

**CITY OF KYLE**



**Contract Documents and Technical  
Specifications For the:**

**N. BURLESON STREET IMPROVEMENTS**

**May 29, 2018**



CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS FOR  
N. BURLESON STREET IMPROVEMENTS

Prepared For:

City of Kyle  
100 West Center Street  
Kyle, Texas 78640

Prepared By:

Freese and Nichols, Inc.  
10431 Morado Circle  
Building 5, Suite 300  
Austin, Texas 78759



May 2018

*Jessica N. Rodriguez*



**DIVISION 00**

**CITY OF KYLE  
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**End**

## INVITATION TO BID

Separate sealed bids addressed to the City of Kyle, ATTENTION: CITY ENGINEER, will be received until 2:00 P.M. on July 2, 2018 at the City of Kyle Public Works Building located at 520 E. RM 150 in Kyle, Texas, 78640 at which time they will be publicly opened and read aloud, for furnishing all labor, material, tools and equipment and performing all work required for the N. BURLESON STREET IMPROVEMENTS including reconstruction of N. Burleson Street as a 38-foot wide roadway, a new 38-foot wide roadway connecting N. Burleson Street to the IH 35 Southbound Frontage Road, storm drain, detention pond improvements, waterline replacement, sanitary sewer replacement and extension, illumination, grading, pavement improvements, curb and gutter, pedestrian improvements and signing and marking for approximately 7,500 linear feet of roadway.

Bids must be submitted on the Bid Form provided, and must be accompanied by a bid security in a penal sum approximately equal to and not less than five percent (5%) of the total amount of the bid. The security shall be in the form of a certified check or cashier's check, or bid bond furnished by a reliable surety company having authority under the laws of Texas to write surety bonds in the amount required, with such security made payable without recourse to the City of Kyle. The envelope containing the bid shall indicate clearly on the front that the bid is for the N. BURLESON STREET IMPROVEMENTS PROJECT.

The final Notice of Award of Contract shall be given to the successful bidder by the City of Kyle within sixty (60) days following the opening of bids and no bidder may withdraw his bid within sixty (60) days after opening thereof. The successful Bidder must furnish a payment bond and performance bond, when required, on the form provided in the amount of one hundred percent (100%) of the contract amount from a surety company holding a permit from the State of Texas to act as surety.

State statutes including wage and hour provisions and contract regulations must be adhered to as they relate to this project. Contractors will be required to comply with all applicable Equal Employment Opportunity laws and regulations.

Copies of the Specifications and Bid Documents will be on file by May 29, 2018 and may be examined at the following locations:

- City Hall, 100 West Center Street, Kyle, Texas 78640
- Public Works Building, 520 E. RM 150, Kyle, Texas 78640
- Builders Exchange, 4047 Naco Perrin, San Antonio, Texas 78217

Bid Documents in an electronic format on Compact Disc (CD) may be obtained at City Hall located at the address above at no cost. Bid Document CD's may also be obtained at the offices of Freese and Nichols, Inc., 10431 Morado Circle, Building 5, Suite 300, Austin, Texas 78759, (512) 617-3100.

Bidders should carefully examine the plans, specifications and other documents, visit the site of work, and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in, or omissions from, the plans, specifications or other documents, or should be in doubt as to their meaning, bidder should notify the City Engineer and obtain clarification prior to submitting any bid, but no later than June 19, 2018. A **non-mandatory pre-bid conference** will be held on **June 11, 2018 at 2:00 p.m.** at the City of Kyle Public Works Department Training Room, 520 E. RR 150, Kyle, TX.

The right is reserved, as the interest of the City of Kyle may require, to reject any and all bids and to waive any informalities in bids received.

Leon Barba, PE, City Engineer  
City of Kyle

## **ARTICLE 1 – DEFINED TERMS**

- 1.01 Item 1 of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges November 1, 2014 is hereby incorporated by reference.

## **ARTICLE 2 – COPIES OF BIDDING DOCUMENTS**

- 2.01 Complete sets of the Bidding Documents in electronic format on Compact Disc may be obtained from Freese and Nichols, Inc., 10431 Morado Circle, Building 5, Suite 300, Austin, Texas 78759 at no cost.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

## **ARTICLE 3 – QUALIFICATIONS OF BIDDERS**

- 3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request, Bidder shall submit written evidence of the following.
- A. The names and positions of the individuals authorized to bind bidder's company, including attesting or countersigning officers.
  - B. An organization chart showing the principals and management personnel who will be involved with the proposed Work.
  - C. The resumes of the superintendent and supervisors for the various disciplines and crafts required for the project.
  - D. A proposed project schedule estimating the completion of the major tasks of the project.
  - E. Current insurance certificate(s) with limits consistent with requirements of these Contract Documents.
  - F. Copies of 3 years of audited financial statements including cash flows, balance sheets and income statements.
  - G. Name of bonding company and bonding capacity.
  - H. Such other information as is required to evaluate Bid or bidder.

## **ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE**

- 4.01 *Subsurface and Physical Conditions*
- A. The Supplementary Conditions identify:
    - 1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
    - 2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.
  - B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been

identified and established in Paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

- A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 *Hazardous Environmental Condition*

- A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Engineer has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established in Paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 4.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Advance notice of at least 7 calendar days shall be given, and coordination with the Owner and any affected property owner will be required. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

- A. examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;
- B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work (coordination with Owner for site visits prior to bidding is required);
- C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions;
- E. obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;
- F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
- I. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and
- J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

#### **ARTICLE 5 – PRE-BID CONFERENCE**

5.01 A non-mandatory pre-bid conference will be held at **2:00 P.M.** local time on **June 11, 2018** at **Public Works Training Room, 520 E. RM 150, Kyle, Texas 78640**. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

#### **ARTICLE 6 – SITE AND OTHER AREAS**

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



## **ARTICLE 7 – INTERPRETATIONS AND ADDENDA**

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

## **ARTICLE 8 – BID SECURITY**

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent (5%) of Bidder's maximum Bid price and in the form of a certified check or bank money order or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.
- 8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.
- 8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

## **ARTICLE 9 – CONTRACT TIMES**

- 9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

## **ARTICLE 10 – LIQUIDATED DAMAGES**

- 10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

## **ARTICLE 11 – SUBSTITUTE AND “OR-EQUAL” ITEMS**

- 11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or “or-equal” items. Whenever it is specified or described in the Bidding Documents that a substitute or “or-equal” item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

## **ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS**

- 12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed

Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

- 12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

### **ARTICLE 13 – PREPARATION OF BID**

- 13.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Engineer.
- 13.02 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item listed therein, or the words “No Bid,” “No Change,” or “Not Applicable” entered.
- 13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.
- 13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.
- 13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.
- 13.06 A Bid by an individual shall show the Bidder’s name, official address, and email address.
- 13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.
- 13.08 All names shall be typed or printed in ink below the signatures.
- 13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.10 The address and telephone number for communications regarding the Bid shall be shown.
- 13.11 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder’s state contractor license number, if any, shall also be shown on the Bid Form.

## **ARTICLE 14 – BASIS OF BID; COMPARISON OF BIDS**

### 14.01 *Unit Price*

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.
- B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

## **ARTICLE 15 – SUBMITTAL OF BID**

15.01 The Bid proposal is to be completed on the forms provided and submitted with the Bid security and the following data in hardcopy and electronic format (CD or flash drive):

- A. acknowledgement of receipt of Addenda issued;
- B. Bid security;
- C. complete responses to information required in Bid;
- D. the entire Bid with all blanks filled in completely.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents.

## **ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID**

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be retained. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

## **ARTICLE 17 – OPENING OF BIDS**

- 17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

## **ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

## **ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT**

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible.
- 19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.
- 19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.
- 19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.

## **ARTICLE 20 – CONTRACT SECURITY AND INSURANCE**

- 20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

## **ARTICLE 21 – SIGNING OF AGREEMENT**

- 21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 7 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 7 days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

**BID FORM**

**N. Burleson Street Improvements**

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**ARTICLE 1 – BID RECIPIENT**

1.01 This Bid is submitted to:

City of Kyle City Hall at 100 West Center Street, Kyle, Texas 78640

1.02 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.

**ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS**

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

**ARTICLE 3 – BIDDER’S REPRESENTATIONS**

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>
_____	_____
_____	_____
_____	_____

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

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02.

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

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

- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

#### **ARTICLE 4 – FURTHER REPRESENTATIONS**

4.01 Bidder further represents that:

- A. this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

#### **ARTICLE 5 – BASIS OF BID**

5.01 Bid includes all items necessary to construct the roadway, bridge, drainage, illumination, water line, and sanitary sewer improvements per the plans. Base Bid will be used in determining the lowest bidder for that work. Award of contract does not constitute approval of Bid Alternate 1 or Bid Alternate 2. Bid Alternate 1 or Bid Alternate 2 will be separately approved and awarded to the lowest bidder for the respective Bid Alternate. Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

#### **ARTICLE 6 – TIME OF COMPLETION**

6.01 Bidder agrees that the Work will be substantially complete in accordance with Paragraph 14.04 and will be finally complete and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

#### **ARTICLE 7 – ATTACHMENTS TO THIS BID**

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

- A. Bid security;
- B. complete responses to information required in Bid;
- C. the entire Bid with all blanks filled in completely.

**ARTICLE 8 – DEFINED TERMS**

8.01 Not Used.

**ARTICLE 9 – BID SUBMITTAL**

9.01 This Bid submitted by:

Bidder (typed or printed): \_\_\_\_\_

By: \_\_\_\_\_  
*(Authorized Signature)*

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Business Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-Mail Address: \_\_\_\_\_



## 00 42 23.01 "Bid Form Exhibit A"

City of Kyle

N. Burleson Street Improvements

Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
1	TxDOT 100 6002	PREPARING ROW	STA	66		
2	TxDOT 104 6015	REMOVING CONC (SIDEWALKS)	SY	200		
3	TxDOT 106 6002	OBLITERATING ABANDONED ROAD	SY	1,053		
4	TxDOT 110 6001	EXCAVATION (ROADWAY)	CY	13,662		
5	TxDOT 110 6002	EXCAVATION (CHANNEL)	CY	40		
6	TxDOT 110 6003	EXCAVATION (POND)	CY	9,800		
7	TxDOT 132 6005	EMBANKMENT (FINAL) (ORD COMP) (TY C)	CY	1,790		
8	TxDOT 160 6003	FURNISHING AND PLACING TOPSOIL (4")	SY	17,142		
9	TxDOT 162 6002	BLOCK SODDING	SY	9,195		
10	TxDOT 162 6002	BLOCK SODDING - BUFFALOGRASS	SY	445		
11	TxDOT 164 6027	CELL FBR MLCH SEED (PERM) (URBAN) (CLAY)	SY	17,142		
12	TxDOT 166 6002	FERTILIZER	TON	4		
13	TxDOT 168 6001	VEGETATIVE WATERING	MG	140		
14	TxDOT 192 6002	PLANT MATERIAL (1-GAL)	EA	102		
15	TxDOT 192 6003	PLANT MATERIAL (3-GAL)	EA	376		
16	TxDOT 192 6004	PLANT MATERIAL (5-GAL)	EA	71		
17	TxDOT 192 6015	LANDSCAPE EDGE	LF	710		
18	TxDOT 192 6018	PLANT MATERIAL (2-GAL)	EA	653		
19	TxDOT 192 6024	PLANT MATERIAL (30 GAL) (TREE)	EA	1		
20	TxDOT 192 6026	PLANT MATERIAL (65 GAL) (TREE)	EA	12		
21	TxDOT 247 6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS) (10")	CY	4,226		
22	TxDOT 247 6366	FLEXIBLE BASE (GRAVEL PAVEMENT REPAIR)	SY	20		
23	TxDOT 260 6002	LIME (HYDRATED LIME (SLURRY))	TON	627		
24	TxDOT 260 6009	LIME TRT (SUBGRADE)(10")	SY	25,325		
25	TxDOT 310 6005	PRIME COAT (AE-P)(0.20 GAL/SY)	GAL	5,069		
26	TxDOT 341 6008	D-GR HMA TY-B PG64-22 (3")	TON	3,580		
27	TxDOT 341 6008	D-GR HMA TY-B PG64-22 (8")	TON	1,592		
28	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (2")	TON	2,385		
29	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (2") (OVERLAY)	TON	309		
30	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (LEVEL UP)	TON	100		
31	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (3")	TON	689		
32	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (PAVEMENT REPAIR)	SY	32		
33	TxDOT 354 6045	PLANE ASPH CONC PAV (2")	SY	2,682		
34	TxDOT 400 6002	STRUCTURAL EXCAVATION	CY	13,098		
35	TxDOT 402 6001	TRENCH EXCAVATION PROTECTION	LF	4,900		
36	TXDOT 420 6007	CONCRETE (DROP STRUCTURE)	CY	40		
37	TXDOT 420 6007	CONCRETE (APRON W BAFFLE BLOCS)	CY	65		
38	TXDOT 420 6007	CONCRETE (PILOT CHANNEL)	CY	45		
39	TXDOT 420 6007	CONCRETE (RAIN GARDEN)	CY	55		
40	TXDOT 420 6007	CONCRETE (POND HEADWALLS AND APRONS)	CY	45		

City of Kyle  
N. Burleson Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
41	TXDOT 422 6001	REIN CONC SLAB	SF	255		
42	TxDOT 423 6001	RETAINING WALL (MSE)	SF	5,418		
43	TxDOT 423 6008	RETAINING WALL (CAST-IN-PLACE)	SF	1,076		
44	TxDOT 432 6002	RIPRAP (CONC) (5 IN)	CY	150		
45	TxDOT SP 432	RIPRAP (MITERED SLOPE)	CY	15		
46	TxDOT 450 6042	RAIL (TY PR1)	LF	608		
47	TxDOT 450 6051	RAIL (HANDRAIL) (TY E)	LF	24		
48	TxDOT 462 6004	CONC BOX CULV (4 FT X 3 FT)	LF	1,837		
49	TxDOT 462 6012	CONC BOX CULV (6 FT X 5 FT)	LF	54		
50	TxDOT 462 6021	CONC BOX CULV (8 FT X 6 FT)	LF	106		
51	TxDOT 464 6001	RC PIPE (CL III) (12 IN)	LF	33		
52	TxDOT 464 6003	RC PIPE (CL III) (18 IN)	LF	893		
53	TxDOT 464 6005	RC PIPE (CL III) (24 IN)	LF	651		
54	TxDOT 464 6008	RC PIPE (CL III) (36 IN)	LF	140		
55	TxDOT 464 6017	RC PIPE (CL IV) (18 IN)	LF	1,389		
56	TxDOT 464 6018	RC PIPE (CL IV) (24 IN)	LF	133		
57	TxDOT 464 6020	RC PIPE (CL IV) (36 IN)	LF	67		
58	TxDOT 465 6002	MANH (COMPL)(PRM)(48IN)	EA	1		
59	TxDOT 465 6006	JCTBOX(COMPL)(PJB)(4FTX4FT)	EA	2		
60	TxDOT 465 6009	JCTBOX(COMPL)(PJB)(5FTX5FT)	EA	5		
61	TxDOT 465 6011	JCTBOX(COMPL)(PJB)(6FTX6FT)	EA	1		
62	TxDOT 465 6012	JCTBOX(COMPL)(PJB)(7FTX7FT)	EA	9		
63	TxDOT 465 6175	INLET (COMPL)(TY C)(5-FT)	EA	2		
64	TxDOT 465 6175	INLET (COMPL)(TY C)(10-FT)	EA	20		
65	TxDOT 466 6152	WINGWALL (FW-0) (HW=5)	EA	1		
66	TxDOT 467 6362	SAFETY END TREATMENT (TY II)(18-IN)(RCP)(6:1)(C)	EA	14		
67	TxDOT 467 6379	SAFETY END TREATMENT (TY II)(24-IN)(RCP)(6:1)(C)	EA	4		
68	TxDOT 476 6023	JACK BOR OR TUN PIPE (30 IN) (STL CASING)	LF	48		
69	TxDOT 481 6016	PIPE (PVC) (SCH 40) (12 IN)	LF	94		
70	TxDOT 496 6006	REMOV STR (HEADWALL)	EA	3		
71	TxDOT 496 6007	REMOV STR (PIPE)	LF	60		
72	TxDOT 500 2001	WARRANTY BOND (5%)	LS	1		
73	TxDOT 500 6001	MOBILIZATION	LS	1		
74	TxDOT 502 6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	23		
75	TxDOT 506 6001	ROCK FILTER DAMS (INSTALL) (TY 1)	LF	732		
76	TxDOT 506 6011	ROCK FILTER DAMS (INSTALL) (REMOVE)	LF	732		
77	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	6,254		
78	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INLET PROTECTION)	LF	682		
79	TxDOT 506 6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	6,936		
80	TxDOT 512 6009	PORT CTB (FUR & INST)(LOW PROF)(TY 1)	LF	20		
81	TxDOT 512 6010	PORT CTB (FUR & INST)(LOW PROF)(TY 2)	LF	160		

City of Kyle  
N. Burleson Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
82	TxDOT 512 6057	PORT CTB (REMOVE)(LOW PROF)(TY 1)	LF	20		
83	TxDOT 512 6058	PORT CTB (REMOVE)(LOW PROF)(TY 2)	LF	160		
84	TxDOT 528 6004	LANDSCAPE PAVERS	SY	64		
85	TxDOT 529 6008	CONC CURB & GUTTER (TY II)	LF	10,410		
86	TxDOT 529 6021	CONC CURB & GUTTER (SAWTOOTH)	LF	208		
87	TxDOT 530 6004	DRIVEWAYS (CONC)	SY	1,074		
88	TxDOT 531 6003	CONC SIDEWALKS (6")	SY	2,645		
89	TxDOT 531 6003	CONC SIDEWALKS (RAISED SIDEWALK)	SY	16		
90	TxDOT 531 6004	CURB RAMPS (TY 1)	EA	10		
91	TxDOT 531 6010	CURB RAMPS (TY 7)	EA	31		
92	TxDOT 531 6013	CURB RAMPS (TY 10)	EA	4		
93	TxDOT 560 6001	MAILBOX INSTALL-S (TWG-POST) TY 1	EA	1		
94	TxDOT 560 6001	MAILBOX INSTALL-S (SPECIAL - BRICK)	EA	1		
95	TxDOT 644 6001	IN SM RD SN SUP&AM TY10BWG (1) SA (P)	EA	32		
96	TxDOT 644 6004	IN SM RD SN SUP&AM TY10BWG (1) SA (T)	EA	2		
97	TxDOT 666 6011	REFL PAV MRK TY I (W) 4" (SLD) (090MIL)	LF	2,238		
98	TxDOT 666 6035	REFL PAV MRK TY I (W) 8" (SLD) (090MIL)	LF	166		
99	TxDOT 666 6047	REFL PAV MRK TY I (W) 24" (SLD) (090MIL)	LF	331		
100	TxDOT 666 6053	REFL PAV MRK TY I (W) (ARROW) (090MIL)	EA	4		
101	TxDOT 666 6092	REFL PAV MRK TY I (RR XING) (090MIL)	EA	2		
102	TxDOT 666 6111	REFL PAV MRK TY I (W) (BIKE SYML) (090MIL)	EA	1		
103	TxDOT 666 6125	REFL PAV MRK TY I (Y) 4" (BRK) (090MIL)	LF	1,721		
104	TxDOT 666 6128	REFL PAV MRK TY I (Y) 4" (SLD) (090MIL)	LF	11,064		
105	TxDOT 666 6166	RE PM TY I (ACC PRK) (WHT) (SYMBOL ONLY)	EA	3		
106	TxDOT 666 6170	REF PAV MRK TY II (W) 4" (SLD)	LF	865		
107	TxDOT 666 6178	REF PAV MRK TY II (W) 8" (SLD)	LF	100		
108	TxDOT 666 6182	REF PAV MRK TY II (W) 24" (SLD)	LF	331		
109	TxDOT 666 6184	REF PAV MRK TY II (W) (ARROW)	EA	4		
110	TxDOT 666 6196	REF PAV MRK TY II (W) (RR XING)	EA	2		
111	TxDOT 666 6205	REF PAV MRK TY II (Y) 4" (BRK)	LF	1,721		
112	TxDOT 666 6207	REF PAV MRK TY II (Y) 4" (SLD)	LF	11,064		
113	TxDOT 666 6220	RE PM TY II (ACC PRK) (BL&WH) (W/BORDR)LG	EA	3		
114	TxDOT 672 6007	REFL PAV MRKR TY I-C	EA	12		
115	TxDOT 672 6009	REFL PAV MRKR TY II-A-A	EA	363		
116	TxDOT 6001 6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	500		
117	TxDOT 6120 6001	DEAD END ROADWAY BARRICADE	LF	40		
118	TxDOT 7156 6001	CASING PIPE (BORE) (30" STEEL)	LF	48		
119	SS 6789	GEOGRID REINFORCEMENT (MSAL)	SY	25,325		
120		RR CROSSING GATES & CROSSING SURFACE	LS	1		
121	26 56 00	TYPE "S1" POLE/FIXTURE	EA	62		
122	TxDOT 610 6032	TYPE "S2" POLE/FIXTURE (MATCH EXISTING)	EA	1		

City of Kyle  
N. Burleson Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
123	26 56 00	2" CONDUIT, TRENCH & BACKFILL	LF	6,429		
124	26 56 00	ELECTRIC SERVICE & METER	EA	1		
125	26 05 19	2#6 XHHW	LF	12,438		
126	26 05 19	1#8 GRD XHHW	LF	6,219		
127	26 05 33	PULLBOX, CONCRETE W/ HINGED COVER	EA	8		
128	26 05 26	SPlicing AND TERMINATING NEW AND EXISTING CIRCUITS	EA	1		
129	26 56 00	120/240V SERVICE POLE DEMO WORK	EA	1		
130	COA 402S-A	FLOWABLE FILL ENCASEMENT	LF	72		
131	COA 437S-B	TREE GRATE AND FRAME	EA	4		
132	COA 505S-A	CONCRETE ENCASEMENT	LF	343		
133	COA 505S-B	16" STEEL CASING BY OPEN CUT	LF	28		
134	COA 501S	16" STEEL CASING BY BORE	LF	80		
135	COA 501S	24" STEEL CASING BY BORE	LF	288		
136	COA 506S MWW	MANHOLE (4' DIAMETER)	EA	14		
137	COA 506S DWW	DROP MANHOLE (4' DIAMETER)	EA	7		
138	COA 506S EDM	EXTRA DEPTH FOR MANHOLE (4' DIAMETER)	VF	44		
139	COA 506S AB	ABANDON EXISTING MANHOLE	EA	5		
140	COA 506	REMOVE EXISTING MANHOLE	EA	5		
141	COA 506	CONNECTION TO EXISTING MANHOLE	EA	1		
142	COA 506	STRUCTURAL LINING OF MANHOLE	VF	8		
143	COA 508S-5S	INLET, STANDARD (5 FT)	EA	8		
144	COA 508S-10S	INLET, STANDARD (10 FT)	EA	7		
145	COA 508S-20S	INLET, STANDARD (20 FT)	EA	3		
146	COA 508S-A	AREA INLET, STANDARD 4 FT X 4 FT	EA	1		
147	COA 509S-1	TRENCH SAFETY	LF	11,464		
148	COA 510-AWW	6" PVC WASTEWATER LINE (SDR-26)	LF	214		
149	COA 510-AWW	8" PVC WASTEWATER LINE (SDR-26)	LF	3,268		
150	COA 510-AWW	8" PVC PRESSURE RATED WASTEWATER LINE (DR-25)	LF	457		
151	COA 510-AWW	12" PVC WASTEWATER LINE (SDR-26)	LF	139		
152	COA 510-AWW	12" PVC PRESSURE RATED WASTEWATER LINE (DR-25)	LF	339		
153	COA 510	NEW SERVICE & CLEANOUT	EA	8		
154	COA 510	CUT/PLUG EXISTING WASTEWATER LINE	EA	6		
155	COA 511	CONNECT TO EXISTING WASTEWATER LINE	EA	9		
156	COA 510-AWRJ	2" PVC WATERLINE (SCH. 80) & FITTINGS	LF	83		
157	COA 510-AWRJ	4" PVC WATERLINE (AWWA C-900, DR-14) & FITTINGS	LF	45		
158	COA 510-AWRJ	6" PVC WATERLINE (AWWA C-900, DR-14) & FITTINGS	LF	285		
159	COA 510-AWRJ	6" DI WATER LINE (AWWA C-100, MIN CLASS 150) & FITTINGS	LF	216		
160	COA 510-AWRJ	8" PVC WATERLINE (AWWA C-900, DR-14) & FITTINGS	LF	1,273		
161	COA 510-AWRJ	12" PVC WATERLINE (AWWA C-900, DR-14) & FITTINGS	LF	5,371		
162	COA 510-AWRJ	12" DI WATER LINE (AWWA C-100, MIN CLASS 150) & FITTINGS	LF	142		
163	COA 510	CUT/PLUG EXISTING WATER LINE	EA	28		

