The number of days to achieve completion is ____ from the date stated above for the commencement of the Work, resulting in a Required Completion Date of _____.

Before starting any Work at the Property, Contractor must comply with the following:

Owner: **Development Corporation of Abilene, Inc.**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Date Issued: _____

Copy: Engineer, Contractor

TECHNICAL SPECIFICATIONS



CITY OF ABILENE

PROJECT SPECIFICATIONS

POLARIS DRIVE SEWER LINE EXTENSION

January 2024



3465 Curry Lane
Abilene, TX 79606
325.695.1070

908 S. Main Street, Suite 100
Boerne, TX 78006
325.695.1070

4920 S. Loop 289, Suite 104
Lubbock, TX 79414
806.368.6375

1925 Fort Worth Highway
Weatherford, TX 76086
817.594.9880

This page intentionally left blank

TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

- 01 01 01 SUMMARY OF WORK**
- 01 02 01 SPECIAL TECHNICAL SPECIFICATIONS AND CONDITIONS**
- 01 09 01 DISINFECTION OF POTABLE WATER PIPING AND TANKS**

DIVISION 02 - EXISTING CONDITIONS

- 02 01 01 SITE CLEARING**

DIVISION 03 - CONCRETE

- 03 04 01 MANHOLES**
- 03 04 04 POLYMER CONCRETE MANHOLES**
- 03 05 01 GROUT**
- 03 09 01 GENERAL CONCRETE**

DIVISION 31 - EARTHWORK

- 31 03 01 TRENCHING, BACKFILLING AND COMPACTING**
- 31 04 01 TRENCH EXCAVATION SAFETY PROTECTION SYSTEM**
- 31 06 01 SITE GRADING AND EARTHWORK**

DIVISION 33 - UTILITIES

- 33 01 01 GENERAL REQUIREMENTS FOR PIPING SYSTEMS**
- 33 01 02 FIELD TESTING OF PIPING SYSTEMS**
- 33 01 03 DUCTILE IRON PIPE**
- 33 01 06 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE**
- 33 01 07 POLYVINYL CHLORIDE (PVC) SANITARY SEWER PIPE**
- 33 01 08 PIPE COUPLINGS AND EXPANSION JOINTS**

This page intentionally left blank

SECTION 01 01 01 - SUMMARY OF WORK

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Construct work as described in the Contract Documents.
 - 1. Provide materials, equipment, and incidentals required to make the project completely operable.
 - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete project.
 - 3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation and all other work required for a complete and operable project.
 - 4. Test and place the completed project in operation.
 - 5. Provide the special tools, spare parts, lubricants, supplies, or other materials as required for the operation and maintenance of the Project.
 - 6. Drawings and Specifications may not indicate or describe all of the work required to complete the project. Additional details required for the completion of the project are to be provide by the CONTRACTOR and coordinated with the ENGINEER.

1.2 REFERENCE STANDARDS

1.3 JOB CONDITIONS

- A. The General Conditions, the Special Conditions, and Division One Specifications apply to each Specification section.
- B. Comply with all applicable federal, state and local codes and regulations pertaining to the nature and character of the work being performed.

1.4 DESCRIPTION OF WORK

- A. This project consists of furnishing and installing approximately 1,715 LF of 10" SDR35 PVC sewer line, approximately 640 LF of 8" SDR35 PVC sewer line, approximately 260 LF of 6" SDR35 PVC sewer line, manholes, connections and all associated incidentals.

1.5 CONSTRUCTION OF UTILITIES

- A. Coordinate with Utility Companies or their contractors to provide all required utilities for this project. Construction of permanent utilities will be paid for by the OWNER.

1.6 OCCUPANCY

- A. As soon as any portion of the Project is ready to use, the OWNER shall have the right to operate the portion upon written notice to the CONTRACTOR.
- B. Testing of Controls, including specified test periods, training, and start-up does not constitute acceptance for operation.
- C. OWNER may accept the facility for continued use after start-up and testing at the option of the OWNER. If acceptance is delayed at option of the OWNER, shut down facilities per approved Operation and Maintenance procedures.
- D. The execution of bonds is understood to indicate the consent of surety.
- E. Conduct operations to insure the least inconvenience to the OWNER and general public.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide materials and products per the individual sections of the Specifications.

PART 3 EXECUTION

3.1 NOT USED

-- END OF SECTION --

This page intentionally left blank

SECTION 01 02 01 - SPECIAL TECHNICAL SPECIFICATIONS AND CONDITIONS**PART 1 GENERAL****1.1 REFERENCE STANDARDS****1.2 SALES TAX EXEMPTION**

- A. The OWNER qualifies as an exempt agency pursuant to the provisions of the Texas Limited Sales, Excise and Use Tax Act, and is not subject to any State or City sales tax on materials and labor used in the performance for this project. The CONTRACTOR shall issue a resale exemption certificate when purchasing said materials. Said exemption certificate complying with Section 151.155 (Exemption Certificate) and 151.309 (Government Entities) of Texas Limited Sales, Excise and Use Tax Act, as amended. Any sales taxes applicable to equipment purchases, rentals, leases, or consumable supplies or other taxable services not incorporated into the project shall be the responsibility of the CONTRACTOR.

1.3 METHODS OF OPERATION

- A. The CONTRACTOR shall inform the ENGINEER in advance concerning his plans for carrying on each part of the work, but the CONTRACTOR alone shall be responsible for safety, adequacy, and efficiency of his plant, equipment, and methods.
- B. The OWNER and ENGINEER will not be responsible for any act or omission of the CONTRACTOR, or any subcontractor, or any of the agents or employees, or any other persons performing any of the work. The OWNER and ENGINEER will not be responsible for any failure of the CONTRACTOR or his subcontractors or any other persons to perform the work in accordance with the requirements of the contract documents.
- C. Review by the OWNER or ENGINEER of any plan or method of work proposed by the CONTRACTOR shall not relieve the CONTRACTOR of any responsibility therefore, and such review shall not be considered as an assumption of any risk or liability by the OWNER or ENGINEER, or any officer, agent, or employee thereof.

1.4 WORKMANSHIP

- A. These specifications contain detailed instructions and descriptions covering the major items of construction and workmanship necessary to construct the above mentioned project. The specifications are intended to be so written that only first class workmanship and finish of the best grade and quality will result. The fact that these specifications may fail to be so complete as to cover all details will not relieve the CONTRACTOR of full responsibility for providing a completed project of high quality, first class finish and appearance and satisfactory for operation, all within the apparent intent of the plans and specifications.

1.5 FINAL QUANTITIES INSTALLED

- A. Should there be a discrepancy between the CONTRACTOR'S claim for quantity of materials installed and the quantity measured by the ENGINEER, the discrepancy may be resolved as follows:
1. The plans shall be thoroughly checked by the ENGINEER and CONTRACTOR to assure that all changes in work have been recorded and no errors exist in the material take-off.
 2. Should the quantity discrepancy not be resolved by means of plan sheet examination, then at the CONTRACTOR'S request, segments of lines may be re-measured: however, if the CONTRACTOR'S figures are not proven to be accurate by re-measurement, then the CONTRACTOR shall pay for cost of re-measurement.
 3. Any deviations in straight-line routing of pipeline not approved by the ENGINEER and/or OWNER shall be paid only for the footage of pipe which would have been required for a straight line installation.

1.6 PROTECTION OF LIVES AND PROPERTY

- A. In order to protect the lives and health of his employees, the CONTRACTOR shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General CONTRACTOR of America, Inc. The CONTRACTOR shall maintain an accurate record of all cases of death, occupational disease and injuries requiring medical attention or causing loss of time from work arising out of and in the course of work under this contract. The CONTRACTOR alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods and for any damage which may result from their failure, improper construction, maintenance or operation.

1.7 SANITARY FACILITIES

- A. The CONTRACTOR shall provide adequate toilet facilities for use by workmen in accordance with O.S.H.A. provisions, and shall maintain such facilities throughout the construction period.

1.8 EXISTING UTILITIES

- A. It shall be the entire responsibility of the CONTRACTOR to locate all existing underground utilities ahead of the work, whether or not shown on the Plans, and to protect and preserve such utilities from any damage from the proposed construction operations. In the event an underground water, oil, gas, telephone line, or other utility is damaged, the respective OWNER of said utility shall be notified immediately by the CONTRACTOR. It shall be the CONTRACTOR'S entire responsibility to see that said utilities are repaired to the satisfaction of the ENGINEER and utility OWNER. If the CONTRACTOR shows a complete disregard for existing utilities, the CONTRACTOR will pay the OWNER, \$1,000 per occurrence in addition to paying all costs for repairing damage to existing utilities. Continued disregard for existing utilities may result in suspension or termination of the Construction Contract. Where overhead poles or anchors are encountered, or are necessary to be disturbed or moved, the CONTRACTOR shall contact the OWNER of the utility and arrange to have the necessary adjustments made, at no additional cost to the OWNER. When signs are disturbed or damaged, the CONTRACTOR shall restore them to the same or better condition that existed prior to construction.

1.9 SATURDAY AND SUNDAY WORK

- A. Construction work on Saturdays or Sundays will not be permitted on the project except to maintain barricades, warning signs and flares. In the event the CONTRACTOR is prevented from working on the project for two or more days in any one calendar week, he may work the following Saturday if approval is given by the ENGINEER and OWNER.

1.10 TPDES GENERAL PERMIT

- A. The CONTRACTOR shall fully comply with the Texas Pollutant Discharge Elimination System Permit TXR 150000. All construction activities shall fully comply with all aspects of this permit, and the CONTRACTOR shall certify to the OWNER said compliance before the certificate of construction completion is issued. The CONTRACTOR shall apply for and obtain the permit before construction. The CONTRACTOR shall be responsible for the permit fee and all other costs associated with the referenced permit.
- B. At least three (3) days before commencement of construction, the CONTRACTOR shall file a Notice of Intent (NOI) with the TCEQ. The notice shall be sent to the TCEQ, Storm Water & Processing Center: MC-228, P.O. Box 13087, Austin, Texas 78711-3087. One copy of the NOI shall be sent to the ENGINEER and one copy shall be posted at the site. The NOI form and permit requirement may be obtained from the TCEQ or on their website www.tceq.state.tx.us. The CONTRACTOR shall prepare a Stormwater Pollution Prevention Plan (SWPPP), obtain,

and fully comply with the Texas Pollutant Discharge Elimination System Permit TXR 150000.
Questions concerning this permit may be addressed to TCEQ at 512-239-3700.

1.11 CONSTRUCTION SURVEYING

- A. The construction surveying described in Paragraph 1 below shall be provided by the OWNER. The surveying work contained in Paragraphs 2, 3, and 4 shall be considered subsidiary to the overall project and no separate payment shall be made for this work. Work contained in Paragraphs 2, 3, and 4 shall be accomplished by the CONTRACTOR.
1. The surveyor shall obtain copies of all private property easements, and public right of way permits. From these easements and permits, the surveyor shall set alignment lathes, stakes, and hubs as needed and benchmarks as needed, plus alignment stakes at every horizontal PI. Also, alignment lathes, stakes, and hubs shall be set at every property line or ROW line crossing. The CONTRACTOR shall notify the ENGINEER at least 24 hours before each segment is to be staked. Each segment to be staked shall be a minimum of 1000 feet in length. Staking will be provided one time only. Stakes that are lost or damaged shall be replaced by the CONTRACTOR at his own cost.
 2. Locate and protect control points prior to starting the site work and preserve permanent reference points during construction. The CONTRACTOR shall not change or relocate points without prior approval of the ENGINEER. Notify ENGINEER when the reference point is lost, destroyed, or requires relocation. Replace project control points on the basis of the original survey.
 3. Provide complete engineering layout of the work needed for construction.
 - a. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
 - b. Record data and measurements per standards.
 4. Construction lines and grades, as well as base lines and bench marks provided by the CONTRACTOR, shall be subject to such checks and reviews as the ENGINEER may, from time to time, desire to make.

1.12 UTILITIES DURING CONSTRUCTION

- A. The CONTRACTOR will be required to make arrangements for and pay for the electrical power and any other utilities required during construction.

1.13 UNCLASSIFIED EXCAVATION

- A. All excavation on this project will be considered to be unclassified, and no extra payment will be made for the removal of any rock, shale, roots and any other material or substance that may be encountered in the construction work as set out on the Drawings and in the Technical Specifications.

1.14 ROCK EXCAVATION

- A. In all areas requiring rock excavation, the Contractor shall install the pipe and complete the "rock free" bedding so that the installation may be inspected prior to backfilling. The Owner's inspector shall be notified by the Contractor when the bedding is complete for each particular segment. Any rock excavation areas backfilled without the Owner's prior inspection will require uncovering and checking at the Contractor's expense.

1.15 PIPELINE CONSTRUCTION ON PRIVATE PROPERTY EASEMENTS

- A. The OWNER has secured necessary easements on private property. The CONTRACTOR shall limit construction operation to a strip 20 feet in width (except as noted), and in the event the CONTRACTOR should damage any property outside the limits of said easements and rights-of-way provided, the CONTRACTOR shall assume all responsibility and pay any damages that may occur at no extra cost to the OWNER. Easements on private property that is used for farmland, the CONTRACTOR shall remove adequate topsoil (not required if the remainder of ditch excavation is essentially the same as topsoil) and place in a windrow so that

upon laying and backfilling of pipeline, the work area can be again covered with top soil.

- B. Existing fences shall not be cut or otherwise disturbed where practical. Should the CONTRACTOR find it necessary to take loose any fences, corner post bracing shall have been set per Plans to avoid slack in the remainder of the fence. The fence shall be restored to the same or better condition that it was prior to the time it was loosened, at no extra cost to the OWNER. Posts used for fence bracing shall be steel.
- C. No extra payment will be made for gravel or asphalt repair.

1.16 WATER LINE PARALLELING OR CROSSING SEWER LINES

- A. The Contractor shall fully comply with all Texas Commission on Environmental Quality regulations pertaining to separation distances as described in Table I of this section. No additional payment shall be made for separation distance compliance, but this work shall be considered subsidiary to the overall project.
- B. Location of waterlines. The following rules apply to installations of waterlines, wastewater mains or laterals, and other conveyances/appurtenances identified as potential sources of contamination. Furthermore, all ratings specified shall be defined by ASTM or AWWA standards unless stated otherwise. New mains, service lines, or laterals are those that are installed where no main, service line, or lateral previously existed, or where existing mains, service lines, or laterals are replaced with pipes of different size or material.
 - 1. When new potable water distribution lines are constructed, they shall be installed no closer than nine feet in all directions to wastewater collection facilities. All separation distances shall be measured from the outside surface of each of the respective pieces.
 - 2. Potable water distribution lines and wastewater mains or laterals that form parallel utility lines shall be installed in separate trenches.
 - 3. No physical connection shall be made between a drinking water supply and a sewer line. Any appurtenance shall be designed and constructed so as to prevent any possibility of sewage entering the drinking water system.
 - 4. Where the nine-foot separation distance cannot be achieved, the following criteria shall apply.
- C. New waterline installation - parallel lines.
 - 1. Where a new potable waterline parallels an existing, non-pressure or pressure rated wastewater main or lateral and the licensed professional engineer licensed in the State of Texas is able to determine that the existing wastewater main or lateral is not leaking, the new potable waterline shall be located at least two feet above the existing wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the existing wastewater main or lateral. Every effort shall be exerted not to disturb the bedding and backfill of the existing wastewater main or lateral.
 - 2. Where a new potable waterline parallels an existing pressure rated wastewater main or lateral and it cannot be determined by the licensed professional engineer if the existing line is leaking, the existing wastewater main or lateral shall be replaced with at least 150 psi pressure rated pipe. The new potable waterline shall be located at least two feet above the new wastewater line, measured vertically, and at least four feet away, measured horizontally, from the replaced wastewater main or lateral.
 - 3. Where a new potable waterline parallels a new wastewater main, the wastewater main or lateral shall be constructed of at least 150 psi pressure rated pipe. The new potable waterline shall be located at least two feet above the wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the wastewater main or lateral.
- D. New waterline installation - crossing lines.
 - 1. Where a new potable waterline crosses above a wastewater main or lateral, the segment of the waterline pipe shall be centered over and must be perpendicular to the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. When crossing an

- existing wastewater main or lateral and it is disturbed or shows signs of leaking, the wastewater main or lateral shall be replaced for at least nine feet in both directions (18 feet total) with at least 150 psi pressure-rated pipe embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end.
- a. The potable waterline shall be at least two feet above an existing, non-pressure rated wastewater main or lateral.
 - b. The potable waterline shall be at least six inches above an existing, pressure-rated wastewater main or lateral.
2. Where a new potable waterline crosses a new, non-pressure rated wastewater main or lateral, the segment of the waterline pipe shall be centered over and shall be perpendicular to the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. The potable waterline shall be at least two feet above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. The wastewater pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The wastewater main or lateral shall be embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end. The materials and method of installation shall conform to one of the following options:
- a. Within nine feet horizontally of either side of the waterline, the wastewater pipe and joints shall be constructed with pipe material having a minimum pressure rating of at least 150 psi. An absolute minimum vertical separation distance of two feet shall be provided. The wastewater main or lateral shall be located below the waterline.
 - b. All sections of wastewater main or lateral within nine feet horizontally of the waterline shall be encased in an 18-foot (or longer) section of pipe. Flexible encasing pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The encasing pipe shall be centered on the waterline and shall be at least two nominal pipe diameters larger than the wastewater main or lateral. The space around the carrier pipe shall be supported at five-foot (or less) intervals with spacers or be filled to the discrepancies with washed sand. Each end of the casing shall be sealed with watertight non-shrink cement grout or a manufactured watertight seal. An absolute minimum separation distance of six inches between the encasement pipe and the waterline shall be provided. The wastewater line shall be located below the waterline.
3. When a new waterline crosses under a wastewater main or lateral, the waterline shall be encased as described for wastewater mains or laterals in clause (ii) of this subparagraph or constructed of ductile iron or steel pipe with mechanical or welded joints as appropriate. An absolute minimum separation distance of one foot between the waterline and the wastewater main or lateral shall be provided. When a new waterline crosses under a wastewater main, the procedures in §217.53(d) of this title (relating to Pipe Design) must be followed.
4. Where a new potable waterline crosses a new, pressure rated wastewater main or lateral, one segment of the waterline pipe shall be centered over and shall be perpendicular to the wastewater line such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the center line of the wastewater main or lateral. The potable waterline shall be at least six inches above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. The wastewater pipe shall have a minimum pressure rating of at least 150 psi. The wastewater main or lateral shall be embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end.
5. Where cement stabilized sand bedding is required, the cement stabilized sand shall have a minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume (at least 2.5 bags of cement per cubic yard of mixture). The cement stabilized sand bedding shall be a minimum of six inches above and four inches

below the wastewater main or lateral. The use of brown coloring in cement stabilized sand for wastewater main or lateral bedding is recommended for the identification of pressure rated wastewater mains during future construction.

- E. Waterline and wastewater main or lateral manhole or cleanout separation. The separation distance from a potable waterline to a wastewater main or lateral manhole or cleanout shall be a minimum of nine feet. Where the nine-foot separation distance cannot be achieved, the potable waterline shall be encased in a joint of at least 150 psi pressure class pipe at least 18 feet long and two nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at five-foot intervals with spacers or be filled to the springline with washed sand. The encasement pipe shall be centered on the crossing and both ends sealed with cement grout or manufactured sealant.
- F. Location of fire hydrants. Fire hydrants shall not be installed within nine feet vertically or horizontally of any wastewater main, wastewater lateral, or wastewater service line regardless of construction.
- G. Location of potable or raw water supply or suction lines. Suction mains to pumping equipment shall not cross wastewater mains, wastewater laterals, or wastewater service lines. Raw water supply lines shall not be installed within five feet of any tile or concrete wastewater main, wastewater lateral, or wastewater service line.
- H. Proximity of septic tank drainfields. Waterlines shall not be installed closer than ten feet to septic tank drainfields.

1.17 TRENCH SETTLEMENT

- A. The CONTRACTOR shall be responsible for all settlement of backfill, fills, and embankments which may occur within one (1) year after final completion of the contract under which the work was performed.
- B. The CONTRACTOR shall make, or cause to be made, all repairs or replacements made necessary by settlement, within thirty (30) days after notice from the ENGINEER or OWNER.

1.18 RESTORATION OF SURFACES

- A. The CONTRACTOR shall replace all surface material (including topsoil in original thickness), and shall restore gravel drives and roadways, fencing, sod and other surfaces disturbed, to a condition equal to that before the work began, furnishing all labor and material incidental thereto.

1.19 SURPLUS EARTH

- A. Surplus excavated materials from all trenching, manholes, and structures shall be disposed of by the CONTRACTOR as approved by the OWNER and ENGINEER.

1.20 CONCRETE BLOCKING

- A. All bends, tees, etc., 2" and larger shall be blocked with concrete per the Plans and Specifications with a minimum soil bearing surface of 1.0 square foot per inch diameter of pipe. The use of rocks, masonry blocks, etc. is not acceptable. Only "Sacrete" which has been thoroughly mixed or Class B concrete shall be used for blocking. No blocking shall be covered up until it has been inspected and approved by the OWNER and/or ENGINEER. If covered prior to inspection, the CONTRACTOR shall uncover the blocking for inspection at his expense.

1.21 FENCES AND SIGNS

- A. When necessary for the CONTRACTOR to take down signs, fences or other obstructions, this shall be done at his own expense and replaced in the original condition after construction operations. Fences which are taken loose by the Contractor shall be done in a manner to prevent slacking of the remainder of the wire. The CONTRACTOR, prior to taking down any fence shall have complete approval of the Project Representative as to the width of the fence

gap to be made and the manner in which existing posts are to be placed. **No fences shall be cut without authorization in writing from OWNER or ENGINEER.**

1.22 BARRICADES, WARNING SIGNS AND PUBLIC CONVENIENCE

- A. The convenience of access of the adjoining property OWNERS on the streets herein scheduled for improvements is of prime importance in the construction operations. In certain locations it may be necessary that property OWNERS use a portion of the roadway being improved to access their property. In such cases, the CONTRACTOR shall schedule his operations to provide such access to the property OWNERS in a safe and convenient manner. The CONTRACTOR shall provide courteous, English speaking and well informed flagmen for directing traffic. Flagmen shall wear a bright red coat and shall use a bright red flag to signal traffic.
- B. At each section of street and each cross street intersecting the section of street under construction, the CONTRACTOR shall provide barricades and other warning signs as necessary. Detour signs shall be placed at all intersections where traffic is diverted from the section under construction and at other intersections of the detour to provide complete directions for detouring traffic around the section under construction. CONTRACTOR shall also provide any necessary special signs to signify any hazards or conditions. All barricades, detour and warning signs that remain in place at night shall be fully lighted by approved methods from sunset to sunrise. All signs shall be kept in a good state of repair and be plainly legible at all times. Upon completion of the project, all signs and evidence thereof shall be completely removed from the site of the work by the CONTRACTOR.

1.23 CLEARING AND CLEAN UP

- A. All necessary clearing shall be done by the CONTRACTOR. All tree branches, limbs and roots shall be removed and disposed of by the CONTRACTOR in order that the right-of-way may be left in a neat and presentable condition. Any damage resulting to trees, grass and shrubbery must be paid for, by the CONTRACTOR, and damage claims, if any, settled by the CONTRACTOR.
- B. Prior to final acceptance of the project, the CONTRACTOR shall clean and smooth up the site of the work and remove all rock, debris, material, etc., leaving the project site with a neat appearance to the satisfaction of the OWNER. Disposed of debris, rubbish, etc. shall be made in an area which shall meet the approval of the OWNER and ENGINEER. The CONTRACTOR shall comply fully with all applicable EPA and TCEQ regulations.

1.24 START UP AND OPERATION

- A. Prior to presentation for final acceptance of the work under this contract, the CONTRACTOR shall have started and operated all units at each site for a sufficient duration of time, thirty (30) days to permit the OWNER and ENGINEER to observe overall performance of the respective units and equipment.
- B. Such operation shall be properly coordinated with the OWNER'S operating personnel.

1.25 "RECORD DRAWING" INFORMATION

- A. The CONTRACTOR shall be responsible for recording and providing all information concerning changes from the original plans as to valve, meter, and/or pipeline location for transfer to the "As-Built" or "Record Drawings" Plans. Final payment will not be released until "Record Drawings" are approved by the ENGINEER.

1.26 WARRANTY

- A. The CONTRACTOR shall guarantee the work performed under this contract against defective materials and workmanship of a period of one (1) year from the date of final acceptance of the

work by the OWNER. The CONTRACTOR shall arrange to have his Performance Bond remain in effect for a period of one (1) year after the date of completion of construction work to cover his guarantee as stipulated under this item and in the General Conditions.

- B. If defective materials and/or workmanship are discovered which require repairs made under this guarantee, all such repairs shall be done by the CONTRACTOR at his own expense within ten days after written notice of such defect. Should the CONTRACTOR fail to repair or correct such deficiency within ten days after notification, the OWNER may make the necessary repairs and charge the CONTRACTOR with the applicable costs of all labor and materials required to correct the deficiency.

PART 2 NOT USED

PART 3 NOT USED

-- END OF SECTION --

SECTION 01 09 01 - DISINFECTION OF POTABLE WATER PIPING AND TANKS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).
- AWWA C652 - Disinfection of Water-Storage Facilities 2019.
- AWWA C653 - Disinfection of Water Treatment Plants Current Edition.

1.2 WORK INCLUDED

- A. Disinfection of water piping, filters, clean clearwells, wetwells, and tanks for filtered, finished, and potable water.
- B. Test and report results.

1.3 QUALITY ASSURANCE

- A. Testing Laboratory: State Health Department certified approved for examination of drinking water in compliance with applicable legislation of the State of Texas.
- B. Piping, tanks, and equipment to be cleaned and disinfected shall be isolated from the finished water (potable water) at all times and shall be placed into service by the OWNER following receipt of acceptable test reports.

1.4 REGULATORY REQUIREMENTS

Conform to applicable Texas Department of Health Rules and TCEQ Regulations for Public Water Systems for work of this section.

1.5 SUBMITTALS

- A. Submit a schedule of the proposed sequence for cleaning and method of sterilization to be used or list of the equipment to be used, and the sterilizing agent and quantities to be used, location and/or sizes of fill, blowdown connections, sources of test water, and proposed plan to dispose of test water.
- B. Submit electronic copies.
- C. Submit reports under provisions of Section 01 04 01.
- D. Disinfection report should accurately record:
 - 1. Type and form of disinfection used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing in ppm for each outlet tested.
- E. Bacteriological report should accurately record:
 - 1. Data issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of Texas Department of Health.
 - 8. Bacteriologist's signature.

PART 2 PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Furnish necessary temporary connections, taps, valves, piping, pumps, hoses, chemicals, and test equipment to accomplish the work.

- B. Disinfection agents shall be chlorine solution prepared from chlorine gas, sodium hypochlorite, or calcium hypochlorite.

PART 3 EXECUTION

3.1 GENERAL

- A. CONTRACTOR shall exercise care at all times during construction to prevent contaminated material from entering the structures and pipelines in the filtered, finished, and potable water system.
- B. All facilities and piping designed to hold or transport process water shall be cleaned, including piping, basins, and channels, prior to disinfection.
- C. Filters, finished water storage tanks, pump station wet wells, pump cans, finished water piping, together with valves and meters, all potable water, service water, and chemical piping shall be disinfected with chlorine solution as specified herein following cleaning and testing. Vertical pumps may be disinfected immediately prior to installation. All surfaces shall be cleaned or washed and disinfected, even though there is no visible evidence of necessity thereof.
- D. Disinfection shall be in accordance with the disinfection procedure described in AWWA C651, AWWA C652, and AWWA C653, and in accordance with the Rules and Regulations for Public Water Systems of the Texas Commission on Environmental Quality and the requirements of this section. Where conflicts exist, the ENGINEER shall determine the appropriate procedures.

3.2 PIPELINE DISINFECTION

- A. Verify that piping system has been cleaned, inspected, and pressure tested. Flush out line, completely replacing its entire volume with potable water.
- B. Purging may be accomplished by passing an appropriate sized "polly-pig(s)" through the pipe, or by flushing.
 - 1. Polly-Pig Method
 - a. In-general, this shall consist of furnishing all equipment, material, and labor to satisfactorily expose cleaning wye, remove cleaning wye covers, etc., as directed by the OWNER's representative or resident inspector.
 - b. Where expulsion of the "polly-pig" is required through a dead-ended main, the CONTRACTOR shall make every effort to prevent backflow of purged water into the main after passage of the pig. One small pipe, such as cast iron pipe through 12 inches (30 cm), backwater re-entry into the pipe can be prevented by the temporary installation of mechanical joint shallow bends and pipe joints to provide a riser out of the trench. On larger pipe, additional excavation of the trench may serve the same purpose.
 - c. Short dead-end pipe sections not swabbed by the pig shall be flushed.
 - d. Backflow water which has inadvertently entered the pipe under conditions similar to those described in the preceding Paragraph b, shall be flushed from the system.
 - e. After passage of the "polly-pig," flushing of all backwater from the pipe, satisfactory test results are received, at the direction of the OWNER, the CONTRACTOR shall proceed with sterilization.
 - 2. Flushing Method: If the "flushing" method of purging is used, the CONTRACTOR shall be required to prepare the main by installing blow-offs at locations and sized as directed by the ENGINEER.
 - a. In general, this shall consist of furnishing all equipment, material and labor to satisfactorily install blow-offs of sizes shown in the following table:

SIZE MAIN	SIZE BLOW-OFF
2-8 Inches	2 Inch
10-12 Inches	4 Inch
16-24 Inches	6 Inch
30 Inches and greater	10 Inch

- b. Before disinfection, flush all foreign matter from the pipeline. Provide hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damage to adjacent properties. Flushing velocities shall be at least 2.5 fps. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipeline in-place from the inside by brushing and sweeping, then flush the line at a lower velocity.
 - c. After flushing is complete and satisfactory test results are received at the direction of the OWNER's representative or resident inspector, the CONTRACTOR shall proceed with sterilization.
- C. Perform scheduling and disinfection activity with startup, testing, adjusting, and balancing, and demonstration procedures, including coordination with related systems.
- D. Provide and attach equipment required to execute work of this section. Do not place concentrated quantities of commercial disinfectants in the line before it is filled with water. Inject treatment disinfectant into piping system being sterilized so that its entire capacity will be filled with potable water containing a free chlorine residual at a level of 50 ppm or other quantity as determined by the ENGINEER. The disinfectant shall be added at one end of the sections being treated through a corporation stop or other approved connection inserted in the horizontal axis of the newly laid pipe. The water being used to fill the line shall be controlled to flow into the section to be sterilized very slowly, and the rate of application of the chlorinating agent shall be in such proportion of the rate of water entering the line that the chlorine dose applied to the water entering the line and released at the opposite end shall have a chlorine concentration of 50 ppm or a level determined by the ENGINEER. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. If required by the OWNER and ENGINEER the CONTRACTOR shall use RPZ device to prevent water from flowing back into the supply line. All valves shall then be closed and the chlorine solution shall remain in the line for a minimum of 24 hours. A minimum residual of 10 ppm shall be present in the main following the 24-hour holding period. Operate all valves, hydrants, and other appurtenances during disinfection to assure that the disinfecting mixture is dispersed into all parts of the line, including dead ends, and similar areas that otherwise may not receive the disinfecting solution.
- E. Remove the chlorine solution and flush the line with potable water. Comply with regulations and obtain necessary approvals for disposal or discharge of chlorine solution and flushing water.
- F. The OWNER will take samples from the sterilized line through a suitable point in accordance with AWWA C651 (not a fire hydrant) and submit to the testing laboratory. A minimum of one sample shall be taken for each 1000 feet of line tested. A second set of samples shall be taken and submitted to the testing laboratory 2 days after the first samples were taken. The sterilized portion of the line shall be placed in service, if the results of two consecutive tests conform to the bacterial standards. If the samples show unsatisfactory quality, the sterilization process shall be repeated until satisfactory results are obtained.