City of Kyle  
N. Burlison Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
164	COA 510-IR	RELOCATE EXISTING SERVICE LINE	EA	15		
165	COA 511S-A	6" GATE VALVE	EA	5		
166	COA 511S-A	8" GATE VALVE	EA	27		
167	COA 511S-A	12" GATE VALVE	EA	34		
168	COA 511S-B	FIRE HYDRANT ASSEMBLY WITH 6" GATE VALVE	EA	15		
169	COA 511S-F	1" COMBINATION AIR VALVE	EA	2		
170	COA 551	PIPE UNDERDRAIN, 6" DIA, PERF PVC	LF	185		
171	COA 620S	FILTER FABRIC	SY	20		
172	COA 660S	BIOFILTRATION MEDIUM	CY	170		
173	SP 551S-A	RAIN GARDEN DRAINAGE STONE	SY	230		
174	SP 551S-A	DRAINAGE STONE (6" DEPTH) (TREE WELLS)	SY	7		
175	SP 551S-B	RAIN GARDEN OVERFLOW STRUCTURE	EA	4		
176	SP 591S	SPLASH PAD ROCK, 3-5 IN DIA	SY	11		
177	SS 02263	PERMANENT TURF REINFORCEMENT MATTING	SY	1,150		
178	SS 02267	HDPE GEOMEMBRANE	SY	93		
179		3'x3'x3' LIMESTONE BOULDERS	EA	3		
180	32 84 23	IRRIGATION SYSTEM	LS	1		
<b>TOTAL BASE BID AMOUNT</b>						

**BID ALTERNATE "1"**

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
1	TxDOT 100 6002	PREPARING ROW	STA	9		
2	TxDOT 110 6002	EXCAVATION (CHANNEL)	CY	84		
3	TxDOT 132 6005	EMBANKMENT (FINAL) (ORD COMP) (TY C)	CY	4,316		
4	TxDOT 160 6003	FURNISHING AND PLACING TOPSOIL (4")	SY	2,038		
5	TxDOT 164 6027	CELL FBR MLCH SEED (PERM) (URBAN) (CLAY)	SY	2,038		
6	TxDOT 166 6002	FERTILIZER	TON	0.42		
7	TxDOT 168 6001	VEGETATIVE WATERING	MG	12		
8	TxDOT 341 6008	D-GR HMA TY-B PG64-22 (8")	TON	1,990		
9	TxDOT 341 6030	D-GR HMA TY-C SAC-B PG76-22 (3")	TON	606		
10	TxDOT 400 6002	STRUCTURAL EXCAVATION	CY	1,224		
11	TxDOT 462 6003	CONC BOX CULV (4 FT X 2 FT)	LF	507		
12	TxDOT 464 6003	RC PIPE (CL III) (18 IN)	LF	375		
13	TxDOT 464 6017	RC PIPE (CL IV) (18 IN)	LF	43		
14	TxDOT 465 6003	MANH (COMPL)(PRM)(60IN)	EA	1		
15	TxDOT 465 6006	JCTBOX(COMPL)(PJB)(4FTX4FT)	EA	1		
16	TxDOT 465 6011	JCTBOX(COMPL)(PJB)(6FTX6FT)	EA	1		
17	TxDOT 466 6179	WINGWALL (PW-1)(HW=4 FT)	EA	1		
18	TxDOT 466 6151	WINGWALL (FW-0)(HW=4 FT)	EA	2		
19	TxDOT 500 6001	MOBILIZATION	LS	1		

City of Kyle  
N. Burleson Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
20	TxDOT 502 6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	2		
21	TxDOT 506 6001	ROCK FILTER DAMS (INSTALL) (TY 1)	LF	25		
22	TxDOT 506 6011	ROCK FILTER DAMS (INSTALL) (REMOVE)	LF	25		
23	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	751		
24	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INLET PROTECTION)	LF	30		
25	TxDOT 506 6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	781		
26	TxDOT 529 6008	CONC CURB & GUTTER (TY II)	LF	1,822		
27	TxDOT 531 6003	CONC SIDEWALKS (6")	SY	747		
28	TxDOT 531 6004	CURB RAMPS (TY 1)	EA	2		
29	TxDOT 531 6010	CURB RAMPS (TY 7)	EA	2		
30	TxDOT 550 6020	CHAIN LINK FENCE (INSTALL) (4')	LF	120		
31	TxDOT 644 6001	IN SM RD SN SUP&AM TY10BWG (1) SA (P)	EA	7		
32	TxDOT 644 6004	IN SM RD SN SUP&AM TY10BWG (1) SA (T)	EA	3		
33	TxDOT 666 6125	REFL PAV MRK TY I (Y) 4" (BRK) (090MIL)	LF	364		
34	TxDOT 666 6128	REFL PAV MRK TY I (Y) 4" (SLD) (090MIL)	LF	1,635		
35	TxDOT 666 6205	REF PAV MRK TY II (Y) 4" (BRK)	LF	364		
36	TxDOT 666 6207	REF PAV MRK TY II (Y) 4" (SLD)	LF	1,635		
37	TxDOT 672 6009	REFL PAV MRKR TY II-A-A	EA	36		
38	COA 505S-B	24" STEEL CASING BY OPEN CUT	LF	70		
39	COA 508S-10S	INLET, STANDARD (10 FT)	EA	3		
<b>TOTAL BID ALTERNATE "1" AMOUNT</b>						

**BID ALTERNATE "2"**

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
1	TxDOT 100 6002	PREPARING ROW	STA	9		
2	TxDOT 110 6002	EXCAVATION (CHANNEL)	CY	84		
3	TxDOT 132 6005	EMBANKMENT (FINAL) (ORD COMP) (TY C)	CY	4,316		
4	TxDOT 160 6003	FURNISHING AND PLACING TOPSOIL (4")	SY	2,038		
5	TxDOT 164 6027	CELL FBR MLCH SEED (PERM) (URBAN) (CLAY)	SY	2,038		
6	TxDOT 166 6002	FERTILIZER	TON	0.42		
7	TxDOT 168 6001	VEGETATIVE WATERING	MG	12		
8	TxDOT 247 6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS) (16")	CY	1,923		
9	TxDOT 310 6005	PRIME COAT (AE-P)(0.20 GAL/SY)	GAL	866		
10	TxDOT 341 6028	D-GR HMA TY-C PG70-22 (5.5")	TON	1,111		
11	TxDOT 400 6002	STRUCTURAL EXCAVATION	CY	1,224		
12	TxDOT 462 6003	CONC BOX CULV (4 FT X 2 FT)	LF	507		
13	TxDOT 464 6003	RC PIPE (CL III) (18 IN)	LF	375		
14	TxDOT 464 6017	RC PIPE (CL IV) (18 IN)	LF	43		
15	TxDOT 465 6003	MANH (COMPL)(PRM)(60IN)	EA	1		
16	TxDOT 465 6006	JCTBOX(COMPL)(PJB)(4FTX4FT)	EA	1		

City of Kyle  
N. Burleson Street Improvements  
Basis of Bid

Item No.	Spec Item	Description	Unit	Estimated Quantity	Unit Price	Extended Amount
17	TxDOT 465 6011	JCTBOX(COMPL)(PJB)(6FTX6FT)	EA	1		
18	TxDOT 466 6179	WINGWALL (PW-1)(HW=4 FT)	EA	1		
19	TXDOT 466 6151	WINGWALL (FW-0)(HW=4 FT)	EA	2		
20	TxDOT 500 6001	MOBILIZATION	LS	1		
21	TxDOT 502 6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	2		
22	TxDOT 506 6001	ROCK FILTER DAMS (INSTALL) (TY 1)	LF	25		
23	TxDOT 506 6011	ROCK FILTER DAMS (INSTALL) (REMOVE)	LF	25		
24	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	751		
25	TxDOT 506 6038	TEMP SEDMT CONT FENCE (INLET PROTECTION)	LF	30		
26	TxDOT 506 6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	781		
27	TxDOT 529 6008	CONC CURB & GUTTER (TY II)	LF	1,822		
28	TxDOT 531 6003	CONC SIDEWALKS (6")	SY	747		
29	TxDOT 531 6004	CURB RAMPS (TY 1)	EA	2		
30	TxDOT 531 6010	CURB RAMPS (TY 7)	EA	2		
31	TxDOT 550 6020	CHAIN LINK FENCE (INSTALL) (4')	LF	120		
32	TxDOT 644 6001	IN SM RD SN SUP&AM TY10BWG (1) SA (P)	EA	7		
33	TxDOT 644 6004	IN SM RD SN SUP&AM TY10BWG (1) SA (T)	EA	3		
34	TxDOT 666 6125	REFL PAV MRK TY I (Y) 4" (BRK) (090MIL)	LF	364		
35	TxDOT 666 6128	REFL PAV MRK TY I (Y) 4" (SLD) (090MIL)	LF	1,635		
36	TxDOT 666 6205	REF PAV MRK TY II (Y) 4" (BRK)	LF	364		
37	TxDOT 666 6207	REF PAV MRK TY II (Y) 4" (SLD)	LF	1,635		
38	TxDOT 672 6009	REFL PAV MRKR TY II-A-A	EA	36		
39	COA 505S-B	24" STEEL CASING BY OPEN CUT	LF	70		
40	COA 508S-10S	INLET, STANDARD (10 FT)	EA	3		
<b>TOTAL BID ALTERNATE "2" AMOUNT</b>						

		<b>TOTAL BASE BID AMOUNT</b>	
		<b>TOTAL AMOUNT BID (BASE BID + BID ALTERNATE "1")</b>	
		<b>TOTAL AMOUNT BID (BASE BID + BID ALTERNATE "2")</b>	

**BID BOND**

THE STATE OF TEXAS §

COUNTY OF HAYS §

KNOW ALL BY THESE PRESENTS:

That \_\_\_\_\_ of the City of \_\_\_\_\_  
County of \_\_\_\_\_ State of \_\_\_\_\_ as Principal, and  
\_\_\_\_\_ authorized under the laws of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto the **CITY OF KYLE, TEXAS ("Owner")**, in the penal sum of five percent (5%) of the total amount of the Bid of the Principal submitted to the Owner, for the Work described below; for the payment whereof, well and truly to be made, and the said Principal and Surety do hereby bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, as follows:

In no case shall the liability of the Surety hereunder exceed the sum of Dollars (\$ \_\_\_\_\_ Dollars (\$ \_\_\_\_\_)).

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that, whereas, the Principal has submitted the above-referenced Bid to the Owner, for construction of the Work under the "Specifications for Construction of **"N. Burleson Street Improvements"**" for which Bids are to be opened at the office of Owner on the **2<sup>nd</sup> day of July, 2018.**

NOW, THEREFORE, if the Principal is awarded the Contract, and within the time and manner required under -the "Instructions to Bidders," after the prescribed forms are presented to her/him for signature, enters into a written Agreement substantially in the form contained in the Specifications, in accordance with the Bid, and files the two (2) bonds with the Owner, one to guarantee faithful performance and the other to guarantee payment for labor and materials, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect.

In the event that suit is brought upon this Bond by the Owner and judgment is recovered, said Surety shall pay all costs incurred by the Owner in such suit, including a reasonable attorney's fee to be fixed by the Court.

IN WITNESS WHEREOF, the said Principal and Surety have signed this instrument on this the \_\_\_\_\_ day of the month of \_\_\_\_\_ 201\_.

\_\_\_\_\_  
Principal  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Surety  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

Resident Agent of Surety:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City, State, Zip



# AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

THIS AGREEMENT is by and between \_\_\_\_\_ City of Kyle, Texas \_\_\_\_\_ (“Owner”) and  
\_\_\_\_\_  
\_\_\_\_\_ (“Contractor”).

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

## ARTICLE 1 – WORK

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

Reconstruction of N. Burleson Street as a 38-foot wide roadway, a new 38-foot wide roadway connecting N. Burleson Street to the IH 35 Southbound Frontage Road, storm drain, detention pond improvements, waterline replacement, sanitary sewer replacement and extension, illumination, grading, pavement improvements, curb and gutter, pedestrian improvements and signing and marking for approximately 7,500 linear feet of roadway and all Extra Work in connection therewith, under the terms as stated in the “Standard General Conditions of the Construction Contract.” At its own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendents,, labor, insurance and other accessories and services necessary to complete the said construction, in accordance with the conditions and prices stated in the “Bid Form” attached hereto, and in accordance with the plans, which includes all maps, plats, blue prints and other drawings and printed explanatory matter thereof, and the specifications thereof (“Plans and Specifications”), as prepared by:

**Freese and Nichols, Inc.  
10431 Morado Circle  
Building 5, Suite 300  
Austin, Texas 78759**

Herein titled the Engineer, each of which has been identified by the endorsement of the Contractor and the Engineer, thereon, together with the Contractor’s written proposal, the Supplementary Conditions, the Standard General Conditions of the Construction Contracts, the Performance and Payment Bonds hereto attached, and the technical specifications, all of which are made a part hereof and collectively evidence and constitute the entire contract.

1.02 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

N. Burleson Street Improvements

## ARTICLE 2 – ENGINEER

2.01 The Project has been designed by Freese and Nichols, Inc. (Engineer).

## ARTICLE 3 – CONTRACT TIMES

3.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract. The Contractor hereby agrees to commence

the Work upon receipt of written Notice to Proceed from the Owner, and to complete the work with the time deadlines described in Paragraph 4.02 of this section.

4.02 *Days to Achieve Substantial Completion and Final Payment*

- A. The Work will be substantially completed and placed in service in accordance with Paragraph 14.04 of the General Conditions within 545 calendar days after the date when the Contract Times commence to run.
- B. The Work will be finally completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 605 calendar days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner \$500.00 for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner \$500.00 for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

**ARTICLE 5 – CONTRACT PRICE**

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A, 5.01.B, and 5.01.C below:

- A. For all Work, at the prices stated in Contractor’s Bid, attached hereto as an exhibit.

**ARTICLE 6 – PAYMENT PROCEDURES**

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer/Owner as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make monthly progress payments on account of the Contract Price on the basis of Contractor’s Applications for Payment submitted on or about 5 business days before the end of each month during performance of the Work as provided in Paragraphs 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

- 1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:
  - a. 95 percent of Work completed (with the balance being retainage).

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

**ARTICLE 7 – NOT USED**

**ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS**

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions.
- E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.
- F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

## ARTICLE 9 – CONTRACT DOCUMENTS

### 9.01 *Contents*

- A. The Contract Documents consist of the following:
1. This Agreement
  2. Performance bond
  3. Payment bond
  4. Bid bond
  5. General Conditions
  6. Supplementary Conditions
  7. Specifications as listed in the table of contents of the Project Manual.
  8. Drawings consisting of 274 sheets with each sheet bearing the following general title: N. Burleson St. Improvements.
  9. Addenda
  10. Exhibits to this Agreement (enumerated as follows):
    - a. Contractor’s Bid
    - b. Documentation submitted by Contractor prior to Notice of Award
  11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    - a. Notice to Proceed
    - b. Work Change Directives
    - c. Change Order(s)
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

## ARTICLE 10 – MISCELLANEOUS

### 10.01 *Terms*

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

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

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

This Agreement will be effective on \_\_\_\_\_ (which is the Effective Date of the Agreement).

OWNER:

CONTRACTOR

City of Kyle, Texas \_\_\_\_\_

\_\_\_\_\_

By: Travis Mitchell \_\_\_\_\_

By: \_\_\_\_\_

Title: Mayor \_\_\_\_\_

Title: \_\_\_\_\_

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address for giving notices:

Address for giving notices:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

License No.: \_\_\_\_\_  
(Where applicable)

Agent for service of process:

\_\_\_\_\_

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

# CERTIFICATE OF INTERESTED PARTIES

# FORM 1295

### OFFICE USE ONLY

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

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

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

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

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

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

**6 AFFIDAVIT** I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

\_\_\_\_\_  
 Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said \_\_\_\_\_, this the \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_, to certify which, witness my hand and seal of office.

\_\_\_\_\_  
 Signature of officer administering oath      Printed name of officer administering oath      Title of officer administering oath

**ADD ADDITIONAL PAGES AS NECESSARY**

**PERFORMANCE BOND**

**THE STATE OF TEXAS                    §                    BOND NO.**

**COUNTY OF \_\_\_\_\_ §**

KNOW ALL BY THESE PRESENTS, THAT :

\_\_\_\_\_ of the City of \_\_\_\_\_, County of \_\_\_\_\_, and State of \_\_\_\_\_, as PRINCIPAL, and \_\_\_\_\_, a corporation organized and existing under the laws of \_\_\_\_\_ and authorized under the laws of the State of Texas to act as SURETY on bonds for PRINCIPALS, are held and firmly bound unto the \_\_\_\_\_ (OWNER), in the penal sum of Dollars (\$ \_\_\_\_\_) for the payment whereof, the said PRINCIPAL and SURETY bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, the PRINCIPAL has entered into a certain written Contract with the OWNER, dated the \_\_\_\_ day of \_\_\_\_\_, 201\_\_ to which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that if the said PRINCIPAL shall faithfully perform the work in accordance with the plans, specifications and under said Contract and shall in all respects duly and faithfully observe and perform all and singular the covenants, conditions and agreements in and by said Contract agreed and covenanted by the PRINCIPAL to be observed and performed, and according to the true intent and meaning of said Contract and the Plans and Specifications thereto annexed, and shall fully indemnify and save the OWNER harmless from any loss, cost or damage by reason of PRINCIPAL's failure to complete the work then this obligation shall be void; otherwise to remain in full force and effect;

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

In the event that the OWNER declares the PRINCIPAL in default under the Contract, the Surety will, within fifteen days of the OWNER'S declaration of such default, at OWNER'S election either: 1) take over and assume completion of said Contract and shall faithfully construct and complete said Contract in a good and workmanlike manner in accordance with the original schedule for completion, the approved Plans and Specifications, or 2) allow OWNER to draw on any part or all of the total amount of this bond by submitting a written request for a draw from the OWNER'S Public Works Director or designee to SURETY'S Attorney-in fact. Conditioned upon the Surety's faithful performance of its obligation, the liability of the Surety for the Principal's default shall not exceed the penalty of this bond.



The Surety agrees to pay the OWNER upon demand all loss and expense, including attorneys' fees, incurred by the OWNER by reason of or on account of any breach of this obligation by the Surety. Provided further, that in any legal action be filed upon this bond, venue shall lie in the county where the work is to be constructed.

This Bond is a continuing obligation and shall remain in full force and effect until cancelled as provided for herein. This Bond may be cancelled upon Surety's receipt of written notice of cancellation by the OWNER stating that the Contract has been completed and accepted by OWNER.

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

IN WITNESS WHEREOF, the said PRINCIPAL and SURETY have signed and sealed this instrument this \_\_\_\_ day of \_\_\_\_\_, 201\_.

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety

By \_\_\_\_\_  
Title \_\_\_\_\_  
Address \_\_\_\_\_

By \_\_\_\_\_  
Title \_\_\_\_\_  
Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

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

(Seal)

## PAYMENT BOND

Bond No. \_\_\_\_\_

Premium \$ \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ (Contractor), City of \_\_\_\_\_, County of \_\_\_\_\_, and State of \_\_\_\_\_, hereinafter referred to as the Principal, and \_\_\_\_\_ a corporation organized and existing under the laws of \_\_\_\_\_ and authorized under the laws of the State of Texas to act as Surety on bonds for Principal, are held and firmly bound unto City \_\_\_\_\_, Texas as Obligee, in the penal sum of \_\_\_\_\_ (\$ \_\_\_\_\_) DOLLARS, lawful money of the United States of America, for the payment of which well and truly to be made, the said Principals and Surety bind themselves, and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the PRINCIPAL has entered into a certain written Contract with the OWNER for the following project: \_\_\_\_\_, dated the \_\_\_\_ day of \_\_\_\_\_, 201\_\_ to which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that if the said Principals shall pay all claimants supplying labor and material to him or a subcontractor in the prosecution of the project, then this obligation shall be void; otherwise to remain in full force and effect.

In the event that either Principal fails to promptly pay when due persons who have supplied labor, materials, or supplies used in the prosecution of the project, the Surety will, upon receipt of notice from the Obligee or a claim in the form required by law, satisfy all undisputed balances due, and make arrangements satisfactory to the interested parties to resolve all amounts disputed in good faith, but in no event shall the liability for the Surety for the Principal's failure to promptly pay for labor, materials, or supplies exceed the penalty of this bond.

The Surety agrees to pay the Obligee upon demand all loss and expense, including attorneys' fees, incurred by the Obligee by reason of or on account of any breach of this obligation by the Surety. Provided further, that in any legal action be filed upon this bond, venue shall lie in the county where the project is to be constructed.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Texas Government Code Chapter 2253 as amended and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein. This bond is made and entered for the protection of all claimants supplying labor and material in the prosecution of the project, and all such claimants shall have a direct right of action under the bond as provided in Section 2253.021, Texas Government Code, as amended. If any

legal action is filed upon this bond, venue shall be in the county where the said project is to be constructed.

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

IN WITNESS WHEREOF, the said PRINCIPAL and SURETY have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 201\_.

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety

By \_\_\_\_\_

By \_\_\_\_\_

Name \_\_\_\_\_

Name \_\_\_\_\_

\_\_\_\_\_  
Title \_\_\_\_\_

\_\_\_\_\_  
Title \_\_\_\_\_

Address \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Seal)



**SECTION 00630 – WARRANTY BOND**

KNOW ALL MEN BY THESE PRESENTS: That we, \_\_\_\_\_ as Principal, and \_\_\_\_\_, a Corporation duly organized under the laws of the State of \_\_\_\_\_ and duly licensed to transact business in the State of \_\_\_\_\_ as Surety, are held and firmly bound unto City of Kyle as Owner and Obligee, in the sum of \_\_\_\_\_ (\$ \_\_\_\_\_). For the payment of which sum well and truly to be made, we, the said Principal and the said Surety, bind ourselves, out heirs, executors, administrators, successors and assigns, jointly and severally, firmly, by these presents.

Executed and dated this \_\_\_\_\_ day of \_\_\_\_\_, 2018

WHEREAS, the said Principal has submitted a Bid to the Owner dated \_\_\_\_\_, 2018 (the “Bid”) and has been selected as the Contractor for the construction of \_\_\_\_\_ as described in the Contract Documents (the “Project”);

WHEREAS, the Principal shall provide warranties directly to the Owner as set forth in the Contract Documents, and has consented to provide this Bond which shall cover any defect in materials or workmanship provided or performed pursuant to the Contract Documents, for a period of one (1) year following substantial completion of the Project.

NOW, THEREFORE, THE CONDITIONS OF THE OBLIGATION ARE SUCH, that if said Principal shall faithfully repair or replace any defect in the materials or workmanship free of charge to Owner which may develop or occur during the one (1) year period following date of substantial completion of the Project by Owner and subject to the limits and liabilities and other terms and conditions set forth in the Contract Documents, then this obligation shall be null and void; otherwise this obligation shall remain in full force and effect.

PROVIDED AND SUBJECT TO THE CONDITIONS PRECEDENT:

1. Obligee shall provide both Principal and Surety with written notice of the discovery (“Notice of Discovery”) of any item of warranty obligation which arises during the covered period (a “Covered Item”). Should Principal improperly fail to remedy the Covered Item, then Obligee shall make a written demand upon the Surety ("Demand") within ninety (90) days of the

Obligee's issuance of the Notice of Discovery of the Covered Item. The Notice of Discovery and the Demand shall be in writing and via certified mail to the Principal and the Surety.

2. Any and all claims made under this Bond shall be subject to the limits and liabilities and other terms and conditions as set forth in the Contract Documents, which terms are incorporated herein by reference.

\_\_\_\_\_  
Principal

By \_\_\_\_\_  
Title \_\_\_\_\_  
Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Surety

By \_\_\_\_\_  
Title \_\_\_\_\_  
Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Owner:

By \_\_\_\_\_  
Title \_\_\_\_\_  
Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

By The name and address of the Resident Agency of the Surety is:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

A copy of the Surety Agent's Power of Attorney must be attached.

# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

**ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE**

and

Issued and Published Jointly by



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## ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

### 1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda* - Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  2. *Agreement* - The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
  3. *Application for Payment* - The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
  4. *Asbestos* - Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
  5. *Bid* - The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  6. *Bidder* - The individual or entity who submits a Bid directly to Owner.
  7. *Bidding Documents* - The Bidding Requirements and the proposed Contract Documents (including all Addenda).
  8. *Bidding Requirements* - The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
  9. *Change Order* - A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
  10. *Claim* - A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
  11. *Contract* - The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents* - Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
13. *Contract Price* - The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
14. *Contract Times* - The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
15. *Contractor* - The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work* - See Paragraph 11.01 for definition.
17. *Drawings* - That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
18. *Effective Date of the Agreement* - The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
19. *Engineer* - The individual or entity named as such in the Agreement.
20. *Field Order* - A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. *General Requirements* - Sections of Division 1 of the Specifications.
22. *Hazardous Environmental Condition* - The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
23. *Hazardous Waste* - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. *Laws and Regulations; Laws or Regulations* - Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens* - Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. *Milestone* - A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
27. *Notice of Award* - The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. *Notice to Proceed* - A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. *Owner* - The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. *PCBs* - Polychlorinated biphenyls.
31. *Petroleum* - Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. *Progress Schedule* - A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. *Project* - The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. *Project Manual* - The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. *Radioactive Material* - Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. *Resident Project Representative* - The authorized representative of Engineer who may be assigned to the Site or any part thereof.
37. *Samples* - Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
38. *Schedule of Submittals* - A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values* - A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
40. *Shop Drawings* - All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
41. *Site* - Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
42. *Specifications* - That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
43. *Subcontractor* - An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
44. *Substantial Completion* - The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
45. *Successful Bidder* - The Bidder submitting a responsive Bid to whom Owner makes an award.
46. *Supplementary Conditions* - That part of the Contract Documents which amends or supplements these General Conditions.
47. *Supplier* - A manufacturer, fabricator, supplier, distributor, materialman, or Supplier having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
48. *Underground Facilities* - All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work* - Work to be paid for on the basis of unit prices.
50. *Work* - The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce



such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive* - A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

## 1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:

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

- c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

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

## **ARTICLE 2 – PRELIMINARY MATTERS**

### *2.01 Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

### *2.02 Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

### *2.03 Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the

Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

#### 2.04 *Starting the Work*

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

#### 2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
  - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
  - 2. a preliminary Schedule of Submittals; and
  - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

#### 2.06 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

#### 2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

### **ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

#### **3.01 *Intent***

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

#### **3.02 *Reference Standards***

- A. Standards, Specifications, Codes, Laws, and Regulations
  1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
  2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

### 3.03 *Reporting and Resolving Discrepancies*

#### A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

#### B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
  - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
  - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

### 3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
  1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

### 3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
  1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
  2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

### 3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

## **ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS**

### 4.01 *Availability of Lands*

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

comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

#### 4.02 *Subsurface and Physical Conditions*

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

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

#### 4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
  - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
  - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
  - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
  - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
  - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer,



or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

#### 4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
  - a. reviewing and checking all such information and data;
  - b. locating all Underground Facilities shown or indicated in the Contract Documents;
  - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
  - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with

reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

#### 4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

#### 4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
  - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
  - 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
  - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall

immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate

Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

## **ARTICLE 5 – BONDS AND INSURANCE**

### *5.01 Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

### *5.02 Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

### *5.03 Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
  - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
  - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
  - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
    - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
    - b. by any other person for any other reason;
  - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
  - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
6. include completed operations coverage:
  - a. Such insurance shall remain in effect for two years after final payment.
  - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

#### 5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

#### 5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
  2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
  3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
  4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
  5. allow for partial utilization of the Work by Owner;
  6. include testing and startup; and
  7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

- E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

#### 5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:
  - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
  - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.



5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

## ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

### 6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

### 6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

### 6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

#### 6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
  2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

#### 6.05 *Substitutes and "Or-Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that:
      - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
      - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
      - 3) it has a proven record of performance and availability of responsive service.
    - b. Contractor certifies that, if approved and incorporated into the Work:
      - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
      - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
  - 1) shall certify that the proposed substitute item will:
    - a) perform adequately the functions and achieve the results called for by the general design,
    - b) be similar in substance to that specified, and
    - c) be suited to the same use as that specified;
  - 2) will state:
    - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
    - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
    - c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
  - 3) will identify:
    - a) all variations of the proposed substitute item from that specified, and
    - b) available engineering, sales, maintenance, repair, and replacement services; and
  - 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

#### 6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or

entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
  - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
  - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

#### 6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its

use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

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

#### 6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

#### 6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner

and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

#### 6.10 *Taxes*

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

#### 6.11 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

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

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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



## 6.12 *Record Documents*

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

## 6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
  - 1. all persons on the Site or who may be affected by the Work;
  - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
  - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts

any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

#### 6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 6.15 *Hazard Communication Programs*

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

#### 6.16 *Emergencies*

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

#### 6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

- 1. *Shop Drawings:*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

- 2. *Samples:*

- a. Submit number of Samples specified in the Specifications.

- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

- 1. Before submitting each Shop Drawing or Sample, Contractor shall have:
  - a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
  - c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
- 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

- 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method,

technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
  2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;
3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
4. use or occupancy of the Work or any part thereof by Owner;
5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
6. any inspection, test, or approval by others; or
7. any correction of defective Work by Owner.

## 6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
  1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

## 6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

## **ARTICLE 7 – OTHER WORK AT THE SITE**

### 7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
  - 1. written notice thereof will be given to Contractor prior to starting any such other work; and
  - 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

#### 7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
  - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
  - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
  - 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

#### 7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

## ARTICLE 8 – OWNER’S RESPONSIBILITIES

### 8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

### 8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

### 8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

### 8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

### 8.05 *Lands and Easements; Reports and Tests*

A. Owner’s duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

### 8.06 *Insurance*

A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

### 8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

### 8.08 *Inspections, Tests, and Approvals*

A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

### 8.09 *Limitations on Owner’s Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws



and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

**ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION**

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations

on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of,

and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

#### 9.10 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

### **ARTICLE 10 – CHANGES IN THE WORK; CLAIMS**

#### 10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

#### 10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

#### 10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
  - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
  - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

#### 10.04 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

#### 10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).
- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
  1. deny the Claim in whole or in part;
  2. approve the Claim; or
  3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

## **ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

### *11.01 Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:
  - 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
  - 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
  - 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any

subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
  - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
  - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
  - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
  - g. The cost of utilities, fuel, and sanitary facilities at the Site.
  - h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

## 11.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:



- a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
- b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
  1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
  2. there is no corresponding adjustment with respect to any other item of Work; and
  3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

## ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

### 12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
  2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
  3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. *Contractor's Fee*: The Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
  2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
    - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
    - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
    - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
    - d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
    - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a

deduction in Contractor's fee by an amount equal to five percent of such net decrease;  
and

- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

#### 12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

#### 12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.
- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

## **ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

### *13.01 Notice of Defects*

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

### *13.02 Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

### *13.03 Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
  - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
  - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
  - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in

the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

#### 13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

#### 13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

### 13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

### 13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
  - 1. repair such defective land or areas; or
  - 2. correct such defective Work; or
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
  - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect

to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

### 13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

### 13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties

are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

## **ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION**

### *14.01 Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

### *14.02 Progress Payments*

#### *A. Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

#### *B. Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for



refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
  - a. the Work has progressed to the point indicated;
  - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
  - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
  - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
  - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
  - a. to supervise, direct, or control the Work, or
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
  - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
  - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
  - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
  - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
  - b. the Contract Price has been reduced by Change Orders;
  - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
  - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

*C. Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

*D. Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
  - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
  - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
  - c. there are other items entitling Owner to a set-off against the amount recommended; or
  - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

#### 14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

#### 14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

#### 14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
  2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
  3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
  4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

#### 14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### 14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
  - b. consent of the surety, if any, to final payment;
  - c. a list of all Claims against Owner that Contractor believes are unsettled; and
  - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

*B. Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

*C. Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment

(for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

#### 14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

### **ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION**

#### 15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

#### 15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
  2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
  3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

### 15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
  2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
  3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
  4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

#### 15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

## **ARTICLE 16 – DISPUTE RESOLUTION**

### 16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.



- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
  - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
  - 2. agrees with the other party to submit the Claim to another dispute resolution process; or
  - 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

## **ARTICLE 17 – MISCELLANEOUS**

### *17.01 Giving Notice*

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

### *17.02 Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

### *17.03 Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

### *17.04 Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the

Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

## 00 73 00 SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement Section 00 72 00 – Standard General Conditions of the Construction Contract prepared by the Engineers Joint Contract Documents Council (EJCDC C-700, 2007 edition) and other provisions of the Contract Documents as indicated below. All provisions which are not amended or supplemented in these Supplementary Conditions remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

### ARTICLE 1: DEFINITIONS AND TERMINOLOGY

#### SC-1.01 DEFINED TERMS

A. Add a new Paragraph 1.01.A.52:

“52. Written Amendment – A written statement modifying the Contract Documents, signed by Owner and Contractor on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

B. Add a new Paragraph 1.01.A.53:

“53. Construction Manager – The authorized representative of Owner who may be assigned to the Site or any part thereof. The individual or entity will be responsible for administration of the Contract as a representative of the Owner. This individual may also serve as the Resident Project Representative. For this Project the Owner has designated JE Garcia to serve as Construction Manager. The Engineer has designated Jessica Rodriguez to assist the Owner under separate contract between the Owner and Engineer.”

#### SC-1.02 TERMINOLOGY

A. Add a new Paragraph 1.02.B.2 as follows:

“2. “At no additional cost to Owner”, “With no extra compensation to Contractor”, “At Contractor’s own expense”, or similar words mean that the Contractor will perform or provide specified Work and that all cost for performing the Work is included in the Contract Price. “

B. Delete Paragraph 1.02.C and add the following:

“C. Day

1. A “calendar day” shall be a day of 24 hours measured from midnight to the next midnight, and is any day of the year, with no days being excluded.”

C. Add new Paragraphs 1.02.E.5 and 1.02.E.6 as follows:

“5. Specifications are written in modified brief style. Requirements apply to all Work of the same kind, class, and type even though the word “all” is not stated.”

“6. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words “furnish”, “install”,

“provide”, or similar words include the meaning of the phrase “The Contractor shall...” before these words.”

**ARTICLE 2: PRELIMINARY MATTERS**

**SC-2.02 COPIES OF DOCUMENTS**

A. Delete Paragraph 2.02.A entirely and insert the following in its place:

“A. Contractor may make as many prints of the documents downloaded for bidding as they require for construction. Engineer will not provide printed or hard copies to the Contractor.”

**SC-2.05 BEFORE STARTING CONSTRUCTION**

A. Add a new paragraph immediately after Paragraph 2.05.A.3:

“B. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to the Engineer any conflict, error, ambiguity or discrepancy which the Contractor may discover and shall obtain a written interpretation from the Engineer before proceeding with any Work affected thereby. In the event of a conflict in the Drawings, Specifications, or other portions of the Contract Documents which were not reported prior to the Award of the Contract, the Contractor shall be deemed to have included the most expensive item in their Bid.”

**ARTICLE 3: CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

**SC-3.01 INTENT**

A. Add the following to Paragraph 3.01.A:

“Drawings and Specifications do not indicate or describe all of the Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

1. The Contract requirements described in the General Conditions, Supplementary Conditions and General Requirements apply to each and all Sections of the Specifications unless specifically noted otherwise.
2. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing Work among Subcontractors, or to establish the extent of Work to be performed by any trade, Subcontractor or Supplier. Specifications or details do not need to be indicated or specified in each specification or drawing. Items shown in the Contract Documents are applicable regardless of location in the Contract Documents.
3. Standard paragraph titles and other identifications of subject matter in the Specifications are intended to aid in locating and recognizing various

requirements of the Specifications. Titles do not define, limit, or otherwise restrict specification text.”

B. Add new Paragraphs 3.01.D through 3.01.F as follows:

“D. Comply with the most stringent requirements where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.

1. Quantity or quality level shown or indicated shall be the minimum to be provided or performed in every instance.
2. Actual installation must meet or exceed the minimum quality indicated.
3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
4. Refer instances of uncertainty to the Engineer for a decision before proceeding.”

“E. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the Project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the Drawings but are not included in the Specifications.”

“F. The Contract Documents comprise the entire Agreement between Owner and Contractor. The Contract Documents may be modified only by Field Order, Change Order or Written Amendment.”

#### SC-3.02 REFERENCE STANDARDS

A. Add a new Paragraph 3.02.B as follows:

“B. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than these referenced standards.

1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.
2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the Work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.
3. Make copies of reference standards available as requested by Engineer or Owner.”

#### SC-3.03 REPORTING AND RESOLVING DISCREPANCIES

- A. Delete Paragraph 3.03.A.3 entirely and insert the following in its place:
- “3. In the event of a conflict in the Drawings, Specifications, or other portions of the Contract Documents which were not reported prior to the Bidding of the Contract, the Contractor shall be deemed to have included the most expensive item, system, procedure, etc. in his Bid.”

SC-3.05 REUSE OF DOCUMENTS

- A. Delete the last sentence of Paragraph 3.05.B entirely and insert the following in its place:
- “B. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes, unless specifically prohibited in writing by the Owner for security reasons. If the Owner so directs, Contractor shall surrender all copies of the construction Contract Documents and other related documents, in paper or digital format and remove these documents from computer equipment or storage devices as a condition of final payment.”

**ARTICLE 4: AVAILABILITY OF LANDS; SUBSURFACE CONDITIONS AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS**

SC-4.01 AVAILABILITY OF LANDS

- A. Add the following to Paragraph 4.01.C:
- “A copy of the written agreements for the use of such land shall be provided to the Owner for record purposes.”

SC-4.02 SUBSURFACE AND PHYSICAL CONDITIONS

- A. Add the following new paragraph immediately after Paragraph 4.02.B:
- “C. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site are known to Owner:
1. *“Geotechnical Data Report, North Burleson Street Improvements, W. Center Street to Market Place Ave, Kyle, Texas”*, August 2014, prepared by Arias Geoprofessionals.
  2. *“Geotechnical Design Memorandum, Pavement Thickness Design”*, August 26, 2014, prepared by Arias Geoprofessionals.
  3. *“Geotechnical Design Memorandum – Global Stability Analysis, Retaining Wall – STA 10+00 – STA 14+14.85”*, July 31, 2015, prepared by Arias Geoprofessionals.

SC-4.03 DIFFERING SUBSURFACE OR PHYSICAL CONDITIONS

- A. Amend Paragraph 4.03.A by deleting “promptly” and inserting “promptly but no later than within 3 days.”

SC-4.04 UNDERGROUND FACILITIES

- A. Amend Paragraph 4.04.B.1 by deleting “promptly” and inserting “promptly but no later than within 3 days.”

SC-4.06 HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE

- A. Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:
  - “A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.”
- B. Delete Paragraph 4.06.G entirely and insert the following in its place:
  - “G. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, OWNER SHALL INDEMNIFY AND HOLD HARMLESS CONTRACTOR, SUBCONTRACTORS, AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO A HAZARDOUS ENVIRONMENTAL CONDITION, PROVIDED THAT SUCH HAZARDOUS ENVIRONMENTAL CONDITION: (I) WAS NOT SHOWN OR INDICATED IN THE DRAWINGS OR SPECIFICATIONS OR IDENTIFIED IN THE CONTRACT DOCUMENTS TO BE INCLUDED WITHIN THE SCOPE OF THE WORK, AND (II) WAS NOT CREATED BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE. NOTHING IN THIS PARAGRAPH 4.06.G SHALL OBLIGATE OWNER TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL’S OR ENTITY’S OWN NEGLIGENCE.**”
- C. Delete Paragraph 4.06.H entirely and insert the following in its place:
  - “H. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO A HAZARDOUS ENVIRONMENTAL CONDITION CREATED BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE. NOTHING IN THIS PARAGRAPH 4.06.H SHALL OBLIGATE CONTRACTOR TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL’S OR ENTITY’S OWN NEGLIGENCE.**”

**ARTICLE 5: BONDS AND INSURANCE**

SC-5.01 PERFORMANCE, PAYMENT AND OTHER BONDS

- A. Add the following to Paragraph 5.01.C:  
 “Failure of the Contractor to provide a satisfactory replacement bond may be considered an event of default under Article 15, Paragraph 15.02.”
- B. Add new paragraphs immediately after Paragraph 5.01.C:
  - “D. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond or payment bond. By Contractor furnishing and Owner accepting these bonds, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor under these bonds, subject to Owner’s priority to use the funds for the completion of the Work.”
  - “E. Contractor or surety on behalf of Contractor shall promptly notify the Owner of all claims filed against the Payment Bond. When a claimant has satisfied the conditions prescribed by Texas Government Code 2253, the Contractor or surety on behalf of Contractor shall, with reasonable promptness, notify the claimant and Owner of the amounts that are undisputed and the basis for challenging any amounts that are disputed, including, but not limited to, the lack of substantiating documentation to support the claim as to entitlement or amount, and the Contractor or surety on behalf of Contractor shall, with reasonable promptness, pay or make arrangements for payment of any undisputed amount; provided, however, that the failure of the Contractor or surety on behalf of Contractor to timely discharge its obligations under this paragraph or to dispute or identify any specific defense to all or any part of a claim shall not be deemed to be an admission of liability by the Contractor or surety as to such claim or otherwise constitute a waiver of the Contractor’s or surety’s defenses to, or right to dispute, such claim.”
  - “F. Owner shall not be liable for payment of any costs or expenses of any claimant under Payment Bonds, and shall have no obligations to make payments to, give notices on behalf of, or otherwise have obligations to claimants under Payment Bonds.”

SC-5.02 LICENSED SURETIES AND INSURERS

- A. Add a new Paragraph 5.02.B as follows:  
 “B. Insurance companies providing insurance required by Contract Documents shall have a minimum rating of A-VIII according to A.M. Best Company.”

SC-5.03 CERTIFICATES OF INSURANCE

- A. Delete Paragraph 5.03.B entirely.

SC-5.04 CONTRACTOR’S INSURANCE

- A. The following additional information is provided as required by Paragraph 5.04 Contractor’s Liability Insurance



- Workers' Compensation and Employer's Liability Insurance required by Paragraph 5.04 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

<b>Workers' Compensation, etc.,</b>	
State	Statutory
Applicable Federal (e.g., Longshore)	Statutory
<b>Employers' Liability</b>	
Bodily Injury by Accident	\$500,000
Bodily Injury by Disease - Each Employee	\$500,000
Bodily Injury by Disease - Policy Limit	\$500,000
Maritime Coverage Endorsement	
Insurance shall include a waiver of subrogation in favor of the Additional Insured identified in these Supplementary Conditions.	

- Contractor's Liability Insurance required by Paragraph 5.04 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

<b>Insurance for Claims of Damages</b>	
General Aggregate (Except Products - Completed Operations)	\$1,000,000 / Occurrence \$2,000,000 / Aggregate
Products - Completed Operations Aggregate	\$1,000,000 / Occurrence \$2,000,000 / Aggregate
Personal and Advertising Injury (One Person/Organization)	\$1,000,000
Each Occurrence (Bodily Injury and Property Damage)	\$1,000,000
Limit Per Person - Medical Expense	\$5000
Personal Injury Liability coverage will include claims arising out of Employment Practices Liability, limited to coverage provided under standard contract.	1,000,000
Property Damage Liability insurance will provide explosion, collapse and underground coverage where applicable	\$1,000,000
Watercraft Liability Policy. Coverage shall apply to all self-propelled vessels	\$1,000,000
Excess Liability, Umbrella Form to include coverage of Watercraft Liability. General Aggregate - Each Occurrence	\$1,000,000

- Contractor's Liability Insurance shall also include completed operations and product liability coverage, and eliminate the exclusion with respect to property under the care, custody and control of Contractor. In lieu of elimination of the exclusion, Contractor may provide and maintain Installation Floater insurance for

property under the care, custody, or control of Contractor. The Installation Floater insurance shall be a broad form or "All Peril" policy providing coverage for all materials, supplies, machinery, fixture, and equipment which will be incorporated into the Work.

- a. Coverage under the Contractors Installation Floater will include:
  - 1). Faulty or defective workmanship, materials, maintenance or construction.
  - 2). Cost to remove defective or damaged Work from the Site or to protect it from loss or damage.
  - 3). Cost to cleanup and remove pollutants.
  - 4). Coverage for testing and startup.
  - 5). Any loss to property while in transit.
  - 6). Any loss at the Site.
  - 7). Any loss while in storage, both on-site and off-site.
  - 8). Any loss to temporary project works if their value is included in the Contract Price.
  