3.3 DISPOSAL OF DISINFECTION WATER

The disinfecting water shall be dechlorinated before being released to natural drainage ways. See AWWA C652 for acceptable neutralization methods. Release neutralized disinfecting water at a controlled rate which shall not damage downstream facilities.

-- END OF SECTION --

This page intentionally left blank

SECTION 02 01 01 - SITE CLEARING

PART 1 GENERAL

1.1 WORK INCLUDED

All paving and surface debris shall be removed, and the work area shall be cleared of plant life and grass. Trees and shrubs not in conflict with the proposed structure shall not be removed, except as designated by the OWNER.

1.2 REGULATORY REQUIREMENTS

CONTRACTOR shall conform to all applicable codes for the disposal of debris. Clearing work shall be coordinated with the appropriate utility companies.

1.3 REFERENCE STANDARDS

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 PREPARATION

Verify that existing trees, plant life, and features designated to remain are tagged or identified. Provide written notification of intent to begin clearing operation. Document trees that are to be protected.

3.2 PROTECTION

CONTRACTOR shall protect existing trees, plant growth, fences and other features designated to remain during clearing procedures. All benchmarks and structures shall be protected from damage or displacement.

3.3 CLEARING

All areas required for access to the site and execution of the Work, except as indicated in paragraph 3.2, shall be cleared.
Trees and shrubs shall be removed within the limits of excavation required. Stumps, main root balls and the root system to a depth of twelve (12) inches below finished grade shall be removed. CONTRACTOR shall clear undergrowth and deadwood without disturbing the subsoil and shall apply herbicide to any remaining stumps to inhibit growth.
All debris, rocks larger than three inches, and extracted plant life shall be promptly removed from the site.

-- END OF SECTION --

This page intentionally left blank

SECTION 03 04 01 - MANHOLES

PART 1 GENERAL

1.1 REFERENCES STANDARDS

- ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets 2021.
- ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections 2019.
- ASTM D3753 - Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Manholes and Wetwells 2020.
- ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2023.
- ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.

1.2 WORK INCLUDED

Provide precast manholes, rims, and covers where indicated on Plans.

1.3 SUBMITTALS

Submittals Required:

- A. Manufacturers detail design for O-ring joints and gaskets.
- B. Catalog cuts of riser sections, covers, frames, grade rings, and pipe sleeves.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT

- A. Comply with Mortar for unit Masonry, ASTM C270, for Type M mortar.
- B. The cement material used in the preparation of the mortar shall be Portland cement, type II.
- C. Mortar and grout shall be composed of one part Portland cement and three parts clean, washed sand, thoroughly mixed with sufficient water for desired consistency.
 - 1. Mortar shall be of a consistency which spreads evenly with a steel trowel.
 - 2. Grout shall be of the consistency required for the particular application.

2.2 REINFORCING STEEL

Steel for bar reinforcement shall be new billet steel of intermediate or hard grade per ASTM A615/A615M. All reinforcing steel shall be deformed in accordance with ASTM A615/A615M, of the sizes specified, and bent cold in the shop accordance with the details shown on the Plans. Reinforcing steel when placed in the work shall be completely free of loose mill scale, rust, dirt, paint, oil or other foreign material. When specified, wire fabric reinforcement shall conform with the provisions of ASTM A1064/A1064M.

2.3 CAST IRON FRAMES AND COVERS

- A. Furnished and installed in accordance with the details on the Plans.
- B. Manhole frames and covers shall be standard ASTM C478 frames and cover, weighing a minimum of 275 pounds and having a cover with a minimum diameter of 30". In several areas, waterproof manhole frames and covers may be required and these shall be in accordance with the applicable AWWA standards and specifications.

2.4 CAST IN PLACE CONCRETE MANHOLE SECTIONS

Manholes shall be standard 4 foot diameter with entrance cone. Manhole steps will not be required. Grade rings shall be furnished with concrete manholes to satisfactorily adjust the manhole cover to a point approximately 2 inches above the existing grade at the location of the manhole. Monolithically placed concrete manholes will be non-reinforced and shall have a minimum wall thickness of 5 inches. Cement for use with monolithically placed manholes shall be Type II concrete.

2.5 PRECAST REINFORCED CONCRETE MANHOLE SECTIONS

- A. Conform to Precast Reinforced Concrete Manhole Sections, ASTM C478. Cement shall be Type II.
- B. Provide and install concrete grade rings, bring the cast iron frames to grade. Grade rings shall be 2 inches by 8 inches with an inside diameter 48 inches.
- C. The concrete manhole riser sections, with the exception of the grade rings, shall be formed with male and female ends and installed with bell ends turned down.
- D. The joints and gaskets in the riser sections shall comply with the requirements of ASTM C443, as modified to incorporate an O-ring type gasket.
- E. Manhole riser sections shall be of sufficient diameter to allow personnel to work inside them and to allow proper joining of all pipes to the manhole wall while maintaining the structural integrity of the riser sections. All manholes shall have a minimum diameter of four feet unless a larger diameter is noted in the plans or required by the piping configuration shown. Provide larger diameter manholes where necessary to maintain at least a 12-inch clearance between any holes cut in the riser section.
- F. Provide eccentric cone immediately below the grade rings sections for each manhole. For manholes larger than 48-inches in yard areas, precast concrete covers with integrally-cast frames and covers may be used when approved by ENGINEER.
- G. Where PVC piping is connected to manholes, provide and install PVC sleeves with rubber gaskets and an abrasive silica outer coating or a flexible boot with clamps. Sleeve shall be as manufactured by GPK Products, Inc., of Fargo, North Dakota, or approved equal. Sleeve shall be firmly grouted into manhole opening in accordance with manufacturer's instructions. Flexible boot type seals shall have a rubber gasket, internal expansion sleeve of 304 stainless steel and stainless steel take-up clamps as manufactured by Press-Seal Gasket Corporation - PSX:Positive Seal.

2.6 FIBERGLASS MANHOLES

Fiberglass reinforced polyester manhole shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resin, with fiberglass reinforcements.

Manhole shall be a one piece unit manufactured to meet or exceed all specifications of ASTM D3753 latest edition as manufactured by L.F. Manufacturing, Inc., Giddings, Texas or an approved equal.

- A. Resin: The resins used shall be commercial grade unsaturated polyester resin or other suitable polyester or vinyl ester resin.
- B. Reinforcing Materials: The reinforcing materials shall be commercial Grade "E" type glass in the form of continuous roving, and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
- C. Interior Surface Material: The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inches thick. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inches (13mm) to maximum length of 2.0 inches (50.8mm) and shall be applied uniformly to an equivalent weight of 3 oz/ft. Each pass of chopped roving shall be well-rolled

prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inches (2.5mm).

- D. Wall Construction Procedure: After inner layer has been applied the manhole wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one piece unit. Seams shall be fiberglass on the inside and the outside using the same glass-resin joint procedure. Field joints shall not be acceptable by anyone except the manufacturer.
- E. Exterior Surfaces: For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added for a minimum thickness of .125 inches.
- F. Stubouts and Connection: Upon request stubouts may be installed. Installation of SDR PVC sewer pipe must be performed by sanding, priming, and using resin fiber-reinforced hand layup. The resin and fiberglass shall be same type and grade as used in the fabrication of the fiberglass manhole. Inserta_Tee fittings may be requested and installed per manufacturers instructions. Kor-N-Seal boots may be installed by manhole manufacturer using fiberglass reinforced pipe stubout for Kor-N-Seal boot sealing surface.
- G. Manhole Bottom: Manholes shall have resin fiber-reinforced bottom. Deeper manholes may require a minimum of two 1 1/2 inch deep x 3 1/2 inch wide stiffening ribs completely enclosed with resin fiber-reinforcement. All fiberglass manholes with a fiberglass bottom will have a minimum 3 inch anti-floating ring. Manhole bottom shall be a minimum of 1/2 inch thick.
- H. Fiberglass enclosed Invert and Bench Area: Fiberglass enclosed invert and bench area shall be installed in the manhole. The invert will be formed using a non-corrosive material and completely enclosed in a minimum 1/4 inch layer of fiberglass chop.
- I. Fillers and Additives: Fillers, when used, shall be inert to the environment and manhole construction. Sand shall not be accepted as an approved filler. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material must meet the requirements of this specification.
- J. Manufacture: Manhole cylinders, manway reducers, and connectors shall be produced from glass fiber-reinforced polyester resin using a combination of chop and continuous filament wound process.
- K. Interior Access: All manholes shall be designed so that a ladder or step system can be supported by the installed manhole.
- L. Manway Reducer: Manway reducers will be concentric with respect to the larger portion of the manhole diameters through 60 inches. Larger manholes may have concentric or eccentric manway reducer openings.
- M. Cover and Ring Support: The manhole shall provide an area from which a grade ring or brick can be installed to accept a typical metal ring and cover and have the strength top support a traffic load without damage to the manhole.
- N. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 0.5 in. in diameter, delamination or fiber show.
- O. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 0.5 in. in diameter and wrinkles of 0.125 in. or greater in depth. Surface pits shall be permitted if they are less than 0.75 in. in diameter and less than 0.0625 deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5 in. in diameter and less than 0.0625 in. thick.

- P. Repairs: Any manhole repair are subject to meet all requirements of this Specification.
- Q. Manhole Length: Manhole lengths shall be in 6 in. increments +/- 2 in.
- R. Diameter Tolerance: Tolerance of inside diameter shall be +/- 1% of required manhole diameter.
- S. Load Rating: The complete manhole shall have a minimum dynamic-load rating of 16,000 lbf. when tested in accordance with ASTM D3753, 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbf. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lb.
- T. Stiffness: The manhole cylinder shall have the minimum pipe-stiffness values shown in table below when tested in accordance with ASTM D3753, 8.5 (note 1).

LENGTH - FT	F/AY - PSI
3 - 6.5	0.75
7 - 12.5	1.26
13 - 20.5	2.01
21 - 25.5	3.02
26 - 35	5.24

- U. Soundness: In order to determine soundness, apply an air or water pressure test to the manhole test sample. Test pressure shall not be less than 3 psig or greater than 5 psig. While holding at the established pressure, inspect the entire manhole for leaks. Any leakage through the laminate is cause for failure of the test. Refer to ASTM D3753, 8.6.
- V. Chemical Resistance: The fiberglass manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection system.
- W. Physical Properties

		<u>Hoop Direction</u>	<u>Axial Direction</u>
a. Tensile Strength	(psi)	18,000	5,000
b. Tensile Modulus	(psi)	0.6 x 10,000,000	0.7 x 10,000,000
c. Flexural Strength	(psi)	26,000	4,500
d. Flexural Modulus	(psi)	1.4 x 10,000,000	0.7 x 10,000,000
e. Compressive	(psi)	18,000	10,000

- X. Test Methods: All tests shall be performed as specified in ASTM D3753 latest addition, section 8. Test method ASTM D790 (see note 5) and test method ASTM D695.
- Y. Quality Control: Each completed manhole shall be examined for dimensional requirements, hardness, and workmanship. All required ASTM D3753 testing shall be completed and records of all testing shall be kept and copies of test records shall be presented to customer upon formal written request within a reasonable time period.
- Z. Certifications: As a basis of acceptance the manufacturer shall provide a independent certification which consist of a copy of the manufacturer's test report and accompanied by a copy of the test results that the manhole has been sampled, tested, and inspected in accordance with the provisions of this specification and meets all requirements.
- AA. Shipping and Handling: Do not drop or impact the fiberglass manhole. Fiberglass manhole may be lifted by inserting a 4"x 4"x 30" timber into the top of manhole with cable attached or by a sling or "choker" connection around center of manhole, lift as required. Use of chains or cables in contact with the manhole surface with the manhole surface is prohibited..

PART 3 EXECUTION

3.1 INSTALLATION

- A. Manhole Base.
 - 1. Manholes shall be constructed at locations indicated on the Plans or as otherwise directed by the ENGINEER. Development of areas through which the sewer main passes may dictate changes in location or increase the number of manholes required. Manholes shall be constructed to the details shown on the Plans. Where there is a drop in the difference of the invert grade shown on the Plans, the elevation drop shall occur through the manhole section.
 - 2. Sewer pipe that is within the limits of excavation of manholes shall be bedded with bedding material as specified.
 - 3. Excavation for manholes shall be large enough to safely perform the work, and if necessary, the excavation shall be sloped to provide a stable wall. Backfill around manholes shall be made in such a manner to prevent movement of the manhole vertically or laterally and shall be backfilled as specified. Manhole construction in the Texas Department of Transportation right-of-way shall be backfilled as specified.
 - 4. Inverts: Inverts shall be built of concrete or half-sections of pipe and shall be true and troweled to a smooth, hard finish. The invert depth shall be equal to one-half of the diameter of the largest pipe connected to the manhole, and shall be sloped at 3:1 between the inlet and outlet pipe flowlines. The top of the poured manhole invert outside of the flow channel shall be steeply-sloped to prevent solids deposition.
 - 5. Concrete and reinforcing steel for the manhole base shall be placed in accordance with the details on the plans and the applicable provisions of these specifications.
- B. Frames and covers shall be furnished and installed as required and indicated on the Plans.
- C. Use no more than 4 grade rings per manhole. Ring hold down bolts shall pass through the rings into the top of the cone.

3.2 MANHOLE TESTING

- A. Manholes shall be tested separately and independently of the wastewater or drain lines. All lines coming into the manhole shall be sealed with an internal pipe plug before testing. All new manholes shall be hydrostatically tested with a maximum loss allowance of 0.025 gallons per foot diameter per foot of head per hour. The testing period shall not be less than one hour. The manhole shall be filled to the top. For concrete manholes, a wetting period of 24 hours should be used prior to testing in order to allow saturation of the concrete.
- B. Vacuum testing of manholes may be allowed per OWNER'S requirements.

-- END OF SECTION --

This page intentionally left blank

SECTION 03 04 04 - POLYMER CONCRETE MANHOLES

PART 1 GENERAL

1.1 SCOPE

This specification covers polymer concrete manholes intended for use in sanitary sewers, storm sewers and water lines where corrosion resistance is required.

1.2 REFERENCES

- ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary Latest Edition.
- ACI 440.1R - Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars 2015 Edition, March 2015.
- ACI 548.6R - Polymer Concrete: Guidelines for Structural Applications 2019 Edition, January 2019.
- ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets 2021.
- ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections 2019.
- ASTM C497 - Standard Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile Revision 19A, October 1, 2019.
- ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes 2023.
- ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes 2018 (Reapproved 2023).
- ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures 2019.
- ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals 2018.
- ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants 2009 (Reapproved 2019).
- ASTM D2584 - Standard Test Method for Ignition Loss of Cured Reinforced Resins Current Edition.
- ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position 2018.
- ASTM D6783 - Standard Specification for Polymer Concrete Pipe Revision 05A, July 1, 2005.
- ISO 9001 - Quality Management Systems — Requirements 2015.
- California Greenbook Standard Specifications for Public Works Construction Section 211-2

1.3 SUBMITTALS

- A. Conform to bid document requirements
- B. Submit manufacturer's data and details of following items for approval:
 - 1. Shop drawings of manhole sections, base units and construction details, jointing methods, materials, and dimensions
 - 2. Summary of criteria used in manhole design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C478 and ASTM C857, reinforced in accordance with ACI 440.1R.
 - 3. Frames, grates, rings, and covers
 - 4. Materials to be used in fabricating pipe drop connections
 - 5. Materials to be used for pipe connections
 - 6. Materials to be used for stubs and stub plugs, if required

7. Proof of independent chemical resistance testing conducted in accordance with the standard specifications for public works construction (California Greenbook) Section 211-2
 8. Current ISO 9001 Certification
 9. References of 10 previous polymer concrete projects including scope in the last 5 years performed with both owner and contractor for reference and review by owner
- C. Submitted sealed drawings by a registered Professional Engineer

PART 2 PRODUCTS

2.1 POLYMER CONCRETE MANHOLES

- A. Provide polymer concrete manhole sections, monolithic base sections and related components referencing to ASTM C478. ASTM C478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product
- B. Provide base riser section with monolithic floors, unless shown otherwise
- C. Provide riser sections joined with bell and spigot / ship-lap design seamed with butyl mastic and or rubber gaskets (ASTM C990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure
- D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings. Use various lengths of polymer concrete manhole sections in combination to provide correct height with the fewest joints
- E. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer
- F. Provide tops to support AASHTO HS-20 loading or loads as required and receiving cast iron frame covers or hatches, as indicated on drawings

2.2 DESIGN CRITERIA:

Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet the intent of ASTM C478 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer.

1. AASHTO HS-20 design or as required loading applied to manhole cover and transition and base slabs
2. Polymer manholes will be designed based upon live and dead load criteria in ASTM C857 and ACI 350.
3. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections
4. Internal liquid pressure based on unit weight of 63 pcf
5. Dead load of manhole sections fully supported by polymer concrete manhole base

2.3 DESIGN:

Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet loading requirements of ASTM C478, ASTM C857 and ACI 350 as modified for polymer concrete manhole design as follows:

1. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment
2. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R as applicable for polymer concrete design
3. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness
4. Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method ASTM D648. The resin content shall not be less than 7% of the weight of the sample as determined by test method ASTM D2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed

5. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more the 5/8 inch. The under run in height of a riser or cone shall not be more than ¼ in/ft of height with a maximum of ½ inch in any one section
6. Marking and Identification - Each manhole shall be marked with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date
7. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or gasketed joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity
8. Minimum clearance between wall penetrations and joints shall be per manufacturer's design
9. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material
10. Provide resilient connectors conforming to requirements of ASTM C923 or other options as available. All connectors are to be water tight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions

2.4 QUALITY CONTROL

Facility Quality Control should be maintained by adhering to ISO 9001 for manufacturing. All fabricators will be ISO 9001 Certified. All fabrication will take place in an all polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility. Fabricator is also to provide references of 10 previous projects in the last 5 years performed with both owner and contractor for reference and the scope and review by owner. Polymer concrete shall be cast in a polymer only facility and shall not be manufactured in a cementitious concrete facility

2.5 GROUTING

All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer

2.6 MANUFACTURER

Armorock LLC, www.armorock.com
702-824-9702

PART 3

NOT USED

END OF SECTION

This page intentionally left blank

SECTION 03 05 01 - GROUT

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- ASTM C1018 - Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading) Current Edition.
- ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete 2023.
- ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle Current Edition.
- ASTM C33/C33M - Standard Specification for Concrete Aggregates 2023.
- COE CRD-C-588 - Corps of Engineers Specification for Nonshrink Grout Current Edition.

1.2 RELATED WORK AND SPECIFICATIONS

- A. Section 07 01 01 - Sealants and Caulking.

1.3 SCOPE

Provide grout as shown on the Plans and as specified herein:

- A. Grout shall be placed at the following locations:
 1. Column and equipment bases.
 2. Handrails and railings.
 3. Topping in concrete tanks.
 4. Foundation grouting.
 5. Tunnel grouting.
 6. Equipment bases.
 7. Wherever so indicated on the Plans.
- B. The types of grout used shall include the following:
 1. Non-shrink, epoxy type.
 2. Non-shrink, non-metallic type.
 3. Ordinary cement-sand.

1.4 QUALITY ASSURANCE

1.5 SUBMITTALS

In addition to all other appropriate requirements of Section 01 04 01, the CONTRACTOR shall submit the following:

- A. Record Data:
 1. Submit copies of manufacturer's specifications and installation instructions for all proprietary materials.
- B. Reports and Certifications:
 1. For proprietary materials, submit copies of reports on quality control tests.
 2. For nonproprietary materials, submit certification that materials meet specification requirements.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Grout materials from manufacturers shall be delivered in unopened containers and shall bear intact manufacturer's labels.
- B. Storage of Materials: Grout materials shall be stored in a dry shelter and shall be protected from moisture.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Non-metallic, 100 percent solids, high strength epoxy grout.
 - 1. Use clean, well-graded sand with epoxy resins suitable for use on dry or damp surfaces.
 - 2. Product and Manufacturer:
 - a. Euco High Strength Grout by The Euclid Chemical Company.
 - b. Sikadur Hi-Mod Grout by Sika Chemical Company.
 - c. Or, Approved Equal.
- B. Non-Shrink, Non-Metallic Grout:
 - 1. Pre-mixed non-staining cementitious grout requiring only the addition of water at the jobsite.
 - 2. Product and Manufacturer:
 - a. Euco N-S by the Euclid Chemical Company.
 - b. Masterflow 713 by Master Builders Company.
 - c. Or, Approved Equal.
- C. Ordinary Cement-Sand Grout:
 - 1. Except where otherwise specified, use one part cement to three parts sand complying with the following:
 - a. Cement: ASTM C150/C150M, Type II.
 - b. Sand: ASTM C33/C33M.
 - 2. Where water repelling and shrinkage reducing requirements are shown or specified, use admixtures.
 - 3. Product and Manufacturer:
 - a. Integral Waterpeller by the Euclid Chemical Company.
 - b. Omicron, Type OM by Master Builders Company.
 - c. Hydrocide Powder by Sonneborn-Contech.
 - d. Or, Approved Equal.
 - 4. Grout to consist of cement and sand to produce a minimum 28-day strength of 4000 psi with maximum slump of 5 inches. Use 2-inch cube strength test to confirm the design mix strength. Use 2-inch cube strength test on job cured cubes.
- D. Water:
 - 1. Use clean, fresh, potable water free from injurious amounts of oils, acids, alkalis or organic matter.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until ENGINEER provides clarification.
 - 2. Drypacking will not be permitted.
 - 3. It shall be the CONTRACTOR'S responsibility to obtain the services of a qualified, full time employee of the manufacturer to aid in assuring proper use of the product under job conditions.
 - 4. Placing grout shall conform to temperature and weather limitations as stated in manufacturer's instructions.
- B. Equipment Bases:
 - 1. After shimming equipment to proper grade, securely tighten anchor bolts.
 - 2. Properly form around the base plates, allowing sufficient room around the edges for placing the grout.
 - 3. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with nonmetallic epoxy grout.
- C. Column Bases:
 - 1. After shimming columns to proper grade, securely tighten anchor bolts.

2. Properly form around the base plates allowing sufficient room around the edges for placing the grout.
 3. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with nonshrink non-metallic grout.
- D. Fiber Reinforced Concrete Topping
1. Cement: Type II.
 2. Components: Screened graded sand, water, water reducer, fiber reinforcing, admixtures, and cement.
 3. Bonding Agent: Cement-water slurry mixture, nonsegregating, thick enough to broom into place just immediately prior to placement of topping to provide approximate 1/4-inch thickness.
 4. Aggregate Gradings: Combine aggregates for grout in proportions providing mixture within grading limits below:

Sieve Sizes	Percent Passing Sand for Grout
No. 4	9 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10
No. 200	

5. Fiber Reinforcing:
 - a. 100 percent virgin polypropylene fibrillated fibers manufactured for concrete reinforcing to provide greater control of cracking.
 - b. ASTM C1116/C1116M, Type III.
 - c. Fiber reinforced grout in accordance with ASTM C1018, toughness Index I5.
 - d. Polypropylene Fibers:
 - 1) Specific Gravity: 0.91.
 - 2) Tensile Strength: 80 to 110 ksi.
 - 3) Fiber Length: Graded by manufacturer for aggregate size.
 - 4) Quantities: Minimum 1.5 pounds per cubic yard.
 - 5) Add fibers at time of batching and mixing grout.
 - 6) Manufacturer: Fibermesh Co., Chattanooga, TN.
6. Fiber Reinforced Concrete Topping Mix Design:
 - a. Design, select, proportion ingredients and test mix independent testing laboratory.
 - b. Prepare trial mixes and cube tests for each design mix.
 - c. Design Strength: 5,000 psi at 28 days (cube strength).
 - d. Minimum Cement Content: 658 pounds per cubic yard, regardless of strength.
 - e. Air Content: 4 to 6 percent.
 - f. Use Water-reducing admixture.
 - g. Slump as required to maintain homogeneous mix and to allow placement to meet equipment manufacturer's placing tolerance.
 - h. Mix fiber-reinforced concrete topping in concrete plant.
 - i. Mix fiber-reinforced concrete topping to consistency, easily screened, but not too thin that topping will not stand to required thickness.

-- END OF SECTION --

This page intentionally left blank

SECTION 03 09 01 - GENERAL CONCRETE

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- AASHTO M85 - Standard Specification for Portland Cement Current Edition.
- ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- ASTM C33/C33M - Standard Specification for Concrete Aggregates 2023.
- ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.
- TxDot Item 423, (2004) Hydraulic Cement Concrete
- THD Bulletin C-11, Construction Bulletin Procedures for the Design and Control of Portland Cement Concrete Mixtures

1.2 WORK INCLUDED

Concrete shall consist of Portland cement, aggregates, and water which shall conform to the requirements as hereinafter specified. All concrete placed under this contract shall be in conformity with this specification.

1.3 SUBMITTALS

- A. Submit complete information for each concrete mix proposed. Include location for mix and proposed finishes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement shall be a standard brand of Portland cement, Type I, in conformity with AASHTO M85. Only one brand of cement may be used in any one structure.
- B. Coarse Aggregate shall comply fully with the minimum requirements of ASTM C33/C33M, for 1 ½ inch maximum size aggregate.
- C. Fine Aggregate shall comply fully with the minimum requirements of ASTM C33/C33M.
- D. Reinforcing Steel shall be new deformed reinforcing bars, ASTM A1064/A1064M, of sizes and shapes noted on the Plans.
- E. Premolded Expansion Joint Material shall conform with the requirements of ASTM D1751.

2.2 CLASSIFICATIONS & PROPORTIONS

- A. Concrete shall be proportioned using methods outlined in the THD Bulletin C-11 for design of a concrete batch to meet the requirements hereinafter set forth. It shall be the entire responsibility of the CONTRACTOR to procure the strength as set out below for the respective class of concrete. All concrete shall be Class C unless otherwise shown on Plans. The concrete shall be uniform and workable. The minimum cement content, maximum allowable water content, and maximum slump shall conform to the following:

Class of Concrete	Minimum Cement (Bags / Cu. Yd.)	Maximum Water (Net Gal / Bag)	Maximum Slump for Hand Tamping	Maximum Slump for Machine Vibration
A	5.00	7.0	4"	3-1/2"
B	4.50	7.5	4"	3-1/2"
C	5.25	6.5	4"	3-1/2"

- B. The concrete mix will be designed with the intent of producing concrete which, when cured and tested as outlined in THD Bulletin C-11, will have strength equal to or greater than the following:

Class of Concrete	Compressive Strength	7-Day Flexural

	(1lb per Sq. In.)		Strength (1 lbs psi)
	28 - Day	7 - Day	
A	3,000	2,250	500
B	2,500	1,875	470
C	3,500	2,600	650

- C. If the strength required for the concrete being produced is not secured with the minimum cement content specified, additional cement shall be used or other aggregates provided at the CONTRACTOR's expense.
- D. Air entrainment shall be used for all exterior concrete.

2.3 CONSTRUCTION JOINTS

Construction joints shall be made only where located on the Plans, unless otherwise approved by the ENGINEER.

2.4 FORMS

All forms shall be of wood or metal and shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained to prevent warping and opening of joints due to shrinkage of the lumber.

2.5 STEEL REINFORCEMENT

- A. Reinforcing steel in the sizes, shapes and lengths as shown shall be placed in the positions as indicated on the Plans. Minimum cover of not less than 1" of concrete shall be provided over the surface of all reinforcing steel.
- B. Stirrups and hoops shall pass around the main reinforcement members and shall be securely attached thereto. The reinforcing steel shall be spaced and secured in the forms by means of approved galvanized metal spacers or precast motor blocks. Steel shall be wired together at all intersections; and when completed, the reinforcement mat shall present practically a rigid cage of steel which will not be distorted or shifted from position in any way by workmen walking on the mat or by concrete placement operations. Reinforcing steel in horizontal slabs shall be supported by chairs to ensure accurate placement. Do not lift reinforcement during concrete placement.
- C. Splicing of bars will be permitted only where shown on the Plans or with the specific approval of the ENGINEER. The bar splice, when so made, shall not be less than 36 bar diameters with the spliced bars securely tied.
- D. Steel bars, when placed in the work, shall be completely free of dirt, grease, loose rust, scale or other foreign matter. After placement, care shall be exercised to keep the steel free of mud, dried concrete or other material. No concrete whatsoever shall be deposited in the forms until the ENGINEER has inspected the final placement and condition of the reinforcement and approved the work for placement of concrete.

PART 3 EXECUTION

3.1 MIXING CONCRETE

- A. Mixing at Site: Concrete shall be thoroughly mixed in a batch mixer of an approved size and type which will insure a uniform distribution of the materials throughout the mass, equipped with adequate water storage and a device for accurately measuring and automatically controlling the amount of water used in each batch.
- B. Truck Mixing: Truck mixers shall be of the revolving drum type, water tight, and so constructed that the concrete can be mixed to insure uniform distribution of materials throughout the mass.

- C. Time of Hauling and Placing Mixed Concrete: Concrete transported in a truck mixer shall be placed in its final position in the forms within 1 ½ hours after the introduction of the mixing water to the cement and aggregate.
- D. Delivery Rate of Concrete during concrete operations shall be such as to provide for the proper handling, placing and finishing of the concrete, and the interval between batches shall not exceed 20 minutes. Concrete which has partially hardened shall not be retempered or remixed.