- 4. Coverage cannot be contingent on an external cause or risk or limited to property for which the Contractor is legally liable. Contractor's Installation Floater will provide limits of insurance adequate to cover the value of the installation. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment which will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation for those listed as additional insured in these Supplemental Conditions.
  
- 5. Contractor's Automobile Liability Insurance required by Paragraph 5.04.A.6 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

<b>Bodily Injury</b>	
Each Person	\$1,000,000
Each Accident	\$1,000,000
<b>Property Damage</b>	
Each Accident, or	\$1,000,000
Combined Single Limit (Bodily Injury and Property Damage)	\$1,000,000

- 6. Additional insured on all insurance policies in accordance with Paragraph 5.04.B include:
  - a. City of Kyle, Texas
  - b. Freese and Nichols, Inc.
  - c. Arias & Associates, Inc.

- d. McGray & McGray Land Surveyors, Inc.
  - e. Prewitt & Associates, Inc.
  - f. CTC, Inc.
  - g. Union Pacific Railroad
  - h. Most Reverend Joe S. Vásquez, Bishop of the Catholic Diocese of Austin and his successors in office
7. Contractor’s Contractual Liability Insurance required by Paragraph 5.04.B is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

<b>Contractor’s Contractual Liability Insurance</b>	
General Aggregate	\$1,000,000
Each Occurrence (Bodily Injury and Property Damage)	\$1,000,000

**SC-5.05 OWNER’S LIABILITY INSURANCE**

- A. Delete Paragraph 5.05.A entirely and insert the following in its place:
  - “A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Contractor shall purchase and maintain for Owner, at no additional cost, Owner’s Protective Liability insurance naming Owner as the named insured with insurance that will protect said parties against claims which may arise from operations under the Contract Documents. This coverage shall be from the same company that provides Contractor’s liability insurance coverage, and in the same minimum amounts. The Engineer and Engineer’s consultants are additional insured as their interest may appear including their officers, directors, agents and employees.”

**SC-5.06 PROPERTY INSURANCE**

- A. Delete Paragraph 5.06.A entirely and insert the following in its place; Subparagraphs 1 through 7 shall remain:
  - “A. Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to deductible amounts as may be provided by the Supplementary Conditions or required by Laws and Regulations). The policies of insurance required to be purchased and maintained by Contractor in accordance with this Paragraph 5.06 shall comply with requirements of Paragraph 5.08. This insurance shall:”
- B. Amend Paragraph 5.06.A.4 by inserting the following language after the word “Work” in the second line:
  - “and in transit for incorporation in the Work from such storage locations”
- C. Delete Paragraph 5.06.B entirely and insert the following in its place:
  - “B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary

Conditions or Laws and Regulations which will include the interests of those listed as an insured or listed as an additional insured in Paragraph SC-5.04.E.”

- D. Delete Paragraph 5.06.D entirely.
- E. Delete Paragraph 5.06.E entirely.

SC-5.07 WAIVER OF RIGHTS

- A. Delete Paragraph 5.07.B entirely.

SC-5.08 RECEIPT AND APPLICATION OF INSURANCE PROCEEDS

- A. Delete Paragraph 5.08 entirely.

SC-5.11 OWNER’S INSURANCE FOR PROJECT

- A. Add a new Paragraph 5.11 as follows:

“5.11 Owner’s Insurance for Project

- A. Owner shall not be responsible for purchasing and maintaining any insurance to protect the interest of the Contractor, Subcontractors, or others in the Work. The stated limits of insurance required are minimum only. Contractor shall determine the limits that are adequate. These limits may be basic policy limits or any combination of basic limits and umbrella limits. In any event, Contractor is fully responsible for all losses arising out of, resulting from or connected with operations under this Contract whether or not said losses are covered by insurance. The acceptance of certificates or other evidence of insurance by the Owner, Engineer, and/or others listed as additional insured in Paragraph SC-5.04.E that in any respect do not comply with the Contract requirements does not release the Contractor from compliance herewith.”

**ARTICLE 6: CONTRACTOR’S RESPONSIBILITIES**

SC-6.05 SUBSTITUTES AND “OR-EQUALS”

- A. Delete Paragraph 6.05.A and insert the following in its place:

“A. Where equipment and products are specified by name, no substitutes or “or-equal” will be considered or approved unless the term “or-equal” is included in the individual Specification. If substitutes or “or equals” are specifically permitted for consideration by the individual Specifications, they must be submitted and will be reviewed and evaluated in accordance with the provisions established in Paragraph 6.05 and in the General Requirements of the Specifications.”

- B. Subparagraphs 6.05.A.1 and 6.05.A.2 remain intact.

- C. Amend Paragraph 6.05.C by deleting the fourth sentence and inserting the following in its place:

“No “or-equal” or substitute will be ordered, installed or utilized until Engineer’s review is complete, which will be evidenced by either a Change Order or Field Order.”

- D. Amend Paragraph 6.05.E by deleting the word “substitute” in all locations and replacing it with the phrase “substitute or “or-equal””.

SC-6.06 CONCERNING SUBCONTRACTORS, SUPPLIERS AND OTHERS

- A. Amend Paragraph 6.06.B by deleting the words “Supplementary Conditions” and inserting the words “Contract Documents” in their place.
- B. Add a new Paragraph 6.06.H as follows:
  - “H. Owner or Engineer may furnish to any such Subcontractor, Supplier, or other person or organization, to the extent practicable, information about amounts paid to Contractor in accordance with Contractor’s Application for Payment on account of the particular Subcontractor’s, Supplier’s, other person’s or other organization’s Work.”

SC-6.07 PATENT FEES AND ROYALTIES

- A. Delete Paragraph 6.07.B entirely and insert the following in its place:
  - “B. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, OWNER SHALL INDEMNIFY AND HOLD HARMLESS CONTRACTOR, AND ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS, AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS INCIDENT TO THE USE IN THE PERFORMANCE OF THE WORK OR RESULTING FROM THE INCORPORATION IN THE WORK OF ANY INVENTION, DESIGN, PROCESS, PRODUCT, OR DEVICE SPECIFIED IN THE CONTRACT DOCUMENTS, BUT NOT IDENTIFIED AS BEING SUBJECT TO PAYMENT OF ANY LICENSE FEE OR ROYALTY TO OTHERS REQUIRED BY PATENT RIGHTS OR COPYRIGHTS.**”
- B. Delete Paragraph 6.07.C entirely and insert the following in its place:
  - “C. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS INCIDENT TO THE USE IN THE PERFORMANCE OF THE WORK OR RESULTING FROM THE INCORPORATION IN THE WORK OF ANY INVENTION, DESIGN, PROCESS, PRODUCT, OR DEVICE NOT SPECIFIED IN THE CONTRACT DOCUMENTS.**”

SC-6.09 LAWS AND REGULATIONS

- A. Delete Paragraph 6.09.B and insert the following in its place:
  - “B. If Contractor performs any Work that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work.”
- B. Add a new Paragraph 6.09.D as follows:
  - “D. All Bidders are required to complete and submit with their Bid the Contractor Compliance to State Law form, which follows the proposal.”

SC-6.10 TAXES

- A. Add the following to Paragraph 6.10.A:
  - “The Owner qualifies as an exempt agency as defined by the statutes of the State of Texas. The Contractor shall comply with all statutes and rulings of the State Comptroller.”

SC-6.11 USE OF SITE AND OTHER AREAS

- A. Delete Paragraph 6.11.A.3 entirely and insert the following in its place:
  - “3. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO ANY CLAIM OR ACTION, LEGAL OR EQUITABLE, BROUGHT BY ANY SUCH OWNER OR OCCUPANT AGAINST OWNER, ENGINEER, OR ANY OTHER PARTY INDEMNIFIED HEREUNDER TO THE EXTENT CAUSED BY OR BASED UPON CONTRACTOR’S PERFORMANCE OF THE WORK.”**

SC-6.13 SAFETY AND PROTECTION

- A. As described in Paragraph 6.13.C, the Contractor is to comply with the applicable requirements of Owner’s safety program presented as Appendix “A.”
- B. Add the following to Paragraph 6.13.F:
  - “The Contractor’s duties and responsibilities for the safety or protection of persons or the Work or property at the Site or adjacent thereto shall be reinstated when any additional efforts are required during the one year correction period to correct defects in the Work.”

SC-6.16 EMERGENCIES

- A. Amend Paragraph 6.16.A by deleting the third sentence and inserting the following in its place:

“If Engineer determines that the incident giving rise to the emergency action was not the responsibility of the Contractor and that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Order, Field Order or Work Change Directive will be issued.”

SC-6.17 SHOP DRAWINGS AND SAMPLES

- A. Delete Paragraph 6.17.C.3 entirely and insert the following in its place:

“3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents on a Shop Drawing Deviation Request form provided by the Engineer and request that a Field Order or Change Order be issued for each of the specific variations submitted for approval. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.”

- B. Delete Paragraph 6.17.D.3 entirely and insert the following in its place:

“3. Engineer’s review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation issuing a Field Order or Change Order. If the proposed modification is approved by the Engineer, the submittal will be considered to be in strict compliance with the Contract Documents and it will be reviewed in accordance with the Contract Documents. If the proposed Modification is not approved, the submittal will be returned to the Contractor with appropriate comments. Engineer’s review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.”

- C. Delete Paragraph 6.17.E.1 entirely and insert the following in its place:

“1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Re-submittals shall reference and respond directly to Engineer’s previous comments. Any variations from strict compliance with the Contract Documents will be identified in the same manner as required in Paragraph 6.17.C.3 and will require the same approvals.”

- D. Add the following new paragraphs immediately after Paragraph 6.17.E:

“F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals. Engineer will record Engineer’s time for reviewing subsequent submittals of Shop Drawings, Samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer’s charges for such time.”

“G. In the event that Contractor requests a change of a previously approved item, Contractor shall reimburse Owner for Engineer’s charges for its review time unless the need for such change is beyond the control of Contractor.”

SC-6.18 CONTINUING THE WORK

A. Add the following to Paragraph 6.18.A:

“Contractor assumes and bears responsibility for all costs and time delays associated with any variation from the requirements of the Contract Documents.”

SC-6.20 INDEMNIFICATION

A. Delete Paragraph 6.20.A entirely and insert the following in its place:

**“A. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, COST, LOSS, OR DAMAGE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE, OR DEATH, OR TO INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE RESULTING THEREFROM BUT ONLY TO THE EXTENT CAUSED BY ANY NEGLIGENT ACT OR OMISSION OF CONTRACTOR, ANY SUBCONTRACTOR, ANY SUPPLIER, OR ANY INDIVIDUAL OR ENTITY DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM TO PERFORM ANY OF THE WORK OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE.”**

B. Delete Paragraph 6.20.C entirely.

**ARTICLE 9: ENGINEER’S STATUS DURING CONSTRUCTION**

SC-9.04 AUTHORIZED VARIATIONS IN WORK

A. Add the following to Paragraph 9.04.A:

“The Contractor shall notify the Engineer in writing prior to beginning any Work addressed in a Field Order if the Contractor does not agree that the Work involved represents no additional cost and/or time change in the Contract Documents.”

**ARTICLE 10: CHANGES IN THE WORK; CLAIMS**

SC-10.03 EXECUTION OF CHANGE ORDERS



- A. Add a new Paragraph 10.03.B as follows:
  - “B. Contractor assumes and bears responsibility for all costs and time delays associated with any variation from the requirements of the Contract Documents unless the variation is specifically approved by Change Order.”

SC-10.05 CLAIMS

- A. Amend Paragraph 10.05.B by deleting “30” and inserting “7” in its place and by deleting “60” and inserting “30” in its place.

**ARTICLE 11: COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

SC-11.01 COST OF THE WORK

- A. Amend Paragraph 11.01.A by deleting the following words in the third sentence:
  - “those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:”and insert the following in its place:
  - “those paid for the Work included in the Contract Price, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B. Contractor shall provide certified payroll records listing personnel classifications and salaries for all individuals involved in additional Work. Salaries for those not included in the certified payroll will be considered as being compensated under Paragraph 11.01.B, and shall include only the following items:”
- B. Amend Paragraph 11.01.A.1 by deleting the following words in the second sentence:
  - “without limitation superintendents, foreman”and inserting the following in its place:
  - “one foreman (unless agreed upon prior to beginning Work)”
- C. Amend Paragraph 11.01.A.1 by deleting the following words in the last sentence:
  - “be included in the above”and inserting the following in its place:
  - “not exceed 1.5 times regular pay and shall be included in the above”
- D. Amend Paragraph 11.01.B.1 by adding “superintendents” to the list of excluded personnel in the first sentence.
- E. Amend Paragraph 11.01.D by inserting “and at intervals” in the last sentence as shown below:
  - “.....and submit in a form and at intervals acceptable to Engineer ...”

SC-11.03 UNIT PRICE WORK

- A. Delete Paragraph 11.03.D entirely and insert the following in its place:
- “D. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. If the total cost of a particular item of Unit Price Work amounts to twenty percent (20%) or more of the total Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by the Contractor differs by more than twenty percent (20%) from the estimated quantity of such item indicated in the Agreement; and
  2. If there is no corresponding adjustment with respect to any other item of Work; and
  3. If Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the Unit Price, either the Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variation in the quantity of the Unit Price Work performed.”

**ARTICLE 12: CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES**

SC-12.03 DELAYS

- A. Add the following to Paragraph 12.03.A:
- “No time extensions will be allowed for weather conditions for Projects using calendar days for the Contract Time.”

SC-12.04 NO DAMAGE FOR DELAYS

- A. Add a new Paragraph 12.04 as follows:
- “12.04 No Damage for Delays
- A. The Contractor agrees to make no claims for damage for delay in the performance of the Contract occasioned by any act or omission to act of the Owner, Engineer, or any of the Engineer’s or Owner’s agents, and agrees that any such claim shall be fully compensated by an extension of time, as set forth in a Change Order, to complete performance of the Work as provided herein.”

**ARTICLE 13: TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK**

SC-13.07 CORRECTION PERIOD

- A. Amend Paragraph 13.07.A by adding:
- “When early acceptance of a Substantially Completed portion of the Work is accomplished in the manner indicated, the correction period for that portion of the Work shall commence at the time of substantial completion of that Work.”

**ARTICLE 14: PAYMENTS TO CONTRACTOR AND COMPLETION**

**SC-14.02 PROGRESS PAYMENTS**

- A. Amend Paragraph 14.02.C.1 by deleting “Ten” and inserting “Thirty” in its place.
- B. Amend Paragraph 14.02.D.1 by deleting “or” in Paragraph 14.02.D.1.c and adding new paragraphs “e”, “f”, “g”, and “h” as follows:
  - “e. Owner has been notified of failure to make payments to Subcontractors or Suppliers or for labor, or”
  - “f. failure to submit up-to-date record documents as required by GC-6.12, or”
  - “g. failure to submit monthly Progress Schedule updates or revised schedules as requested by the Owner or Engineer, or”
  - “h. failure to provide project photographs required by the Specifications.”
- C. Amend Paragraph 14.02.D.2 by adding “to Owner’s satisfaction.”
- D. Amend Paragraph 14.02.D.3 by deleting “and subject to interest as provided in the Agreement.”
- E. Add a new Paragraph 14.02.D.4 as follows:
  - “4. Owner may permanently withhold payment from Contract Price for:
    - a. liquidated damages incurred by Contractor, or
    - b. Costs for tests performed by the Owner to verify that Work previously tested and found to be defective has been corrected. Verification testing is to be provided at the Contractor’s expense to verify products or constructed works are in compliance after corrections have been made.”

**SC-14.04 SUBSTANTIAL COMPLETION**

- A. Add a new paragraph immediately after Paragraph 14.04.E.
  - “F. For water line construction, Substantial Completion shall be achieved when the Work, including all disinfection and testing, has been completed and accepted and the line(s) placed into service. Work that remains after Substantial Completion could include the final pavement of roadways, adjustment of structures to final grade and revegetation. Owner’s Representative will issue a notice specifying what portion of the Work is partially completed for the purpose of payment and what Work remains to be done on the portion being accepted.”

**ARTICLE 15: SUSPENSION OF WORK AND TERMINATION**

**SC-15.01 OWNER MAY TERMINATE FOR CAUSE**

- A. Add a new Paragraph 15.02.A.5 as follows:
  - “5. If Contractor fails to provide the replacement bond required by General Conditions, Section 5.01.C or insurance coverage as required by General Conditions Article 5 and as amended by Supplemental Conditions.”

- B. Add a new Paragraph 15.02.A.6 as follows:

“6. If any petition of bankruptcy is filed by or against Contractor, or if Contractor is adjudged as bankrupt or insolvent or makes a general assignment for the benefit of creditors, or if a receiver is appointed for the benefit of Contractor’s creditors, or if a receiver is appointed on account of Contractor’s insolvency, upon the occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions hereof. Failure to comply with such request within 7 days of delivery of the request shall entitle Owner to terminate this agreement and to the accompanying rights set forth in Paragraphs 15.02 and 15.03 hereof. In all events pending receipt of adequate assurance of performance and actual performance in accordance therewith, Owner shall be entitled to proceed with the Work with its own forces or with other contractors on a time and material or other appropriate basis. The cost of work by Owner or other contractors will be back charged against the Contract Sum hereof.”

- C. Delete Paragraph 15.02.F entirely.

**SC-15.04 CONTRACTOR MAY STOP WORK OR TERMINATE**

- A. Add a new Paragraph 15.04.C as follows:

“C. This Contract may not be assigned in whole or in part by the Contractor without the previous written consent of the Owner.”

**ARTICLE 16: DISPUTE RESOLUTION**

**SC-16.01 METHODS AND PROCEDURES**

- A. Delete Paragraph 16.01 entirely and insert the following in its place:

“16.01 Methods and Procedures

- A. Owner and Contractor may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Law.”

**ARTICLE 17: MISCELLANEOUS**

- A. Add a new Paragraph 17.02.B as follows:

“B. All references and conditions for a “calendar day contract” in the General Conditions and Supplementary Conditions shall apply for a “Fixed Date Contract.” A “Fixed Date Contract” is one in which the calendar dates for reaching Substantial Completion and/or final completion are specified in lieu of identifying the actual calendar days involved.”

- B. Add a new Paragraph 17.06 as follows:

“17.06 Independent Contractor

- A. Each Party will perform its duties under this Agreement as an independent contractor. The Parties and their personnel will not be considered to be employees or agents of the other Party. Nothing in this Agreement will be

interpreted as granting either Party the right or authority to make commitments of any kind for the other. This Agreement will not constitute, create, or be interpreted as a joint venture, partnership or formal business organization of any kind.”

- C. Add a new Paragraph 17.07 as follows:

“17.07 Sovereign Immunity

  - A. The parties agree that the Owner has not waived it’s sovereign immunity by entering into and performing its obligations under this Agreement.”
- D. Add a new Paragraph 17.08 as follows:

“17.08 Severability

  - A. If a court of competent jurisdiction renders any part of this Agreement invalid or unenforceable, that part will be severed and the remainder of this Agreement will continue in full force and effect.”
- E. Add a new Paragraph 17.09 as follows:

“17.09 Headings

  - A. The Article and paragraph headings in this Agreement are inserted for convenience only and do not constitute parts of these General Conditions or as a limitation of the scope of the particular section to which they refer. This Agreement will be fairly interpreted in accordance with its terms and conditions and not for or against either Party.”
- F. Add a new Paragraph 17.10 as follows:

“17.10 No Third Party Beneficiaries

  - A. Nothing in this Agreement shall be construed to create any right in any third party not a signatory to this Agreement, and the parties do not intend to create any third party beneficiaries by entering into this Agreement.”

**END OF SECTION**

**CONTRACTOR'S  
RIGHT OF ENTRY AGREEMENT**

**THIS AGREEMENT** is made and entered into as of the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_  
by and between **UNION PACIFIC RAILROAD COMPANY**, a Delaware corporation ("Railroad"); and \_\_\_\_\_  
\_\_\_\_\_ a \_\_\_\_\_ corporation ("Contractor").

**RECITALS:**

Contractor has been hired by \_\_\_\_\_ to perform work relating  
to \_\_\_\_\_  
\_\_\_\_\_  
(the "work"), with all or a portion of such work to be performed on property of Railroad in the vicinity of Railroad's Milepost  
\_\_\_\_\_ on Railroad's \_\_\_\_\_ [Subdivision] [Branch] [at or near DOT No. --  
located at or near \_\_\_\_\_, in \_\_\_\_\_ County, State of \_\_\_\_\_, as such location is in the general  
location shown on the print marked **Exhibit A**, attached hereto and hereby made a part hereof, which work is the subject of a  
contract dated \_\_\_\_\_ between Railroad and \_\_\_\_\_

Railroad is willing to permit Contractor to perform the work described above at the location described above subject to  
the terms and conditions contained in this Agreement

**AGREEMENT:**

**NOW, THEREFORE**, it is mutually agreed by and between Railroad and Contractor, as follows:

**ARTICLE 1 - DEFINITION OF CONTRACTOR.**

For purposes of this Agreement, all references in this agreement to Contractor shall include Contractor's contractors,  
subcontractors, officers, agents and employees, and others acting under its or their authority.

**ARTICLE 2 - RIGHT GRANTED; PURPOSE.**

Railroad hereby grants to Contractor the right, during the term hereinafter stated and upon and subject to each and all  
of the terms, provisions and conditions herein contained, to enter upon and have ingress to and egress from the property  
described in the Recitals for the purpose of performing the work described in the Recitals above. The right herein granted to  
Contractor is limited to those portions of Railroad's property specifically described herein, or as designated by the Railroad  
Representative named in Article 4.

**ARTICLE 3 - TERMS AND CONDITIONS CONTAINED IN EXHIBITS B, C AND D.**

The terms and conditions contained in **Exhibit B**, **Exhibit C** and **Exhibit D**, attached hereto, are hereby made a part of  
this Agreement.

**ARTICLE 4 - ALL EXPENSES TO BE BORNE BY CONTRACTOR: RAILROAD REPRESENTATIVE.**

A. Contractor shall bear any and all costs and expenses associated with any work performed by Contractor, or  
any costs or expenses incurred by Railroad relating to this Agreement.

B. Contractor shall coordinate all of its work with the following Railroad representative or his or her duly authorized representative (the "Railroad Representative"):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

C. Contractor, at its own expense, shall adequately police and supervise all work to be performed by Contractor and shall ensure that such work is performed in a safe manner as set forth in Section 7 of **Exhibit B**. The responsibility of Contractor for safe conduct and adequate policing and supervision of Contractor's work shall not be lessened or otherwise affected by Railroad's approval of plans and specifications involving the work, or by Railroad's collaboration in performance of any work, or by the presence at the work site of a Railroad Representative, or by compliance by Contractor with any requests or recommendations made by Railroad Representative.

**ARTICLE 5 - SCHEDULE OF WORK ON A MONTHLY BASIS.**

The Contractor, at its expense, shall provide on a monthly basis a detailed schedule of work to the Railroad Representative named in Article 4B above. The reports shall start at the execution of this Agreement and continue until this Agreement is terminated as provided in this Agreement or until the Contractor has completed all work on Railroad's property.

**ARTICLE 6- TERM: TERMINATION.**

A. The grant of right herein made to Contractor shall commence on the date of this Agreement, and continue until \_\_\_\_\_, unless sooner terminated as herein provided, or at such time as Contractor has completed its work on Railroad's property, whichever is earlier. Contractor agrees to notify the Railroad Representative in writing when it has completed its work on Railroad's property.

B. This Agreement may be terminated by either party on ten (10) days written notice to the other party.

**ARTICLE 7 - CERTIFICATE OF INSURANCE.**

A. Before commencing any work, Contractor will provide Railroad with the (i) insurance binders, policies, certificates and endorsements set forth in **Exhibit C** of this Agreement, and (ii) the insurance endorsements obtained by each subcontractor as required under Section 12 of **Exhibit B** of this Agreement.

B. All insurance correspondence, binders, policies, certificates and endorsements shall be sent to:

Union Pacific Railroad Company

\_\_\_\_\_  
[Insert mailing address]

\_\_\_\_\_  
Attn: \_\_\_\_\_

Folder No. 3012-39

**ARTICLE 8 - DISMISSAL OF CONTRACTOR'S EMPLOYEE.**

At the request of Railroad, Contractor shall remove from Railroad's property any employee of Contractor who fails to conform to the instructions of the Railroad Representative in connection with the work on Railroad's property, and any right of Contractor shall be suspended until such removal has occurred. Contractor shall indemnify Railroad against any claims arising from the removal of any such employee from Railroad's property.

**ARTICLE 9- ADMINISTRATIVE FEE.**

Upon the execution and delivery of this Agreement, Contractor shall pay to Railroad \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), as reimbursement for clerical, administrative and handling expenses in connection with the processing of this Agreement.

**ARTICLE 10 - CROSSINGS: COMPLIANCE WITH MUTCD AND FRA GUIDELINES.**

A. No additional vehicular crossings (including temporary haul roads) or pedestrian crossings over Railroad's trackage shall be installed or used by Contractor without the prior written permission of Railroad.

B. Any permanent or temporary changes, including temporary traffic control, to crossings must conform to the Manual of Uniform Traffic Control Devices (MUTCD) and any applicable Federal Railroad Administration rules, regulations and guidelines, and must be reviewed by the Railroad prior to any changes being implemented. In the event the Railroad is found to be out of compliance with federal safety regulations due to the Contractor's modifications, negligence, or any other reason arising from the Contractor's presence on the Railroad's property, the Contractor agrees to assume liability for any civil penalties imposed upon the Railroad for such noncompliance.

**ARTICLE 11.- EXPLOSIVES.**

Explosives or other highly flammable substances shall not be stored or used on Railroad's property without the prior written approval of Railroad.

**IN WITNESS WHEREOF**, the parties hereto have duly executed this agreement in duplicate as of the date first herein written.

**UNION PACIFIC RAILROAD COMPANY**

By: \_\_\_\_\_  
Title: \_\_\_\_\_

\_\_\_\_\_  
(Name of Contractor)

By: \_\_\_\_\_  
Title: \_\_\_\_\_



**EXHIBIT A**

**Exhibit A will be a print showing the general location of the work site.**

**EXHIBIT B**  
**TO**  
**CONTRACTOR'S RIGHT OF ENTRY AGREEMENT**

**Section 1. NOTICE OF COMMENCEMENT OF WORK - FLAGGING.**

A. Contractor agrees to notify the Railroad Representative at least ten (10) working days in advance of Contractor commencing its work and at least thirty (30) working days in advance of proposed performance of any work by Contractor in which any person or equipment will be within twenty-five (25) feet of any track, or will be near enough to any track that any equipment extension (such as, but not limited to, a crane boom) will reach to within twenty-five (25) feet of any track. No work of any kind shall be performed, and no person, equipment, machinery, tool(s), material(s), vehicle(s), or thing(s) shall be located, operated, placed, or stored within twenty-five (25) feet of any of Railroad's track(s) at any time, for any reason, unless and until a Railroad flagman is provided to watch for trains. Upon receipt of such thirty (30)-day notice, the Railroad Representative will determine and inform Contractor whether a flagman need be present and whether Contractor needs to implement any special protective or safety measures. If flagging or other special protective or safety measures are performed by Railroad, Railroad will bill Contractor for such expenses incurred by Railroad, unless Railroad and a federal, state or local governmental entity have agreed that Railroad is to bill such expenses to the federal, state or local governmental entity. If Railroad will be sending the bills to Contractor, Contractor shall pay such bills within thirty (30) days of Contractor's receipt of billing. If Railroad performs any flagging, or other special protective or safety measures are performed by Railroad, Contractor agrees that Contractor is not relieved of any of its responsibilities or liabilities set forth in this Agreement.

B. The rate of pay per hour for each flagman will be the prevailing hourly rate in effect for an eight-hour day for the class of flagmen used during regularly assigned hours and overtime in accordance with Labor Agreements and Schedules in effect at the time the work is performed. In addition to the cost of such labor, a composite charge for vacation, holiday, health and welfare, supplemental sickness, Railroad Retirement and unemployment compensation, supplemental pension, Employees Liability and Property Damage and Administration will be included, computed on actual payroll. The composite charge will be the prevailing composite charge in effect at the time the work is performed. One and one-half times the current hourly rate is paid for overtime, Saturdays and Sundays, and two and one-half times current hourly rate for holidays. Wage rates are subject to change, at any time, by law or by agreement between Railroad and its employees, and may be retroactive as a result of negotiations or a ruling of an authorized governmental agency. Additional charges on labor are also subject to change. If the wage rate or additional charges are changed, Contractor (or the governmental entity, as applicable) shall pay on the basis of the new rates and charges.

C. Reimbursement to Railroad will be required covering the full eight-hour day during which any flagman is furnished, unless the flagman can be assigned to other Railroad work during a portion of such day, in which event reimbursement will not be required for the portion of the day during which the flagman is engaged in other Railroad work. Reimbursement will also be required for any day not actually worked by the flagman following the flagman's assignment to work on the project for which Railroad is required to pay the flagman and which could not reasonably be avoided by Railroad by assignment of such flagman to other work, even though Contractor may not be working during such time. When it becomes necessary for Railroad to bulletin and assign an employee to a flagging position in compliance with union collective bargaining agreements, Contractor must provide Railroad a minimum of five (5) days notice prior to the cessation of the need for a flagman. If five (5) days notice of cessation is not given, Contractor will still be required to pay flagging charges for the five (5) day notice period required by union agreement to be given to the employee, even though flagging is not required for that period. An additional thirty (30) days notice must then be given to Railroad if flagging services are needed again after such five day cessation notice has been given to Railroad.

**Section 2. LIMITATION AND SUBORDINATION OF RIGHTS GRANTED**

A. The foregoing grant of right is subject and subordinate to the prior and continuing right and obligation of the Railroad to use and maintain its entire property including the right and power of Railroad to construct, maintain, repair, renew, use, operate, change, modify or relocate railroad tracks, roadways, signal, communication, fiber optics, or other wirelines, pipelines and other facilities upon, along or across any or all parts of its property, all or any of which may be freely done at any time or times by Railroad without liability to Contractor or to any other party for compensation or damages.

B. The foregoing grant is also subject to all outstanding superior rights (whether recorded or unrecorded and including those in favor of licensees and lessees of Railroad's property, and others) and the right of Railroad to renew and extend the same, and is made without covenant of title or for quiet enjoyment.

**Section 3. NO INTERFERENCE WITH OPERATIONS OF RAILROAD AND ITS TENANTS.**

A. Contractor shall conduct its operations so as not to interfere with the continuous and uninterrupted use and operation of the railroad tracks and property of Railroad, including without limitation, the operations of Railroad's lessees, licensees or others, unless specifically authorized in advance by the Railroad Representative. Nothing shall be done or permitted to be done by Contractor at any time that would in any manner impair the safety of such operations. When not in use, Contractor's machinery and materials shall be kept at least fifty (50) feet from the centerline of Railroad's nearest track, and there shall be no vehicular crossings of Railroads tracks except at existing open public crossings.

8 Operations of Railroad and work performed by Railroad personnel and delays in the work to be performed by Contractor caused by such railroad operations and work are expected by Contractor, and Contractor agrees that Railroad shall have no liability to Contractor, or any other person or entity for any such delays. The Contractor shall coordinate its activities with those of Railroad and third parties so as to avoid interference with railroad operations. The safe operation of Railroad train movements and other activities by Railroad takes precedence over any work to be performed by Contractor.

**Section 4. LIENS.**

Contractor shall pay in full all persons who perform labor or provide materials for the work to be performed by Contractor. Contractor shall not create, permit or suffer any mechanic's or materialmen's liens of any kind or nature to be created or enforced against any property of Railroad for any such work performed. Contractor shall indemnify and hold harmless Railroad from and against any and all liens, claims, demands, costs or expenses of whatsoever nature in any way connected with or growing out of such work done, labor performed, or materials furnished. If Contractor fails to promptly cause any lien to be released of record, Railroad may, at its election, discharge the lien or claim of lien at Contractor's expense.

**Section 5. PROTECTION OF FIBER OPTIC CABLE SYSTEMS.**

A. Fiber optic cable systems may be buried on Railroad's property. Protection of the fiber optic cable systems is of extreme importance since any break could disrupt service to users resulting in business interruption and loss of revenue and profits. Contractor shall telephone Railroad during normal business hours (7:00 a.m. to 9:00 p.m. Central Time, Monday through Friday, except holidays) at 1-800-336-9193 (also a 24-hour, 7-day number for emergency calls) to determine if fiber optic cable is buried anywhere on Railroad's property to be used by Contractor. If it is, Contractor will telephone the telecommunications company(ies) involved, make arrangements for a cable locator and, if applicable, for relocation or other protection of the fiber optic cable. Contractor shall not commence any work until all such protection or relocation (if applicable) has been accomplished.

8. In addition to other indemnity provisions in this Agreement, Contractor shall indemnify, defend and hold Railroad harmless from and against all costs, liability and expense whatsoever (including, without limitation, attorneys' fees, court costs and expenses) arising out of any act or omission of Contractor, its agents and/or employees, that causes or contributes to (1) any damage to or destruction of any telecommunications system on Railroad's property, and/or (2) any injury to or death of any person employed by or on behalf of any telecommunications company, and/or its contractor, agents and/or employees, on Railroad's property. Contractor shall not have or seek recourse against Railroad for any claim or cause of action for alleged loss of profits or revenue or loss of service or other consequential damage to a telecommunication company using Railroad's property or a customer or user of services of the fiber optic cable on Railroad's property.

**Section 6. PERMITS - COMPLIANCE WITH LAWS.**

In the prosecution of the work covered by this Agreement, Contractor shall secure any and all necessary permits and shall comply with all applicable federal, state and local laws, regulations and enactments affecting the work including, without limitation, all applicable Federal Railroad Administration regulations.

**Section 7. SAFETY.**

A. Safety of personnel, property, rail operations and the public is of paramount importance in the prosecution of the work performed by Contractor. Contractor shall be responsible for initiating, maintaining and supervising all safety, operations and programs in connection with the work. Contractor shall at a minimum comply with Railroad's safety standards listed in **Exhibit D**, hereto attached, to ensure uniformity with the safety standards followed by Railroad's own forces. As a part of Contractor's safety responsibilities, Contractor shall notify Railroad if Contractor determines that any of Railroad's safety standards are contrary to good safety practices. Contractor shall furnish copies of **Exhibit D** to each of its employees before they enter the job site.

B. Without limitation of the provisions of paragraph A above, Contractor shall keep the job site free from safety and health hazards and ensure that its employees are competent and adequately trained in all safety and health aspects of the job.

C. Contractor shall have proper first aid supplies available on the job site so that prompt first aid services may be provided to any person injured on the job site. Contractor shall promptly notify Railroad of any U.S. Occupational Safety and Health Administration reportable injuries. Contractor shall have a nondelegable duty to control its employees while they are on the job site or any other property of Railroad, and to be certain they do not use, be under the influence of, or have in their possession any alcoholic beverage, drug or other substance that may inhibit the safe performance of any work.

D. If and when requested by Railroad, Contractor shall deliver to Railroad a copy of Contractor's safety plan for conducting the work (the "Safety Plan"). Railroad shall have the right, but not the obligation, to require Contractor to correct any deficiencies in the Safety Plan. The terms of this Agreement shall control if there are any inconsistencies between this Agreement and the Safety Plan.

**Section 8. INDEMNITY.**

A. To the extent not prohibited by applicable statute, Contractor shall indemnify, defend and hold harmless Railroad, its affiliates, and its and their officers, agents and employees (individually an "Indemnified Party" or collectively "Indemnified Parties") from and against any and all loss, damage, injury, liability, claim, demand, cost or expense (including, without limitation, attorney's, consultant's and expert's fees, and court costs), fine or penalty (collectively, "Loss") incurred by any person (including, without limitation, any Indemnified Party, Contractor, or any employee of Contractor or of any Indemnified Party) arising out of or in any manner connected with (i) any work performed by Contractor, or (ii) any act or omission of Contractor, its officers, agents or employees, or (iii) any breach of this Agreement by Contractor.

B. The right to indemnity under this Section 8 shall accrue upon occurrence of the event giving rise to the Loss, and shall apply regardless of any negligence or strict liability of any Indemnified Party, except where the Loss is caused by the sole active negligence of an Indemnified Party as established by the final judgment of a court of competent jurisdiction. The sole active negligence of any Indemnified Party shall not bar the recovery of any other Indemnified Party.

**C. Contractor expressly and specifically assumes potential liability under this Section 8 for claims or actions brought by Contractor's own employees. Contractor waives any immunity it may have under worker's compensation or industrial insurance acts to indemnify the Indemnified Parties under this Section 8. Contractor acknowledges that this waiver was mutually negotiated by the parties hereto.**

D. No court or jury findings in any employee's suit pursuant to any worker's compensation act or the Federal Employers' Liability Act against a party to this Agreement may be relied upon or used by Contractor in any attempt to assert liability against any Indemnified Party.

E. The provisions of this Section 8 shall survive the completion of any work performed by Contractor or the termination or expiration of this Agreement. In no event shall this Section 8 or any other provision of this Agreement be deemed to limit any liability Contractor may have to any Indemnified Party by statute or under common law.

**Section 9. RESTORATION OF PROPERTY.**

In the event Railroad authorizes Contractor to take down any fence of Railroad or in any manner move or disturb any of the other property of Railroad in connection with the work to be performed by Contractor, then in that event Contractor shall, as soon as possible and at Contractor's sole expense, restore such fence and other property to the same condition as the same were in before such fence was taken down or such other property was moved or disturbed. Contractor shall remove all of Contractor's tools, equipment, rubbish and other materials from Railroad's property promptly upon completion of the work, restoring Railroad's property to the same state and condition as when Contractor entered thereon.

**Section 10. WAIVER OF DEFAULT.**

Waiver by Railroad of any breach or default of any condition, covenant or agreement herein contained to be kept, observed and performed by Contractor shall in no way impair the right of Railroad to avail itself of any remedy for any subsequent breach or default.

**Section 11. MODIFICATION - ENTIRE AGREEMENT.**

No modification of this Agreement shall be effective unless made in writing and signed by Contractor and Railroad. This Agreement and the exhibits attached hereto and made a part hereof constitute the entire understanding between Contractor and Railroad and cancel and supersede any prior negotiations, understandings or agreements, whether written or oral, with respect to the work to be performed by Contractor.

**Section 12. ASSIGNMENT - SUBCONTRACTING.**

Contractor shall not assign or subcontract this Agreement, or any interest therein, without the written consent of the Railroad. Contractor shall be responsible for the acts and omissions of all subcontractors. Before Contractor commences any work, the Contractor shall, except to the extent prohibited by law; (1) require each of its subcontractors to include the Contractor as "Additional Insured" in the subcontractor's Commercial General Liability policy and Business Automobile policies with respect to all liabilities arising out of the subcontractor's performance of work on behalf of the Contractor by endorsing these policies with ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage; (2) require each of its subcontractors to endorse their Commercial General Liability Policy with "Contractual Liability Railroads" ISO Form CG 24 17 10 01 (or a substitute form providing equivalent coverage) for the job site; and (3) require each of its subcontractors to endorse their Business Automobile Policy with "Coverage For Certain Operations In Connection With Railroads" ISO Form CA 20 70 10 01 (or a substitute form providing equivalent coverage) for the job site.

**EXHIBIT C**  
**TO**  
**CONTRACTOR'S**  
**RIGHT OF ENTRY AGREEMENT**

**Union Pacific Railroad Company**  
**Insurance Provisions For**  
**Contractor's Right of Entry Agreement**

Contractor shall, at its sole cost and expense, procure and maintain during the course of the Project and until all Project work on Railroad's property has been completed and the Contractor has removed all equipment and materials from Railroad's property and has cleaned and restored Railroad's property to Railroad's satisfaction, the following insurance coverage:

- A. Commercial General Liability** insurance. Commercial general liability (CGL) with a limit of not less than \$5,000,000 each occurrence and an aggregate limit of not less than \$10,000,000. CGL insurance must be written on ISO occurrence form CG 00 01 12 04 (or a substitute form providing equivalent coverage).

The policy must also contain the following endorsement, which must be stated on the certificate of insurance:

- Contractual Liability Railroads ISO form CG 241710 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Railroad Company Property" as the Designated Job Site.
- Designated Construction Project(s) General Aggregate Limit ISO Form CG 25 03 03 97 (or a substitute form providing equivalent coverage) showing the project on the formschedule.

- B. Business Automobile Coverage** insurance. Business auto coverage written on ISO form CA 00 01 10 01 (or a substitute form providing equivalent liability coverage) with a combined single limit of not less \$5,000,000 for each accident and coverage must include liability arising out of any auto (including owned, hired and non-owned autos).

The policy must contain the following endorsements, which must be stated on the certificate of insurance:

- Coverage For Certain Operations In Connection With Railroads ISO form CA 20 70 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Property" as the Designated Job Site.
- Motor Carrier Act Endorsement - Hazardous materials clean up (MCS-90) if required by law.

- C. Workers' Compensation and Employers' Liability** insurance. Coverage must include but not be limited to:
- Contractor's statutory liability under the workers' compensation laws of the state where the work is being performed.
  - Employers' Liability (Part B) with limits of at least \$500,000 each accident, \$500,000 disease policy limit \$500,000 each employee.

If Contractor is self-insured, evidence of state approval and excess workers compensation coverage must be provided. Coverage must include liability arising out of the U. S. Longshoremen's and Harbor Workers' Act, the Jones Act, and the Outer Continental Shelf Land Act, if applicable.

The policy must contain the following endorsement, which must be stated on the certificate of insurance:

- Alternate Employer endorsement ISO form WC 00 03 01 A (or a substitute form providing equivalent coverage) showing Railroad in the schedule as the alternate employer (or a substitute form providing equivalent coverage).

- D. Railroad Protective Liability** insurance. Contractor must maintain "Railroad Protective Liability" (RPL) insurance written on ISO occurrence form CG 00 35 12 04 (or a substitute form providing equivalent coverage) on behalf of Railroad as named insured, with a limit of not less than \$2,000,000 per occurrence and an aggregate of \$6,000,000. The definition of "JOB LOCATION" and "WORK" on the declaration page of the policy shall refer to this Agreement and shall describe all WORK or OPERATIONS performed under this agreement. Contractor shall provide this Agreement to Contractor's insurance agent(s) and/or broker(s) and Contractor shall instruct such agent(s) and/or broker(s) to

procure the insurance coverage required by this Agreement. A BINDER STATING THE POLICY IS IN PLACE MUST BE SUBMITTED TO RAILROAD BEFORE THE WORK MAY COMMENCE AND UNTIL THE ORIGINAL POLICY IS FORWARDED TO UNION PACIFIC RAILROAD .

- E.** **Umbrella or Excess** insurance . If Contractor utilizes umbrella or excess policies, these policies must "follow form" and afford no less coverage than the primary policy.
- F.** **Pollution Liability** insurance. Pollution liability coverage must be included when the scope of the work as defined in the Agreement includes installation, temporary storage, or disposal of any "hazardous" material that is injurious in or upon land, the atmosphere, or any watercourses; or may cause bodily injury at any time.

If required, coverage may be provided in separate policy form or by endorsement to Contractors CGL or RPL. Any form coverage must be equivalent to that provided in ISO form CG 24 15 "Limited Pollution Liability Extension Endorsement" or CG 28 31 "Pollution Exclusion Amendment" with limits of at least \$5,000,000 per occurrence and an aggregate limit of \$10,000,000.

If the scope of work as defined in this Agreement includes the disposal of any hazardous or non-hazardous materials from the job site, Contractor must furnish to Railroad evidence of pollution legal liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting the materials, with coverage in minimum amounts of \$1,000,000 per loss, and an annual aggregate of \$2,000,000.

### **Other Requirements**

- G.** All policy(ies) required above (except worker's compensation and employers liability) must include Railroad as "Additional Insured" using ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage). The coverage provided to Railroad as additional insured shall, to the extent provided under ISO Additional Insured Endorsement CG 20 26, and CA 20 48 provide coverage for Railroad's negligence whether sole or partial, active or passive, and shall not be limited by Contractor's liability under the indemnity provisions of this Agreement.
- H.** Punitive damages exclusion, if any, must be deleted (and the deletion indicated on the certificate of insurance), unless the law governing this Agreement prohibits all punitive damages that might arise under this Agreement.
- I.** Contractor waives all rights of recovery, and its insurers also waive all rights of subrogation of damages against Railroad and its agents, officers, directors and employees. This waiver must be stated on the certificate of insurance.
- J.** Prior to commencing the work, Contractor shall furnish Railroad with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements in this Agreement.
- K.** All insurance policies must be written by a reputable insurance company acceptable to Railroad or with a current Best's Insurance Guide Rating of A- and Class VII or better, and authorized to do business in the state where the work is being performed.
- L.** The fact that insurance is obtained by Contractor or by Railroad on behalf of Contractor will not be deemed to release or diminish the liability of Contractor, including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railroad from Contractor or any third party will not be limited by the amount of the required insurance coverage.



**EXHIBIT D**  
**TO**  
**CONTRACTOR'S RIGHT OF ENTRY AGREEMENT**

**MINIMUM SAFETY REQUIREMENTS**

The term "employees" as used herein refer to all employees of Contractor as well as all employees of any subcontractor or agent of Contractor.

**I. Clothing**

- A. All employees of Contractor will be suitably dressed to perform their duties safely and in a manner that will not interfere with their vision, hearing, or free use of their hands or feet.

Specifically, Contractor's employees must wear:

- (i) Waist-length shirts with sleeves.
- (ii) Trousers that cover the entire leg. If flare-legged trousers are worn, the trouser bottoms must be tied to prevent catching.
- (iii) Footwear that covers their ankles and has a defined heel. Employees working on bridges are required to wear safety-toed footwear that conforms to the American National Standards Institute (ANSI) and FRA footwear requirements.