3.2 HANDLING AND PLACING OF CONCRETE

- A. During and immediately after depositing, concrete shall be thoroughly compacted by mechanical vibration with satisfactory equipment and in a manner and to the extent as may be approved by the ENGINEER. Concrete shall not be poured in weather below freezing.
- B. In preparation for placement of concrete, all sawdust, chips or other construction debris and extraneous matter shall be completely removed from the interior of the forms. When placing concrete on previously placed construction joints, the surface shall be cleaned by compressed air or vacuum methods, if so directed, and the surface of the existing joint shall be completely free of dust, dirt, sawdust or other foreign material. Concrete shall not be placed in any form prior to specific inspection and approval by the ENGINEER.
- C. Foundations and footings shall be placed on firm, undisturbed earthen subgrade which is free of mud or excessive moisture. If groundwater is encountered, prior to placement of concrete the area shall be dewatered sufficiently for the subgrade to be firm and stable with the last 6 inches of excavation being removed immediately ahead of the concrete placement. Concrete for footing and/or foundations will not be placed on unstable, soggy or otherwise unsatisfactory earthen subgrade.
- D. Concrete shall be placed in a manner to avoid segregation of the materials and the displacement of reinforcement. All chutes, troughs, tremies and pipes shall be kept clean and free from coatings of hardened concrete. When placing operations involving dropping the concrete more than 5 feet, the concrete shall be deposited through approved pipes or tremies. In walls less than 11 feet in height and widths less than 12 inches, tremies will not be required.
- E. During and immediately after depositing, the concrete shall be thoroughly compacted by mechanical vibrating equipment and in a manner and to the extent as may be approved by the ENGINEER. Where placed in sidewalks, pavement or driveways, satisfactory hand methods for compaction and consolidation may be used.
- F. Concrete shall be placed in horizontal layers not more than 12" thick except as provided herein. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulk head. Each layer shall be placed and compacted before the preceding batch has taken initial set to avoid surfaces of separation between the batches and to avoid the formation of construction joint with a preceding layer and surfaces of separation between batches.
- G. When placement of concrete is unavoidably temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete, and the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather" edge might be produced at a construction joint, an inset formwork shall be used to produce an edge thickness of not less than 6" in the succeeding layer. Work shall not be discontinued within 18" of the top of any face, unless provisions have been made for a coping less than 18" thick, in which case, and if permitted by the ENGINEER, the construction joint may be made at the underside of the coping.
- H. CYLINDER OR BEAM TESTS: During work progress, the OWNER, at his discretion, shall have cylinders or beam tests performed as specified herein. The laboratory testing and services shall be provided by the OWNER. The OWNER does hereby reserve the right to

collect all cylinder samples himself, if desired, and deliver same to the testing laboratory approved to perform the tests prior to the placement of concrete. The tests will be performed to maintain a check on the compressive or flexural strength of the concrete that is actually placed.

The test shall be defined as the average of the breaking of two cylinders or two beams as the case may be. Test beam or cylinder specimens shall be required for each 167.5 cubic yards, or a portion thereof, placed each day. For smaller concrete placements, the OWNER's Representative may vary the test specimen to 25 cubic yard placement, over a several day period. Cylinders or beam specimens shall be field protected per THD Bulletin C-11 until transported to the testing laboratory. The test specimens shall be cured in accordance with THD Bulletin C-11

3.3 CURING & FINISHING

- A. Concrete surfaces exposed to conditions causing premature drying shall be protected by covering as soon as possible with approved curing compound, burlap, sand, or other satisfactory material and kept moist. Curing shall continue for a period of not less than 7 days after placing the concrete.
- B. Surface finishes shall be classified as follows:
1. Class I - Ordinary Surface Finish
 2. Class II- Rubbed Finish
 3. Class III - Broom Finish
 4. Class IV - Steel Trowel Surface Finish
 5. Class V - Adhesive Grout Finish
 6. Class VI - Sidewalk Finish
- All concrete shall be given Class I, ordinary surface finish, and in addition, if further finishing is required, such other types of finish as specified. If not otherwise specified, the following surfaces shall be given Class II -Rubbed Finish: exposed faces of structures; outside faces of slabs, brackets, curbs, headwalls, railings. Slab surfaces shall be given Class III - Broom Finish and Class IV - Steel Trowel Surface Finish.
- C. Inspector to approve all finishes for slabs prior to their installations. Contractor to acquire from Engineer written instruction of finishing slabs in each specific area of building and exterior slabs.
1. Class I, Ordinary Surface Finish: Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed. On ALL surfaces, the cavities produced by form ties and other holes, honey comb spots, broken corners or edges and other defects shall be thoroughly cleaned, carefully pointed and cured with a mortar of cement and fine aggregate. The resulting surface shall be to the satisfaction of the ENGINEER.
 2. Class II, Rubbed Finish: After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for a minimum period of three hours. Surfaces to be finished shall be rubbed with a medium carborundum stone, using a small amount of mortar on its face. The mortar shall be composed of cement and fine sand mixed in proportions used in the concrete being finished. Rubbing shall be continued until all form marks, projections and irregularities have been removed, all voids filled, and a uniform surface has been obtained. The final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color.
 3. Class III, Broom Finish: After the concrete is compacted, the surface shall be carefully rodded and struck off with a strike board to conform to the cross-section and grade shown on the Plans. After striking off and consolidating as specified above, the surfaces shall be made uniform by longitudinal or transverse floating, or both. When the concrete has hardened sufficiently, the surface shall be given a broom finish with a broom of an approved type. The strokes shall be square across the slab, from edge to edge with

- adjacent strokes slightly overlapped. The surface when finished shall be uniform, free of porous spots, irregularities, depressions and small pockets or rough spots.
4. Class IV, Steel Trowel Finish: The concrete surface shall be struck off and given a float finish as outlined for Class III finish above. After the surface has been tested with a straight edge and irregularities corrected, the entire system shall be finished with an acceptable steel bladed rotary type mechanical finishing machine to a smooth and uniformly finished condition. Hand troweling methods with a steel trowel will be used to finish corners or other areas inaccessible to the finishing machine and to remove all blade marks, burrs and other irregularities left by the machine, and the entire surface completed in a smooth and workmanlike manner, of uniform texture, and to the entire satisfaction of the ENGINEER.
 5. Class 5, Adhesive Grout Finish: The surface of the concrete shall be given an Class 1 finish, chamfer lines lightly rubbed, irregularities corrected, and then covered with an adhesive grout textured coating a minimum of 1/16" thickness. Coating shall be composed of one part white cement, one part natural (gray) cement, two parts masonry sand, and one part (latex) emulsion and enough water to form a viscous slurry of a consistency that may be applied by spray gun, brush or roller with appreciable running or sagging. The proportions of white and gray cement may be varied slightly to obtain the desired color. Gradation of the masonry sand shall be as required to product a texture satisfactory to the ENGINEER. Prepackaged materials meeting these requirements and acceptable to the ENGINEER as to color, texture and appearance will be permitted. The adhesive grout coating shall be applied to the moistened concrete surface in a manner which will provide a uniform texture and color, in the thickness specified, and shall be completely protected from rain and/or freezing for a period of 24 hours minimum. The adhesive grout type coating shall meet the test requirements of TxDot Item 423 for Adhesive Grout Type Coatings. If requested, the CONTRACTOR shall furnish the ENGINEER a certificate from the manufacturer stating the product furnished complies with these specifications.
 6. Class 6, sidewalk Finish: After the concrete has been deposited in place, it shall be compacted, the surface struck off by means of a strike board, and then finished with a steel trowel. An edging tool shall be used on all edges and at all expansion joints and dummy joints. The surface shall not vary more than 1/8" under a 10 foot straight edge. The surface shall then be given a granular or matted texture by light brushing with a wetted brush or broom to provide a non-skid surface when wet and meeting the entire approval of the ENGINEER.
- D. Temperature of Concrete: When placing concrete at a temperature below 45 degrees F., the concrete shall have a temperature not lower than 50 degrees F. and not higher than 95 degrees F. Suitable means shall be provided to maintain the concrete at a temperature not less than 50 degrees F. for the first five days after placement, or until it has hardened sufficiently, or until the first three days if high early strength concrete is used. The method of heating the materials at all times shall be subject to the ENGINEER's approval. No salt, chemical or other foreign matter shall be mixed with the concrete for the purpose of preventing freezing. If warm water is used, the cement shall be put in before other aggregates to prevent a flash set. If concrete is placed when weather is such that the temperature of the concrete would exceed 95 degrees F., as determined by the ENGINEER, the CONTRACTOR shall employ effective means, such as placing early in the day, as necessary to maintain the temperature of the concrete as it is placed below 95 degrees F.

-- END OF SECTION --

This page intentionally left blank

SECTION 31 03 01 - TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.1 WORK INCLUDED

Trenching for buried piping systems as well as subsequent embedment, backfill and compaction operations, necessary to install the pipe as specified.

1.2 QUALITY ASSURANCE

1.3 REFERENCE STANDARDS

TxDOT Specification Item 247

1.4 PROTECTION

- A. Protect trees, shrubs, and lawn areas to receive planting, and other features remaining as part of final landscaping.
- B. Protect benchmarks, existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic. Install and maintain bridging, planking and cants to provide access to Work.
- C. Protect excavations by shoring, bracing, sheet piling, underpinning, or by other methods, as required to prevent cave-ins or loose soil from falling into excavations.
- D. Underpin or otherwise support adjacent structures which may be damaged by excavation work. This includes service lines and pipe chases.
- E. Notify the ENGINEER of unexpected subsurface conditions.
- F. Where damage could result from continuing work, discontinue work in area until resident inspector notifies the CONTRACTOR of the required modifications.
- G. Protect bottom of excavations and soil around and beneath foundations from frost, freezing, and excessive moisture changes.
- H. Grade around trenches to prevent surface water runoff into excavated areas.
- I. Protect above or below grade utilities including lateral lines, sprinkler system lines, and all other lines which are to remain. The cost of replacing damaged lines is to be borne by the CONTRACTOR.

PART 2 PRODUCTS

2.1 BED AND FILL MATERIALS

- A. Refer to specifications Section 31 06 01, SITE GRADING AND EARTHWORK, for requirements of Aggregate Fill Classifications and to the Drawings for locations and dimensional requirements.
 - 1. Embedment and initial backfill for PVC pipe larger than 2 inches, steel pipe, and DIP pipe shall be Class 2 Aggregate Fill. If not shown on the Plans, embedment and initial backfill shall be Class 2 Aggregate fill. Embedment and initial backfill for small plastic pipe shall be sand fill.
 - 2. Embedment for RCCP and HCP shall be Class 3 Aggregate Fill. Initial backfill shall be non-expansive earthfill.
 - 3. Flowable fill (foam grout) shall conform to specifications Section 31 01 01, FLOWABLE FILL.
 - 4. Concrete shall conform to Section 03 09 01, GENERAL CONCRETE.
 - 5. Trench backfill under paving and to 5 feet outside of pavement shall be sand to within top 1 foot. Top 1 foot shall be Flowable fill with top 2 inches being cold mix asphalt.

PART 3 EXECUTION

3.1 PREPARATION AND LAYOUT

- A. Establish extent of excavation by line and elevation. Designate and identify datum elevations.
- B. Set required lines and levels.

- C. Maintain benchmarks, monuments and other reference points.

3.2 UTILITIES

- A. Known underground utilities are indicated on the Drawings.
- B. Before starting excavation, establish the location and extent of underground utilities occurring in the work area.
- C. As excavation approaches utilities, hand excavate to uncover utilities.
- D. Notify the ENGINEER for direction for removal and/or relocation of utility companies' lines which are in the way of excavation.
- E. Maintain, re-route or extend as required, existing utility lines to remain which pass through work area with the approval of the OWNER. Relocations are at the CONTRACTOR's cost.
- F. Protect utility services uncovered by excavation.
- G. Accurately locate and record abandoned and active lines rerouted or extended on Project Record Documents.

3.3 TRENCHING

- A. Ensure trenching does not interfere with normal 45 degree bearing splay of any foundation.
- B. Excavate in accordance with lines and grades. Excavated material which meets respective backfill requirements may be used for backfilling, stockpile or remove as applicable.
- C. Cut trenches sufficiently wide to enable proper installation of services and to allow for inspection. Minimum trench width shall be 6 inches wider than the pipe outside diameter. Pipe shall be installed in center of trench, with not more than 12-inch clearance nor less than 6-inch clearance between pipe wall and trench wall at any point. Trim and shape trench bottoms and leave free of irregularities, lumps and projections. Over excavated trench depths shall be filled to the proper grade with embedment material at no additional cost to the OWNER.
- D. Existing pavement over trenches shall be removed to a width of 6 inches outside the trench on each side by sawing methods and to a neat line. Asphalt pavements shall be sawed for full depth. Concrete pavement shall be sawed to a depth which will allow the section to be removed smoothly without underbreakage. Brick pavement shall be removed by hand methods in a manner that will not damage bricks, and the bricks shall be delivered and hand stacked as designated by the OWNER.
- E. Trench width shall be not more than 24 inches wider than outside diameter of pipes. Walls shall be vertical to elevation equal to 12 inches above the top of the pipe. Whenever the prescribed maximum trench width is exceeded, the CONTRACTOR shall use the next higher class of embedment, at no additional cost to the OWNER.
- F. Do not disturb soil within branch spread of existing trees or shrubs that are to remain. If it is necessary to excavate through roots, perform work by hand and cut roots with a sharp axe.
- G. When complete, request the resident inspector to inspect excavations. Correct unauthorized excavation as directed, at no cost to the OWNER.
- H. If, in the opinion of the resident inspector, the undisturbed material at grade depth is unstable, the CONTRACTOR shall be required to remove the unstable material and fill the trench to the proper subgrade with embedment material. Payment will be made to the CONTRACTOR at the unit price per cubic yard set forth in the Bid Schedule.
- I. Unsuitable excavated subsoil including perishable, spongy material, large rock, or other material designated by the resident inspector shall not be used in backfilling. Unsuitable material shall be disposed of by the CONTRACTOR in a manner approved by the resident inspector.

3.4 SHEETING AND SHORING

- A. In caving ground or in wet, saturated or flowing or otherwise unstable materials, the sides of all trenches and excavations shall be adequately sheeted and braced, to maintain the excavation

from slides or cave-ins and to provide safety for workmen.

- B. Sheeting and shoring shall be designed by professional ENGINEER, licensed in the State of Texas.
- C. Sheeting, shoring, and bracing shall be removed unless otherwise approved by the ENGINEER. Removal of sheeting, shoring, and bracing shall be performed in a manner to prevent damage to new or existing structures and to avoid cave-ins or sliding of the banks. All holes and voids from the sheeting shall be immediately and completely filled and compacted with suitable materials. All costs associated with the abandonment of sheeting, shoring and bracing shall be borne by the CONTRACTOR.

3.5 DEWATERING

- A. Keep trenches dry. Provide necessary equipment including pumps, piping and temporary drains. Maintain groundwater level a minimum of 3 feet below bottom of excavations during construction.
- B. Direct surface drainage away from excavated areas. Provisions shall be made for the satisfactory disposal of water pumped to prevent damage to public or private property.
- C. Control the grading in and adjacent to excavations to prevent water running into excavated areas or onto adjacent properties or thoroughfares.
- D. Furnish and operate suitable pumps on a 24 hour basis to keep excavations free of water until services have been placed and backfilling is completed.

3.6 BEDDING

The CONTRACTOR shall install the pipe and complete the bedding so that the installation may be inspected prior to backfilling. The OWNER's inspector shall be notified by the CONTRACTOR when the bedding is complete for each particular segment. Any excavation areas backfilled without the OWNER's prior inspection will require uncovering and checking at the CONTRACTOR's expense.

Manually place and compact bedding material in layers not exceeding six inches.

Manually shape bedding material to conform to pipe barrel and bell or flanges such that the entire length of the pipe barrel is supported by the bedding material.

Embedment and initial backfill materials shall be placed as shown on the plans and compacted in six inch layers along sides of pipe and to a minimum depth of 12 inches over the top of the pipe.

3.7 SETTING VALVES, VALVE BOXES AND FITTINGS

Gate valves and pipe fittings shall be set joint to new pipe in the manner specified for cleaning, laying and jointing pipe.

Valve boxes shall be firmly supported and centered plumb over the wrench nut of the gate valve, with box cover flush with the surface of the finished pavement or at such level as directed.

Standard plugs shall be inserted into the bells of all dead ends of pipe, tees or crosses and spigot ends shall be capped. Plugs or caps shall be jointed to the pipe or fitting in the manner specified above.

Concrete blocking will be required at all tees, bends, crosses and fire hydrants as provide herein. Blocking shall be placed between solid ground and the fittings. The bearing on the pipe and ground to be as detailed or as may be directed.

3.8 BACKFILLING

After pipe has been laid on the specified bedding material and all joints have been made, the backfilling of the trench shall begin. All trenches as a minimum shall have the bedding material extended to the top of the pipe and select backfill to a point 8" above top of pipe. Except as specified for backfilling trenches in streets, the remainder of the trench shall be backfilled using

material excavated. In areas where the natural terrain provides less than 2 feet of cover for the proposed line, the CONTRACTOR shall construct a backfill mound over the trench. This trench shall be no less than 6 feet wide, not greater than 14 inches tall, and shall provide 24 inches of cover over the proposed line. In areas where the proposed line crosses drainage channels, a 6 inch concrete cap shall be placed over the line to the satisfaction of the ENGINEER.

- A. Do not start backfilling until services have been inspected.
- B. Ensure trenches are free of building debris, snow, ice, and water and that ground surfaces are not in a frozen condition.
- C. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.
- D. Place and compact backfill materials in continuous layers according to the approved method of compaction. Use a method which will not disturb or damage services. No excessively large rocks or debris of any sort shall be used as backfill.
- E. Maintain moisture content and compaction density of fill materials as required.
- F. Acceptable backfill shall be placed from eight inches over the pipe to the surface.
- G. Excavated unsuitable material and excess material shall be disposed of by the CONTRACTOR in a manner approved by the resident inspector or OWNER's representative.
- H. Backfilling Trenches in Alleys and Outside Roadways: After pipe has been placed to the grade, alignment and bedding to the top of pipe, the trench shall be backfilled with select material to a level 8 inches above the top of pipe. The select backfill shall be placed carefully by depositing the backfill material vertically by hand or by machines in such a manner that the pipe will not be displaced laterally and the pipe will not be damaged by contact with the backfill material, tools or equipment. Above this level, backfill may be shoveled or pushed into the ditch by hand or machine, completely filling the trench. In no event shall the backfill material contain rocks larger than 2 inches. The backfill material shall be neatly rounded over the trench and smoothed such that the height of the backfill mound over the trench does not exceed 9 inches above the original ground surface. Any excess excavated material that is not required to make the mound over the pipe trench shall be disposed of to the satisfaction of the OWNER. Any deficiency of backfill material shall be supplied by the CONTRACTOR.
- I. Backfilling Trenches in Open Country: After bedding material is completed, and the pipe has been placed on the grade and alignment, the trench located in open country or fields shall be backfilled with select material excavated from the trench, free of rocks or clods with dimensions greater than 2" to a level 8 inches above the top of pipe. This select backfill shall be placed carefully by depositing the backfill material vertically by hand or by machines in a manner that the pipe will not be displaced laterally and the pipe will not be damaged by contact with the backfill material, tools or equipment. Above this level, backfill may be shoveled or pushed into the ditch by hand or machine, completely filling the trench. In no event shall the backfill material contain rocks or clods larger than 2". The backfill material shall be neatly rounded over the trench and smoothed such that the height of the backfill mound over the trench does not exceed 9 inches above the original ground surface. Any excess excavated material that is not required to make the mound over the pipe trench shall be smoothed and leveled on the ROW to the satisfaction of the OWNER. Any deficiency of backfill material shall be supplied by the CONTRACTOR.
 - 1. A minimum of 6 inches topsoil with grass roots shall be replaced for all trenches through existing residential yards.
- J. Backfilling Trenches under Pavement, Concrete, Gravel Streets, Highways: Where the trench crosses or lies within existing paved or graveled areas, the trench shall be backfilled with sand or granular material to top of finish grade for a distance of 8 feet outside the edge of paving and shall be jetted. The base material for the 6" crushed base course shall meet the requirements

of TxDOT Specification Item 247, Grade 1, Type A. In paved areas the base course shall be primed with 0.25 gallon per square yard with MC-30. After allowing a minimum of 6 hours curing time, the areas shall receive 2 inches of Type "D" Hot Mix asphalt at a compacted density of 220 pounds per square yard and applied in a manner to be smooth and level with existing pavement.

3.9 COMPACTION

- A. Compact embedment and initial backfill materials per General Requirements.
- B. Remove and replace improperly compacted backfill material at no cost to OWNER. Additional trench settlement following completion shall be restored to a level surface. Trench surfaces may be left crowned in open country.
- C. Water jetting for consolidation will not be permitted within 25 feet of any structures, unless acceptable to the ENGINEER.

3.10 TRENCH SETTLEMENT

The CONTRACTOR shall be responsible for all settlement of backfills, fills, and embankments which may occur within one (1) year after final completion of the contract under which the work was performed.

The CONTRACTOR shall make, or cause to be made, all repairs or replacements made necessary by settlement, within thirty (30) days after notice from ENGINEER or OWNER at the CONTRACTOR's own expense.

3.11 CLEAN UP

Remove surplus fill materials off-site.

-- END OF SECTION --

This page intentionally left blank

SECTION 31 04 01 - TRENCH EXCAVATION SAFETY PROTECTION SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. This item will consist of the basic requirements which the CONTRACTOR must comply with in order to provide for the safety and health of workers in a trench. The CONTRACTOR shall develop, design and implement the trench excavation safety protection system. The CONTRACTOR shall bear the sole responsibility for the adequacy of the trench safety system and providing "a safe place to work" for the workman.

1.2 GENERAL

- A. The trench excavation safety protection system shall be used for all trench excavations deeper than five (5) feet. The Excavating and Trenching Operation Manual of the Occupational Safety and Health Administration, U.S. Department of Labor, shall be the minimum governing requirement of this item and is hereby made a part of this Specification. The CONTRACTOR shall, in addition, comply with all other applicable federal, state and local rules, regulations and ordinances. The design of the trench excavation safety protection system shall be performed by or under the supervision of a professional engineer licensed to practice in the State of Texas.
- B. If evidence of possible cave-ins or slides is apparent, all work in the trench shall cease until the necessary precautions have been taken by the CONTRACTOR to safeguard personnel entering the trench. It is the sole duty, responsibility and prerogative of the CONTRACTOR, not the OWNER or ENGINEER or resident inspector, to determine the specific applicability of the designed trench safety systems to each field condition encountered on the project. The CONTRACTOR shall maintain a permanent record of daily inspections.

1.3 REFERENCE STANDARDS

1.4 INDEMNIFICATION

- A. The CONTRACTOR shall indemnify and hold harmless the OWNER, their employees and agents, from any and all damages, costs, (including without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this project.
- B. The CONTRACTOR acknowledges and agrees that this indemnity provision provides indemnity for the OWNER and ENGINEER in case the OWNER or ENGINEER is negligent either by act of omission in providing for trench safety, including, but not limited to inspections and failure to issue stop work orders.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

-- END OF SECTION --

This page intentionally left blank

SECTION 31 06 01 - SITE GRADING AND EARTHWORK

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- ASTM C131/C131M - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine Latest Edition.
- ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine Latest Edition.
- ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate Latest Edition.
- ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)) 2012 (Reapproved 2021).
- ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).
- ASTM D4221 - STANDARD TEST METHOD FOR DISPERSIVE CHARACTERISTICS OF CLAY SOIL BY DOUBLE HYDROMETER Latest Edition.
- ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table Latest Edition.
- ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction 2012 (Reapproved 2022).
- ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)) 2012 (Reapproved 2021).
- TXDOT Item 247

1.2 WORK INCLUDED

- A. General excavation and fill operations for buildings. Rough grading and contouring of site, and drainage ditches.
- B. Aggregate fill and earth fill material classifications and requirements.
- C. OWNER is responsible for payment of all soils test. ENGINEER is responsible for determining all tests necessary. CONTRACTOR is responsible for allowing time in the construction schedule for testing any required rework.

1.3 QUALITY ASSURANCE

- A. All materials to be used whether excavated on-site or imported as offsite borrow, shall be tested for compliance with the requirements of this section prior to placement.
- B. Notify OWNER and ENGINEER when bearing material (bottom of excavation) is reached for observation of founding strata.
- C. Prior to furnishing any soils to the site, CONTRACTOR shall furnish a written, notarized certification from the landowner of each proposed offsite soil borrow source stating that to the best of the landowner's knowledge and belief, there has never been contamination at the borrow source site with hazardous toxic materials.

1.4 SUBMITTALS

Submit test reports for all specified parameters for each material classification used prior to placing material and at intervals of 2000 cy during placement. Obtain representative samples from multiple locations from stockpiles for each test.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Stockpile excavated materials and/or borrow in designated areas or in areas as approved by the ENGINEER. Do not stockpile material in the flood plain.
- B. Lightly compact and slope top of stockpiles to prevent excessive erosion and ponding of water.

1.6 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.
- B. Protect benchmarks, existing structures, fences, roads, sidewalks and paving.
- C. Protect above or below grade utilities which are to remain. Do not take existing utilities out of service without specific authorization by the OWNER. Notify OWNER at least five working days prior to taking existing utilities out of service to make connections or for removal of utility.
- D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods, as required to prevent cave-ins or loose soil from falling into excavations.
- E. Underpin adjacent structures which may be damaged by excavation work, including service lines and pipe chases.
- F. Notify the ENGINEER of unexpected subsurface conditions.
- G. Where damage could result from continuing work, discontinue work in area until ENGINEER notifies the CONTRACTOR of the required modifications.
- H. Protect bottom of excavations and soil around and beneath foundations from frost, freezing, and excessive moisture changes.
- I. Grade around excavations to prevent surface water runoff into excavated areas. During excavation, maintain grades for complete drainage. Install temporary drains or drainage ditches as needed to intercept or divert surface water and prevent interference or delay of the Work. Install groundwater pumping facilities and hoses/piping required to perform the work. The pumping of water shall be included in the appropriate lump sum bid items. No separate payment will be made for drainage control or ground water pumping.
- J. Repair damage, promptly, at no cost to OWNER.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Class 1 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131/C131M or ASTM C535. When material is subjected to five (5) cycles of the sodium sulfate soundness test in accordance with ASTM C88, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the ENGINEER and shall meet the following gradation in accordance with ASTM D448, size number 57:

SIEVE SIZE SQUARE OPENING	PERCENT PASSING
1-1/2 inches	100
1-inch	95-100
1/2 inch	25-60
No. 4	0-10
No. 8	0-5

- B. Class 2 Aggregate Fill: Consist of durable particles of crushed or weathered limestone free of unsuitable, soft, or organic material will be considered. The source of the material shall be approved by the ENGINEER. Bin #10 or chat material complying with the following gradation requirements:

SIEVE SIZE SQUARE OPENING	PERCENT PASSING
3/4-inch	100
1/2-inch	95-100
3/8-inch	90-100
1/4-inch	65-80
No. 4	30-40

No. 20	0-5
--------	-----

- C. Class 3 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131/C131M or ASTM C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the ENGINEER and meet the following gradation:

SIEVE SIZE SQUARE OPENING	PERCENT PASSING
1-3/4-inch	100
7/8-inch	65-90
3/8-inch	50-70
No. 4	35-55
No. 40	15-30
No. 100	0-12
	Wet Sieve Method

- D. Crushed Limestone Base Material: Shall meet the requirements of 2004 TXDOT Item 247, Type A, Grade 2 or better.
- E. Non-Expansive Earth Fill: Consist of soil materials with a liquid limit of 35 or less, a plasticity index between 5 and 15, a minimum of 35 percent passing the No. 200 sieve, a minimum of 85 percent passing the No. 4 sieve, and which are free of organics or other deleterious materials. When compacted to the recommended moisture and density, the material shall have a maximum free swell value of 0.5 percent and a maximum hydraulic conductivity (permeability) of 1 E-05 cm/sec, as determined by laboratory testing of remolded specimens of the actual materials proposed for the non-expansive earth fill.
- F. General Earth Fill: Consist of any soil materials which have a minimum plasticity index of 8, a minimum of 20 percent passing the No. 200 sieve, a minimum of 75 percent passing the No. 4 sieve, and which are free of organics or other deleterious material. On-site soils are sometime suitable for use as general earth fill.
- G. Select Fill:
1. Non-organic, sandy clay or clayey sand.
 2. Liquid limit less than 36.
 3. Plasticity index ranging from 5 to 18.
 4. Sieve Analysis: Maximum percent retained on No.4 sieve = 25 to 50 and on No.40 sieve = 50 to 75.
 5. Maximum of 70 percent passing #200 sieve.
 6. Maximum size of aggregate 1-3/4 inches.
 7. On-site soils may be blended and utilized for select fill if approved by the ENGINEER and if the blended material complies with the select fill requirements above.
- H. Sand Fill or Sandy Select:
1. Granular material of uniformly graded crushed rock from 3/4-inch U.S. sieve downward.
 2. Plasticity Index: Maximum of 5.
 3. Sieve Analysis:

SIEVE NO.	MAX. PERCENT PASSING
1-inch	100
No. 10	50
No. 40	30
No. 200	8

- I. Low-Permeability Earth Fill: Consist of soil materials classified as CH or CL in accordance with ASTM D2487. The materials also shall have a minimum liquid limit of 40, a minimum plasticity index of 20, a minimum of 50 percent passing the No. 200 sieve, and shall be free of organics or other deleterious materials. The material shall have a Percent Dispersion of less than 20 when tested in accordance with ASTM D4221. When compacted to the recommended moisture and density, the material shall have a maximum hydraulic conductivity of 1 E-07 cm/sec, as determined by laboratory testing of remolded specimens of the actual materials proposed for the low-permeability fill.
- J. Unclassified Material: All material excavated from site not meeting the requirements for topsoil, or classified materials.

PART 3 EXECUTION

3.1 PREPARATION AND LAYOUT

- A. Establish extent of site grading by area and elevation; designate and identify datum elevation.
- B. CONTRACTOR shall set required lines and levels.
- C. Maintain benchmarks, monuments and other reference points.

3.2 UTILITIES

- A. Approximate locations of known underground utilities are indicated on the Drawings. The CONTRACTOR is responsible for locating all existing utilities prior to construction.
- B. Before starting excavation, the CONTRACTOR is to establish location and extent of underground utilities occurring in work area.
- C. Notify the ENGINEER for direction for removal and/or relocation of lines which are in the way of excavation.
- D. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area with the approval of the OWNER.
- E. Support and protect utility services uncovered by excavation.
- F. Accurately locate and record abandoned and active lines rerouted or extended, on Project Record Documents.
- G. As excavation approaches utilities, hand excavate to uncover utilities.

3.3 EXCAVATION

- A. Before starting excavation, clear and grade work area to minimum depth shown on Plans. Strip top soil approximately 6 inches to 12 inches, depending on location and stockpile.
- B. Excavate in accordance with lines and levels required for construction of the Work.
- C. When excavation is through paved areas, cut pavement to provide a square, uniform edge with minimum disturbance of remaining pavement and replace in accordance with the Drawings.
- D. In all areas requiring rock excavation, the CONTRACTOR shall install the pipe and complete the "rock free" bedding so that the installation may be inspected prior to backfilling. The OWNER's inspector shall be notified by the CONTRACTOR when the bedding is complete for each particular segment. Any rock excavation areas backfilled without the OWNER's prior inspection will require uncovering and checking at the CONTRACTOR's expense.
- E. Machine slope banks.
- F. Hand trim excavations and leave free from loose or organic matter.
- G. Provide and maintain surface and groundwater control until backfilling is complete. Keep excavations free from standing water.
- H. Do additional excavation only by written authorization of ENGINEER.
- I. Correct unauthorized excavation as directed, at no cost to OWNER. Areas that are excavated to elevations below those shown on the Plans shall be backfilled and compacted with crushed rock (Class 3 Aggregate Fill) if area is under aggregate fill, pipe, or structure, and otherwise

with non-expansive earth fill.