- B. Employees shall not wear boots (other than work boots), sandals, canvas-type shoes, or other shoes that have thin soles or heels that are higher than normal.

- C. Employees must not wear loose or ragged clothing, neckties, finger rings, or other loose jewelry while operating or working on machinery.

**II. Personal Protective Equipment**

Contractor shall require its employees to wear personal protective equipment as specified by Railroad rules, regulations, or recommended or requested by the Railroad Representative.

- (i) Hard hat that meets the American National Standard (ANSI) Z89.1 - latest revision. Hard hats should be affixed with Contractor's company logo or name.
- (ii) Eye protection that meets American National Standard (**ANSI**) for occupational and educational eye and face protection, Z87.1 - latest revision. Additional eye protection must be provided to meet specific job situations such as welding, grinding, etc.
- (iii) Hearing protection, which affords enough attenuation to give protection from noise levels that will be occurring on the job site. Hearing protection, in the form of plugs or muffs, must be worn when employees are within:
  - 100 feet of a locomotive or roadway/work equipment
  - 15 feet of power operated tools
  - 150 feet of jet blowers or pile drivers
  - 150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection - plugs and muffs)
  -
- (iv) Other types of personal protective equipment, such as respirators, fall protection equipment, and face shields, must be worn as recommended or requested by the Railroad Representative.



### III. On Track Safety

Contractor is responsible for compliance with the Federal Railroad Administration's Roadway Worker Protection regulations - 49CFR214, Subpart C and Railroad's On-Track Safety rules. Under 49CFR214, Subpart C, railroad contractors are responsible for the training of their employees on such regulations. In addition to the instructions contained in Roadway Worker Protection regulations, all employees must:

- ⓪ Maintain a distance of twenty-five (25) feet to any track unless the Railroad Representative is present to authorize movements.
- ⓪ Wear an orange, reflectorized workwear approved by the Railroad Representative.
- ⓪ Participate in a job briefing that will specify the type of On-Track Safety for the type of work being performed. Contractor must take special note of limits of track authority, which tracks may or may not be fouled, and clearing the track. Contractor will also receive special instructions relating to the work zone around machines and minimum distances between machines while working or traveling.

### IV. Equipment

- A. It is the responsibility of Contractor to ensure that all equipment is in a safe condition to operate. If, in the opinion of the Railroad Representative, any of Contractor's equipment is unsafe for use, Contractor shall remove such equipment from Railroad's property. In addition, Contractor must ensure that the operators of all equipment are properly trained and competent in the safe operation of the equipment. In addition, operators must be:
  - Familiar and comply with Railroad's rules on lockout/tagout of equipment.
  - Trained in and comply with the applicable operating rules if operating any hy-rail equipment on-track.
  - Trained in and comply with the applicable air brake rules if operating any equipment that moves rail cars or any other railbound equipment.
- B. All self-propelled equipment must be equipped with a first-aid kit, fire extinguisher, and audible back-up warning device.
- C. Unless otherwise authorized by the Railroad Representative, all equipment must be parked a minimum of twenty-five (25) feet from any track. Before leaving any equipment unattended, the operator must stop the engine and properly secure the equipment against movement.
- D. Cranes must be equipped with three orange cones that will be used to mark the working area of the crane and the minimum clearances to overhead powerlines

### V. General Safety Requirements

- A. Contractor shall ensure that all waste is properly disposed of in accordance with applicable federal and state regulations.
- B. Contractor shall ensure that all employees participate in and comply with a job briefing conducted by the Railroad Representative, if applicable. During this briefing, the Railroad Representative will specify safe work procedures (including On-Track Safety) and the potential hazards of the job. If any employee has any questions or concerns about the work, the employee must voice them during the job briefing. Additional job briefings will be conducted during the work as conditions, work procedures, or personnel change.
- C. All track work performed by Contractor meets the minimum safety requirements established by the Federal Railroad Administration's Track Safety Standards 49CFR213.
- D. All employees comply with the following safety procedures when working around any railroad track:
  - (i) Always be on the alert for moving equipment. Employees must always expect movement on any track, at any time, in either direction.

- (ii) Do not step or walk on the top of the rail, frog, switches, guard rails, or other track components.
- (iii) In passing around the ends of standing cars, engines, roadway machines or work equipment, leave at least 20 feet between yourself and the end of the equipment. Do not go between pieces of equipment if the opening is less than one car length (50 feet).
- (iv) Avoid walking or standing on a track unless so authorized by the employee in charge.
- (v) Before stepping over or crossing tracks, look in both directions first.
- (vi) Do not sit on, lie under, or cross between cars except as required in the performance of your duties and only when track and equipment have been protected against movement.

E. All employees must comply with all federal and state regulations concerning workplace safety.

**DIVISION 01**

## **01 11 00      SUMMARY OF WORK**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Construct Work as described in the Contract Documents.
  - 1. Provide the materials, equipment, and incidentals required to make the Project completely and fully 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 indicated in Contract Documents for the operation and maintenance of the Project.
  - 6. Install Owner provided products and place in operation.
  - 7. The Contract Documents do not indicate or describe all of the Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer.

#### **1.02    JOB CONDITIONS**

- A. The General Conditions, the Supplementary Conditions, and General Requirements apply to each Section of the Specifications.
- B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the Work being performed.

#### **1.03    DESCRIPTION OF WORK**

- A. Work is described in general, non-inclusive terms as:
  - 1. Roadway reconstruction
  - 2. New roadway construction
  - 3. Paving
  - 4. Storm drainage
  - 5. Illumination
  - 6. Grading
  - 7. Curb and gutter
  - 8. Sidewalks
  - 9. Signing
  - 10. Pavement Markings

- 11. Water lines
- 12. Sanitary sewers

1.04 WORK UNDER OTHER CONTRACTS

- A. In the case of a disagreement between the above list and those specified elsewhere in the Contract Documents, the Contractor is to base his Bid on the most expensive listing.
- B. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.
  - 1. Coordinate construction activities through the Owner.
  - 2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.

1.05 WORK BY OWNER

- A. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.
  - 1. Coordinate construction activities through the Owner.
  - 2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.
- B. Owner will provide normal operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.06 OWNER-SELECTED PRODUCTS

- A. Owner has or will select the Suppliers for the following products:

Description	Supplier	Appendix
None		

- 1. Products are described in the referenced appendices. Obtain clarification from the Engineer in the case of a disagreement between the above list and those specified elsewhere in the Contract Documents.
- B. Execute an agreement with each designated Supplier upon receiving the Notice to Proceed.
- C. Include the cost for the purchase, delivery, installation, testing, finishing, and startup of the product in the proposed bid price.
- D. Assume responsibilities for Owner selected products as for products selected by the Contractor.

1.07 OWNER-PROVIDED PRODUCTS

- A. Owner has or will purchase and provide the following products to the Contractor for installation:

Description	Supplier	Appendix
None		

1. Products are described in the referenced appendices. Obtain clarification from the Engineer in the case of a disagreement between the above list and those specified elsewhere in the Contract Documents.
- B. Assume responsibilities for coordination, installation and startup of Owner provided products as for products selected and purchased by the Contractor.
- C. Provide labor, materials, equipment, tools, consumable supplies, and incidentals not specifically required by the contract between the Owner and Supplier but required to provide a complete and operable product.
- D. Payment for the product will be made directly from the Owner to the product provider.
- E. Include all other costs for the product in the proposed bid price.

1.08 CONSTRUCTION OF UTILITIES

- A. Utility companies or their contractors will provide new or enhanced utilities for this Project. Coordinate with others performing Work associated with this Project.
- B. Power and Electrical Services:
  1. Contractor shall provide permanent power connections for the Site through the power utility unless indicated otherwise in the Contract Documents.
  2. Cost for providing permanent power shall be paid for by the Contractor.
  3. Contractor is required to coordinate and cooperate with others performing this Work.
  4. Provide conduit, conductors, pull boxes, manholes, and other appurtenances for the installation of power cable between the property line and the transformer and between the transformer and the main power switch.
  5. Test conductors in accordance with Section 01 40 00 "Quality Requirements" and coordinate with the power utility to energize the system when ready.
  6. Pay for temporary power, including but not limited to construction cost, meter connection, fees and permits.
  7. When permanent power is available at the Site, the Contractor may use this power source in lieu of temporary power source previously used.
    - a. Notify Engineer and Owner of intent to use the permanent power source.
    - b. Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.
  8. Pay for the power consumed until the Project has been accepted as substantially complete.

1.09 OCCUPANCY

- A. As soon as any portion of the structure and equipment are ready for use, the Owner shall have the right to occupy or operate that portion upon written notice to the Contractor.
- B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.
- C. Owner may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the 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 the surety to these provisions.
- E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.
- F. Conduct operations to insure the least inconvenience to the Owner and general public.

**2.00 PRODUCTS**

**2.01 MATERIALS**

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

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 23 10      ALTERNATES AND ALLOWANCES**

### **1.00    GENERAL**

#### **1.01    REQUIREMENTS**

##### **A. Alternates:**

1. This Section describes each alternate by number and describes the basic changes to be incorporated into the Work when this alternate is made a part of the Work in the Agreement.
2. Drawings and Specifications will outline the extent of Work to be included in the alternate Contract Price.
3. Coordinate related Work and modify surrounding Work as required to properly integrate the Work under each alternate, and provide a complete and functional system as required by the Contract Documents.
4. Alternates will be accepted or rejected at the option of the Owner.
5. Alternate prices will be maintained a minimum of 120 days, unless noted otherwise.

##### **B. Allowances:**

1. Include specified allowance amount in Contract Price.
2. The amount of each allowance includes:
  - a. The cost of the product to the Contractor less any applicable trade discounts.
  - b. Delivery to the Site.
  - c. Applicable taxes.
3. Include in the Contract Price all costs for:
  - a. Handling at the Site, including unloading, uncrating, and storage per Section 01 31 00 "Project Management and Coordination."
  - b. Cost for labor and equipment for installation and finishing.
  - c. Cost for related products not specifically listed in the allowance required for installation, including consumable supplies and materials.
  - d. All overhead, profit, and related costs.
4. Assist Owner in the selection of products.
  - a. Determine qualified Suppliers.
  - b. Obtain proposals from qualified Suppliers.
  - c. Present available alternates to the Owner through the Engineer. Notify Engineer of:
    - 1). Any objections to a particular Supplier or product.
    - 2). Effect on the Construction Schedule anticipated by the selection of each option.
    - 3). Cost of each option.



5. Upon selection of the product:
  - a. Purchase and install the product.
  - b. Contractor's responsibilities for products shall be the same as for products selected by the Contractor.
6. Submit a Contract Modification Request per Section 01 31 13 "Project Coordination" to adjust Contract Price if the net cost of the product is more or less than the specified amount.
  - a. For products specified as Unit Price Work, the unit cost shall apply to the quantities installed per the method of payment described in Section 01 29 00 "Payment Procedures."
  - b. Do not perform Work until selection of alternate has been approved in writing by the Owner.
  - c. Provide actual invoices for the materials.

1.02 SUBMITTALS

- A. Provide submittals for materials furnished as part of the alternate in accordance with Section 01 33 00 "Submittal Procedures."

1.03 DESCRIPTION OF ALTERNATES

- A. Add Alternate A:
  1. **Construction of Marketplace Avenue Extension, including pavement, sidewalk, and storm drain. Pavement section will be 3" HMAC Type D / 8" HMAC Type B.**
- B. Add Alternate B:
  1. **Construction of Marketplace Avenue Extension, including pavement, sidewalk, and storm drain. Pavement section will be 5.5" HMAC Type D / 16" Flexible Base.**

1.04 DESCRIPTION OF ALLOWANCES

- A. (None)

1.05 GUARANTEES

- A. Provide guarantees for products furnished under alternate bids / proposals or purchased by allowances as required by the Contract Documents.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 29 00      PAYMENT PROCEDURES**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Payments for Work shall conform to the provisions of the General Conditions, the Supplementary Conditions, the Agreement, and this Section. Apply provisions for payments in the Section to all Subcontractors and Suppliers.
- B. Submit Applications for Payment at the amounts indicated in the Agreement:
  - 1. Amounts for each item in the Agreement shall include but not be limited to cost for:
    - a. Mobilization, demobilization, cleanup, bonds, and insurance.
    - b. Professional services including but not limited to engineering and legal fees.
    - c. The products to be permanently incorporated into the Project.
    - d. The products consumed during the construction of the Project.
    - e. The labor and supervision to complete the Project.
    - f. The equipment, including tools, machinery, and appliances required to complete the Project.
    - g. The field and home office administration and overhead costs related directly or indirectly to the Project.
    - h. Any and all kinds, amount or class of excavation, backfilling, pumping or drainage, sheeting, shoring and bracing, disposal of any and all surplus materials, permanent protection of all overhead, surface or underground structures; removal and replacement of any poles, conduits, pipelines, fences, appurtenances and connections, cleaning up, overhead expense, bond, public liability and compensation and property damage insurance, patent fees, and royalties, risk due to the elements, and profits, unless otherwise specified.
  - 2. Provide Work not specifically set forth as an individual payment item but required to provide a complete and functional system. These items are a subsidiary obligation of the Contractor and are to be included in the Cost of Work.
  - 3. Payment will be made for materials on hand.
    - a. Store materials properly on Site per Section 01 31 00 "Project Management and Coordination."
      - 1). Payment will be made for the invoice amount less the specified retainage.
      - 2). Provide invoices at the time materials are included on the materials-on-hand tabulation.
    - b. Provide documentation of payment for materials-on-hand with the next payment request. Adjust payment to the amount actually paid if this differs from the invoice amount. Remove items from the materials on hand tabulation if this documentation is not provided so payment will not be made.

- c. Payment for materials-on-hand is provided for the convenience of the Contractor and does not constitute acceptance of the product.
- 4. The Work covered by progress payments becomes the property of the Owner at the time of payment.

#### 1.02 SCHEDULE OF VALUES AND PAYMENTS

- A. Submit a detailed Schedule of Values for the Work to be performed on the project.
  - 1. Submit schedule within 10 days prior to submitting the first Application for Payment.
  - 2. Line items in the Agreement are to be used as line items in the schedule.
  - 3. Payment will be made on the quantity of Work completed per Contract Documents during the payment period and as measured per this Section.
    - a. Payment amount is the Work quantity measured multiplied by the unit prices for that line item in the Agreement.
    - b. Payment on a unit price basis will not be made for Work outside finished dimensions shown in the Contract Documents.
    - c. Partial payments will be made for lump sum line items in the Agreement.
      - 1). Lump sum line items in the Agreement are to be divided into smaller unit prices to allow more accurate determination of the percentage of the item that has been completed.
        - a). Provide adequate detail to allow more accurate determination of the percentage of Work completed for each item.
        - b). Provide amounts for items that do not exceed \$50,000.00. An exception may be made for equipment packages that cannot be subdivided into units or subassemblies.
        - c). Separate product costs and installation costs.
          - (1). Product costs include cost for product, delivery and unloading costs, royalties and patent fees, taxes, and other cost paid directly to the Subcontractor or Supplier.
          - (2). Installation costs include cost for the supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and overhead and profit.
      - d). Lump sum items may be divided into an estimated number of units.
        - (1). The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
        - (2). Payment will be made for all of the lump sum line item amount.
      - e). Include a directly proportional amount of overhead and profit for each line item.
      - f). Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of Work completed for each item.

- 2). These line items may be used to establish the value of Work to be added or deleted from the Project.
  - 3). Correlate line items with other administrative schedules and forms:
    - a). Progress schedule.
    - b). List of Subcontractors.
    - c). Schedule of allowances.
    - d). Schedule of alternatives.
    - e). List of products and principal Suppliers.
    - f). Schedule of Submittals.
  - 4). Costs for mobilization shall be in accordance with Item 500 in the Texas Department of Transportation 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges.
  - 5). The sum of all values listed in the schedule must equal the total Contract amount.
4. Submit a schedule indicating the anticipated schedule of payments to be made by the Owner. Schedule shall indicate:
    - a. The Application for Payment number.
    - b. Date the request is to be submitted.
    - c. Anticipated amount of payment to be requested.
  5. Update the Schedule of Values quarterly or more often if necessary to provide a reasonably accurate indication of the funds that the Owner will need to have available to make payment to the Contractor for the Work performed.
- B. Provide written approval of the Schedule of Values, Application for Payment form, and method of payment by the Surety Company providing performance, and bonds prior to submitting the first Application for Payment. Payment will not be made without this approval.

### 1.03 PAYMENT PROCEDURES

- A. Submit Applications for Payment per the procedures indicated in Section 01 33 00 "Submittal Procedures." Submit a Schedule of Values in the Application for Payment format to be used.
- B. Applications for Payment may be submitted on a pre-printed form as indicated in Section 01 31 13.13 "Forms" or may be generated by computer. Computer generated payment requests must have the same format and information indicated in the pre-printed form and be approved by the Engineer.
  1. Indicate the total contract amount and the Work completed to date on the Tabulation of Values for Original Contract Performed (Attachment "A.").
  2. Include only approved Change Order items in the Tabulation of Extra Work on Approved Change Orders (Attachment "B.").

3. List all materials on hand that are presented for payment on the Tabulation of Materials on Hand (Attachment "C.") Once an item has been entered on the tabulation it is not to be removed.
  4. Include the Project Summary Report (Attachment "D") with each Application for Payment. Data included in the Project Summary Report are to be taken from the other tabulations. Include a completed summary as indicated in with each Applications for Payment submitted.
    - a. Number each application sequentially and indicate the payment period. Revised Applications for Payment will be resubmitted as A, B, C and so forth to note changes in content.
    - b. Show the total amounts for value of original Contract performed, extra Work on approved Change Orders, and materials on hand on the Project Summary Report. Show total amounts that correspond to totals indicated on the attached tabulation for each.
    - c. Note the number of pages in tabulations in the blank space on the Project Summary Report to allow a determination that all sheets have been submitted.
    - d. Execute Contractor's certification by the Contractor's agent of authority and notarize for each Application for Payment.
    - e. Note the number of actual worked days and reason for days not worked. This is a calendar day contract, so all days will be charged regardless if work was performed.
  5. Do not alter the schedule of values and the form for the submission of requests without the written approval of the Engineer once these have been approved by the Engineer.
  6. Final payment requires additional procedures and documentation per Section 01 70 00 "Execution and Closeout Requirements."
- C. Progress payments shall be made as the Work progresses on a monthly basis.
1. End the payment period on the day indicated in the Agreement and submit an Application for Payment for Work completed and materials received since the end of the last payment period.
  2. At the end of the payment period, submit a draft copy of the Application for Payment for that month to the Engineer. Agreement is to be reached on:
    - a. The percentage of Work completed for each lump sum item.
    - b. The quantity of Work completed for each unit price item.
    - c. The percentage of Work completed for each approved Change Order item.
    - d. The amount of materials-on-hand.
  3. On the basis of these agreements the Contractor is to prepare a final copy of the Application for Payment and submit it to the Engineer for approval.
  4. The Engineer will review the Application for Payment and if appropriate will recommend payment of the application to the Owner.
- D. Provide a revised and up-to-date Progress Schedule per Section 01 32 16 "Construction Progress Schedules" with each Application for Payment.

- E. Provide project photographs and video per Section 01 32 34 "Video and Photographic Documentation" with final Application for Payment.

1.04 ALTERNATES AND ALLOWANCES

- A. Include amounts for specified Alternate Work in the Agreement in accordance with Section 01 23 10 "Alternates and Allowances."
- B. Include amounts for specified Allowances for Work in the Agreement in accordance with Section 01 23 10 "Alternates and Allowances."

1.05 MEASUREMENT PROCEDURES

- A. Measure the Work described in the Agreement for payment. Payment will be made only for the actual measured and/or computed length, area, solid contents, number and weight, unless otherwise specifically provided. No extra or customary measurements of any kind will be allowed.

1.06 BASIS OF PAYMENT

- A. The Basis of Payment will be as established in the Contract Documents and as described in the applicable "Measurement" and "Payment" sections of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges and the City of Austin Standard Specifications Manual.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 31 00 PROJECT MANAGEMENT AND COORDINATION**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish equipment, manpower, products, and other items necessary to complete the Project with an acceptable standard of quality and within the Contract time. Construct Project in accordance with current safety practices.
- B. Manage Site to allow access to Site and control construction operations.
- C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- D. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.
- E. Provide temporary controls for pollutions, management of water and management of excess earth as required in Section 01 57 00 "Temporary Controls."
- F. Cost for Project Management and Coordination as described in this section are to be included in the Contract Price.

#### **1.02 QUALITY ASSURANCE**

- A. Employ competent workmen, skilled in the occupation for which they are employed. Provide Work meeting quality requirements of the Contract Documents as determined by the Engineer and Owner.
- B. Remove defective Work from the Site immediately unless provisions have been made and approved by the Engineer to allow repair of the product at the Site. Clearly mark the Work as "defective" until it is removed or allowable repairs have been completed.

#### **1.03 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 "Submittal Procedures."
  - 1. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation. Maintain one copy of these documents at the Site until the Project is complete. Incorporate this information into submittals.
  - 2. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings.

#### **1.04 STANDARDS**

- A. Perform Work to comply with local, State and Federal ordinances and regulations.
- B. Provide materials and equipment that has National Science Foundation 60/61 approval for use in potable water supply systems. Advise the Engineer of any material requirements in

these Contract Documents that conflict with National Science Foundation 60/61 requirements.

#### 1.05 PERMITS

- A. Obtain a building permit for the Project from the local authorities having jurisdiction. Building permit fees will be waived by the Owner.
- B. Retain copies of permits and licenses at the Site and observe and comply with all regulations and conditions of the permit or license, including additional insurance requirements.
- C. Obtain and pay for all other necessary permits including any and all necessary highway, street and road permits for transporting pipe and/or heavy equipment necessary for construction of the Project.
- D. Obtain and pay for other permits necessary to conduct any part of the Work.
- E. Arrange for inspections and certification by agencies having jurisdiction over the Work.
- F. Make arrangements with private utility companies and pay for fees associated with obtaining services, or for inspection fees.

#### 1.06 SAFETY REQUIREMENTS

- A. Assume sole responsibility for safety at the Site. Protect the safety and welfare of persons at the Site.
- B. Provide safe access to move through the Site. Provide and maintain barricades, guard rails, covered walkways, and other protective devices to warn and protect from hazards at the Site.
- C. Comply with latest provisions of the Occupational Health and Safety Administration and other regulatory agencies in performing Work.
- D. Cooperate with accident investigations related to the Site. Provide two copies of all reports, including insurance company reports, if requested by the Owner, prepared concerning accidents, injury, or death on the Site to the Engineer as Record Data per Section 01 33 00 "Submittal Procedures."

#### 1.07 COORDINATION

- A. Coordinate the Work of various trades having interdependent responsibilities for installing, connecting to, and placing equipment in service.
- B. Coordinate requests for substitutions to provide compatibility of space, operating elements, effect on the Work of other trades, and on the Work scheduled for early completion.
- C. Coordinate the use of Project space and the sequence of installation of equipment, elevators, walks, mechanical, electrical, plumbing, or other Work that is indicated diagrammatically on the Drawings.
  - 1. Follow routings shown for tubes, pipes, ducts, conduits, and other items as closely as practical, with due allowance for available physical space.
  - 2. Utilize space efficiently to maximize accessibility for Owner's maintenance and repairs.



3. Schematics are diagrammatic in nature. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document the actual routing on the Record Drawings.
- D. Conceal ducts, pipes, wiring, and other non-finish items in finished areas, except as otherwise shown. Coordinate locations of concealed items with finish elements.
- E. Coordinate with architectural reflected ceiling plans the exact location and dimensioning of items which occur within hung ceilings. Request clarification from the Engineer prior to proceeding with fabrication or installation if a conflict exists.
- F. Schedule construction activities in sequence required to obtain best results where installation of one part of the Work is dependent on installation of other components, either before or after its own installation.
- G. Make adequate provisions to accommodate items scheduled for later installation, including:
  1. Accepted alternates.
  2. Installation of products purchased with allowances.
  3. Work by others.
  4. Owner-supplied, Contractor-installed items.
- H. Sequence, coordinate, and integrate the various elements of mechanical, electrical, and other systems, materials, and equipment. Comply with the following requirements:
  1. Coordinate mechanical and electrical systems, equipment, and materials installation with other building components.
  2. Verify all dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction.
  4. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete and other structural components, as they are constructed.
  5. Install systems, materials, and equipment as permitted by codes to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
  6. Coordinate the connection of systems with exterior underground and overhead utilities and services. Comply with the requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to the greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document changes in the indicated routings on the Record Drawings.
  8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

9. Install systems, materials, and equipment to facilitate servicing, maintenance, and repair or replacement of components. As much as practical, connect for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to accessible locations.
10. Install access panel or doors where units are concealed behind finished surfaces.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

#### 1.08 CONTRACTOR'S USE OF SITE

- A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Engineer. Coordinate the use of the premises with the Engineer.
- B. Repair or correct any damage to existing facilities, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment.
- C. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.
- D. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 00 "Temporary Controls."
- E. Park employees' vehicles in designated areas only.
- F. Obtain written permission of the Owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.
- G. Do not allow the use of audio devices, obnoxious, vulgar or abusive language, or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.
- H. Require Workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing to be worn on the project.
- I. Do not allow firearms or weapons of any sort to be brought on to the Site under any conditions. No exception is to be made for persons with concealed handgun permits. Remove any firearms or weapons and the person possessing these firearms or weapons permanently and immediately from the Site.

#### 1.09 ACCESS TO THE SITE

- A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe temporary walks or other structures to allow access for normal operations during construction.
- B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.

- C. Provide security at the Site as necessary to protect against vandalism and loss by theft.
- D. Use State, County, or City roadways for construction traffic only with written approval of the appropriate representatives of each entity. State, County, or City roadways may not all be approved for construction traffic. Obtain written approval to use State, County, City or private roads to deliver pipe and/or heavy equipment to the Site. Copies of the written approvals must be furnished to the Owner as Record Data before Work begins. No additional compensation will be paid because the Contractor is unable to gain access to the easement from public roadways.

#### 1.10 PROPERTY PROVISIONS

- A. Make adequate provisions to maintain the flow of storm sewers, sanitary sewers, drains and water courses encountered during the construction. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not curtailed. Restore structures which may have been disturbed during construction to their original position as soon as construction in the area is completed.
- B. Protect trees, fences, signs, poles, guy wires, and all other property unless their removal is authorized. Restore any property damaged to equal or better condition per Paragraph 1.11 of this Section.

#### 1.11 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the Site and review the available information concerning the Site. Locate utilities, streets, driveways, fences, drainage structures, sidewalks, curbs, and gutters. Verify the elevations of the structures adjacent to excavations. Report these to the Engineer before beginning construction.
- B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 35 00 "Special Procedures." Coordinate Work with Contractor, local utility company and others. Include cost of demolition and replacement, restoration or relocation of these structures in the Cost of Work.
- C. Protect buildings, utilities, street surfaces, driveways, sidewalks, curb and gutter, fences, wells, drainage structures, piping, valves, manholes, electrical conduits, and other systems or structures unless they are shown to be replaced or relocated on the Drawings. Restore damage to items to be protected to the satisfaction of the Engineer, utility owner and Owner without additional compensation from the Owner.
- D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless shown in the Contract Documents or approved by the Engineer. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines or other obstructions. Include the cost of relocation and permits required to move existing utilities in the Cost of Work.
- E. Protect existing trees and landscaping at the site.
  - 1. Visit the Site with Engineer to identify trees that may be removed during construction.
  - 2. Mark trees to be removed with paint.

3. Protect trees to remain from damage by wrapping trunks with 2 x 4 timbers around the perimeter, securely wired in place, where machinery must operate around existing trees. Protect branches and limbs from damage by equipment.
- F. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs.

#### 1.12 DISRUPTION TO SERVICES / CONTINUED OPERATIONS

- A. Existing facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Disruptions to existing utilities, piping, process piping, or electrical services shall be kept to a minimum.
1. Do not restrict access to critical valves, operators, or electrical panels.
  2. Do not store material or products inside structures.
  3. Limit operations to the minimum amount of space needed to complete the specified Work.
  4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not restricted.
- B. Provide a Plan of Action in accordance with Section 01 35 00 "Special Procedures" if facilities must be taken out of operation.

#### 1.13 FIELD MEASUREMENTS

- A. Perform complete field measurements for products required to fit existing conditions prior to purchasing products or beginning construction.
- B. Verify property lines, control lines, grades, and levels indicated on the Drawings.
- C. Verify pipe class, equipment capacities, existing electrical systems and power sources for existing conditions.
- D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.
- E. Include field measurements in Record Drawings as required in Section 01 31 13 "Project Coordination."

#### 1.14 REFERENCE DATA AND CONTROL POINTS

- A. The Engineer will provide the following control points:
1. Base line or grid reference points for horizontal control.
  2. Benchmarks for vertical control.
  3. Designated control points may be on an existing structure or monument.
- B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Do 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.

- C. Provide complete engineering layout of the Work needed for construction.
  - 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
  - 2. Provide surveying with accuracy meeting the requirements established for Category 5 Construction Surveying as established in the Manual of Practice of Land Surveying in Texas published by the Texas Society of Professional Surveyors, latest revision.
  - 3. Record data and measurements per standards.

#### 1.15 DELIVERY AND STORAGE

- A. Deliver products and materials to the Site in time to prevent delays in construction.
- B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in packages or other containers until installed.
- C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs.
- D. Assume full responsibility for the protection and safekeeping of products stored at the Site.
- E. Store products at locations acceptable to the Engineer and to allow Owner access to maintain and operate existing facilities.
- F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- G. Obtain and pay for the use of any additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.
- H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work. Cap or plug ends of installed pipe in an approved manner when pipe is not being installed. Clean or wash out pipe sections that become contaminated before continuing with installation. Take precautions to prevent the pipe from floating or moving out of the proper position during or after laying operations. Immediately correct any pipe that moves from its correct position.
- I. Provide adequate exterior storage for products that may be stored out-of-doors.
  - 1. Provide substantial platforms, blocking, or skids to support materials and products above ground; slope to provide drainage. Protect products from soiling or staining.

2. Cover products subject to dislocation or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
  3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
  4. Provide surface drainage to prevent erosion and ponding of water.
  5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
  6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
  7. Store light weight products to prevent wind damage.
- J. Protect and maintain mechanical and electrical equipment in storage.
1. Provide Supplier's service instructions on the exterior of the package.
  2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data at the completion of the Project.
  3. Provide power to and energize space heaters for all equipment for which these devices are provided.
  4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.
- K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
1. Storage facilities continue to meet specified requirements.
  2. Supplier's required environmental conditions are continually maintained.
  3. Surfaces of products exposed to the elements are not adversely affected.
- L. Replace any stored item damaged by inadequate protection or environmental controls.
- M. Payment may be withheld for any products not properly stored.

#### 1.16 CLEANING DURING CONSTRUCTION

- A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from discharging into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.
- B. Clean the Project as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers on Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

- C. Comply with codes, ordinances, regulations, and anti-pollution laws. Do not burn or bury waste materials. Remove waste materials, rubbish and debris from the Site and legally dispose of these at public or private dumping areas.

1.17 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

- A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Submit a written request for Owner's approval of a street closing. The request shall state:
  - 1. The reason for closing the street.
  - 2. How long the street will remain closed.
  - 3. Procedures to be taken to maintain the flow of traffic.
  - 4. Do not close public roads overnight.
- B. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations.
- C. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).
- D. Assume responsibility for any damage resulting from construction along roads or drives.

1.18 BLASTING

- A. Blasting is not allowed for any purpose.

1.19 ARCHAEOLOGICAL REQUIREMENTS

- A. Cease operations immediately and contact the Owner for instructions if an historical or archaeological find is made during construction.
- B. Conduct all construction activities to avoid adverse impact on the Sites where significant historical or archaeological Sites have been identified at the Site.
  - 1. Obtain details for Working in these areas.
  - 2. Maintain confidentiality regarding the Site.
  - 3. Adhere to the requirements of the Texas Historical Commission.
  - 4. Notify the Owner, Texas Water Development Board and the Texas Historical Commission.
- C. Do not disturb Archaeological Sites.
  - 1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
  - 2. Coordinate activities to permit Archaeological Work to take place within the area.
    - a. Attempt to archaeologically clear areas needed for construction as soon as possible.
    - b. Provide a determination of priority for such areas.

- D. Assume responsibility for any unauthorized destruction that might result to such Sites by construction personnel, and pay all penalties assessed by the State or Federal agencies for non-compliance with these requirements.
- E. Contract time will be modified to compensate for delays caused by such archaeological finds. No additional compensation shall be paid for delays.

#### 1.20 CUTTING AND PATCHING

- A. Perform cutting, fitting, and patching required to complete the Work or to:
  - 1. Uncover Work to provide for installation of new Work or the correction of defective Work.
  - 2. Provide routine penetrations of non-structural surfaces for installation of mechanical, electrical, and plumbing Work.
  - 3. Uncover Work that has been covered prior to observation by the Engineer.
- B. Submit written notification to the Engineer in advance of performing any cutting which affects:
  - 1. Work of any other Contractor or the Owner.
  - 2. Structural integrity of any structure or system of the project.
  - 3. Integrity or effectiveness of weather exposed or moisture resistant structure or systems.
  - 4. Efficiency, operational life, maintenance, or safety of any structure or system.
  - 5. Appearance of any structure or surfaces exposed occasionally or constantly to view.
- C. The notification shall include:
  - 1. Identification of the Project.
  - 2. Location and description of affected Work.
  - 3. Reason for cutting, alteration, or excavation.
  - 4. Effect on the Work of any separate contractor or Owner.
  - 5. Effect on the structural or weatherproof integrity of the project.
  - 6. Description of proposed Work, including:
    - a. Scope of cutting, patching, or alteration.
    - b. Trades that will perform the Work.
    - c. Products proposed for use.
    - d. Extent of refinishing to be performed.
    - e. Cost proposal, when applicable.
  - 7. Alternatives to cutting and patching.
  - 8. Written authorization from any separate Contractor whose Work would be affected.
  - 9. Date and time Work will be uncovered or altered.



- D. Examine the existing conditions, including structures subject to damage or to movement during cutting or patching.
  - 1. Inspect conditions affecting installation of products or performance of the Work after uncovering the Work.
  - 2. Provide a written report of unacceptable or questionable conditions to the Engineer. The Contractor shall not proceed with Work until Engineer has provided further instructions. Beginning Work will constitute acceptance of existing conditions by the Contractor.
- E. Protect the structure and other parts of the Work and provide adequate support to maintain the structural integrity of the affected portions of the Work. Provide devices and methods to protect adjacent Work and other portions of the Project from damage. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching Work.
- F. Execute cutting and demolition by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs.
- G. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- H. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to, the removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the modified Work.
- I. Restore Work which has been cut or removed. Install new products to provide completed Work per the Contract Documents.
- J. Fit Work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe or insert with materials with physical characteristics equivalent to fire resistance requirements of penetrated surface.
- K. Patch finished surfaces and building components using new products specified for the original installation.
- L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
  - 1. For continuous surfaces, refinish to the nearest intersection.
  - 2. For an assembly, refinish the entire unit.

#### 1.21 PRELIMINARY OCCUPANCY

- A. Owner may deliver, install and connect equipment, furnishings, or other apparatus in buildings or other structures. These actions do not indicate acceptance of any part of the building or structure and does not affect the start of warranties or correction periods.
- B. Protect the Owner's property after installation is complete.
- C. Owner or Engineer may use any product for testing or determine that the product meets the requirements of the Contract Documents. This use does not constitute acceptance by either

the Owner or Engineer. These actions do not indicate acceptance of any part of the product and does not affect the start of warranties or correction periods.

#### 1.22 INITIAL MAINTENANCE AND OPERATION

- A. Maintain equipment until the Project is accepted by the Owner. Ensure that mechanical equipment is properly maintained as recommended by the Supplier.
- B. Do not operate air handling equipment unless filters are in place and are clean. Change filters weekly during construction.
- C. Provide maintenance and start-up services prior to acceptance of equipment, per Section 01 75 00 "Starting and Adjusting."
- D. Remove and clean screens and strainers in piping systems.
- E. Clean insects from intake louver screens.
- F. Provide documentation of maintenance and operations when Owner takes over operation and control of the Project.

#### 1.23 ENDANGERED SPECIES RESOURCES

- A. No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of Texas Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species.
- B. If a threatened or endangered species is encountered during construction, the Contractor shall immediately cease Work in the area of the encounter and notify the Owner, who will immediately implement actions in accordance with the ESA and applicable State statutes. These actions shall include reporting the encounter to the Texas Water Development Board, the U. S. Fish and Wildlife Service, and the Texas Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the Work to continue, or implement other mitigative actions. The Contractor shall not resume construction in the area of the encounter until authorized to do so by the Owner.

### 2.00 PRODUCTS

#### 2.01 MATERIALS

- A. Provide materials in accordance with the requirements of the individual Sections.

### 3.00 EXECUTION

#### 3.01 PERFORMANCE OF WORK

- A. Perform the Work per the Supplier's published instructions. Do not omit any preparatory step or installation procedure unless specifically exempted or modified by Field Order.

**END OF SECTION**

## **01 31 13 PROJECT COORDINATION**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the Engineer or Owner.

#### **1.02 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 "Submittal Procedures."

#### **1.03 COMMUNICATION DURING THE PROJECT**

- A. The Engineer is to be the first point of contact for all parties on matters concerning this project.
- B. The Engineer will coordinate correspondence concerning:
  - 1. Submittals, including Applications for Payment.
  - 2. Clarification and interpretation of the Contract Documents.
  - 3. Contract modifications.
  - 4. Observation of Work and testing.
  - 5. Claims.
- C. The Engineer will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.
- D. Direct written communications to the Engineer at the address indicated at the Pre-construction Conference. Include the following with communications as a minimum:
  - 1. Name of the Owner.
  - 2. Project name.
  - 3. Contract title.
  - 4. Project number.
  - 5. Date.
  - 6. A reference statement.
- E. Submit communications on the forms referenced in this Section or in Section 01 33 00 "Submittal Procedures."

#### **1.04 PROJECT MEETINGS**

- A. Pre-construction Conference:
  - 1. Attend a pre-construction conference.
  - 2. The location of the conference will be determined by the Engineer.

3. The time of the meeting will be determined by the Engineer but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued.
  4. The Owner, Engineer, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference.
  5. Provide and be prepared to discuss:
    - a. Preliminary construction schedule per Section 01 32 16 "Construction Progress Schedule."
    - b. Preliminary submittal schedule per Section 01 33 00 "Submittal Procedures."
    - c. Schedule of values and anticipated schedule of payments per Section 01 29 00 "Payment Procedures."
    - d. List of Subcontractors and Suppliers.
    - e. Contractor's organizational chart as it relates to this Project.
    - f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests.
  6. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests.
- B. Progress Meetings:
1. Attend meetings with the Engineer and Owner.
    - a. Meet on a monthly basis or as requested by the Engineer to discuss the Project.
    - b. Meet at the Site or other location as designated by the Engineer.
    - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
    - d. Notify the Engineer of any specific items to be discussed a minimum of 1 week prior to the meeting.
  2. Provide information as requested by the Engineer or Owner concerning this Project. Prepare to discuss:
    - a. Status of overall project schedule.
    - b. Contractor's detailed schedule for the next month.
    - c. Anticipated delivery dates for equipment.
    - d. Coordination with the Owner.
    - e. Status of submittals.
    - f. Information or clarification of the Contract Documents.
    - g. Claims and proposed modifications to the Contract.
    - h. Field observations, problems, or conflicts.

- i. Maintenance of quality standards.
  3. Engineer will prepare minutes of meetings. Review the minutes of the meeting and notify the Engineer of any discrepancies within ten days of the date of the meeting memorandum. The minutes will not be corrected after the ten days have expired. Corrections will be reflected in the minutes of the following meeting or as an attachment to the minutes.
- C. Pre-submittal and Pre-installation Meetings:
1. Conduct pre-submittal and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Engineer (for example, instrumentation, roofing, concrete mix design, etc.).
  2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph **[1.07]** for the meeting 2 weeks before the meeting. Engineer and Owner must approve of the proposed time and location.
  3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.
  4. Prepare minutes of the meeting and submit to the Engineer and Owner for review. Owner and Engineer will review the minutes of the meeting and notify the Contractor of any discrepancies within ten days of the date of the meeting memorandum. The minutes will not be corrected after the ten days have expired. Corrections will be reflected in a revised set of meeting minutes.

#### 1.05 REQUESTS FOR INFORMATION

- A. Submit Request for Information (RFI) to the Engineer to obtain additional information or clarification of the Contract Documents.
  1. Submit a separate RFI for each item on the form provided by the Engineer.
  2. Attach adequate information to permit a written response without further clarification. Engineer will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple submittals due to inadequate information.
  3. A response will be made when adequate information is provided. Response will be made on the RFI form or in attached information.
- B. Response to an RFI is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.
- C. Engineer will initiate a Contract Modification Request per Paragraph **[1.08]** if the RFI indicates that a contract modification is required.
- D. Use the Project Issues Log to document decisions made at meetings and actions to be taken in Accordance with Paragraph **[1.06]**.

## 1.06 PROJECT ISSUES LOG

- A. Engineer will maintain a project issues log to document key decisions made at meeting and track action on these issues:
  - 1. Review the log prior to each regular meeting.
  - 2. Report actions taken subsequent to the previous progress meeting on items in the log assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Engineer. Report on status of progress 1 week prior to each progress meeting established in Paragraph **[1.04]** to allow Engineer to update the log prior to the Progress meetings.
  - 3. Be prepared to discuss the status at each meeting.
- B. Decisions or action items in the log that require a change in the Contract Documents will have the preparation of a contract modification as an action items if appropriate. The Contract Documents can only be changed by a Change Order or Field Order.

## 1.07 NOTIFICATION BY CONTRACTOR

- A. Notify the Engineer of:
  - 1. Need for testing.
  - 2. Intent to work outside regular working hours.
  - 3. Request to shut down facilities or utilities.
  - 4. Proposed utility connections.
  - 5. Required observation by Engineer or inspection agencies prior to covering Work.
  - 6. Training.
  - 7. Closure of roads, differing from the plans.
- B. Provide notification a minimum of 2 weeks in advance in order to allow Owner and Engineer time to respond appropriately to the notification.
- C. Use “Notification by Contractor” form provided by the Engineer.

## 1.08 REQUESTS FOR MODIFICATIONS

- A. Submit a request to the Engineer for any change in the Contract Documents.
  - 1. Use the “Contract Modification Request” (CMR) form provided by the Engineer.
  - 2. Assign a number to the Contract Modification Request when issued.
  - 3. Include with the Contract Modification Request:
    - a. A complete description of the proposed modification.
    - b. The reason the modification is requested.
    - c. A detailed breakdown of the cost of the change (necessary only if the modification requires a change in contract amount). The itemized breakdown is to include:
      - 1). List of materials and equipment to be installed.

- 2). Man hours for labor by classification.
  - 3). Equipment used in construction.
  - 4). Consumable supplies, fuels, and materials.
  - 5). Royalties and patent fees.
  - 6). Bonds and insurance.
  - 7). Overhead and profit.
  - 8). Field office costs.
  - 9). Home office cost.
  - 10). Other items of cost.
- d. Provide the level of detail outline in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark-ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outline in the paragraph above for self-performed Work.
  - e. Provide a revised schedule indicating the effect on the critical path for the Project and a statement of the number of days the Project may be delayed by the modification.
4. Submit a Contract Modification Request to the Engineer to request a field change.
  5. A Contract Modification Request is required for all substitutions or deviations from the Contract Documents.
  6. Engineer will evaluate the request for a contract modification.
- B. Owner will initiate changes through the Engineer.
1. Engineer will prepare a description of proposed modifications to the Contract Documents.
  2. Engineer will use the Contract Modification Request form. Engineer will assign a number to the Contract Modification Request when issued.
  3. Return the Contract Modification Request with a proposal to incorporate the requested change. Include a breakdown of costs into materials and labor in detail outline above to allow evaluation by the Engineer.
- C. Engineer will issue a Field Order or a Change Order per the General Conditions if a contract modification is appropriate.
1. Modifications to the contract can only be made by a Field Order or a Change Order.
  2. Changes in the Project will be documented by a Field Order or by a Change Order.
  3. Field Orders may be issued by the Engineer for contract modifications that do not change the Contract Price or Contract Time.
  4. Any modifications that require a change in Contract Price or Contract Time can only be approved by Change Order.

- a. Proposals issued by the Contractor in response to a Contract Modification Request will be evaluated by the Engineer.
  - b. If a Change Order is recommended, the Engineer will prepare the Change Order.
  - c. The Change Order will be sent to the Contractor for execution with a copy to the Owner recommending approval.
  - d. Change Orders can only be approved by the Owner.
    - 1). Work performed on the proposed contract modifications prior to the approval of the Change Order will be performed at the Contractor's risk.
    - 2). No payment will be made for Work on Change Orders until approved by the Owner.
- D. The Contractor may be informed that the Contract Modification Request is not approved and construction is to proceed in accordance with the Contract Documents.

#### 1.09 RECORD DRAWINGS

- A. Maintain at the site one complete record copy of:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Contract modifications.
  - 5. Approved Shop Drawings and record data.
  - 6. One set of construction photographs.
  - 7. Test records.
  - 8. Clarifications and other information provided in Request for Information responses.
  - 9. Reference standards.
- B. Store documents and Samples in the Contractor's field office.
  - 1. Documents are to remain separate from documents used for construction. Do not use these documents for construction.
  - 2. Provide files and racks for the storage of documents.
  - 3. Provide a secure storage space for the storage of Samples.
  - 4. Maintain documents in clean, dry, legible conditions, and in good order.
  - 5. Make documents and Samples available at all times for inspection by the Engineer and Owner.
- C. Marking Drawings:
  - 1. Label each document as "Project Record" in large printed letters.
  - 2. Record information as construction is being performed.
    - a. Do not conceal any Work until the required information is recorded.