- J. Excavations should not interfere with normal 45 degree bearing splay of any foundation unless sheeting and/or shoring is designed and provided for excavation.
- K. Stockpile excavated material in areas designated by ENGINEER according to classifications given under materials portion of this section.
- L. Do not disturb soil within branch spread of existing trees or shrubs that are to remain.
- M. Coordinate with OWNER's representative prior to reaching founding level for foundations and prior to placing mud slabs to request observation.

3.4 COMPACTED FILL

A. Preparation for Fill Placement:

- 1. Do not start backfilling operations until structures have been inspected and backfilling authorized by OWNER's representative or the ENGINEER. Backfill against structures in accordance with Section 31 02 01, STRUCTURAL EXCAVATING, BACKFILLING AND COMPACTING.
- 2. Ensure areas to be filled are free from debris, snow, ice and water, and that ground surfaces are not in a frozen condition.
- 3. Do not place fill over existing subgrade surfaces which are porous, wet or spongy.
- 4. Proofroll subgrade with minimum 25-ton pneumatic roller or loaded dump truck under observation of OWNER's representative. Remove soft or unstable areas and replace with select fill, then scarify subgrade to a depth of 6 inches and compact to a minimum of 95 percent of ASTM D698 at a moisture content within 3 percent of optimum moisture. Density and moisture content of the compacted subgrade shall be maintained until it has been covered with the next course of construction.
- 5. Place compacted fill to grades, contours, levels and elevations shown on Drawings. After dumping, spread the material in horizontal layers. Place fill in maximum 6-inch compacted lifts compacted to a minimum of 95 percent Standard Proctor (ASTM D698) at a moisture content within 3 percent of optimum moisture. Density and moisture content of each lift of fill must be maintained until the next lift is placed.
- 6. Existing hillsides or slopes which will receive fill should be loosened by scarifying or plowing to a depth of not less than 8 inches. The fill material shall be benched into the existing slope in such a manner as to provide adequate bonding between the fill and slope, as well as to allow the fill to be placed in horizontal lifts.
- 7. Fills should extend a minimum of 5 feet outside of building lines and slope to natural grade.

B. Material Placement:

- 1. General:
 - a. Place fill in maximum 6-inch compacted lifts compacted to a minimum of 95 percent Standard Proctor (ASTM D698) at a moisture content within 3 percent of optimum moisture. Density and moisture content of each lift of fill must be maintained until the next lift is placed. Use a method so as not to disturb or damage completed work constructed in the excavations.
 - b. If the surface is too smooth and hard to bond properly with a succeeding layer, the surface shall be roughened and loosened by diskings before the succeeding layer is placed.
 - c. Where fill is to be placed next to existing fill, that fill shall be removed to unweathered, dense material. Each layer shall be benched and disked as adjoining lifts are placed. Material hauling equipment shall be so routed to prevent the formation of ruts.
 - d. The surface of the fill shall be graded to drain freely and maintained throughout construction. During the dumping and spreading process, all roots, debris and all rocks greater than 3 inches in maximum dimension shall be removed.
 - e. Following the spreading and mixing of the soil, it shall be processed by diskings or pulverizing throughout its thickness to break up and reduce clod size, and provide additional blending of materials.

- f. The moisture content of the soil shall be adjusted, if necessary, by either aeration or the addition of water to bring the moisture content within the recommended range. Water required for sprinkling to bring the fill material to the proper moisture content shall be applied evenly through each layer.
 - g. Any layers which become damaged by weather conditions shall be processed to meet recommended requirements. The compacted surface of a layer of fill shall be lightly loosened by disking before the succeeding layer is placed.
- C. Compaction:
- 1. Compact fill materials listed below to required percentages of maximum dry density.
 - a. Compact non-expansive earth fill in top 12 inches under paving or building to a minimum of 95 percent of maximum dry density of an ASTM D1557 Modified Proctor at a moisture content with 3 percent of optimum moisture.
 - b. Compact non-expansive earth fill and general earth fill not under roads or in embankment and more than 1 foot beneath roads to a minimum of 95 percent of ASTM D698 at a moisture content within 3 percent of optimum moisture.
 - c. Compact non-expansive earth fill against underground walls to between 95 and 100 percent of ASTM D698 at a moisture content within 3 percent of optimum moisture.
 - d. Place Select Fill in maximum 6-inch compacted lifts compacted to a minimum of 95 percent Standard Proctor (ASTM D698) at a moisture content within 3 percent of optimum moisture.
 - e. Minimum Frequency of Density Tests:
 - 1) Bearing: 1 test/3000 square feet per lift or minimum of 2 tests per lift.
 - 2) Structure Fills: 1 test/3000 square feet per lift, minimum 2 test per lift.
 - 3) Backfill: 1 test/6000 square feet per lift, minimum 2 tests per lift.
 - 4) Trench backfill: 1 test/150 Lf trench per lift, minimum 2 tests per lift.
 - f. The CONTRACTOR shall be responsible for the actual quality of the fill, in place. Satisfactory test results shall not be considered as the sole factor of the quality of the fill operation.
 - g. The moisture content and density of all fill shall be maintained at the specified range of moisture and density.
 - 2. Compact aggregate fill material in maximum 6-inch thick lifts.
 - a. Aggregate fill for pipe bedding shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D4253. The moisture content shall be in a range that will accommodate efficient placement and compaction.
 - 3. Prior to placement of aggregate base course material for paved areas, remove soft or unstable areas and replace with aggregate base course material, then scarify subgrade to a depth of 6 inches and compact to a minimum of 95 percent of ASTM D698 at a moisture content within 3 percent of optimum moisture. Density and moisture content of the compacted subgrade shall be maintained until it has been covered with base course material.

3.5 SUBGRADE

- A. The CONTRACTOR shall excavate or fill to the top of proposed subgrade so that the specified thickness of base course material will be obtained across the section. After excavation or fill has been made to the subgrade elevation as shown on the Plans, the CONTRACTOR shall prepare the subgrade for compaction by scarifying and disking the subgrade a minimum of 6 inches and a maximum of 8 inches. Water shall be added to the soil if necessary, and the soil disked again to obtain a uniform moisture content throughout the depth of the subgrade. Moisture of the compacted subgrade shall be at optimum moisture content or at a tolerance of +/- 3%, which will be determined by soil laboratory analysis. If it is determined the moisture content is not uniform or within the limits specified, water shall be added and the subgrade disked again; or the soil shall be disked to the extent necessary to dry the soil to the specified limits, all at the CONTRACTOR's expense.
- B. After the subgrade has been prepared to the specified moisture content, subgrade shall be compacted for the full street section to 95% per ASTM D698 for a depth of 6 inches. Any areas

of subgrade failing to meet the specified density shall be re-disked and recompact until the correct density is obtained, all at the CONTRACTOR's expense. If determined by the ENGINEER or City Representative, a minimum of one density test per 6,000 square feet shall be made by an independent soil testing laboratory for Quality Control of the finished work.

- C. Compaction of the subgrade shall be performed with sheep foot rollers, pneumatic rollers and flat steel wheel rollers to the extent necessary to obtain the specified soil density. Final compaction shall be made by flat steel wheel rollers or pneumatic tire rollers to leave a smooth surface on which to install the base course material.
- D. The subgrade shall be shaped with a self-propelled grader, and all holes, ruts and depressions filled with an approved material and rolled to the extent directed by the ENGINEER. The surface of the subgrade shall be finished to the required lines and grade; and any deviation in excess of 1/4 inch, when checked with a 16 foot straight edge, shall be corrected by the CONTRACTOR.

3.6 SCHEDULE

- A. General Earth Fill:
 - 1. Use under seeded areas, backfill at depths of more than 5 feet below and 5 feet outside of roads and in embankments (except for clay liner material) unless, otherwise shown on Drawings.
 - 2. Fill to within 4 inches of finished grade as backfill adjacent to structures.
- B. Non-Expansive Earth Fill: Use as backfill for the top 5 feet depth under roads as shown on Drawings. Use to 5 feet outside the limits of roads.
- C. Low Permeability Earth Fill: Use for top 2 feet of interior slope of embankments.
- D. Select Fill: Use as backfill against structure walls and beneath structures.
- E. Class I Aggregate Fill: Use for over excavated areas under structures and as otherwise shown on Drawings.
- F. Class 2 Aggregate Fill: Use for pipe embedment and initial backfill per details in the Plans.
- G. Sand Fill: Use for small pipe embedment (#2-inch diameter).
- H. Topsoil: Use within limits of seeded areas after substantial completion of construction and other fill has been placed.
- I. Unclassified Material: Dispose of off-site.

3.7 TOLERANCES

- A. Site grading to conform to Plans within the following tolerances:
 - 1. Drainage ditches: 0.10 feet.
 - 2. Excavations: plus zero to -0.10 feet.
 - 3. Compacted fill: 0.10 feet.

3.8 SURPLUS MATERIAL

- A. Dispose of unclassified material, surplus fill materials and excess topsoil off-site.
- B. Leave stockpile areas and entire jobsite clean and raked, ready to receive seeding.

3.9 WATER INJECTION

General specifications for water injection under the new building are included below. Compliance with this Specification is essential. The injection depth is a minimum of 10 feet below existing grade.

- A. Injection process shall be observed on a full-time basis by a qualified inspector under the direction of the OWNER's designated geotechnical ENGINEER.
- B. A surfactant (wetting agent) shall be added to the water. The amount of surfactant used should be in accordance with the manufacturer's recommendations.
- C. The lower portion of the injection nozzle shall consist of a hole pattern that will uniformly disperse the water throughout the entire depth.

- D. Injection pressures should be adjusted to disperse as large a volume of water as possible within a pressure range of 50 to 200 pounds per square inch.
- E. Injection pipe shall be forced downward (not jetted or washed) in 12 to 18 inch intervals, injecting to refusal at each interval. For an injection depth of 10 feet a minimum of 7 intervals shall be used and for an injection depth of 5 feet a minimum of 4 intervals shall be used. Refusal will be determined on site by the inspector.
- F. Spacing for the injections not to exceed five feet on center each way, and injections shall be carried at least five feet outside building lines. Subsequent injections should be offset from initial locations in a pattern that maximizes distribution of the mixture.
- G. After the recommended number of injection passes the moisture content of the soils shall be evaluated by the OWNER's designated geotechnical ENGINEER on the basis of laboratory tests on tube samples (not cuttings) obtained from borings under his supervision following a twenty-four-hour curing period. This ENGINEER shall develop recommendations on the need for any additional injections.
- H. In the event that more than three injections passes are required, the surface of the injected area shall be scarified to a depth of at least eight inches and re-compacted prior to the next injection.
- I. The surface of the injected area should be sealed or otherwise protected against moisture loss as soon as possible after acceptance of the water injection process.

3.10 MAINTENANCE

Following the final shaping of material, the base course shall be maintained throughout its entire length by the use of a standard road machine or motor grade and rollers until such time as, in the judgment of the ENGINEER, base course meets the required density, is properly bonded and is suitable for priming. The base shall be properly drained at all times. During this maintenance period, any deficiencies in thickness, composition, smoothness or density shall be corrected in a satisfactory manner.

The CONTRACTOR shall be fully responsible for maintaining and preserving the completed base course during the period prior to surface treatment. Upon completion of the base course, if the asphaltic surface cannot be applied, the CONTRACTOR shall apply an emulsion of primer coat to the base surface in order to afford dust control and assist in base maintenance.

CONTRACTOR shall return to the project as often as required to fill holes in the base surface and add primer as required or recommended by the ENGINEER.

-- END OF SECTION --

SECTION 33 01 01 - GENERAL REQUIREMENTS FOR PIPING SYSTEMS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop 1974.
- MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- MSS SP-69 - Pipe Hangers and Supports - Selection and Application 2012.
- NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

1.2 WORK INCLUDED

- A. All exposed, submerged and buried plant and station piping including modifications to existing systems as well as new pipe systems.
- B. Potable water and raw water mains, sanitary sewers, storm drains and culverts shown on Drawings.

1.3 RELATED WORK

- A. Section 31 03 01 TRENCHING, BACKFILLING AND COMPACTING
- B. Division 33 UTILITIES

1.4 QUALITY ASSURANCE

- A. All material may be rejected for failure to meet any of the requirements of this specification. Material rejected by the ENGINEER shall be removed from the site.
- B. Inspection: The quality of all materials, process or manufacture and the finished installation shall be subject to the inspection and approval of the ENGINEER.
- C. All surfaces and materials in contact with water, or in contact with a chemical being added to water that is being treated for potable use, shall conform to NSF/ANSI 61 and be certified by an organization accredited by ANSI, or shall meet the TCEQ requirements for contact with potable water.
- D. The use of pipes and pipe fittings that contain more than 8.0% lead or solders and flux that contain more than 0.2% lead is prohibited.

1.5 DESCRIPTION OF PIPING SYSTEMS

- A. The configuration and layout of yard, process, and station piping systems are shown on the Drawings.
- B. The type of pipe and joints, and embedment (if buried) to be used for each system are shown on the Drawings or included in the appropriate Specifications.
- C. In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Drawings, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the CONTRACTOR's responsibility to provide a complete system of pipe supports, to provide expansion joints, and to provide restraints and anchor all piping, in accordance with the requirements set forth herein. Additional pipe supports may be required adjacent to expansion joints, couplings, or valves.
- D. Pipe and fittings shown on yard piping Drawings are general in nature. CONTRACTOR shall determine exact lengths and fittings required and make field adjustments necessary to complete piping and avoid conflicts. Changes to Plans and profiles of piping shall be submitted to ENGINEER for approval. Pipe and fittings not incorporated into the project shall remain the property of the CONTRACTOR. Costs will not be paid by the OWNER for materials not used in the project, even if shown on the Drawings. Additions and deletions to the scope shall be

incorporated by Change Order.

1.6 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Comply with the provisions of Section 01 04 01 and the supplemental requirements below.
 - 2. Submit detailed layout drawings for all piping systems. Those drawings may be organized by system or by areas. Prepare drawings to scale and show the following information on them:
 - a. Type of piping including material, weight, linings, and coatings. If desired, use code and key to product data sheet specified below.
 - b. Location and type of joints, fittings, taps, supports, restraint systems, kickers and blocking (as applicable).
 - 3. Submit fabrication drawings for specials including fabricated fittings, wall pipes and wall sleeves. Show dimensions and materials of construction.
 - 4. Submit manufacturer's standard drawings showing dimensions, configuration and materials of construction for the following items:
 - a. Joints.
 - b. Flanges.
 - c. Couplings.
 - d. Expansion joints.
 - e. Hangers, brackets and other similar accessories.
 - 5. Submit the following product data on all piping materials.
 - a. Reference standard.
 - b. Type material.
 - c. Wall thickness, schedule or class as appropriate.
 - d. Outside diameter.
 - e. Type and thickness of lining.
 - f. Type and thickness of coating.
 - g. Pressure rating, if applicable.
- B. Affidavits of Compliance:
 - 1. Submit manufacturer's affidavits of compliance with the reference standards.
- C. CONTRACTOR shall mark actual flowline or top of pipe elevations and actual coordinates on record drawings when pipelines are being installed.

1.7 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with manufacturer's instructions.
- B. Delivery and Handling:
 - 1. Do not deliver piping materials to project site prior to ENGINEER's approval of required submittals.
 - 2. Unload and handle piping materials using proper materials handling equipment.
 - 3. Do not drop, roll, skid piping materials.
 - 4. Take such additional precautions as necessary to avoid damaging piping materials and coatings thereon.
- C. Storage:
 - 1. Store piping materials in a manner which will reduce risk of damage.
 - 2. Block piping materials to prevent rolling.
 - 3. Protect materials from weather and sun as recommended by the manufacturer.

PART 2 PRODUCTS

2.1 GENERAL

- A. See other Sections in Division 33 for piping materials specifications.
- B. No asbestos materials shall be used in any piping materials, linings, and gaskets for this project.
- C. PVC piping shall not be used beneath structures except for chlorine gas and chemical service. Where PVC pressure pipe is called out for a system, furnish continuous copper tubing for less

than 4-inch diameter and DIP for 4 inches and larger sizes. Transition 3 feet outside slabs and 1-foot above slabs unless otherwise shown. All piping beneath slabs and to 2 feet outside of slab shall be concrete encased.

- D. Gravity drain systems beneath slabs shall be ductile iron except for chemical drains, unless shown specifically on the Plans. Encase all piping beneath slabs.
- E. All buried potable water piping installed in this project shall have metal detectable tape indicating "Potable Water Line" installed 12 inches above the pipe.
- F. Install cleanouts on sludge piping so that all runs between bends may be accessed and at intervals not exceeding 250 feet on straight runs. Refer to Standard details.
- G. All bolts and fasteners on buried fittings and valves and fittings and valves in manholes shall be 304 stainless steel. Buried MJ fitting bolts may be Corten. Bolts and fasteners on submerged fittings and valves shall be 316 SS.
- H. For buried pipes, provide a flexible joint (Dresser coupling or push on or mechanical joint) within 10 feet from a structure connection to allow differential movement. Provide proper restraint on pressure systems.
- I. Provide taps and connections for flushing, testing, and disinfecting pipeline systems.
- J. Provide taps or weld-u-lets with stainless steel ball valves and piping at all high points in the piping systems for addition of air valves.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install all piping systems in accordance with the Drawings, Technical Specifications, approved shop drawings and manufacturer's installation instructions at CONTRACTOR's expense.
- B. Examine all piping materials prior to installation and replace items that are damaged or otherwise defective.
- C. Thoroughly clean inside of all piping, valves, and accessories, and outside of all materials which will be exposed. Clean before installation and maintain in that condition until accepted by OWNER.
- D. Provide secure temporary caps or inflatable plugs at all pipe ends at the end of each day to prevent foreign material from entering the piping systems. Brace pipe to restrain from floating.
- E. Do not modify structures, equipment, or piping for the purpose of installing piping unless specifically authorized by the ENGINEER.
- F. All piping systems shall be cleaned and tested prior to making connections at structures and to existing pipe systems. Small diameter pipes shall be flushed and large diameter pipes shall have mandrels pulled or other acceptable verification furnished that pipes are clean and no construction debris remains. Temporary blocking and forms used to grout inverts and blockouts shall be removed and manholes and pipes shall be tested before payment will be approved for the last 10 percent of the respective pipe pay estimate items.
- G. CONTRACTOR shall be responsible for, development, and comply with the trench safety plan and a confined space entry plan.
- H. Where indicated on the Plans, the CONTRACTOR shall furnish and install Polyvinyl Chloride (PVC) plastic water stops, Sealtight, Duo-PVC water stops as manufactured by W.R. Meadows, Inc., Electrovert, Inc., or approved equal. The water stops shall meet the requirements of COE CRD-C 572 for PVC water stops. The water stops shall be 9" or 6" width as shown on the Plans and shall have a minimum web thickness of 3/8". The PVC water stops shall be of the "U" bulb design or center circle design, having a minimum inside diameter 3/4.

3.2 INSTALLATION OF BURIED PIPING SYSTEMS

- A. Line and Grade:
 - 1. Install piping to lines and grades shown on Drawings or as stated.

2. Temporary support, adequate protection and maintenance of all underground utilities such as gas service, poles, guy wires, drains, sewer or any other underground utility shall be furnished by the CONTRACTOR at his own expense whether or not such services are shown on the Plans.
 3. Slope piping uniformly between flowline elevations shown.
 4. If centerline and flowline elevations are not shown on Drawings, install piping so that there is at least 30 inches of cover over same, except under ditches where the minimum cover is to be 24 inches. Piping less than 4-inch diameter may be installed with 3 feet of cover.
 5. Comply with requirements for minimum and maximum trench widths shown in the Plans. If maximum trench width is exceeded, use next higher class of embedment at no additional cost.
 6. Refer to special detail for installation of chemical and small diameter PVC piping.
 7. Service lines shall have a minimum cover of 24-inches.
 8. The top of the water line must be located below the frost line and in no case shall the top of the water line be less than 24 inches below the ground surface.
- B. Dewatering:
1. Keep trenches free of water when performing any type of work in them.
 2. Discharge groundwater from construction pumps as directed by OWNER.
- C. Bedding:
1. Install bedding as shown on Drawings. Shape bedding to allow for coupling and bells and to provide support over full length of pipe section. Place embedment under haunches and on sides of pipe and compact in lifts and in a manner which does not disturb pipe from line and grade.
 2. If bedding is not called for on Drawings or Specifications, piping less than 4-inch diameter shall be installed and encased in sand or granular material. Use embedment type shown in the standard details for larger pipes.
 3. Provide concrete encasement for all pipe under structures and to 2' beyond structure and as shown on Drawings.
 4. Provide concrete cradle (Class V) Embedment to first pipe joint at all connections to structures unless otherwise shown.
- D. Laying of Pipe:
1. Do not drop or roll pipe into trench. Inspect thoroughly prior to laying and then place carefully by hand or materials handling equipment.
 2. Do not lay pipe in water.
 3. Lay bell and spigot type piping with bell end facing direction of laying which is normally upgrade.
 4. Joint pipe as specified in piping material specifications.
 5. Do not deflect pipe unless shown on Drawings or approved by ENGINEER.
 6. When deflection of pipe is authorized, do not exceed the manufacturer's recommended maximum deflection.
 7. Shoring or other trench safety systems utilized shall be of thin cross-section such that when the sections are pulled, the embedment is not disturbed or displaced.
- E. Encasement of Piping and Valves:
1. Provide polyethylene encasement for steel, RCCP, cast iron and ductile iron piping and valves.
 2. Comply with Section 31 03 01, TRENCHING, BACKFILLING AND COMPACTING, for embedment of PVC pipe.
 3. Embedment shall extend at least eight inches above pipe and four inches below Pipe.
 4. Use Class C concrete or flowable fill when concrete encasement is called for on Drawings. Such encasement to extend a distance of Pipe OD/6 with a minimum of six inches from pipe in all directions unless otherwise noted on Drawings.
- F. Concrete Blocking:
1. Concrete thrust blocking shall be used for all buried piping two inches in diameter and larger that is under pressure.
 2. Provide thrust and restraint blocks at all bends, tees, wyes, hydrants, valves, and plugs.

3. Use Class B concrete or thoroughly mixed sacrete if approved by ENGINEER.
 4. Place concrete against undisturbed firm earth.
 5. Area of concrete in contact with earth to be as required to prevent pipe movement at specified field test pressure or working pressure plus surge allowance.
 6. Provide thrust blocking on back side of tees on pressure lines without adequate length to restrain joints.
 7. No blocking shall be covered up until it has been inspected and approved by the OWNER's representative or resident inspector. If covered prior to inspection, the CONTRACTOR shall uncover the blocking for inspection at his expense.
- G. Restrained Joints:
1. Use restrained joint piping and fittings for all mechanical joint fittings and valves under pressure. Joint restraint shall be provided for test pressures shown on the Plans and Specified for each piping system with a safety factor of 1.5 minimum, except for the following: The potable water, service water, and high service pump discharge pipes restraint design shall account for surge pressure based on 6 fps velocity in addition to working pressure shown on the Plans and safety factor of 1.5.
 2. Joint Restraints shall be Megalug Joint Restraints as manufactured by EBAA Iron, or approved equal.
- H. Backfilling:
1. Comply with Section 31 03 01, TRENCHING, BACKFILLING AND COMPACTING, and the following supplemental requirements.
 2. Backfill as soon as practicable after installation of piping, valves, encasement, restraint and blocking.
 3. Touch up damaged protective coatings prior to backfilling.
 4. Exercise care to avoid damaging piping or protective coatings with tamping equipment.
 5. When authorized by the ENGINEER, sheeting and bracing may be left in trench. Cut off all members so that tops of same are at least 18 inches below ground. Sheeting and bracing left in place shall be indicated on Record Drawings.
- I. Connections to New Manholes:
1. Couplings for pipe connections shall be cast into the manhole walls. PVC sleeves with rubber gaskets and abrasive silica outer coating may also be utilized.
 2. All clamps shall be 316 stainless steel.
 3. Support manhole connection to first pipe joint with concrete cradle.
- J. Making Field Connections to Manholes (when approved by ENGINEER):
1. Cut neat opening in manhole no larger than necessary to insert pipe.
 2. Utilize PVC sleeves with rubber gaskets and abrasive silica outer coating. After installing new lines, place concrete collar around pipe on outside of manhole to seal joint. Make collar approximately 8 inches wide by 8 inches deep. Use Class B concrete.
 3. Modify invert channel in manhole to provide smooth transition into or out of new pipe. Use Class B concrete.
- K. Valves:
1. Provide restrained joints on buried valves. Flanges may be utilized for valves 12 inches and larger when approved by the ENGINEER.
- L. Testing:
1. Comply with Section 33 01 02, FIELD TESTING OF PIPING SYSTEMS, and pipe Specifications and Drawings.

3.3 INSTALLATION OF EXPOSED PIPING SYSTEMS

- A. Alignment and Elevation:
1. Install straight runs true to line and elevation.
 2. Install vertical pipe truly plumb in all directions.
 3. Install piping parallel or perpendicular to building walls. Piping at odd angles and 45 degree runs across corners will not be accepted unless specifically shown on Drawings.
 4. Install small diameter piping generally as shown on Drawings when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, etc.

5. Install piping so that pipe, flanges, valves, and associated appurtenances are at least eight feet above finish floors, stairs, and landings unless lesser clearances are specifically dimensioned on the Drawings.
 6. Bring piping to alignment and elevation without forcing or springing pipe.
 7. For PVC or CPVC or ABS piping runs of 10 feet or longer, provide supports that accommodate expansion and contraction without bending the pipe out of alignment.
- B. Joints:
1. Joint pipe in accordance with piping material specifications and the supplemental requirements below.
 2. Wire brush flange faces and threads before jointing.
 3. Bring piping to proper alignment and elevation with permanent support system before tightening flange bolts and nuts.
- C. Unions for Threaded Piping:
1. Install unions near threaded valves and equipment to facilitate assembly and disassembly of piping, in addition to the specific locations shown on Plans.
 2. Install dielectric unions wherever dissimilar metals are joined.
- D. Expansion Joints:
1. Install in accordance with Drawings, Specifications for expansion joints and approved shop drawings.
 2. Use of additional couplings and adaptors to be approved by ENGINEER prior to installation.
 3. All expansion joints shall be restrained.
- E. Flexible Couplings and Flanged Coupling Adaptors:
1. Install in accordance with Drawings, Specifications for couplings and adaptors, and approved shop drawings.
 2. CONTRACTOR may use couplings and adaptors over and above those shown on Drawings to facilitate installation of piping. Use of additional couplings and adaptors to be approved by ENGINEER prior to installation.
 3. All flexible couplings and flanged coupling adaptors shall be restrained.
- F. Piping Supports and Restraints:
1. General:
 - a. Restrain, block, brace, support, or suspend pipe and fittings to prevent displacement, vibration, sagging, warping, deformation, or failure of piping and fittings, and to allow for expansion and contraction.
 - b. Support and restrain piping so that no piping loads from weight or thrust will be imparted to pumps or other equipment.
 - c. Materials: Unless otherwise specified, all pipe supports shall comply with MSS SP-58 and MSS SP-69. Materials of construction for fabricated steel supports are covered in the structural steel section. All pipe support materials shall be packaged as necessary to ensure delivery in satisfactory condition.
 - d. Unless otherwise specified or indicated on the Drawings, pipe supports shall be fabricated of manufacturer's standard materials and provided with manufacturer's standard finish.
 - e. Except as specified herein, the use of supports which rely on stressed thermoplastic components to support the pipe will not be acceptable. PVC pipe 4 inches and smaller, interior locations and exterior chemical storage area locations, shall be supported by pultruded vinylester channel and components as specified below:
 - 1) Material: Vinylester Fiberglass, Class 1 Fire Rated per ASTM E84, Premium Grade, pultruded channel as manufactured by Entrum Industries, Strut Tech Series 200 or equal. Support system shall be as specified herein and as recommended by the manufacturer.
 - 2) Adjustable strap type pipe clamps are not acceptable. Any metal components, if required, for this type support system shall be Type 316 stainless steel.
 - f. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be

copper plated. Those portions of pipe supports which contact other dissimilar metals shall be rubber or vinyl coated.

- g. All pipe supports, fasteners, anchors and hardware in wetwells, manholes, vaults, pipe trenches and submerged locations shall be AISI Type 316 stainless steel. Stainless steel supports fabricated by welding shall be AISI Type 316L material.

G. Supports for Horizontal Piping and Spacing of Expansion Joints:

- 1. Location: Unless closer spacing is indicated on the Drawings, the maximum spacing for pipe supports and expansion joints shall be:

<u>Type of Pipe</u>	Pipe Support Max Spacing, Feet	Max Run Without Expansion Joint, Loop, or Bend (Note a), Feet	Expansion Joint Max Spacing (Note b), Feet
Cast Iron	15	80	80
Cast Iron, glass-lined	12	80	80
<u>Steel for hot water heating</u>			
1-1/4 inch and smaller	7	30	100
1-1/2 inch to 4 inch	10	30	100
Over 4 inch	15	30	100
<u>Steel for other services</u>			
1-1/4 inch and smaller	7	30	100
1-1/2 inch to 4 inch	10	30	100
Over 4 inch	15	80	80
<u>Stainless Steel</u>			
1-1/4 inch and smaller	7	30	100
1-1/2 inch to 4 inch	10	30	100
Over 4 inch	15	80	80
<u>Copper for hot water</u>			
1 inch and smaller	5	20	100
Over 1 inch	7	20	100
<u>Copper for other services</u>			
1 inch and smaller	5	--	--
Over 1 inch	7	50	100
<u>CPVC, PVC, and ABS Schedule 80</u>			

1/8 inch and 1/4 inch	continuous support	20	60
1/2 inch	3-1/2	20	60
3/4 inch	4	20	60
1 inch and 1-1/4 inch	4-1/2	20	60
1-1/2 inch and 2 inch	5	20	60
2-1/2 inch	5-1/2	20	60
3 inch	6-1/2	20	60
4 inch	7	20	60
6 inch	8	20	60
8 inch	9	20	60
10 inch	9-1/2	20	60
12 inch	10	20	60
<u>Polypropylene</u>	6	--	--
<u>Cast Iron Soil</u>	10	--	--
<u>PVC, Schedule 40</u>			
1/2 inch	3-1/2	20	60
3/4 inch and 1 inch	4	20	60
1-1/4 inch and 1-1/2 inch	4-1/2	20	60
2 inch	5	20	60
2-1/2 inch	5-1/2	20	60
3 inch	6	20	60
4 inch	6-1/2	20	60
6 inch	7-1/2	20	60
8 inch	8	20	60
10 inch	8-1/2	20	60
12 inch	9-1/2	20	60

NOTES:

- a. Unless otherwise permitted, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.
 - b. Unless otherwise permitted, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.
 - c. Expansion joint fittings shall be as specified in the pipe joint and expansion joints section.
 - d. Correction factors shall be applied to the above table as recommended by the manufacturer to adjust for fluid specific gravities other than 1.0.
 - e. Maximum allowable spacing for PVC pipe shall be reduced when required by manufacturer's recommendations for maximum fluid temperatures.
2. Locate hangers or supports immediately adjacent to or at any change in piping direction, on both sides of valves, couplings, and heavy fittings, and on either end of pipe sections being removed unless specifically noted otherwise on Drawings.
 3. Install all hangers and supports so as not to interfere with the free expansion and contraction of the pipe.

4. When hangers are used to support insulated piping, provide shields to protect insulation.
 5. Provide concrete supports as shown on Drawings, or when required to comply with these Specifications. Construct in accordance with concrete Specifications and details shown on Drawings.
 6. Rubber hose and flexible tubing shall be provided with continuous angle or channel support, except at injector and chemical feed pump locations.
 7. Unless otherwise indicated on the drawings or permitted by the ENGINEER, piping shall be supported approximately 1-1/2 inches out from the face of walls and at least 3 inches below ceilings.
 8. Concrete inserts or L-shaped anchor bolts shall be used to support piping from new cast-in-place concrete. Capsule anchors shall be used to fasten supports to existing concrete and masonry. Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.
 9. Pipe supports shall be manufactured for the size and type of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.
 10. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.
 11. Pipe guides shall be provided adjacent to bellows type expansion joints. Guides will not be required when mechanical couplings are permitted as expansion joints. Guides shall be placed on both sides of expansion joints except where anchors are adjacent to the joint. Unless otherwise indicated on the Drawings, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for support. Pipe guides shall be installed as recommended by the manufacturer.
- H. Drain Valves and Air Bleed Valves:
1. Provide drain petcocks 1/4-inch diameter opening at all low points in air piping.
 2. Provide air bleed valves 1/8-inch diameter opening at all high points in force mains unless specifically indicated otherwise.
- I. Supports for Vertical Piping:
1. Support in accordance with Drawings and approved shop drawings.
 2. For piping 4 inches and smaller, install riser clamps so as to support piping at each floor sleeve.
 3. Use at least 3/4-inch of nonshrink grout in setting base elbows and tees. See Section 03 05 01, GROUT, for nonshrink grout requirements.
 4. For piping larger than 4 inches, locate supports at change of direction, at both sides of valves and couplings, and at maximum spacing of 10 feet.
- J. Piping Restraints:
1. Provide kickers and mechanical restraint system as shown on Drawings and required herein.
 2. Use at least 3/4-inch of nonshrink grout between kickers and walls or floors and between piping supports and floors or walls unless otherwise shown on Drawings. See Section 03 05 01, GROUT, for nonshrink grout requirements.
- K. Supports for Valves:
1. Provide supports for valves 16 inches and larger. Use the type of support shown on Drawings. If type is not shown, use concrete cradle type. CONTRACTOR may utilize an alternate type if acceptable to the ENGINEER.
 2. Install floor stands as shown on Drawings and as recommended by the manufacturer.
 3. Provide lateral restraints for extension bonnets and extension stems as shown on Drawings and as recommended by the manufacturer.
 4. Provide sleeves where operating stems pass through floor.

5. Place approved asphalt fill in recessed areas as shown on Drawings where flush bottom sluice gates or special valve installations are indicated. Size recessed areas as recommended by valve or gate manufacturer. Compact fill after placement.
 6. Install valve boxes so that they will not transmit shock or stress to valve and will be centered and plumb over the operating nuts.
- L. Wall Fittings:
1. Wall fittings shall be as shown on the Plans and the standard detail sheets.
 2. Wall fittings shall match the wall thickness, pipeline diameters, and connection types specified for the applicable pipeline designation.
- M. Field Painting: Comply with Section listed.
1. Buried Piping: Ductile iron, cast iron and steel coatings per Sections 33 01 03, DUCTILE IRON PIPE, and 33 01 04, STEEL PIPE AND FITTINGS, as applicable.
 2. Exposed Piping: Paint all exposed piping, supports, fittings and valves except stainless steel and fiberglass in accordance with Section 09 03 01, COATINGS & PAINTING FOR WATER TREATMENT PLANTS.
- N. Pipe Testing.
Comply with Section 33 01 02, FIELD TESTING OF PIPING SYSTEMS, and pipe Specifications.
- O. Insulation and Heat Trace
Insulate all exposed pipes 8-inch and smaller and where specifically called for on the plans.

-- END OF SECTION --

SECTION 33 01 02 - FIELD TESTING OF PIPING SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Provide all necessary labor, materials and equipment, including test pumps and gauges, as well as temporary valves and piping to perform the testing operations of piping systems as specified herein.
- B. If demonstrated workmanship on one or more tests show that lines are sufficiently watertight, the ENGINEER may waive remaining testing on any given type or section of line.
- C. CONTRACTOR's Responsibility:
 - 1. Take such precautions as required to prevent damage to lines and appurtenances being tested.
 - 2. Repair any damage resulting from tests.
 - 3. Repair and retest all items which do not pass the tests as specified herein.
 - 4. Conduct all tests in the presence of the Resident Inspector, and to the satisfaction of the ENGINEER and all State and local authorities having jurisdiction.
 - 5. All necessary pumps, water, pipe connections, meters, gauges, and any necessary apparatus to perform and conduct the tests shall be furnished by the CONTRACTOR. CONTRACTOR shall furnish all necessary equipment and make all tests at CONTRACTOR's expense without separate measurement and payment, but said expense shall be subsidiary to installation of pipe.
- D. Test pressures are shown on the Plans. If not shown, refer to schedule at end of this section.
- E. Water used for testing shall be potable water only, unless approved by OWNER.

1.2 REFERENCE STANDARDS

AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings 2021.
AWWA M23 - PVC Pipe—Design and Installation 2020.

1.3 SUBMITTALS

- A. Submit information and data describing proposed testing methods, procedures, pressures, time periods, schedule, and apparatus for ENGINEER's record, prior to testing.
- B. Conform to any other applicable requirements of Section 01 04 01, SUBMITTALS.
- C. Submit a certified test report for each test to ENGINEER certifying the date tests were performed, names of the people in attendance, brand name of the pipe and pressure rating, the location of the joint or section tested, the test pressures at the start and end of each test, duration of the test, leakage and pertinent observations and comments.

1.4 GENERAL SEQUENCE OF WORK

- A. Obtain the OWNER's approval of proposed testing methods, procedures, and apparatus, before performing any test.
- B. Upon receipt of the OWNER's approval, submit a schedule of testing dates and times at least 24 hours in advance of testing.
- C. Perform tests as specified herein.

1.5 DEFINITIONS

- A. "Gravity lines" shall refer to CCFRP, PVC, clay pipe, reinforced concrete (non-cylinder type) pipe, and other such pipes designed to normally operate in a partially full condition.
- B. "Pressure lines" shall refer to all pipes indicated as such in the plans and in general to ductile iron, PVC, RCCP, steel, and other such pipes designed to operate in a full condition, with the system's energy grade line more than 20 feet above the top of the pipe during normal operating conditions.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

Test equipment shall be selected, obtained, and maintained by the CONTRACTOR. All gauges shall be calibrated prior to beginning testing and as often as is necessary to provide accurate, reliable information.

PART 3 EXECUTION

3.1 TESTING OF DRAINS, SEWERS, AND OTHER GRAVITY LINES

A. General:

1. For all pipe, the method of testing shall be an exfiltration test using either a hydrostatic test or a pneumatic test. For any flexible, non-metallic or nonconcrete pipe, such as plastic (PVC, HDPE, PE, etc.) or fiber reinforced plastic pipe or similar flexible pipe materials, a deflection test shall be performed in addition to an exfiltration test.
2. Do not perform any test until backfill has been completed to proposed final grade.
3. Make first test promptly after first joint or section of line is laid and backfilled (as applicable). A section of pipe will normally be a run between two manholes, or between structures.
4. Do not lay additional piping of the type being tested until test of first section is complete.
5. Settlement in backfill during exfiltration tests will be taken as an indication of leakage.

B. Hydrostatic Exfiltration Test Procedure:

1. Seal ends of section being tested with watertight plugs.
2. Fill section with water 24 hours prior to start of test.
3. Vent line during filling so that no air is trapped in line.
4. Leave outlets of stacks, inlets, and service lines exposed and unplugged until after exfiltration test has been made.
5. Outlets terminating below level of test water surface to be temporarily extended upward by installing lengths of pipe.
6. Measure leakage or exfiltration during test period by adding measured quantities of water to maintain water level in test structure.
7. Quantity of water added to maintain water level is amount of leakage or exfiltration.
8. Test for at least two hours with minimum head of four feet measured above top crown, inside pipe at upper end of run being tested.
9. Storm sewer leads to be tested with water level at gutter grade.
10. After completion of satisfactory test, remove lengths of pipe added for test.
11. Allowable Leakage: Allowable leakage for exfiltration test in any individual section or entire sewer line under construction shall not exceed 10 gallons per inch of inside diameter per mile of pipe per 24 hours.

C. Pneumatic Test Method (Air Test):

1. Air tests shall be made by the pressure drop versus time method, in accordance with UNI-B-6.
2. Equipment: The equipment used shall meet the following minimum requirements:
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - c. All air used shall pass through a single control panel.
 - d. Three individual hoses shall be used for the following connections:
 - 1) From the control panel to pneumatic plugs for inflation.
 - 2) From the control panel to a sealed line for introducing the low pressure air.
 - 3) From a sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
 - e. Air compressor of adequate capacity for charging the system.
3. Procedures: All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with

the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole-to-manhole reach of pipe has been backfilled and the pneumatic plugs have been checked by the above-mentioned procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig. Allow at least two minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. If the pipe to be tested is submerged in ground water, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is back pressure due to ground water submergence over the end of the probe. All gauge pressure in the test should be increased by this amount. After the stabilization period (3.5 psig of minimum pressure in the pipe), start stopwatch. Determine time in seconds that is required for the internal air pressure for each 2.5 psig.

4. Allowable Leakage: For sections of pipe less than 36-inch average inside diameter, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

$$T = 0.0850 (D) (K) / (Q)$$

Where,

T= shortest time for pressure to drop 1.0 pound per square inch gauge in seconds

K= $0.000419(D)(L)$, but not less than 1.0

D= average inside diameter in inches

L= length of line in feet of same pipe size being tested

Q= rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used

Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as follows:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	99	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

D. Low Pressure Air Joint Test:

1. Pipe joints shall be tested in accordance with this Section.
2. Equipment shall be the product of manufacturers having more than 5 years regular production of successful joint testers. Joint tester shall be as Manufactured by Chane Industrial, Inc., of Edina, Minnesota, or approved equal.
3. Testing shall be performed on all joints after backfill has been installed and properly compacted. As installation progresses, at no time shall pipe installation exceed 100 feet beyond the last joint tested.

4. Joints failing to meet the requirements of this test should be repaired to the satisfaction of the ENGINEER or the defective pipe shall be replaced. Rejected pipe shall be removed from the project. Installation shall be stopped until defective joints are repaired or replaced.
 5. Follow equipment manufacture's recommendations when performing tests; only experienced technicians shall perform tests.
 6. The testing equipment shall be assembled and positioned over the center of the pipe joint and the end element tubes inflated to a maximum of 25 psi.
 7. Pressurize the center joint test area to 4.0 psig and allow the temperature and pressure to stabilize at the minimum of 2.5 psig for a period of 2.0 minutes prior to testing.
 8. To test, adjust the pressure to 4.0 psig and measure the time required to decrease the pressure from 4.0 psig to 2.0 psig.
 9. The joint is acceptable if the time for the pressure to drop from 4.0 psig to 2.0 psig is greater than 15 seconds.
- E. Deflection Test
1. For all flexible and/or semi-rigid non-metallic, non-concrete pipe such as PVC, HDPE, FRP, etc., a deflection test shall be performed in addition to any other required leakage tests.
 2. Two deflection tests using a mandrel will be required for each pipe segment after installation. The first deflection test shall be performed after the pipe has been completely installed and backfilled where a mandrel shall be pulled through the entire line segment to determine whether the maximum allowable percent of deflection has been exceeded. The first deflection test shall be performed a maximum of 800 feet behind pipe laying operations. A second test shall be performed following installation of the entire time but a minimum of two (2) months after installation and backfill for any section by pulling a mandrel through the entire line to determine whether the maximum allowable deflection percent has been exceeded.
 3. The diameter of the mandrel shall be the maximum allowable percent deflection specified less than the inside diameter of the sewer line. The maximum allowable percent deflection shall be based on the nominal diameter. All mandrels and measurements shall be based on the nominal diameter (e.g., 42-inch nominal pipe diameter with a maximum 5 percent deflection requirement will have a maximum allowable 5 percent deflection of 2.1 inches ($0.05 \times 42 = 2.1$): a mandrel outside diameter (minimum) of 39.9 inches ($42 - 2.1 = 39.9$); and a minimum deflection measurement of 39.90 inches).
 4. In cases where the mandrel may hang due to excess deflection, the pipe shall be uncovered at this point and the conditions shall be corrected. Correction may be by reworking of the embedment and backfill, or by replacing that section of the pipe. This portion of the pipe shall again be backfilled, and the mandrel pulled through again, and this process repeated until the pipe is clear of all obstructions. The test shall be performed without mechanical pulling devices.

3.2 TESTING OF PRESSURE LINES

- A. General:
1. Allow concrete blocking to cure for at least 7 days before testing.
 2. Backfill and compact soil behind all blocking.
 3. Backfill over pipe to extent necessary to restrain the piping. Backfill shall extend to within 1-foot of proposed final grade.
 4. Conduct water leakage test after completing hydrostatic pressure tests.
 5. Lines which fail to hold the specified test pressure for at least four hours or which exceed an allowable leakage rate specified below, shall be repaired to the satisfaction of the ENGINEER and retested at the CONTRACTOR's expense.
- B. Procedures for Leakage and Hydrostatic Pressure Tests:
1. Slowly fill isolated section of line with water.
 2. Insure that all air has been expelled through air and vacuum release valves, taps, or connections shown on Plans for permanent piping, valves, or accessories. Do not make additional taps solely for air expulsion purposes unless approved by ENGINEER. No

- additional compensation will be made for additional taps.
3. Apply test pressure at 1.5 times the working pressure or rated pressure of the pipe, whichever is greater. Duration of test shall be four hours.
 4. Allow concrete pipe to stand full of water at least 12 hours before starting leakage test.
 5. For HDPE pipe the test procedure consists of initial expansion, and test phases. During the initial expansion phase, the test section is pressurized to the test pressure, and sufficient make-up water is added each hour for three (3) hours to return to test pressure. After the initial expansion phase is complete then the four (4) hour test phase can begin.
 6. At the end of the four-hour test, the entire route of the pipeline shall be inspected to locate any leaks or breaks. Any defective joints, cracked or defective pipe, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced with sound material in the manner provided and the test shall be repeated until satisfactory results are obtained. Any and all noticeable leaks shall be repaired regardless of whether the actual leakage is within the allowable. The pipe shall be tested again for a period of four hours.
 7. All pipe shall be tested for leakage by a hydrostatic pressure test. Lines shall be filled slowly, with a maximum velocity of 1-foot per second, while venting all air. If permanent air vents have not been installed, the CONTRACTOR shall install corporation cocks at all high points to expel air during initial filling and testing of the lines. Leakage is defined as the net quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, necessary to return to the initial pressure of the specified leakage test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = (SD (P)^{1/2}) / 148,000 \text{ (See AWWA M23 Equation No. 5)}$$

Where,

L = allowable leakage in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, inches

P = average test pressure during the leakage test, in pounds per square inch

The above equation is based on a leakage rate of 10.5 gallons per day per mile per inch of nominal diameter of pipe. Leakage values determined by the above formula for 1000 feet of pipe are presented in the table below. These values are similar to those presented in AWWA C605 and DIPRA (DIPRA, 2003).

ALLOWABLE LEAKAGE (gal/hr) FOR 1000 FT OF GASKETED PVC OR DIP PIPE							
Nominal Pipe Size (in)	Average Test Pressure in Pipeline, psi						
	50	75	100	125	150	175	200
2	0.10	0.12	0.14	0.15	0.17	0.18	0.19
3	0.14	0.18	0.20	0.23	0.25	0.27	0.29
4	0.19	0.23	0.27	0.30	0.33	0.36	0.38
6	0.29	0.35	0.41	0.45	0.50	0.54	0.57
8	0.38	0.47	0.54	0.60	0.66	0.72	0.76
10	0.48	0.59	0.68	0.76	0.83	0.89	0.96
12	0.57	0.70	0.81	0.91	0.99	1.07	1.15
14	0.67	0.82	0.95	1.06	1.16	1.25	1.34
16	0.76	0.94	1.08	1.21	1.32	1.43	1.53
18	0.86	1.05	1.22	1.36	1.49	1.61	1.72
20	0.96	1.17	1.35	1.51	1.66	1.79	1.91

24	1.15	1.40	1.62	1.81	1.99	2.15	2.29
30	1.43	1.76	2.03	2.27	2.48	2.68	2.87
36	1.72	2.11	2.43	2.72	2.98	3.22	3.44
42	2.01	2.46	2.84	3.17	3.48	3.75	4.01
48	2.29	2.81	3.24	3.63	3.97	4.29	4.59
54	2.58	3.16	3.65	4.08	4.47	4.83	5.16
60	2.87	3.51	4.05	4.53	4.97	5.36	5.73
64	3.06	3.75	4.32	4.83	5.30	5.72	6.12
ALLOWABLE LEAKAGE (gal/hr) FOR 1000 FT OF GASKETED PVC OR DIP PIPE							
Nominal Pipe Size (in)	Average Test Pressure in Pipeline, psi						
	<u>225</u>	<u>250</u>	<u>275</u>	<u>300</u>	<u>350</u>	<u>400</u>	<u>450</u>
2	0.20	0.21	0.22	0.23	0.25	0.27	0.29
3	0.30	0.32	0.34	0.35	0.38	0.41	0.43
4	0.41	0.43	0.45	0.47	0.51	0.54	0.57
6	0.61	0.64	0.67	0.70	0.76	0.81	0.86
8	0.81	0.85	0.90	0.94	1.01	1.08	1.15
10	1.01	1.07	1.12	1.17	1.26	1.35	1.43
12	1.22	1.28	1.34	1.40	1.52	1.62	1.72
14	1.42	1.50	1.57	1.64	1.77	1.89	2.01
16	1.62	1.71	1.79	1.87	2.02	2.16	2.29
18	1.82	1.92	2.02	2.11	2.28	2.43	2.58
20	2.03	2.14	2.24	2.34	2.53	2.70	2.87
24	2.43	2.56	2.69	2.81	3.03	3.24	3.44
30	3.04	3.21	3.36	3.51	3.79	4.05	4.30
36	3.65	3.85	4.03	4.21	4.55	4.86	5.16
42	4.26	4.49	4.71	4.92	5.31	5.68	6.02
48	4.86	5.13	5.38	5.62	6.07	6.49	6.88
54	5.47	5.77	6.05	6.32	6.83	7.30	7.74
60	6.08	6.41	6.72	7.02	7.58	8.11	8.60
64	6.49	6.84	7.17	7.49	8.09	8.65	9.17

Note: The allowable leakage for test sections with different diameters is the sum of the computed leakage for each pipe size.

The test pressure shall be applied by means of a pump connected to the pipe and to an approved water container, or other approved method, for accurate measurement. The test pressure shall be maintained (by additional pumping, if necessary) for the specified time. While the line is under pressure, the system and all exposed pipe, fittings, valves, and hydrants shall be carefully examined for leakage. All defective elements shall be repaired or replaced and the test repeated until all visible leakage has been stopped and the allowable leakage requirements have been met.

8. On completion of tests, any newly installed, approved taps shall be tightly plugged with brass fittings.
9. Thoroughly purge all compressed air lines after testing.

3.3 TEST PRESSURES FOR PRESSURE LINES

All pressure (force mains, plant water, and potable water) shall be tested to 1.5 times the working pressure or the rated pressure of the pipe, whichever is greater. Chemical piping shall

be tested to 100 psig. Process, sludge, and drain piping using pressure pipe shall be tested at 75 psig if not specified elsewhere.

All potable, filtered, finished, and chemical pipe shall be disinfected in accordance with Section 01 09 01, DISINFECTION OF POTABLE WATER PIPING AND TANKS.

-- END OF SECTION --

This page intentionally left blank

SECTION 33 01 03 - DUCTILE IRON PIPE

PART 1 GENERAL

1.1 WORK INCLUDED

The work included in this section of the Specifications shall consist of furnishing, installing, and testing:

- A. Mechanical joint, push-on and flanged ductile iron pipe in sizes 4-inch through 48-inch.
- B. Mechanical joint and flanged ductile iron and cast iron fittings in sizes 4-inch through 60-inch.
- C. Gaskets and fasteners for above pipe and fittings.
- D. Restrained pipe and fittings, 4-inch thru 64-inch.
- E. Protective coatings, linings and encasements for above pipe and fittings.
- F. Hydrostatic testing, cleaning, and disinfecting of installed pipe and fittings.

1.2 REFERENCE STANDARDS

ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

AWWA C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings 2022.

AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2021.

AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2023.

AWWA C116/A21.16 - Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings Latest Edition.

AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe 2021.

AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).

AWWA C153/A21.53 - Ductile-Iron Compact Fittings 2019.

AWWA M41 - Ductile-Iron Pipe and Fittings 2009.

NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

1.3 QUALITY ASSURANCE

- A. All surfaces and materials in contact with water, or in contact with a chemical being added to water that is being treated for potable use, shall conform to NSF 61 and be certified by an organization accredited by ANSI, or shall meet the TCEQ requirements for contact with potable water.

1.4 DELIVERY, STORAGE AND HANDLING

Comply with the requirements of the Contract Documents, Specifications and the manufacturer's recommendations.

1.5 SUBMITTALS

Submit the following information in accordance with the requirements of the Contract Documents:

- A. Submit the following for all pipe systems:
 - 1. Pipe material
 - 2. Fittings
 - 3. Appurtenances
 - 4. Adaptors
 - 5. Pipe layout schedule/drawings including pipeline stationing and elevations with pressure classes, design and surge pressure ratings.
 - 6. All materials, coatings, and linings furnished.
 - 7. Thrust restraint design.
The pipe layout drawings and data shall clearly indicate where pipe requiring special provisions are provided.
- B. Certificate of Compliance with all applicable and appropriate reference standards certifying that all pipe, fittings, and specials, and other products and materials furnished, comply with the

applicable provision of the Specification. Pipe systems submitted without the certificate of compliance may be returned without review.

- C. Certification of Adequacy of Design: The Certificate of Adequacy of Design shall show the necessary provisions required in the design of the pipe to comply with applicable sections of this Specification. The Certificate of Adequacy of Design shall be sealed by a Texas Registered Engineer.

PART 2 PRODUCTS

2.1 GENERAL

Ductile iron pipe shall be made of good quality ductile iron, tough, resilient, even-grained, and soft enough to satisfactorily permit drilling and cutting. All pipe shall be sound and free of cracks. Ductile iron pipe shall have a minimum tensile strength of 60,000 psi, a yield strength of 42,000 psi, and shall have a minimum working pressure rating of 150 psi, thickness Class 50. Ductile iron pipe shall be manufactured to the requirements of AWWA C150/A21.50 and AWWA C151/A21.51 standards. The raw material for ductile iron shall have an average minimum content consisting of 90% recycled iron and steel.

The ductile iron pipe joint shall be rubber gasketed, push-on joint, similar to that known as Bell-Tite, Tite-On, Fastite, Tyton Joint by US Pipe or equal, as may be approved by the ENGINEER; mechanical joint or flanged as called for on the Plans. The rubber gasket push-on joints and mechanical joints specified on the Plans shall be manufactured to the requirements of AWWA C151/A21.51 and AWWA C111/A21.11.

2.2 PUSH ON AND MECHANICAL JOINT PIPE AND FITTINGS

- A. Thickness Class: As required for working pressures and test pressures shown on the Plans for each pipe system.
- B. Laying Length: 18 or 20 feet.
- C. Gaskets: Neoprene, vulcanized styrene butadiene rubber (SBR) or equivalent material.

2.3 FLANGED PIPE AND FITTINGS

- A. All exposed ductile iron pipe shall have ductile iron flanged fittings unless otherwise noted. CONTRACTOR shall coordinate ductile iron flanges with connecting flanges of pump and valves. Thrust collars shall be provided where required for connection to restrained or harnessed flanged coupling adapters (FCA) and flexible couplings.
- B. Flanges: Thread pipe, tighten flanges, and face in shop equipped with machinery designed for such work. Hand or field work is not acceptable.
- C. Gaskets:
 - 1. Full face rubber 1/16-inch-thick factory cut unless otherwise specified. For ductile iron pipe and fittings between pump and steel discharge header gaskets shall be Toruseal by American or equal as approved by ENGINEER.
 - 2. For air systems only, full-face Buna-N gaskets, 1/16-inch thick factory cut. Gaskets shall be suitable for temperatures of 200 F with lubrication oil present.
- D. Bolts and Nuts:
 - 1. Type: Hex heads and nuts.
 - 2. Material: Low carbon steel conforming to ASTM A307 Grade B except for submerged and buried locations.
 - 3. Submerged bolts and nuts shall be 316 stainless steel.
 - 4. Bolts and nuts in buried locations or in manholes shall be 304 stainless steel.
- E. Thickness Class: As noted on Plans. Use Class 150 if not shown on Plans.

2.4 FITTINGS

- A. Fittings shall be ductile iron castings, all conforming to AWWA C110/A21.10 or AWWA C153/A21.53. Flanged ends shall be made of ductile iron, and shall have comparable pressure rating to pipe.

- B. Coatings shall be as specified for ductile iron pipe.
- C. All buried fittings shall be wrapped with a polyethylene wrapping.
- D. All fasteners, bolts, and hardware that are buried or in manholes shall be 304 stainless steel. Buried MJ fitting bolts may be Corten.

2.5 PROTECTIVE COATINGS, LININGS, AND ENCASEMENT

- A. Inside of Pipe:
 - 1. Unless otherwise shown, all ductile iron shall be provided with a cement-mortar lining in accordance with AWWA C104/A21.4. A bituminous seal coat shall be applied over the mortar lining in accordance with AWWA C104/A21.4.
 - 2. Inside of Pipe: Where specifically shown or specified, epoxy lining shall be provided. Epoxy lining shall be high solids, high build fusion bonded epoxy per AWWA C116/A21.16 suitable for use in potable water, minimum 16 mils dft.
- B. Outside of Pipe:
 - 1. For exposed piping including piping in vaults provide one shop coat of primer and field paint with one coat of primer and one finish coat in accordance with Section 09 03 01, COATING & PAINTING FOR WATER TREATMENT PLANTS.
 - 2. For buried piping, provide bituminous coating.
- C. Provide V-Bio Enhance Polyethylene Encasement for all buried piping and fittings except for concrete encased pipe and fittings and pipes in tunnels or bores.

2.6 INSULATED CONNECTIONS

The pipe vendor shall furnish dielectric insulation gaskets and/or bushings at all places where steel pipe or valves connect to ductile and cast iron pipe and fittings. Where flanges are to be insulated, furnish and install a complete flange isolation kit including a flange gasket, isolating sleeve for each bolt, and two isolating washers for each bolt. Flange isolation kits shall be Saint Ferrer Model #105-EK2 by Westermann, or approved equal.

2.7 RESTRAINED PIPE AND FITTING JOINTS

Restrained pipe and fitting joints shall utilize push on type joint fittings with ductile iron components as fabricated by U.S. Pipe - TR FLEX or approved equivalent. Field cut pipe shall be provided with U.S. Pipe - TR FLEX gripper ring US Pipe HDSS or approved equivalent sized for working pressures shown on plans (150 psi minimum) for sizes through 36-inch. At CONTRACTOR's option, restrained buried fittings and pipes with working pressures at or below 100 psi may utilize mechanical joints with EBAA iron Megalug type joint restraint with Corten bolts. Pipe and fittings that are concrete encased do not require mechanical restraint.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Use the types of pipe and joints specified and shown on the Plans.
 - 2. Follow the manufacturer's installation instructions.
 - 3. Wrap all buried piping and fittings with polyethylene.
 - 4. Pipe shall be installed on constant grade between control depths as shown on the Plans, with minimum depth of cover maintained.
 - 5. Utilize [Class III] embedment if not shown on Plans.
 - 6. Provide a restrained push-on joint or MJ joint 10 feet outside of structures. Alternatively, provide a restrained coupling 10 feet outside of structures.
- B. Flexible Couplings and Flanged Coupling Adaptors:
 - 1. Install in accordance with the Plans, specifications for couplings and adaptors, and approved shop drawings.
 - 2. Use of additional couplings and adaptors to be approved by OWNER prior to installation.
 - 3. All flexible couplings and flanged coupling adaptors shall be restrained.
- C. Joining of Push-on Piping:

DUCTILE IRON PIPE

1. Preparation of pipe ends: Remove from bell and spigot ends all lumps, blisters, excess coal-tar coating, oil and grease, then wire brush and wipe clean and dry before laying pipe.
2. Installation of ring gasket:
 - a. Wipe gasket seat in socket with clean dry cloth.
 - b. Place gasket with large end entering first.
 - c. Spring gasket into seat in bell so that groove fits overhead in seat.
 - d. Apply thin film of food grade lubricant to inside surface of gasket.
3. Setting spigot:
 - a. Apply food grade lubricant to engaging surface of spigot if necessary.
 - b. Align spigot with bell and start into bell so that it contacts gasket.
 - c. Pipe 6 inches and smaller may be driven with a bar lever on end of pipe.
 - d. For larger pipe, use only approved ratchet-type jacking tool to pull pipe "home."
- D. Joining of Mechanical Joint Pipe:
 1. Remove all mud and foreign matter from pipe ends, gaskets and fittings before installation.
 2. Wash pipe ends, gaskets and fittings with soapy water before installation.
 3. Mechanical joints must be suitably restrained to prevent movement.
- E. Joining of Flanged Pipe:
 1. Setting gasket:
 - a. If non-graphited gaskets are used, apply graphite and water solution to gasket before placing on flange.
 - b. Wire-brush flange and clean inside of pipe before placing gasket.
 2. Tightening bolts:
 - a. After initial alignment, place flange bolts with all heads in same direction.
 - b. Tighten flange bolts, each in turn, at uniform rate around joint until all are tightened to the manufacturer's recommended torque.
 3. All flanged coupling adaptors must be restrained.
- F. Restrained Joints
Install restrained joints in strict accordance to manufacturer's recommendations. Pressure utilized shall be working pressures shown and/or specified, plus an additional 100 psig for surge for potable water and service water piping, and high service pump discharge piping. Use test pressure times 1.5 for all other pipelines.

-- END OF SECTION --

SECTION 33 01 06 - POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 GENERAL

1.1 WORK INCLUDED

Furnishing, installing (by General CONTRACTOR), and testing (by General CONTRACTOR) of polyvinyl chloride (PVC) pressure pipe and fittings in sizes 1/2-inch through 36-inch.

Hydrostatic testing, cleaning, and disinfecting installed pipe and fittings.

1.2 REFERENCE STANDARDS

ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds 2020.

ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.

ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.

ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2023.

ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2023.

ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2020.

ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals 2019.

ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe 2014 (Reapproved 2021).

ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2022.

AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm) 2022.

AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution Latest Edition.

NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

1.3 SUBMITTALS

- A. Submit shop drawings and product data in accordance with the requirements of Sections 01 04 01, SUBMITTALS and 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS.
- B. Submit manufacturer's installation instructions.
- C. Submit affidavits of compliance with the referenced standards. Pipe systems submitted upon without the affidavits of compliance shall be returned without review.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with the general requirements of Section 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS and the supplemental requirements below.
- B. Comply with the manufacturer's handling and storage recommendations.

- C. Use nylon slings or rope to lift bundles of pipe. Do not use chains.
- D. Do not drop pipe.
- E. Support pipe every 4 feet.
- F. Limit stacking height of pallets to prevent any undue stress or deflection in pipe materials.

PART 2 PRODUCTS

2.1 GENERAL

- A. Pressure pipe for potable water systems shall bear the seal of approval of the National Sanitation Foundation for use in potable water systems.
- B. All PVC pipe shall be new and shall be stamped to show the design working pressure.
- C. Pressure pipe shall be as manufactured by JM Eagle, North American, Diamond Plastics or approved equal.
- D. The pipe shall have true section complying with the sizes specified. All pipe shall be free from cracks, holes, blisters, voids, projections, defects, roughness and chalking, sticky or tacky material.
- E. All pipe and fittings furnished under this section shall be clearly marked by the manufacturer with the following information in such a manner that it will remain legible after inspection:
 - 1. Manufacturer's name, trademark and code which includes the date, shift, plant and extruder of manufacturer.
 - 2. Nominal pipe size in inches.
 - 3. PVC cell classification.
 - 4. AWWA/ASTM designation.

2.2 EXPOSED PIPING

- A. Pipe:
 - 1. Referenced Standard: ASTM D1785.
 - 2. Type: Type 1, Grade 1, unplasticized.
 - 3. Schedule: Schedule 80 is required, unless otherwise shown on Drawings or specified in Piping Schedule.
- B. Joints:
 - 1. Type: Solvent welded unless otherwise shown on Drawings or specified in Piping Schedule.
 - 2. Referenced Standard for Cement ASTM D2564.
- C. Fittings:
 - 1. Referenced Standards: ASTM D2464, ASTM D2466 and ASTM D2467.
 - 2. Type: Solvent weld unless otherwise shown on Drawings or specified in Piping Schedule.

2.3 BURIED PRESSURE PIPING

- A. Sized Under 1-1/2 Inches:
As specified above for exposed piping.
- B. Sizes Through 4 Inches:
 - 1. Pipe:
 - a. Referenced Standard: ASTM D1785 and ASTM D2241.
 - b. Type: Type 1, Grade 1, unplasticized.
 - c. Schedule as shown on the Plans.
 - 2. Joints:
 - a. Referenced Standard: ASTM D3139.
 - b. Gasket Type: ASTM F477.
 - 3. Fittings:
 - a. Referenced Standard: ASTM D2466.
 - b. Type: Solvent weld unless otherwise shown on drawings or specified in piping schedule.
- C. Sizes 4 Inches Through 36 Inches:
 - 1. Pipe:

- a. Referenced Standards: AWWA C900.
 - b. Type: Bell and spigot with elastomeric gasket joint formed integral with Pipe.
 - c. Pressure Class and Dimension Ratio: 235 psig; D.R. 18 if not shown on Plans.
2. Joints:
- a. Referenced Standard: ASTM D3139.
 - b. Gasket Type: ASTM F477.
3. Fittings:
- a. Type: Mechanical joint or push-on type, ductile iron fittings.
 - b. Fittings shall utilize mechanical joint restraint systems designed by Supplier. If not shown, utilize 150 psig test pressure and 7 fps velocity for surge calculation.
 - c. Bolts, fasteners, and hardware for buried fittings shall be 304 stainless steel. Buried MJ fitting bolts may be Corten. Submerged bolts, fasteners, and hardware shall be 316 stainless steel.

2.4 CHEMICAL PIPING

- A. PVC Piping: PVC pipe for chemicals, vacuum and solution, shall be ASTM D1785, Type 1, Grade 1, Schedule 80 for exposed piping and Schedule 40 for buried piping, rigid, unplasticized PVC, normal impact, bearing NSF seal. Fittings shall be molded, bearing NSF seal, as manufactured by Tube Turn Plastics, or equal. Pipe threads, if used, shall conform to ASA 82.1, NPT, and shall be full and cleanly cut with sharp dies.
1. If glued joints are used, cement shall be of type which welds plastic surfaces together. Cement shall be as recommended by the pipe manufacturer and shall be compatible with the chemical conveyed. Teflon tape shall be used on all threaded joints. Teflon tape shall be mil spec P-77304 or as recommended by the pipe supplier for the chemical service. Tubing connecting to piping shall utilize barbed fittings and 316 stainless steel tube clamps, two per connection. Barbed fittings shall be CPVC or other material recommended by the manufacturer rated for working pressure of 50 psig and chemical service up to 110 Degrees F.
 2. Gaskets and O-rings for chlorine vacuum and solution piping shall be Viton. Gaskets and O-rings for other chemicals shall be compatible with the chemical being used.
 3. Cement and primers shall be suitable for use in potable water. Cement shall be industrial grade and primer shall be purple color. Cement used shall have a manufacture date within 14 months of the date being utilized. Containers shall be kept tightly closed when not in use. Brush or swab applicators shall be appropriately sized and utilized as recommended by the manufacturer.
 4. Chemical piping shall be tested to a hydrostatic pressure of 150 psig in accordance with Section 33 01 02, FIELD TESTING OF PIPING SYSTEMS.
 5. Mark pipe in accordance with ASTM D1785.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:
1. Comply with the general requirements of Sections 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS and the supplemental requirements following.
 2. Install all piping in accordance with pipe manufacturer's instructions.
 3. Chemical piping shall be installed at uniform grades or slopes without any high points in the pipe except at the pumps.
- B. Making of Joints:
1. General:
 - a. Make joints in accordance with pipe manufacturers recommendations and the supplemental specifications below.
 - b. For shorter than standard pipe lengths, field cuts may be made with either hand or mechanical saws with fine tooth blade (16-18 teeth per inch) or plastic pipe cutters. Cut piping accurately and squarely within 1/8 inch and install without forcing or springing.
 - c. Ream out all pipes and tubing to full inside diameter after cutting.

- d. Remove all cuttings and foreign matter from the inside of pipes and ends shall be smoothly beveled by a mechanical beveller or by hand with a rasp or file before installation. Field spigots shall be stop-marked with an adequate marker for the proper length of assembly insertion.
- e. Joints shall not be covered until approved by ENGINEER or his representative. Connections which are made for future use shall be properly capped.
2. Solvent Weld Joints Only:
 - a. Comply with the requirements of ASTM D2855 and ASTM F493.
 - b. File end of PVC Pipe to form a 10 to 15 degree bevel 1/16-inch to 3/32-inch wide on the exterior of the pipe end.
 - c. The pipe and fittings shall be cleaned of all loose dirt and moisture and then lightly roughened with emery cloth over the entire surfaces to be glued, after cutting pipe and removing all burrs and prior to applying the primer.
 - d. Apply primer to the female end, then the male end and then reapply to female end, keeping the surface wet with primer over 5- to 15-second period.
 - e. Apply solvent cement to pipe end and socket and then apply a second coat to pipe end using a brush one-half of the diameter of the pipe. Hold for 30 seconds.
 - f. Immediately insert pipe end in socket and wipe off excess cement.
 - g. Rotate pipe under 6 inches about one-quarter turn after inserting in socket.
 - h. Completed glue joints shall not have any gaps or voids in the glue between the pipe and the fitting.
 - i. Do not perform solvent welding operations when temperature is below 40 Degrees F or above 90 Degrees F, or when rain or drizzle is present.
 - j. Do not move or disturb the glued joints for 3 minutes after completion. Joints shall not have any pressure or deflection applied for at least 1 hour after completing the joint. Allow all joints to set 24 hours prior to performing pressure test on system.
 - k. All joints shall be checked for leakage 48 hours and again 15 days after placing them in service with the proposed chemical. Joints which show signs of leaking or signs of salt buildup shall be replaced and system retested and checked again 48 hours and 15 days after repair until satisfactory results are obtained.
 - l. Small diameter pipes shall be checked for excess glue after the joints have set. Joints with more than one-half of the pipe area blocked shall be drilled or reamed out.
 - m. All pipe systems shall be flushed at velocity greater than 5 fps for a minimum of 5 minutes and longer for pipes larger than 300 feet.
3. Threaded Joints Only:
 - a. Use liquid lubricant for permanent joints.
 - b. Use tape lubricant at valves and equipment where piping may have to be disconnected for maintenance.
4. Gasketed Joints Only:
 - a. Thoroughly clean pipe ends and gaskets before installation.
 - b. Apply lubricant recommended by manufacturer.
5. Plastic to Metal Connections:
 - a. Make all plastic to metal connections by means of PVC adapters.
 - b. Do not cut threads on PVC Pipe.
- C. Buried Piping:
 1. All excavation shall be done in an approved manner to the elevations and grades shown on the Plans or specified. The trench bottom shall be free of sharp rocks and large clods of dirt.
 2. Bedding for PVC pipe (larger than 2-inch) shall be as shown on the Plans: Utilize Class IV embedment if not called out on the Plans.
 3. Backfill shall be placed according to Section 31 03 01, TRENCHING, BACKFILLING AND COMPACTING.
 4. Sand or granular embedment material shall be used for PVC pipe 2 inches and smaller.
- D. Exposed Piping:

1. Where required, PVC piping shall be installed in the locations indicated with hangers, brackets, supports, etc., at spacings specified in Section 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS and recommended by the pipe manufacturer.
 2. Flexible connections shall be required at locations where pipe passes through a concrete wall.
- E. Restrained Joints
All buried pressure pipe systems utilizing mechanical joints shall be restrained as specified in Section 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS.

3.2 FIELD TESTING

Comply with the requirements of Section 33 01 02.

-- END OF SECTION --

This page intentionally left blank

SECTION 33 01 07 - POLYVINYL CHLORIDE (PVC) SANITARY SEWER PIPE

PART 1 GENERAL

1.1 WORK INCLUDED

Furnishing, installing (by General CONTRACTOR), and testing (by General CONTRACTOR) of Polyvinyl Chloride (PVC) sanitary sewer pipe and fittings in sizes 1/2-inch through 36-inch.

1.2 REFERENCE STANDARDS

ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2023.

ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals Latest Edition.

ASTM F1336 - Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings Latest Edition.

ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings 2021.

PART 2 PRODUCTS

2.1 GENERAL

- A. All PVC pipe shall be new and shall be stamped to show the design working pressure.
- B. Sanitary sewer pipe shall be as manufactured by JM Eagle, North American, Diamond Plastics or approved equal.
- C. The pipe shall have true section complying with the sizes specified. All pipe shall be free from cracks, holes, blisters, voids, projections, defects, roughness and chalking, sticky or tacky material.
- D. All pipe and fittings furnished under this section shall be clearly marked by the manufacturer with the following information in such a manner that it will remain legible after inspection:
 - 1. Manufacturer's name, trademark and code which includes the date, shift, plant and extruder of manufacturer.
 - 2. Nominal pipe size in inches.
 - 3. PVC cell classification.
 - 4. ASTM designation.

2.2 BURIED SANITARY SEWER PIPING

- A. Sizes 4 Inches Through 15 Inches:
 - 1. Pipe:
 - a. Referenced Standards: ASTM D3034.
 - b. Type: Bell and spigot with elastomeric gasket joint formed integral with pipe.
 - 2. Joints:
 - a. Referenced Standard: ASTM D3212.
 - b. Gasket Type: ASTM F1336.
- B. Sizes 18 Inches Through 60 Inches:
 - 1. Pipe:
 - a. Referenced Standards: ASTM F679.
 - b. Type: Bell and spigot with elastomeric gasket joints formed integral with pipe.
 - 2. Joints:
 - a. Referenced Standard: ASTM D3212.
 - b. Gasket Type: ASTM F1336.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:

1. Comply with the general requirements of Section 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS and the supplemental requirements following.
 2. Install all piping in accordance with pipe manufacturer's instructions.
- B. Making of Joints:
1. General:
 - a. Make joints in accordance with pipe manufacturers recommendations and the supplemental specifications below.
 - b. For shorter than standard pipe lengths, field cuts may be made with either hand or mechanical saws with fine tooth blade (16-18 teeth per inch) or plastic pipe cutters. Cut piping accurately and squarely within 1/8 inch and install without forcing or springing.
 - c. Ream out all pipes and tubing to full inside diameter after cutting.
 - d. Remove all cuttings and foreign matter from the inside of pipes and ends shall be smoothly beveled by a mechanical beveller or by hand with a rasp or file before installation. Field spigots shall be stop-marked with an adequate marker for the proper length of assembly insertion.
 - e. Joints shall not be covered until approved by ENGINEER or his representative. Connections which are made for future use shall be properly capped.
 2. Gasketed Joints Only:
 - a. Thoroughly clean pipe ends and gaskets before installation.
 - b. Apply lubricant recommended by manufacturer.

3.2 BURIED PIPING

- A. All excavation shall be done in an approved manner to the elevations and grades shown on the Plans or specified. The trench bottom shall be free of sharp rocks and large clods of dirt.
- B. Bedding for PVC pipe (larger than 2-inch) shall be as shown on the Plans: (Class II aggregate fill, per Section 31 06 01, SITE GRADING AND EARTHWORK, embedment below the pipe to a depth 4" on each side of the pipe to the trench wall (maximum 12") and to 8" over the pipe. All bedding and granular backfill material shall be consolidated to 85 percent standard proctor density.) Utilize Class III embedment if not called out on the Plans.
- C. Backfill shall be placed according to Section 31 03 01, TRENCHING, BACKFILLING AND COMPACTING.

3.3 GRADING PIPING

The ENGINEER will set line and grade stakes every 100 feet and furnish the CONTRACTOR with cut sheets. CONTRACTOR shall furnish and set grade boards, grade lines, plumb bobs, and measure poles necessary for laying pipe within the tolerances allowed. Grade boards shall be set at intervals not to exceed 50 feet, and the CONTRACTOR shall keep at least three grade boards in place during grading and laying operations. Use of Laser control will be acceptable for use in lieu of grade boards.

3.4 HORIZONTAL CURVATURE

Gravity sewers shall be laid in straight alignment with uniform grade between manholes when possible. Deviations from straight alignment shall be justified to the satisfaction of the Texas Commission on Environmental Quality and comply with the following criteria. Deviations from uniform grade without manholes, i.e., grade breaks or vertical curves, shall not be allowed.

- A. Construction methods which utilize both flexure of the pipe and deflection at the pipe joint shall not be allowed. The ENGINEER shall detail the proposed curvature on the Plans. Deflection design shall be based upon either joint deflection or pipe flexure as described below:
 1. Joint Deflection. The maximum allowable joint deflection shall be the lesser of the following three alternatives:
 - a. equal to 5 degrees; or,
 - b. 80% of the manufacturer's recommended maximum deflection; or,

- c. 80% of the appropriate ASTM, AWWA, ANSI or nationally-established standard for joint deflection.
- 2. Pipe Flexure. The minimum radius of curvature shall be computed by assuming standard lengths of straight pipe with deflections at each joint.
For purposes of this subparagraph the standard pipe length shall be considered to be the maximum length manufactured for the specific type of pipe to be installed. Gravity sewers with horizontal curvature shall be sloped greater than the minimum allowable slope for the same diameter pipe as specified by TCEQ in order to account for additional losses due to curvature and potential for solids deposition.
- B. The maximum allowable manhole spacing for sewers with horizontal curvature shall be 300 feet.
- C. Trench excavation shall be parallel to the proposed pipe curvature, i.e., curved pipe shall be laid in a curved trench. To obtain the proposed pipe curvature, a construction method shall be used which specifies using either the flexure of the pipe installed completely "home" or equal deflections at each joint with straight lengths of pipe. Construction methods which utilize both flexure of the pipe and deflection at the pipe joint shall not be allowed. Specific care shall be taken to ensure that the joint is placed in the center of the trench and properly bedded.
- D. Reaches of sewer which include horizontal curvature using joint deflection shall be tested with a rigid mandrel.
- E. All reaches of sewer which include horizontal curvature shall be hydrostatically tested using a maximum allowed exfiltration of 10 gallons per inch diameter per mile of pipe.

3.5 FIELD TESTING

Comply with the requirements of Section 33 01 02, FIELD TESTING OF PIPING SYSTEMS.

-- END OF SECTION --

This page intentionally left blank

SECTION 33 01 08 - PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 GENERAL

1.1 WORK INCLUDED

Flexible couplings, flange coupling adapters, expansion joints, and restraining hardware for above items.

1.2 REFERENCE STANDARDS

ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts 2014 (Reapproved 2020).

ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

AWWA C606 - Grooved and Shouldered Joints 2022.

NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

1.3 QUALITY ASSURANCE

A. Factory Assurance:

1. Test each item for mechanical and material defects per manufacturer's standard practice.
2. Hydrostatically test each item to 150 percent of its maximum allowable working pressure.

B. All surfaces and materials in contact with water, or in contact with a chemical being added to water that is being treated for potable use, shall conform to NSF 61 and be certified by an organization accredited by ANSI, or shall meet the TCEQ requirements for contact with potable water.

1.4 SUBMITTALS

A. Shop Drawings, Product Data and Samples:

Comply with the general requirements of Section 01 04 01, SUBMITTALS and supplemental requirements below.

B. Submit the following items for each type flexible coupling, flanged coupling adaptor, and rubber expansion joint.

1. Description and illustration of construction.
2. List of materials.
3. Description of factory-applied protective coatings.
4. Dimensions.
5. Pressure rating.
6. For expansion joints only, the movement, force, and spring rate capabilities.
7. Shop drawings for restraining systems such as tie bolt assemblies. Drawings to show layout, dimensions, number and size of bolts, and lug details.
8. Manufacturer's installation instructions.

C. Product data described in the previous paragraph may be submitted in the form of catalog bulletins or other standard manufacturer literature and drawings as long as all the data specified are furnished. If catalog bulletins are submitted, they are to be marked up to show the styles, options, and other data which are applicable.

D. If CONTRACTOR elects to use more couplings and expansion joints than are shown on Drawings, submit piping layout drawings showing the location of each proposed additional unit and describing the type of each such unit.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Comply with the requirements of Section 33 01 01, GENERAL REQUIREMENTS FOR PIPING SYSTEMS.

PART 2 PRODUCTS

2.1 FLEXIBLE COUPLINGS

- A. Flexible couplings to be mechanical compression type with sleeve two follower glands, two resilient wedge-shaped gaskets, and a set of bolts and nuts to draw the two follower glands together.
- B. Construction of Coupling:
 - 1. Middle ring: Carbon steel.
 - 2. Followers: Carbon steel except that ductile or malleable iron may be used in sizes 12 inches and smaller.
 - 3. Gaskets:
 - a. Resilient rubber compound suitable for air, water, and sewage service and temperatures below 15° F. Buna-N for 240° F for air service.
 - b. Wedge shaped.
 - 4. Bolts and nuts:
 - a. Cadmium-plated high strength steel for exposed couplings in noncorrosive environments.
 - b. Number and size as required for size and type coupling and as recommended by manufacturer for test pressure.
 - c. Buried couplings or couplings in manholes shall utilize 304 SS bolts and hardware.
 - d. Submerged couplings shall utilize 316 SS bolts and hardware.
- C. Restraining System:
 - 1. To be used for all flexible couplings unless specifically noted otherwise.
 - 2. Description:
 - a. Restraining system or harness to consist of tie bolts anchored on each side of coupling to prevent separation of pipe and coupling due to pressure or other causes.
 - b. Tie bolts to be anchored to lugs bolted to nearest flange each side of coupling. On steel pipe, tie bolts may be anchored to lugs shop welded to pipe.
 - c. Number and size of tie bolts to be as determined by manufacturer for specified piping system test pressure. A minimum of two tie bolts diametrically opposite one another are required for each restrained coupling.
 - 3. Tie bolts and nuts: As specified above for flexible coupling.
- D. Factory Painting:
 - 1. Apply epoxy-type protective coating system to interior suitable for potable water contact, and exterior of couplings. Coating to be manufacturer's standard epoxy system complete with prime and finish coats.
 - 2. Do not paint bolts, nuts, and gaskets.
 - 3. Coatings used on exterior of couplings which will be exposed to be compatible with specified coating system for piping so that pipe and couplings can be painted a common color. Coating for buried couplings shall be epoxy.
 - 4. Coatings on air pipe systems shall be suitable for 240° F.
- E. Manufacturer and Model:
 - 1. Hymax
 - 2. Smith Blair - Type 411.
 - 3. Or approved equivalent.

2.2 FLANGED COUPLING ADAPTERS

- A. Flanged coupling adapters to consist of a body or sleeve with pipe flange on one end and compression-type coupling on the other end. Compression coupling to consist of follower, resilient wedge-shaped gasket, and a set of bolts to draw follower against gasket. All flanged coupling adapters shall include restraining systems unless otherwise noted on Drawings.
- B. Construction:
 - 1. Body and follower: Carbon steel except that cast iron is acceptable in sizes 12 inches and smaller.
 - 2. Flange: ANSI Class 125 or 250 flat face. Match class to that of piping system.

3. Bolts and nuts:
 - a. Cadmium plated high strength steel for exposed locations in noncorrosive environments.
 - b. Number and sized to suit specified piping system test pressure.
 - c. All bolts and nuts in buried applications or in manholes shall be 304 stainless steel. Bolts and nuts in submerged or intermittently submerged applications shall be 316 stainless steel.
4. Gasket:
 - a. Resilient rubber compound suitable for air, water, and sewage service, and temperatures below 150° F. Buna-N for 240° F for air service.
 - b. Wedge shaped.
- C. Restraining System:
 1. Restraining or harnessing system to be as specified for flexible couplings except that anchor studs or locking pins may be used on sizes 12 inches and under.
 2. Anchor studs or locking pins extend through threaded tap or boss in body of adaptor into pipe that has been inserted into compression coupling, thus preventing further longitudinal movement.
 3. Number and size for tie bolts and anchor studs or locking pins to suit specified piping system test pressure. Minimum of two diametrically opposed restraints required for restrained adapters.
- D. Factory Painting:
 1. Apply epoxy-type protective coating system to interior suitable for potable water contact, and exterior of adapters. Coating to be manufacturer's standard epoxy system complete with prime and finish coats.
 2. Do not paint bolts and gaskets.
 3. Coatings used on exterior of couplings which will be exposed to be compatible with specified coating system for piping so that end coupling can be painted a common color. Coating for buried couplings shall be epoxy.
- E. Manufacturer and Model:
 1. All sizes:
 - a. Dresser Industries, Inc. - Dresser type 128.
 - b. Smith Blair - Type 913 for all sizes.
 - c. Or approved equivalent.
 2. Twelve inches and smaller alternate:
 - a. Dresser Style 127.
 - b. Smith Blair Style 912.
 - c. Or approved equivalent.

2.3 EXPANSION JOINTS

- A. Expansion Joints for General Service:
 1. Expansion Joints: Flexible bellows type with equalizing rings, except as otherwise specified or indicated on the Drawings.
 2. Manufacturers:
 - a. Expansion Joints: One of the following or equal:
 - 1) Flexonics Inc., Controlled Flexing Expansion Joint.
 - 2) Flex-Weld Inc., Keflex, Series 308.
 - b. Pipe Alignment Guides: One of the following or equal:
 - 1) Flexonics Inc.
 - 2) Flex-Weld, Inc.
 - c. Intermediate Supports: Provide with protective saddles. One of the following or equal:
 - 1) Unistrut Corporation, Roller-type.
 - 2) Bergen-Paterson Pipesupport Corp.
 3. Design:
 - a. Expansion Joint Rating: 150 pounds per square inch gauge, at 400 degrees Fahrenheit.

- b. Bellows: Laminated stainless steel, equipped with a self-draining liner guide.
 - c. Axial Travel of Expansion Joints: Not less than 1.50 inches.
 - d. Ends: 150-pound ANSI flanges, or plain suitable for welding connections, as required for piping in which installed.
- B. Copper Piping Expansion Joints:
1. Expansion Joints for Copper Pipe: As specified before, except externally guided, without equalizing rings, and provide for 3-1/4-inch expansion per 100 feet of piping.
- C. Rubber Expansion Joints:
1. Manufacturers: One of the following or equal:
 - a. Mercer Rubber Company, Style 500 or 700.
 - b. Red Valve Company, Inc., Type J-1.
 2. Provide rubber expansion joints complete with control units and split retaining rings.
 3. Design:
 - a. Neoprene rubber, reinforced with embedded steel rings, and a strong synthetic fabric.
 - b. Expansion rings, suitable for pressures of at least 125 pounds per square inch gauge, except as follows:
 - 1) Expansion joints in pump suction piping and where indicated on the drawings suitable for minimum 90 pounds per square inch gauge, pressure and minimum 30 inches mercury vacuum.
 - 2) Split retaining rings, galvanized.
 - 3) Ends of expansion joints, 150-pound ANSI flanges with drilling to match that of the piping.
 - 4) Expansion Joints for Blowers: Butyl type rubber formulated for service application and for maximum temperature of 250 degrees Fahrenheit, suitable for minimum 40 pounds per square inch gauge pressure, and minimum 15 inches mercury vacuum.
- D. Expansion Joints for Chemical Service:
1. Manufacturers: One of the following or equal:
 - a. Red Valve Company, Inc., Type T-205, Teflon Lined.
 - b. Mercer, Teflon Lined, Series 700.
 2. Provide Teflon-lined Hypalon or rubber expansion joints, reinforced with embedded steel rings, and a strong synthetic fabric. Teflon lined rubber expansion joints shall be required to have Teflon liner extend through the entire length of the joint and cover end flanges completely. Teflon-lined Hypalon expansion joints shall be required to have the Teflon liner extend through the entire length of the joint up into the outer edge of the raised flanged faces.
 3. Expansion rings, suitable for pressures of at least 125 pounds per square inch.
 4. Ends of expansion joints, 150-pound ANSI flanges with drilling to match that of the piping.

PART 3 EXECUTION

3.1 INSTALLATION

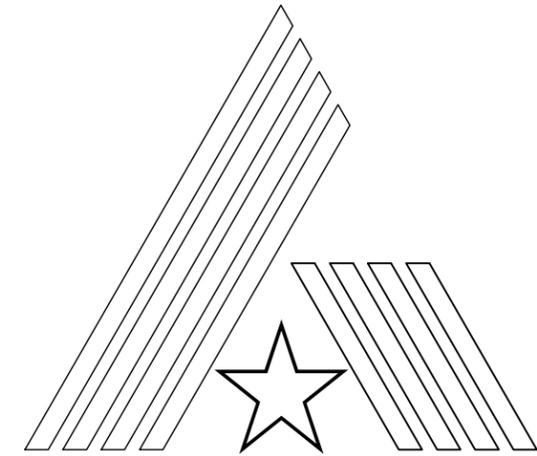
- A. General:
1. Inspect each coupling, adaptor, and expansion joint for damage and defects before installation and replace defective items.
 2. Install each item in accordance with the Drawings, TECHNICAL SPECIFICATIONS, approved piping layout shop drawings, and approved manufacturer's installation instructions.
 3. CONTRACTOR may provide additional flexible couplings, flanged coupling adapters, and expansion joints over and above those shown on Drawings to facilitate installation of piping.
 - a. Use of such additional items is to be approved by the ENGINEER prior to installation.
 - b. Additional joints are to be at no expense to the OWNER.
 4. Verify that inside diameters of flexible couplings and flanged coupling adapters are compatible with outside diameters of piping with which couplings or adapters are being used.

- B. Flexible Couplings:
 - 1. Clean and lubricate pipe ends before installation.
 - 2. Leave a gap between the pipe ends to permit pipe expansion and increase flexibility of the joint. Gaps between pipe ends to be approximately as follows:
 - a. 12-inch diameter and smaller: +/- 1 inch.
 - b. 24-inch diameter through 36-inch: +/- 1 1/2 inch.
 - c. Over 36 inches: 2 inch.
 - 3. Tighten bolts in manner and to torques prescribed by manufacturer.
- C. Expansion and Vibration Control Joints:
 - 1. Prevent equipment vibration transmitted through piping system, and prevent damaging stresses due to normal expansion and contraction with temperature changes in piping and connected equipment.
 - a. Where anticipated expansion is greater than can be absorbed by the normal piping configuration, install loops, bends, and expansion joints as indicated on the drawings, to absorb excess expansion.
 - 2. Install expansion joints so as to allow 2 1/4-inch expansion per 100 linear feet of piping.
 - 3. Where possible, install expansion joints adjacent to an anchor, and provide one concentric guide on piping within 12 pipe diameters, but not more than 5 feet, from the end of the joint opposite the anchor. Locate a similar guide approximately 30 diameters but not more than 10 feet from the first.
 - 4. For expansion joints not installed adjacent to an anchor, provide two concentric guides similarly located at each end of the joint.
 - 5. Provide control rods and additional guides where indicated on the Drawings, but at no greater intervals than recommended by the joint manufacturer in published instructions.
 - 6. Space intermediate supports a minimum of 10 feet, and tack weld the protective saddles to the pipe.
- D. Field Painting:
 - 1. Touch up factory finishes which have been damaged.
 - 2. Apply protective coating to bolts and nuts after tightening. Use same coating system as that specified for adjoining piping.
- E. Testing:
 - 1. Joints are tested as a part of the overall piping system.
 - 2. See Section 33 02 01, FIELD TESTING OF PIPING SYSTEMS.

-- END OF SECTION --

CONSTRUCTION DRAWINGS

PLANS FOR CITY OF ABILENE, TEXAS POLARIS DRIVE SEWER LINE EXTENSION JANUARY 2024



CITY OF ABILENE CITY COUNCIL

WELDON HURT - MAYOR

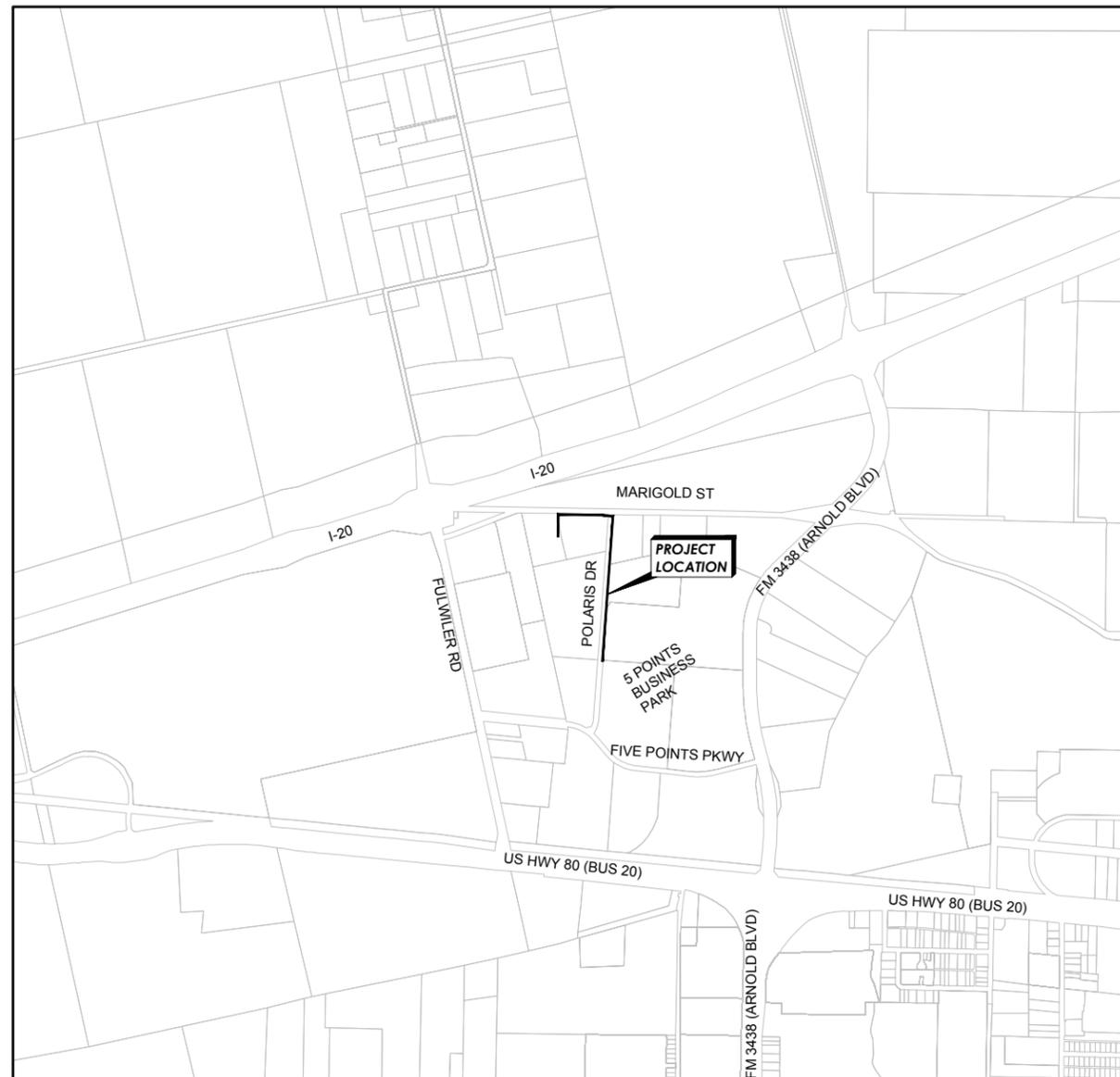
SHANE PRICE LYNN BEARD

BLAISE REGAN BRIAN YATES

KYLE McALISTER TRAVIS CRAVER

ROBERT HANNA - CITY MANAGER

RODNEY TAYLOR - DIRECTOR OF WATER UTILITIES



PROJECT LOCATION MAP



1"=2000'

APPROVED FOR CONSTRUCTION

BY THE
CITY OF ABILENE, TEXAS

SCOTT CHANDLER, P.E.

DATE



01/18/2024



3465 CURRY LANE
ABILENE, TEXAS 79606
325.695.1070

TBPE FIRM
2448

TBAE FIRM
BR 2261

TBPELS FIRM
10194493

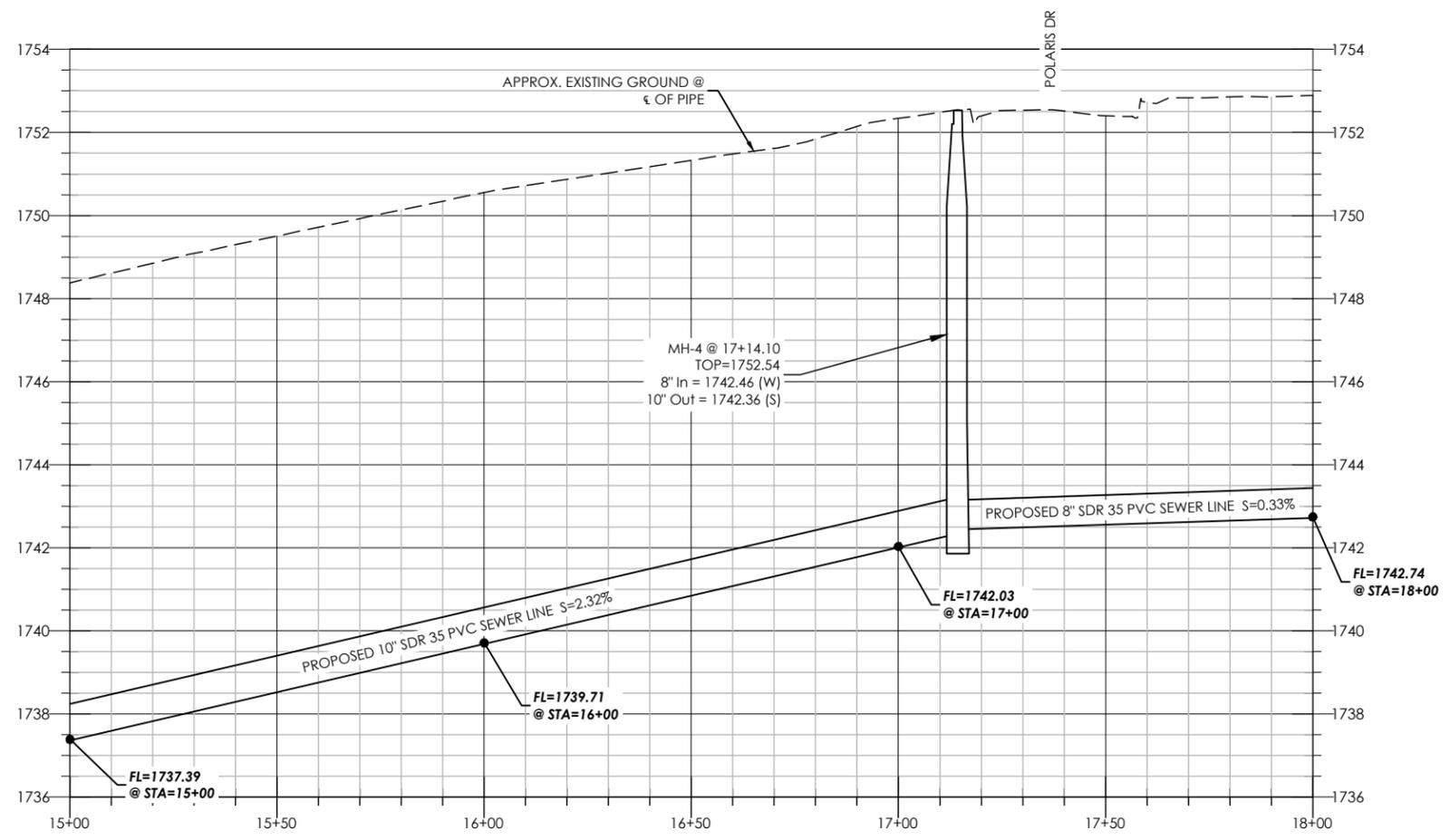
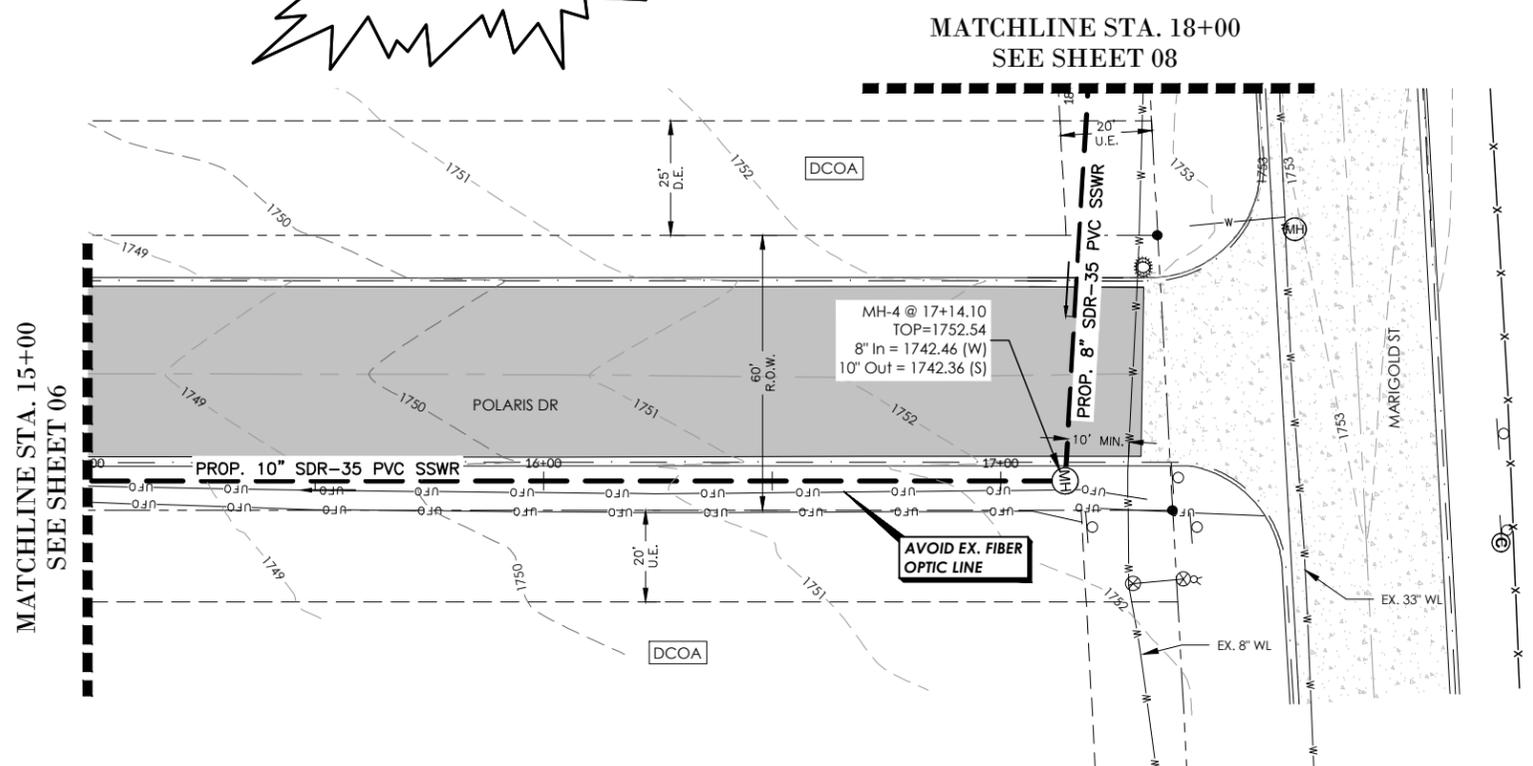
X:\C:\Abilene\23503 - Polaris Drive Sewer Line Extension - City of Abilene\Drafting\Plans\Civil\07 PLAN AND PROFILE STA. 15+00-18+00.dwg
 Saved By: King
 Save Time: 12/19/2023 11:42 AM
 Plotted by: Tristan King
 Plot Date: 1/18/2024 7:49 AM

CAUTION!!!
 Contractor to call for locates
 (1-800-DIG-TESS) and field verify the
 location of all existing utilities prior to
 excavation.



ISSUED FOR CONSTRUCTION

JACOB MARTIN
 TBAE FIRM # BR 2261
 TBE FIRM # 2448
 TBE FIRM # 1019493



SCALE:
 H:1"=40'
 V:1"=4'

CITY OF ABILENE
POLARIS DR SEWER LINE EXTENSION

PLAN AND PROFILE STA. 15+00-18+00

NO.	REVISION	DATE

PROJECT # | SCALE | BARS ONE INCH IN LENGTH ON ORIGINAL DRAWING.
 23503 | AS SHOWN |

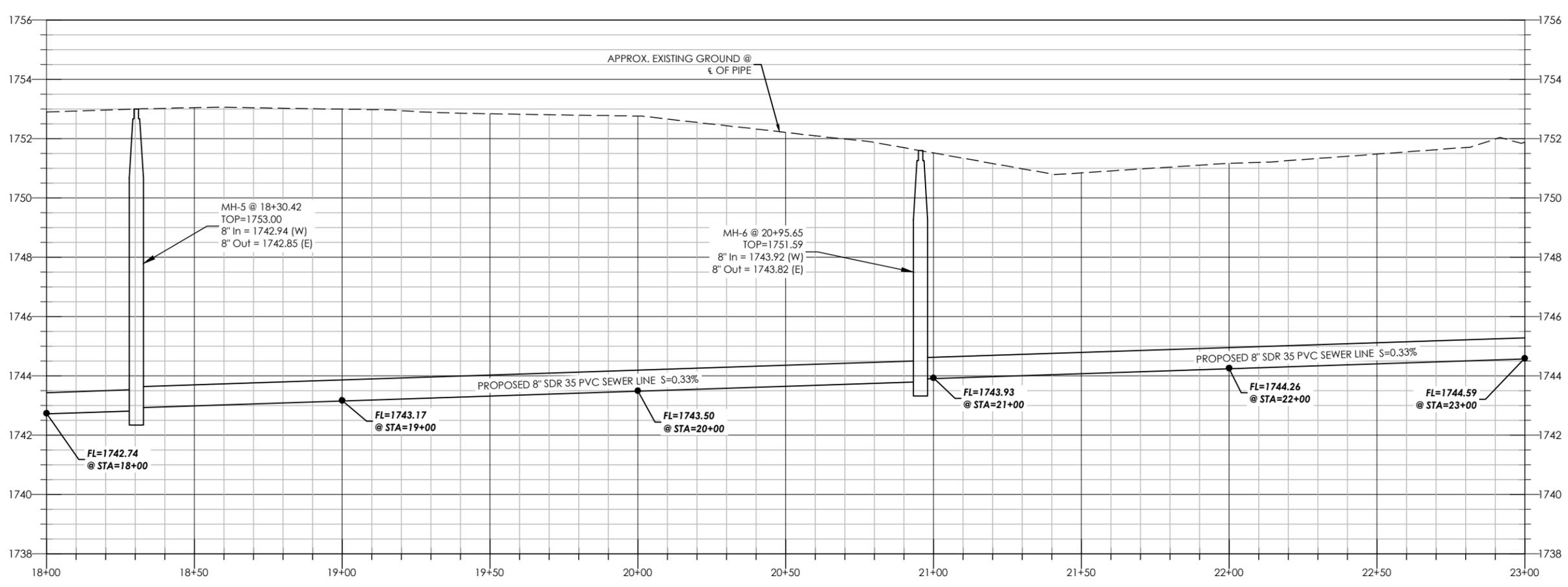
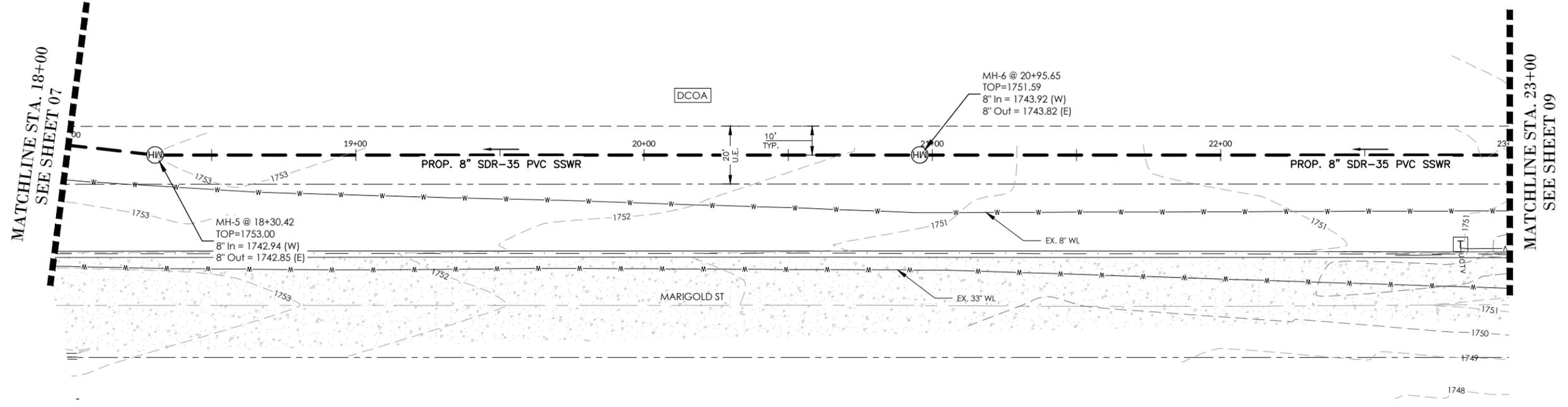
SEQ. SHEET
 07 07

X:\C:\Abilene\23503 - Polaris Drive Sewer Line Extension - City of Abilene\Drafting\Plans\Civil\08 PLAN AND PROFILE STA. 18+00-23+00.dwg
 Saved By: King
 Save Time: 12/19/2023 11:42 AM
 Plotted by: Tristan King
 Plot Date: 1/18/2024 7:50 AM

CAUTION!!!
 Contractor to call for locates
 (1-800-DIG-TESS) and field verify the
 location of all existing utilities prior to
 excavation.



ISSUED FOR CONSTRUCTION



SCALE:
 H:1"=40'
 V:1"=4'

CITY OF ABILENE
POLARIS DR SEWER LINE EXTENSION
PLAN AND PROFILE STA. 18+00-23+00

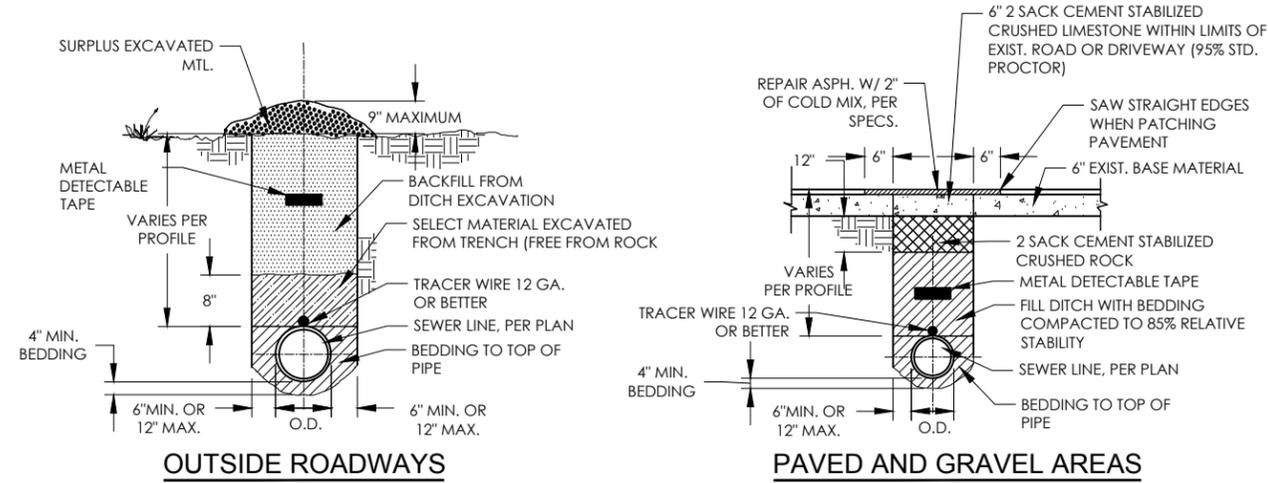
NO.	REVISION	DATE

PROJECT # 23503
 SCALE AS SHOWN
 BARS ONE INCH IN LENGTH ON ORIGINAL DRAWING.
 CHECK SCALE AND ADJUST ACCORDINGLY.

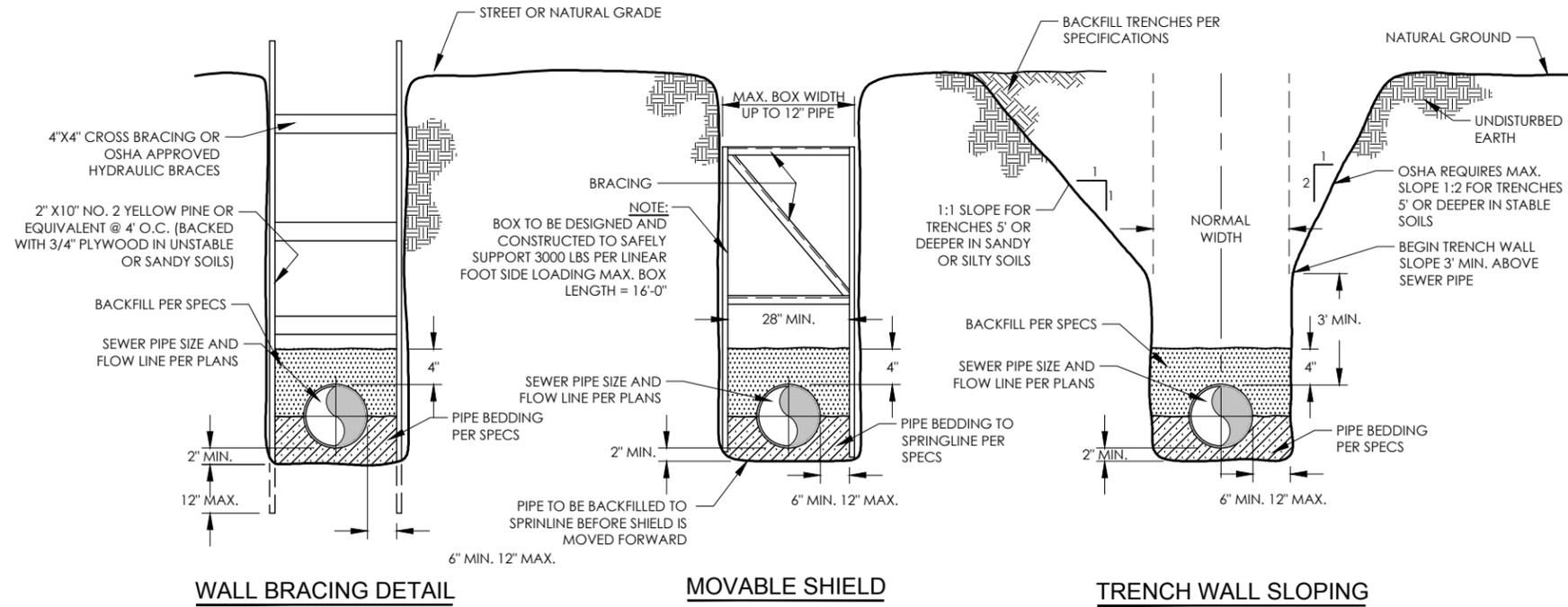
SEQ. 08	SHEET 14	08	
---------	----------	----	--



ISSUED FOR CONSTRUCTION



WASTEWATER TRENCH DETAILS N.T.S.



TRENCH WALL PROTECTION N.T.S.

CITY OF ABILENE
POLARIS DR SEWER LINE EXTENSION

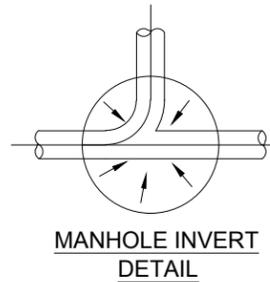
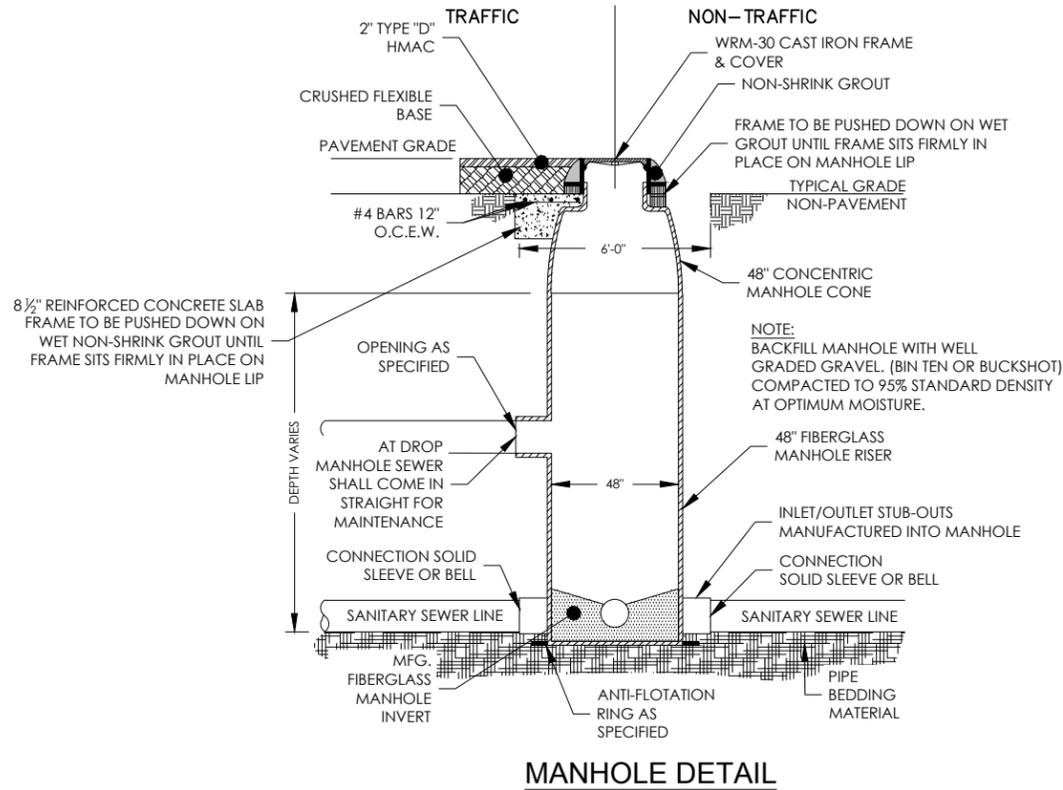
SEWER DETAILS 1

NO.	REVISION	DATE

PROJECT # | SCALE | SHEET

23503 | N.T.S. | 10

BARS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.



CITY OF ABILENE FIBERGLASS MANHOLE DETAILS
N.T.S.



ISSUED FOR CONSTRUCTION



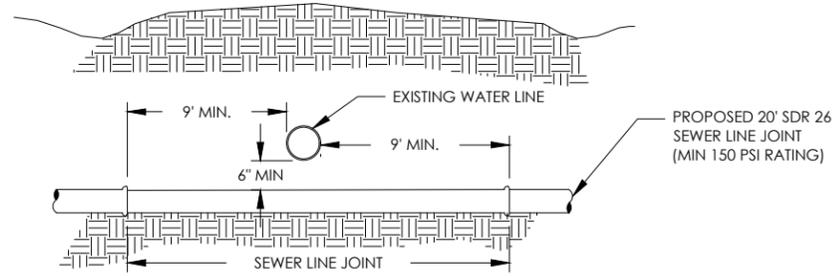
CITY OF ABILENE
POLARIS DR SEWER LINE EXTENSION

SEWER DETAILS 3

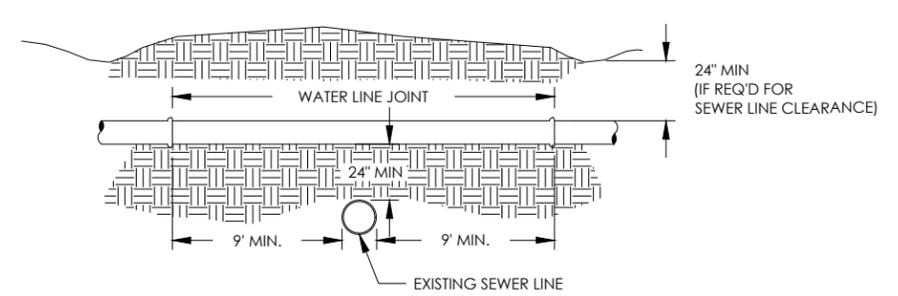
NO.	REVISION	DATE

PROJECT # | SCALE | DATE
23503 | N.T.S. | 01/18/2024

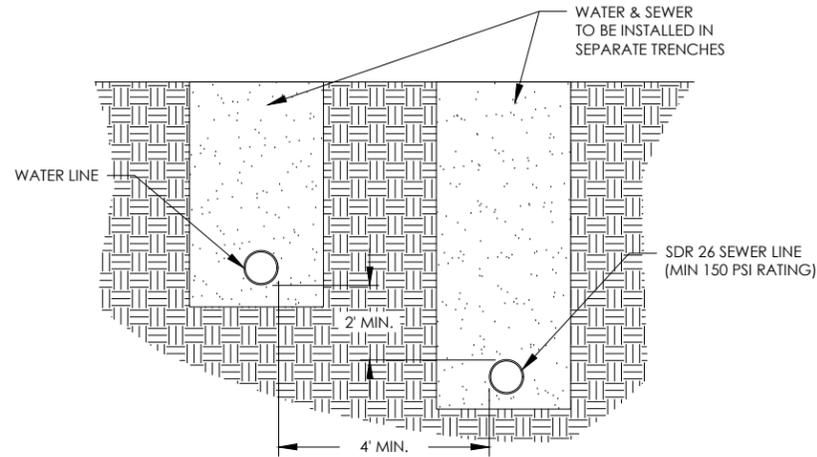
BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING.
CHECK SCALE AND ADJUST ACCORDINGLY.



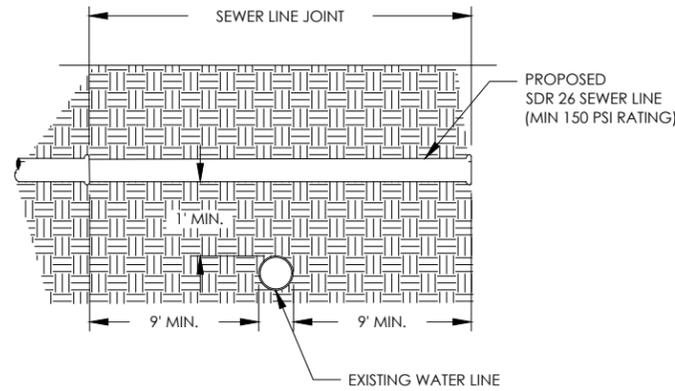
PROPOSED SEWER LINE CROSSING UNDER EXISTING WATER LINE
(PER TCEQ SEE SPECIFICATIONS) NTS



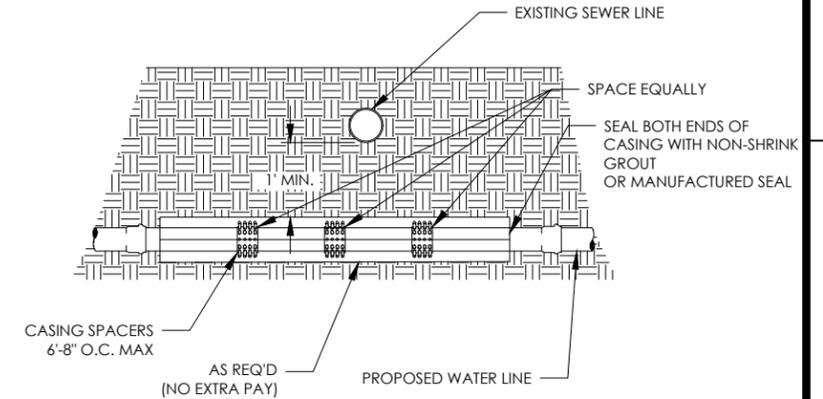
PROPOSED WATER LINE CROSSING OVER EXISTING SEWER LINE
(PER TCEQ SEE SPECIFICATIONS) NTS



PARALLEL WATER AND SEWER LINES
(WHEN 9' SEPARATION IS NOT POSSIBLE) NTS



PROPOSED SEWER LINE CROSSING OVER EXISTING WATER LINE
NTS



PROPOSED WATER LINE CROSSING UNDER EXISTING SEWER LINE
NTS

TCEQ TAC CHAPTER 290.44(e) WATER & SEWER SEPARATION NOTES:

(e) LOCATION OF WATERLINES. THE FOLLOWING RULES APPLY TO INSTALLATIONS OF WATERLINES, WASTEWATER MAINS OR LATERALS, AND OTHER CONVEYANCES/APPURTENANCES IDENTIFIED AS POTENTIAL SOURCES OF CONTAMINATION. FURTHERMORE, ALL RATINGS SPECIFIED SHALL BE DEFINED BY ASTM OR AWWA STANDARDS UNLESS STATED OTHERWISE. NEW MAINS, SERVICE LINES, OR LATERALS ARE THOSE THAT ARE INSTALLED WHERE NO MAIN, SERVICE LINE, OR LATERAL PREVIOUSLY EXISTED, OR WHERE EXISTING MAINS, SERVICE LINES, OR LATERALS ARE REPLACED WITH PIPES OF DIFFERENT SIZE OR MATERIAL.

- (1) WHEN NEW POTABLE WATER DISTRIBUTION LINES ARE CONSTRUCTED, THEY SHALL BE INSTALLED NO CLOSER THAN NINE FEET IN ALL DIRECTIONS TO WASTEWATER COLLECTION FACILITIES. ALL SEPARATION DISTANCES SHALL BE MEASURED FROM THE OUTSIDE SURFACE OF EACH OF THE RESPECTIVE PIECES.
- (2) POTABLE WATER DISTRIBUTION LINES AND WASTEWATER MAINS OR LATERALS THAT FORM PARALLEL UTILITY LINES SHALL BE INSTALLED IN SEPARATE TRENCHES.
- (3) NO PHYSICAL CONNECTION SHALL BE MADE BETWEEN A DRINKING WATER SUPPLY AND A SEWER LINE. ANY APPURTENANCE SHALL BE DESIGNED AND CONSTRUCTED SO AS TO PREVENT ANY POSSIBILITY OF SEWAGE ENTERING THE DRINKING WATER SYSTEM.
- (4) WHERE THE NINE-FOOT SEPARATION DISTANCE CANNOT BE ACHIEVED, THE FOLLOWING CRITERIA SHALL APPLY.
 - (A) NEW WATERLINE INSTALLATION - PARALLEL LINES.
 - (i) WHERE A NEW POTABLE WATERLINE PARALLELS AN EXISTING, NON-PRESSURE OR PRESSURE RATED WASTEWATER MAIN OR LATERAL AND THE LICENSED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS IS ABLE TO DETERMINE THAT THE EXISTING WASTEWATER MAIN OR LATERAL IS NOT LEAKING, THE NEW POTABLE WATERLINE SHALL BE LOCATED AT LEAST TWO FEET ABOVE THE EXISTING WASTEWATER MAIN OR LATERAL, MEASURED VERTICALLY, AND AT LEAST FOUR FEET AWAY, MEASURED HORIZONTALLY, FROM THE EXISTING WASTEWATER MAIN OR LATERAL. EVERY EFFORT SHALL BE EXERTED NOT TO DISTURB THE BEDDING AND BACKFILL OF THE EXISTING WASTEWATER MAIN OR LATERAL.
 - (ii) WHERE A NEW POTABLE WATERLINE PARALLELS AN EXISTING PRESSURE-RATED WASTEWATER MAIN OR LATERAL AND IT CANNOT BE DETERMINED BY THE LICENSED PROFESSIONAL ENGINEER IF THE EXISTING LINE IS LEAKING, THE EXISTING WASTEWATER MAIN OR LATERAL SHALL BE REPLACED WITH AT LEAST 150 PSI PRESSURE-RATED PIPE. THE NEW POTABLE WATERLINE SHALL BE LOCATED AT LEAST TWO FEET ABOVE THE NEW WASTEWATER LINE, MEASURED VERTICALLY, AND AT LEAST FOUR FEET AWAY, MEASURED HORIZONTALLY, FROM THE REPLACED WASTEWATER MAIN OR LATERAL.
 - (iii) WHERE A NEW POTABLE WATERLINE PARALLELS A NEW WASTEWATER MAIN, THE WASTEWATER MAIN OR LATERAL SHALL BE CONSTRUCTED OF AT LEAST 150 PSI PRESSURE-RATED PIPE. THE NEW POTABLE WATERLINE SHALL BE LOCATED AT LEAST TWO FEET ABOVE THE WASTEWATER MAIN OR LATERAL, MEASURED VERTICALLY, AND AT LEAST FOUR FEET AWAY, MEASURED HORIZONTALLY, FROM THE WASTEWATER MAIN OR LATERAL.
 - (B) NEW WATERLINE INSTALLATION - CROSSING LINES.
 - (i) WHERE A NEW POTABLE WATERLINE CROSSES ABOVE A WASTEWATER MAIN OR LATERAL, THE SEGMENT OF THE WATERLINE PIPE SHALL BE CENTERED OVER AND MUST BE PERPENDICULAR TO THE WASTEWATER MAIN OR LATERAL SUCH THAT THE JOINTS OF THE WATERLINE PIPE ARE EQUIDISTANT AND AT LEAST NINE FEET HORIZONTALLY FROM THE CENTERLINE OF THE WASTEWATER MAIN OR LATERAL. WHEN CROSSING AN EXISTING WASTEWATER MAIN OR LATERAL AND IT IS DISTURBED OR SHOWS SIGNS OF LEAKING, THE WASTEWATER MAIN OR LATERAL SHALL BE REPLACED FOR AT LEAST NINE FEET IN BOTH DIRECTIONS (18 FEET

TOTAL) WITH AT LEAST 150 PSI PRESSURE-RATED PIPE EMBEDDED IN CEMENT STABILIZED SAND (SEE CLAUSE (V) OF THIS SUBPARAGRAPH) FOR THE TOTAL LENGTH OF ONE PIPE SEGMENT PLUS 12 INCHES BEYOND THE JOINT ON EACH END.

- (i) THE POTABLE WATERLINE SHALL BE AT LEAST TWO FEET ABOVE AN EXISTING, NON-PRESSURE RATED WASTEWATER MAIN OR LATERAL.
- (ii) THE POTABLE WATERLINE SHALL BE AT LEAST SIX INCHES ABOVE AN EXISTING, PRESSURE-RATED WASTEWATER MAIN OR LATERAL.
- (iii) WHERE A NEW POTABLE WATERLINE CROSSES A NEW, NON-PRESSURE RATED WASTEWATER MAIN OR LATERAL, THE SEGMENT OF THE WATERLINE PIPE SHALL BE CENTERED OVER AND SHALL BE PERPENDICULAR TO THE WASTEWATER MAIN OR LATERAL SUCH THAT THE JOINTS OF THE WATERLINE PIPE ARE EQUIDISTANT AND AT LEAST NINE FEET HORIZONTALLY FROM THE CENTERLINE OF THE WASTEWATER MAIN OR LATERAL. THE POTABLE WATERLINE SHALL BE AT LEAST TWO FEET ABOVE THE WASTEWATER MAIN OR LATERAL. WHENEVER POSSIBLE, THE CROSSING SHALL BE CENTERED BETWEEN THE JOINTS OF THE WASTEWATER MAIN OR LATERAL. THE WASTEWATER PIPE SHALL HAVE A MINIMUM PIPE STIFFNESS OF 115 PSI AT 5.0% DEFLECTION. THE WASTEWATER MAIN OR LATERAL SHALL BE EMBEDDED IN CEMENT STABILIZED SAND (SEE CLAUSE (V) OF THIS SUBPARAGRAPH) FOR THE TOTAL LENGTH OF ONE PIPE SEGMENT PLUS 12 INCHES BEYOND THE JOINT ON EACH END. THE MATERIALS AND METHOD OF INSTALLATION SHALL CONFORM TO ONE OF THE FOLLOWING OPTIONS:
 - (i) WITHIN NINE FEET HORIZONTALLY OF EITHER SIDE OF THE WATERLINE, THE WASTEWATER PIPE AND JOINTS SHALL BE CONSTRUCTED WITH PIPE MATERIAL HAVING A MINIMUM PRESSURE RATING OF AT LEAST 150 PSI. AN ABSOLUTE MINIMUM VERTICAL SEPARATION DISTANCE OF TWO FEET SHALL BE PROVIDED. THE WASTEWATER MAIN OR LATERAL SHALL BE LOCATED BELOW THE WATERLINE.
 - (ii) ALL SECTIONS OF WASTEWATER MAIN OR LATERAL WITHIN NINE FEET HORIZONTALLY OF THE WATERLINE SHALL BE ENCASED IN AN 18-FOOT (OR LONGER) SECTION OF PIPE. FLEXIBLE ENCASED PIPE SHALL HAVE A MINIMUM PIPE STIFFNESS OF 115 PSI AT 5.0% DEFLECTION. THE ENCASED PIPE SHALL BE CENTERED ON THE WATERLINE AND SHALL BE AT LEAST TWO NOMINAL PIPE DIAMETERS LARGER THAN THE WASTEWATER MAIN OR LATERAL. THE SPACE AROUND THE CARRIER PIPE SHALL BE SUPPORTED AT FIVE-FOOT (OR LESS) INTERVALS WITH SPACERS OR BE FILLED TO THE SPRINGLINE WITH WASHED SAND. EACH END OF THE CASING SHALL BE SEALED WITH WATERTIGHT NON-SHRINK CEMENT GROUT OR A MANUFACTURED WATERTIGHT SEAL. AN ABSOLUTE MINIMUM SEPARATION DISTANCE OF SIX INCHES BETWEEN THE ENCASEMENT PIPE AND THE WATERLINE SHALL BE PROVIDED. THE WASTEWATER LINE SHALL BE LOCATED BELOW THE WATERLINE.
 - (iii) WHEN A NEW WATERLINE CROSSES UNDER A WASTEWATER MAIN OR LATERAL, THE WATERLINE SHALL BE ENCASED AS DESCRIBED FOR WASTEWATER MAINS OR LATERALS IN CLAUSE (II) OF THIS SUBPARAGRAPH OR CONSTRUCTED OF DUCTILE IRON OR STEEL PIPE WITH MECHANICAL OR WELDED JOINTS AS APPROPRIATE. AN ABSOLUTE MINIMUM SEPARATION DISTANCE OF ONE FOOT BETWEEN THE WATERLINE AND THE WASTEWATER MAIN OR LATERAL SHALL BE PROVIDED. WHEN A NEW WATERLINE CROSSES UNDER A WASTEWATER MAIN, THE PROCEDURES IN §217.53(D) OF THIS TITLE (RELATING TO PIPE DESIGN) MUST BE FOLLOWED.
 - (iv) WHERE A NEW POTABLE WATERLINE CROSSES A NEW, PRESSURE RATED WASTEWATER MAIN OR

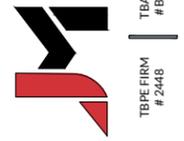
LATERAL, ONE SEGMENT OF THE WATERLINE PIPE SHALL BE CENTERED OVER AND SHALL BE PERPENDICULAR TO THE WASTEWATER LINE SUCH THAT THE JOINTS OF THE WATERLINE PIPE ARE EQUIDISTANT AND AT LEAST NINE FEET HORIZONTALLY FROM THE CENTER LINE OF THE WASTEWATER MAIN OR LATERAL. THE POTABLE WATERLINE SHALL BE AT LEAST SIX INCHES ABOVE THE WASTEWATER MAIN OR LATERAL. WHENEVER POSSIBLE, THE CROSSING SHALL BE CENTERED BETWEEN THE JOINTS OF THE WASTEWATER MAIN OR LATERAL. THE WASTEWATER PIPE SHALL HAVE A MINIMUM PRESSURE RATING OF AT LEAST 150 PSI. THE WASTEWATER MAIN OR LATERAL SHALL BE EMBEDDED IN CEMENT STABILIZED SAND (SEE CLAUSE (V) OF THIS SUBPARAGRAPH) FOR THE TOTAL LENGTH OF ONE PIPE SEGMENT PLUS 12 INCHES BEYOND THE JOINT ON EACH END.

(v) WHERE CEMENT STABILIZED SAND BEDDING IS REQUIRED, THE CEMENT STABILIZED SAND SHALL HAVE A MINIMUM OF 10% CEMENT PER CUBIC YARD OF CEMENT STABILIZED SAND MIXTURE, BASED ON LOOSE DRY WEIGHT VOLUME (AT LEAST 2.5 BAGS OF CEMENT PER CUBIC YARD OF MIXTURE). THE CEMENT STABILIZED SAND BEDDING SHALL BE A MINIMUM OF SIX INCHES ABOVE AND FOUR INCHES BELOW THE WASTEWATER MAIN OR LATERAL. THE USE OF BROWN COLORING IN CEMENT STABILIZED SAND FOR WASTEWATER MAIN OR LATERAL BEDDING IS RECOMMENDED FOR THE IDENTIFICATION OF PRESSURE RATED WASTEWATER MAINS DURING FUTURE CONSTRUCTION.

- (5) WATERLINE AND WASTEWATER MAIN MANHOLE OR LATERAL MANHOLE OR CLEANOUT SEPARATION. THE SEPARATION DISTANCE FROM A POTABLE WATERLINE TO A WASTEWATER MAIN MANHOLE OR LATERAL MANHOLE OR CLEANOUT SHALL BE A MINIMUM OF NINE FEET. WHERE THE NINE-FOOT SEPARATION DISTANCE CANNOT BE ACHIEVED, THE POTABLE WATERLINE SHALL BE ENCASED IN A JOINT OF AT LEAST 150 PSI PRESSURE CLASS PIPE AT LEAST 18 FEET LONG AND TWO NOMINAL SIZES LARGER THAN THE NEW CONVEYANCE. THE SPACE AROUND THE CARRIER PIPE SHALL BE SUPPORTED AT FIVE-FOOT INTERVALS WITH SPACERS OR BE FILLED TO THE SPRINGLINE WITH WASHED SAND. THE ENCASEMENT PIPE SHALL BE CENTERED ON THE CROSSING AND BOTH ENDS SEALED WITH CEMENT GROUT OR MANUFACTURED SEALANT.
- (6) LOCATION OF FIRE HYDRANTS. FIRE HYDRANTS SHALL NOT BE INSTALLED WITHIN NINE FEET VERTICALLY OR HORIZONTALLY OF ANY WASTEWATER MAIN, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE REGARDLESS OF CONSTRUCTION.
- (7) LOCATION OF POTABLE OR RAW WATER SUPPLY OR SUCTION LINES. SUCTION MAINS TO PUMPING EQUIPMENT SHALL NOT CROSS WASTEWATER MAINS, WASTEWATER LATERALS, OR WASTEWATER SERVICE LINES. RAW WATER SUPPLY LINES SHALL NOT BE INSTALLED WITHIN FIVE FEET OF ANY TILE OR CONCRETE WASTEWATER MAIN, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE.
- (8) PROXIMITY OF SEPTIC TANK DRAINFIELDS. WATERLINES SHALL NOT BE INSTALLED CLOSER THAN TEN FEET TO SEPTIC TANK DRAINFIELDS.



ISSUED FOR CONSTRUCTION



CITY OF ABILENE
POLARIS DR SEWER LINE EXTENSION

WATER & SEWER CROSSING DETAILS

NO.	REVISION	DATE
13		
14		
SEQ.	SHEET	
13	13	
PROJECT # 23503 N.T.S.		
BARI ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.		

Plotted by: triston king Plot Date: 1/18/2024 7:50 AM
 Saved By: tking Save Time: 12/21/2023 9:48 AM
 X:\CityAbilene\23503 - Polaris Drive Sewer Line Extension - City of Abilene\Drafting\Plans\C-Civil\1.4 EROSION CONTROL DETAILS.dwg



ISSUED FOR CONSTRUCTION

JACOB MARTIN
 TBE FIRM # 1079493
 TBE FIRM # 2448

CITY OF ABILENE
 POLARIS DR SEWER LINE EXTENSION
 EROSION CONTROL DETAILS

NO.	REVISION	DATE
14		
14		

PROJECT # 23503
 SCALE N.T.S.
 BARS ONE INCH IN LENGTH ON ORIGINAL DRAWING.
 CHECK SCALE AND ADJUST ACCORDINGLY.

EROSION CONTROL REQUIREMENTS:

IT IS REQUIRED THAT ALL CONSTRUCTION ACTIVITY BE IN COMPLIANCE WITH THE LATEST REGULATIONS OF THE ENVIRONMENTAL PROTECTION AGENCY, THE TEXAS COMMISSION OF ENVIRONMENTAL QUALITY, AND ALL OTHER CITY, STATE, AND FEDERAL REGULATIONS.

TO BE IN COMPLIANCE THE CONTRACTOR WILL FURNISH, INSTALL AND MAINTAIN ALL DEVICES NECESSARY TO INSURE THE ENVIRONMENT IS PROTECTED AS REQUIRED BY SAID REGULATIONS. PROTECTION WILL BE IN PLACE BEFORE CONSTRUCTION BEGINS. UPON COMPLETION OF THE PROJECT, THE CONTRACTOR IS RESPONSIBLE FOR LEAVING THE PROJECT IN A STABILIZED CONDITION THAT ASSURES PREVENTION OF FUTURE EROSION AND SEDIMENTATION POLLUTION.

"STABILIZED CONDITION" IMPLIES THAT DISTURBED AREAS AFFECTED BY THIS ACTIVITY HAVE BEEN RESTORED TO A CONDITION EQUAL TO, OR BETTER THAN, THEY WERE BEFORE THE ACTIVITY OCCURRED. DIFFERENT METHODS SUCH AS PERMANENT GRASS SOD, CONCRETE RIPRAP, CONCRETE RETARDS, GRASS COVERED EARTH BERMS, AND OTHER METHODS MAY ACCOMPLISH THE RESTORATION. UNTIL PERMANENT POLLUTION AND SEDIMENTATION CONTROL IS ESTABLISHED, THE CONTRACTOR WILL PROVIDE TEMPORARY CONTROL SUCH AS SILT FENCE, ROCK RETARDS, BERMS, ETC.

THE COST ASSOCIATED WITH PROVIDING THESE CONTROLS WILL BE CONSIDERED SUBSIDIARY UNLESS SPECIFIC BID ITEMS ARE INCLUDED IN THE PLANS.

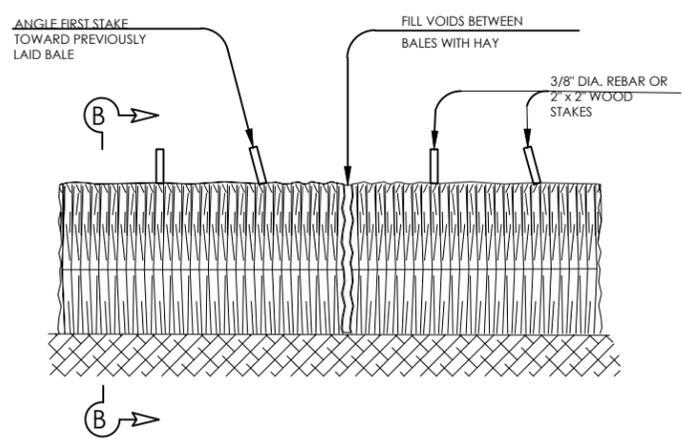
SEDIMENT CONTROL FENCE USAGE GUIDELINES:

A SEDIMENT CONTROL FENCE MAY BE CONSTRUCTED NEAR THE DOWNSTREAM PERIMETER OF A DISTURBED AREA ALONG A CONTOUR. A SEDIMENT CONTROL FENCE MAY BE CONSTRUCTED NEAR THE TO INTERCEPT SEDIMENT FROM OVERLAND RUNOFF. A 2 YEAR STORM FREQUENCY MAY BE USED TO CALCULATE THE FLOW RATE TO BE FILTERED.

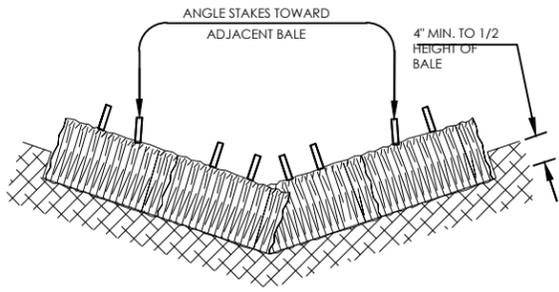
SEDIMENT CONTROL FENCE SHOULD BE SIZED TO FILTER A MAX. FLOW THROUGH RATE OF 100 GPM/FT. SEDIMENT CONTROL FENCE IS NOT RECOMMENDED TO CONTROL EROSION FROM A DRAINAGE AREA LARGER THAN 2 ACRES.

GENERAL NOTES:

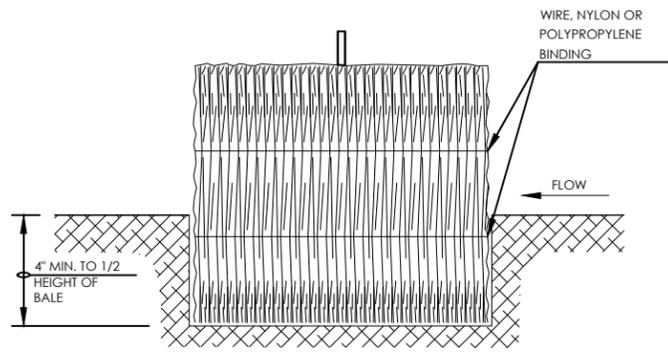
1. THE GUIDELINES SHOWN HEREON ARE SUGGESTIONS ONLY AND MAY BE MODIFIED BY THE ENGINEER.



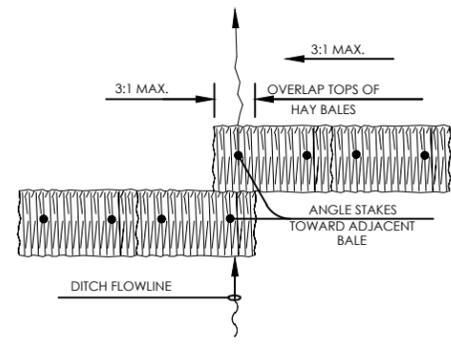
BALED HAY FOR EROSION CONTROL



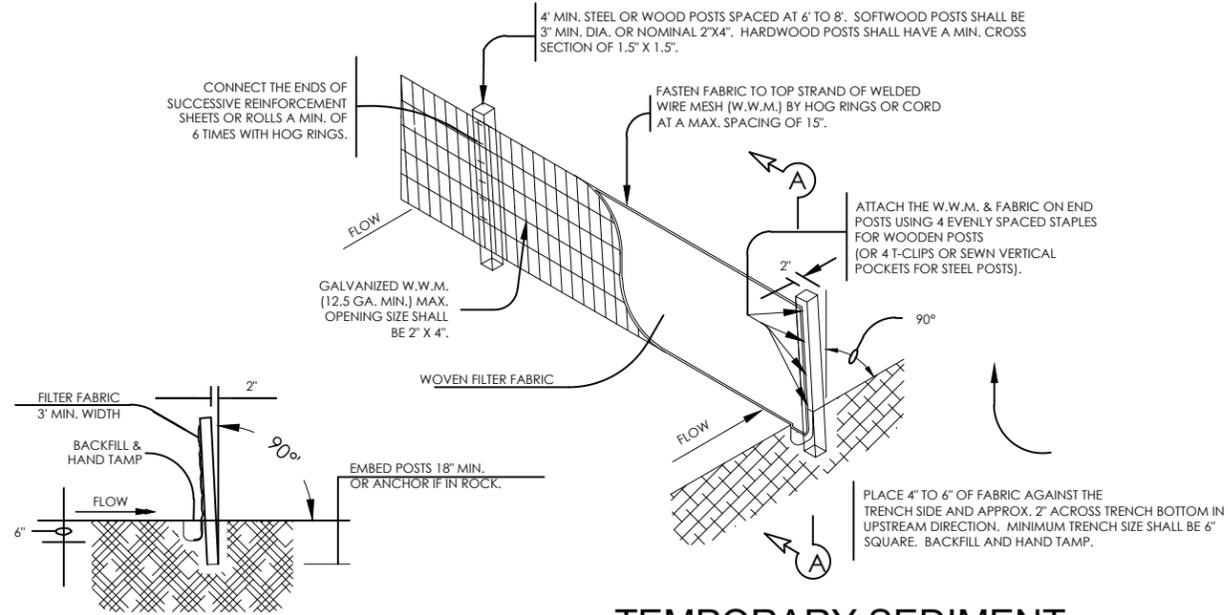
PROFILE VIEW



SECTION B-B

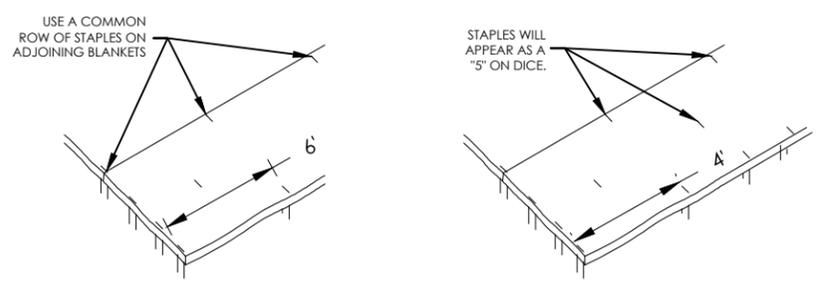


PLAN VIEW



TEMPORARY SEDIMENT CONTROL FENCE

SECTION A-A



SLOPE INSTALLATION

DITCH INSTALLATION

SOIL RETENTION BLANKET EROSION CONTROL

GENERAL NOTES:

- USE WIRE STAPLES, .091" IN DIAMETER OR GREATER "U" SHAPED WITH LEGS 6" IN LENGTH AND A 1" CROWN. SIZE AND SHAPE OF STAPLES USED WILL VARY WITH SOIL CONDITIONS. DRIVE STAPLES VERTICALLY INTO THE GROUND. USE FOUR STAPLES ACROSS AT THE START OF EACH ROLL.
- FOR SLOPE INSTALLATION, CONTINUE TO STAPLE ALONG THE LENGTH OF THE ROLL AT 6 FT. INTERVALS.
- FOR DITCH LINER, STAPLE ALONG THE LENGTH OF THE ROLL AT 4 FT. INTERVALS.
- ANOTHER ROW OF STAPLES IN THE CENTER OF EACH BLANKET SHOULD BE ALTERNATELY SPACED BETWEEN EACH SIDE FOR EITHER SLOPE OR DITCH.
- USE A COMMON ROW OF STAPLES ON ADJOINING BLANKETS.

BALED HAY USAGE GUIDELINES:

A BALED HAY INSTALLATION MAY BE CONSTRUCTED NEAR THE DOWNSTREAM PERIMETER OF A DISTURBED AREA ALONG A CONTOUR TO INTERCEPT SEDIMENT FROM OVERLAND RUNOFF. A TWO YEAR STORM FREQUENCY MAY BE USED TO CALCULATE THE FLOW RATE TO BE FILTERED. THE INSTALLATION SHOULD BE SIZED TO FILTER A MAXIMUM FLOW THRU RATE OF 5 GPM/FT OF CROSS SECTIONAL AREA. BALED HAY MAY BE USED AT THE FOLLOWING LOCATIONS:

- WHERE THE RUNOFF APPROACHING THE BALED HAY FLOWS OVER DISTURBED SOIL FOR LESS THAN 100'. IF THE SLOPE OF THE DISTURBED SOIL EXCEEDS 10%, THE LENGTH OF SLOPE UPSTREAM THE BALED HAY SHOULD BE LESS THAN 50'.
- WHERE THE INSTALLATION WILL BE REQUIRED FOR LESS THAN 3 MONTHS.
- WHERE THE CONTRIBUTING DRAINAGE AREA IS LESS THAN 1/2 ACRE. FOR BALED HAY INSTALLATIONS IN SMALL DITCHES, THE ADDITIONAL FOLLOWING CONSIDERATIONS APPLY:
 - THE DITCH SIDESLOPES SHOULD BE GRADED AS FLAT AS POSSIBLE TO MAXIMIZE THE DRAINAGE FLOW RATE THRU THE HAY.
 - THE DITCH SHOULD BE GRADED LARGE ENOUGH TO CONTAIN THE OVERTOPPING DRAINAGE WHEN SEDIMENT HAS FILLED TO THE TOP OF THE BALED HAY. BALES SHOULD BE REPLACED USUALLY EVERY 2 MONTHS OR MORE OFTEN DURING WET WEATHER WHEN LOSS OF STRUCTURAL INTEGRITY IS ACCELERATED.

GENERAL NOTES:

- HAY BALES SHALL BE A MINIMUM OF 30" IN LENGTH AND WEIGH A MINIMUM OF 50 LBS.
- HAY BALES SHALL BE BOUND BY EITHER WIRE OR NYLON OR POLYPROPYLENE STRING. THE BALES SHALL BE COMPOSED ENTIRELY OF VEGETATIVE MATTER.
- HAY BALES SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 4" AND WHERE POSSIBLE 1/2 THE HEIGHT OF THE BALE.
- HAY BALES SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES. THE BALES SHALL BE PLACED WITH BINDINGS PARALLEL TO THE GROUND.
- HAY BALES SHALL BE SECURELY ANCHORED IN PLACE WITH 3/8" DIA. REBAR OR 2" X 2" WOOD STAKES, DRIVEN THROUGH THE BALES. THE FIRST STAKE SHALL BE ANGLED TOWARDS THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.
- THE GUIDELINES SHOWN HEREON ARE SUGGESTIONS ONLY AND MAY BE MODIFIED BY THE ENGINEER.