- b. Mark Drawings to record actual construction, including the following:
    - 1). Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
    - 2). Horizontal and vertical locations of underground utilities and appurtenances constructed and existing utilities encountered during construction.
    - 3). Location of internal utilities and appurtenances concealed in the construction. Refer measurements to permanent structure on the surface. Include the following equipment:
      - a). Piping.
      - b). Ductwork.
      - c). Equipment and control devices requiring periodic maintenance or repair.
      - d). Valves, unions, traps, and tanks.
      - e). Services entrance.
      - f). Feeders.
      - g). Outlets.
    - 4). Changes of dimension and detail.
    - 5). Changes made by Field Order and Change Order.
    - 6). Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to RFIs.
  - c. Mark Specifications and Addenda to identify products provided.
    - 1). Record product name, trade name, catalog number, and each Supplier (with address and phone number) of each product and item of equipment actually installed.
    - 2). Record changes made by Field Order and Change Order.
  - d. Mark additional Work or information in erasable pencil.
    - 1). Use red for new or revised indication.
    - 2). Use purple for Work deleted or not installed (lines to be removed).
    - 3). Highlight items constructed per the Contract Documents in yellow.
  - e. Submit record documents to Engineer for review and acceptance 30 days prior to final completion of the Project.
    - 1). Provide one set of marked up Drawings.
    - 2). Provide six sets of Specifications.
- D. Applications for Payment will not be recommended for payment if record documents are found to be incomplete or not in order. Final payment will not be recommended without complete record documents.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

**01 31 13.13 FORMS**

**1.00 GENERAL**

**1.01 PROJECT FORMS**

- A. Use the forms provided by the Engineer for contract administration, applications for payment, submittals, documentation of test results, equipment installation and documentation, and project closeout.
- B. A digital copy of the required forms will be provided to the Contractor before or at the pre-construction conference.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 32 16 CONSTRUCTION PROGRESS SCHEDULE**

### **1.00 GENERAL**

#### **1.01 REQUIREMENTS**

- A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.
- B. Provide schedule in adequate detail to allow Owner to monitor the Work progress, to anticipate the time and amount of Applications for Payment, and to relate submittal processing to sequential activities of the Work.
- C. Incorporate and specifically designate the dates of anticipated submission of submittals and the dates when submittals must be returned to the Contractor into the schedule.
- D. Assume complete responsibility for maintaining the progress of the Work per the schedule submitted.
- E. Take all requirements of Section 01 35 00 "Special Procedures" into consideration when preparing schedule.

#### **1.02 SUBMITTALS**

- A. Submit Progress Schedules in accordance with Section 01 33 00 "Submittal Procedures." Submit schedules within the following times:
  - 1. Preliminary schedule within 10 days after the Notice of Award. The schedule is to be available at the pre-construction conference.
  - 2. Detailed schedule at least 10 days prior to the first payment request.
- B. Submit Progress Schedules with Applications for Payment. Schedules may be used to evaluate the Applications for Payment. Failure to submit the schedule may cause delay in the review and approval of Applications for Payment.

#### **1.03 SCHEDULE REQUIREMENTS**

- A. Schedule is to be in adequate detail to:
  - 1. Assure adequate planning, scheduling, and reporting during the execution of the Work.
  - 2. Assure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers.
  - 3. Assist in monitoring the progress of the Work.
  - 4. Assist in evaluating proposed changes to Contract Time and project schedule.
  - 5. Assist the Owner in review of Contractor's Application for Payment.
- B. Provide personnel with 5 years' minimum experience in scheduling construction work comparable to this Project.
- C. Provide the schedule in the form of a time scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The graph is to indicate:

1. Complete sequence of construction by activity.
  2. Identification of the activity by structure, location, and type of Work.
  3. Chronological order of the start of each item of Work.
  4. The activity start and stop dates.
  5. The activity duration.
  6. Successor and predecessor relationships for each activity. Group related activities or use lines to indicate relationships.
  7. A clearly indicated critical path. Indicate only one critical path on the schedule. The subsystem with the longest time of completion is the critical path where several subsystems each have a critical path. Float time is to be assigned to other subsystems.
  8. Project percentage of completion, based on dollar value of the Work included in each activity to the last day of the pay period for each Application for Payment.
- D. Submit a separate submittal schedule indicating the dates when the submittals are to be sent to the Engineer.
1. List specific dates submittal is to be sent to the Engineer.
  2. List specific dates submittal must be processed in order to meet the proposed schedule.
  3. Allow a reasonable time to review submittals, taking into consideration the size and complexity of the submittal, the submission of other submittals, and other factors that may affect review time.
  4. Allow time for re-submission of the submittals for each item. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous submittals and for the time lost when submittals are submitted for products that do not meet specification requirements.
- E. Update the schedule at the end of each monthly partial payment period to indicate the progress made on the Project to that date.

#### 1.04 SCHEDULE REVISIONS

- A. Submit a written report if the schedule indicates that the Project is more than 30 days behind schedule. The report is to include:
1. Number of days Project is behind schedule.
  2. Narrative description of the steps to be taken to bring the Project back on schedule.
  3. Anticipated time required to bring the Project back on schedule.
  4. Submit a revised schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.
- B. Revise the schedule to indicate any adjustments in Contract Time approved by Change Order.
1. Revised schedule is to be included with Contract Modification Request for which an extension of time is requested.

2. Failure to submit a revised schedule indicates that the modification shall have no impact on the ability of the Contractor to complete the Project on time and that the cost associated with the change of additional plant or work force have been included in the cost proposed for the modification.
- C. Updating the project schedule to reflect actual progress is not considered a revision to the project schedule.
- D. Applications for Payment will not be recommended for payment without a revised schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

**1.05 FLOAT TIME**

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.
- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Contract time cannot be changed by the submission of this schedule. Contract Time can only be modified by approved Change Order.
- D. Schedule completion date must be the same as the contract completion date. Time between the end of construction and the contract final completion date is to be indicated as float time.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 32 34 VIDEO AND PHOTOGRAPHIC DOCUMENTATION**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Provide a video recording of the Site prior to the beginning of construction.
  - 1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including but not limited to streets, curb and gutter, utilities, driveways, fencing, landscaping, etc.
  - 2. Record after construction staking is complete but prior to any clearing.
  - 3. Provide one copy of the recording, dated and labeled to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.
- B. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.
  - 1. Provide a minimum of ten different views.
  - 2. Photograph a panoramic view of the entire Site.
  - 3. Photograph all significant areas of completed construction.
  - 4. Completion photographs are not to be taken until all construction trailers, excess materials, trash and debris have been removed.
  - 5. Employ a professional photographer approved by the Construction Manager to photograph the Project.
  - 6. Provide one aerial photograph of the Site from an angle and height to include the entire Site while providing adequate detail.
- C. All photographs, video recordings and a digital copy of this media are to become the property of the Owner. Photographs or recordings may not be used for publication, or public or private display without the written consent of the Owner.

#### **1.02 QUALITY ASSURANCE**

- A. Provide clear photographs and recordings taken with proper exposure. View photographs and recordings in the field and take new photographs or recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

#### **1.03 SUBMITTALS**

- A. Submit photographic documentation as record data in accordance with Section 01 33 00 "Submittal Procedures."
- B. Submit two DVDs of the video recording as record data in accordance with Section 01 33 00 "Submittal Procedures."

## **2.00 PRODUCTS**

### **2.01 PHOTOGRAPHS**

- A. Provide photographs in digital format with a minimum resolution of 1280 x 960, accomplished without a digital zoom.
- B. Take photographs at locations acceptable to the Construction Manager.
- C. Provide two color prints of each photograph and a digital copy on a DVD of each photograph taken.
- D. Identify each print on back with:
  - 1. Project name.
  - 2. Date, time, location, and orientation of the exposure.
  - 3. Description of the subject of photograph.
- E. Submit photograph in clear plastic sheets designed for photographs. Place only one photograph in each sheet to allow the description on the back to be read without removing the photograph.
- F. Final photographs are to include two 8-by-10-inch glossy color prints for each of ten photographs selected by the Owner. These photographs are in addition to normal prints.

### **2.02 VIDEO RECORDING**

- A. Provide digital format on DVD that can be played with Windows Media Player in common format in full screen mode.
- B. Identify Project on video by audio or visual means.
- C. Video file size should not exceed 400 MB.
- D. Video resolution shall be 1080p.
- E. The quality of the video must be sufficient to determine the existing conditions of the construction area. Camera panning must be performed while at rest, do not pan the camera while walking or driving. Camera pans should be performed at intervals sufficient to clearly view the entire construction area.
- F. DVD shall be labeled with construction stationing and stationing should be called out, voice recorded, in the video.
- G. The entire construction area recording shall be submitted at once. Sections submitted separately will not be accepted.

## **3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**



## **01 33 00 SUBMITTAL PROCEDURES**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:
  - 1. Record the products incorporated into the Project for the Owner.
  - 2. Provide information for operation and maintenance of the Project.
  - 3. Provide information for the administration of the Contract.
  - 4. Allow the Engineer to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.
- B. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the Engineer's review of submittals. Contract modifications can only be approved by Change Order or Field Order.

#### **1.02 CONTRACTOR'S RESPONSIBILITIES**

- A. Review and certify all submittals prior to submission.
- B. Determine and verify:
  - 1. Field measurements.
  - 2. Field construction requirements.
  - 3. Location of all existing structures, utilities and equipment related to the submittals.
  - 4. Submittals are complete for their intended purpose.
  - 5. Conflicts between the submittals related to the various Subcontractors and Suppliers have been resolved.
  - 6. Quantities and dimensions shown on the submittals.
- C. Submit information per the procedures described in this section and the Specifications.
- D. Furnish the following submittals:
  - 1. As specified in the attached Submittal Schedule or as specified in the individual Specification Sections.
  - 2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions and Contract Documents.
  - 3. Documentation required for the administration of the Contract per Section 01 31 13 "Project Coordination."
  - 4. Shop Drawings required for consideration of a contract modification per Paragraph **[1.08]**.
  - 5. Submittals as required in the Specifications.
  - 6. Submittals not required will be returned without Engineer's review.

- E. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the Project. Make submittals promptly in accordance with the schedule to cause no delay in the Project.
  - 1. Send submittals to the Engineer allowing a reasonable time for delivery, review and marking submittals. Include time for review of a resubmission if necessary. Allow adequate time for the submittal review process, ordering, fabrication, and delivery of the product to not delay progress on the Project.
  - 2. Schedule submittal to provide all information for interrelated Work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.
- F. Submit information for all of the components and related equipment required for a complete and operational system in the same submittal.
  - 1. Include electrical, mechanical, and other information required to indicate how the various components of the system function.
  - 2. Provide certifications, warranties, and written guarantees with the submittal package for review when they are required.
  - 3. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owner's option.
- G. Payment will not be made for products for which submittals are required until the submittals have been received. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Engineer.

#### 1.03 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting these criteria will be returned without review.
- B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including Drawings and Specifications as modified by Addenda, Field Orders, and Change Orders.
- C. Furnish and install products that fully comply with the information included in the submittal.

#### 1.04 SUBMITTAL PROCEDURES

- A. Submit an electronic copy of each submittal through the Project portal (website) provided by the Engineer. The Contractor will be provided access to log onto the website to post submittal documents and check the status of submittals.
  - 1. The complete contents of each submittal, including associated drawings product data, etc., shall be submitted in Portable Document Format (PDF.) Submit PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 papers.

2. Create and submit color PDF documents where color is important to the evaluation of the submittal and / or where comments will be lost if only black and white PDF documents are provided. Submit Samples and color charts per Paragraph [1.04.H].
- B. Transmit all submittals, with a properly completed Submittal Transmittal Form as provided by the Engineer.
1. Use a separate transmittal form for each specific product, class of material, and equipment system.
  2. Submit items specified in different sections of the Specifications separately unless they are part of an integrated system.
- C. Assign a submittal number to the documents originated to allow tracking of the submittal during the review process.
1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes shall be as follows:

<b>Prefix</b>	<b>Description</b>	<b>Originator</b>
AP	Application for Payment	Contractor
CO	Change Order	Engineer
CMR	Contract Modification Request	Contractor
CTR	Certified Test Report	Contractor
EIR	Equipment Installation Report	Contractor
FO	Field Order	Engineer
NBC	Notification by Contractor	Contractor
O&M	Operation & Maintenance Manuals	Contractor
PD	Photographic Documentation	Contractor
RD	Record Data	Contractor
RFI	Request for Information	Contractor
SAM	Sample	Contractor
SD	Shop Drawing	Contractor
SCH	Schedule of Progress	Contractor

2. Issue sequence numbers in chronological order for each type of submittal.
3. Issue numbers for resubmittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Engineer for processing. For example: SD 025 A represents shop drawing number 25 and the letter "A" designates this is the second time this submittal has been sent for review.
4. Clearly note the submittal number on each page or sheet of the submittal.
5. Correct assignment of numbers is essential since different submittal types are processed in different ways.

- D. Submit documents with uniform markings.
  - 1. Mark submittals to:
    - a. Highlight Contractor's corrections in green.
    - b. Highlight items pertinent to the products being furnished in yellow and delete items that are not when the Supplier's standard drawings or information sheets are provided.
    - c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.
    - d. Mark dimensions with the prefix FD to indicate field verified dimensions on the Shop Drawings.
    - e. Provide an 8-by-3-inch blank space for Contractor's and Engineer's stamp. Contractor may use a digital certification if this is preferred. The certification must bear a digital signature.
  - 2. Define abbreviations and symbols used in Shop Drawings.
    - a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
    - b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
    - c. Provide a legend for symbols used on Shop Drawings.
- E. Mark submittals to reference the Drawing number and/or section of the Specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.
- F. Deliver Samples required by the Specifications to the Site. Provide a minimum of two Samples.
- G. Construct mock-ups from the actual products to be used in construction per detailed Specifications.
- H. Submit color charts and Samples for every product requiring color, texture or finish selection.
  - 1. Submit all color charts and Samples at one time.
  - 2. Do not submit color charts and Samples until all record data have been submitted or Shop Drawings for the products have been approved.
  - 3. Submit color charts and Samples not less than 30 days prior to when these products are to be ordered or released for fabrication to comply with the schedule for construction of the Project.
- I. Submit Contract Modification Request per Section 01 31 13 "Project Coordination" to request modifications to the Contract Documents.

#### 1.05 REVIEW PROCEDURES

- A. Shop drawings are reviewed in the order received, unless Contractor request that a different priority be assigned.

- B. Mark a submittal as “Priority” to place the review for this submittal ahead of submittals previously delivered. Priority submittals will be reviewed before other submittals for this Project which have been received but not reviewed. Use discretion in the use of “Priority” submittals as this may delay the review of submittals previously submitted. Revise the Schedule of Contractor’s Submittals for substantial deviations from the previous schedule.
- C. Review procedures vary with the type of submittal as described in Paragraph **[1.06]**.

1.06 SUBMITTAL REQUIREMENTS

- A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection or installation of the product without additional detailed information from the Supplier.
  - 1. Shop Drawings are requested so that the Engineer can:
    - a. Assist the Owner in selecting colors, textures or other aesthetic features.
    - b. Compare the proposed features of the product with the specified features so as to advise the Owner that the product does, in general, conform to the Contract Documents.
    - c. Compare the performance features of the proposed product with those specified so as to advise the Owner that it appears that the product will meet the designed performance criteria.
    - d. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.
  - 2. Certify on the Contractor’s stamp that the Contractor has reviewed the Shop Drawings and made all necessary corrections such that the products, when installed, will be in full compliance with the Contract Documents. Shop Drawings submitted without this certification will be returned without review.
  - 3. Submit Shop Drawings for:
    - a. Products indicated in the submittal schedule following this section or as specified in the individual Specification Sections.
    - b. When a substitution or equal product is proposed in accordance with Paragraph 1.08 of this Section.
  - 4. Include a complete description of the material or equipment to be furnished. Information is to include:
    - a. Type, dimensions, size, arrangement, model number, and operational parameters of the components.
    - b. Weights, gauges, materials of construction, external connections, anchors, and supports required.
    - c. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components.
    - d. All applicable standards such as ASTM or Federal specification numbers.

- e. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings.
  - f. Wiring and piping diagrams and related controls.
  - g. Mix designs for concrete, asphalt, or other materials proportioned for the Project.
  - h. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the submittal that the measurements represent actual dimensions obtained at the Site.
5. Provide all required statements of certification, guarantees, extended service agreements, and other related documents with the Shop Drawing. The effective date of these documents shall be the date of acceptance of the Work by the Owner.
6. Comments will be made on items called to the attention of the Engineer for review and comment. Any marks made by the Engineer do not constitute a blanket review of the submittal or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
- a. Submittals that are reviewed will be returned with one or more of the following designations:
    - 1). Approved: Submittal is found to be acceptable as submitted.
    - 2). Approved as Noted: Submittal is acceptable with corrections or notations made by Engineer and may be used as corrected.
    - 3). Revise and Resubmit: Submittal has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.
    - 4). Not Approved: Products are not acceptable.
  - b. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted" and "Revise and Resubmit." These drawings are to be revised to provide a clean record of the submittal.
  - c. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as "At Variance With" (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with Contract Documents.
- B. Certifications, Warranties and Service Agreements include documents as specified in the individual Specifications, as shown in the submittal schedule, or as follows:
- 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications (refer to Section 01 40 00 "Quality Requirements.").
  - 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300 mile radius of the Site. List names, addresses, and telephone numbers of approved service organizations on or attach it to the certificate.

3. Extended Warranty (EW): A guarantee of performance for the product or system beyond the normal 1 year warranty described in the General Conditions. Issue the warranty certificate in the name of the Owner.
  4. Extended Service Agreement (ESA): A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the warranty period. Issue the service agreement in the name of the Owner.
  5. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
  6. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the Applicator or Subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.
- C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the Project and allow replacement or repair at some future date.
1. Provide record data for all products per the submittal schedule or as specified in the individual Specification Sections. Record data is not required for items for which Shop Drawings and/or operations and maintenance manuals are required.
  2. Provide information only on the specified products. Submit a Contract Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting record data.
  3. Provide the same information required for Shop Drawings.
  4. Record data will be received by the Engineer, logged, and provided to Owner for the Project record.
    - a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.
    - b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
- D. Provide Samples for comparison with products delivered to the Site for use on the Project.
1. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
  2. Indicate the full range of color, texture, and patterns.
  3. Dispose of Samples when related Work has been completed and approved, and disposal is requested by the Engineer. At Owner's option Samples will become the property of the Owner.
- E. Submit Request for Information (RFI) in accordance with Section 01 31 13 "Project Coordination."

- F. Submit a Schedule of Values and Application for Payment (AP) in accordance with Section 01 29 00 "Payment Procedures."
- G. Submit Progress Schedules (SCH) in accordance with Section 01 32 16 "Construction Progress Schedule."
- H. Submit Certified Test Reports (CTR) from independent testing laboratories in accordance with Section 01 40 00 "Quality Requirements."
  - 1. Submit test reports for material fabricated for this Project with Shop Drawings for that product.
  - 2. Submit test reports produced at the point of production for standard production products with the record data for that product.
- I. Submit a list of Suppliers and Subcontractors as record data in accordance with Section 01 31 13 "Project Coordination."
- J. Submit Equipment Installation Reports (EIR) in accordance with Section 01 75 00 "Starting and Adjusting."
- K. Submit Notifications by Contractor (NBC) in accordance with Section 01 31 13 "Project Coordination."
- L. Submit Photographic Documentation (PD) in accordance with Section 01 32 33 "Photographic Documentation."
- M. Submit Process Performance Bonds (PPB) in accordance with Section 00 73 00 "Supplementary Conditions" and the detailed equipment specifications.

1.07 SUBMITTALS REQUIRED FOR THIS PROJECT

- A. Furnish the following Submittals:
  - 1. Schedules, data and other documentation as described in detail in this section, as specified in the individual Specification Sections, or referenced in the General Conditions.
  - 2. Documentation required for the administration of the Contract.
  - 3. Submittals as required in the Specifications.

1.08 REQUESTS FOR DEVIATION

- A. Submit requests for deviation from the Contract Documents for any product that does not fully comply with the Contract Documents.
- B. Submit request by Contract Modification Request (CMR) per Section 01 31 13 "Project Coordination." Identify the deviations and the reason the change is requested.
- C. Include the amount of cost savings to the Owner for deviations that result in a reduction in cost.
- D. A Change Order or Field Order will be issued by the Engineer for deviations approved by the Owner. Deviations from the Contract Documents may only be approved by Change Order or Field Order.



#### 1.09 SUBMITTALS FOR EQUAL NON SPECIFIED PRODUCTS

- A. The products of the listed suppliers are to be furnished where Specifications list several manufacturers but do not specifically list “or equal” or “or approved equal” products. Use of any products other than those specifically listed is a substitution and must be approved per Paragraph **[1.10]**.
- B. Contractor may submit other manufacturers’ products that are in full compliance with the specification where Specifications list one or more manufacturers followed by the phase “or equal” or “or approved equal.”
  - 1. Submit Shop Drawings of adequate detail to document that the proposed product is equal or superior to the specified product.
  - 2. Prove that the product is equal. It is not the Engineer’s responsibility to prove the product is not equal.
    - a. Indicate on a point by point basis for each specified feature that the product is equal to the Contract Document requirements.
    - b. Make a direct comparison with the specified manufacturer’s published data sheets and available information. Provide this printed material with the submittal.
    - c. The decision of the Engineer regarding the acceptability of the proposed product is final.
  - 3. Provide a typewritten certification that, in furnishing the proposed product as an equal, the Contractor:
    - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
    - b. Has determined that the product will perform in the same manner and result in the same process as the specified product.
    - c. Will provide the same warranties and/or bonds as for the product specified.
    - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.
    - e. Will maintain the same time schedule as for the specified product.
  - 4. A modification request is not required for any product that is in full compliance with the Contract Documents.

#### 1.10 SUBMITTALS FOR SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.
- B. Submit the following for consideration of approval of a Supplier or product which is not specified:
  - 1. Contract Modification Request for deviation from the Contract Documents per Paragraph **[1.08]**.

2. Prove that the product is acceptable as a substitute. It is not the Engineer's responsibility to prove the product is not acceptable as a substitute.
    - a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
    - b. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the submittal.
    - c. The decision of the Engineer regarding the acceptability of the proposed substitute product is final.
  3. Provide a written certification that, in making the substitution request, the Contractor:
    - a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
    - b. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
    - c. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent.
    - d. Will maintain the same time schedule as for the specified product.
- C. Pay engineering cost for review of substitutions.
1. Cost for additional review time will be billed to the Owner by the Engineer for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."
  2. Cost for the additional review shall be paid to the Owner by the Contractor on a monthly basis.

#### 1.11 WARRANTIES AND GUARANTEES

- A. Submit warranties and guarantees required by the Contract Documents with the Shop Drawings or record data.
- B. Provide additional copies for equipment and include this additional copy in the Operation and Maintenance Manuals. Refer to Section 01 78 23 "Operation and Maintenance Data."
- C. Provide a separate manual for warranties and guarantees.
  1. Provide a log of all products for which warranties or guarantees are provided, and for all equipment. Index the log by Specification section number on forms provided by the Engineer.
  2. Indicate the start date, warranty or guarantee period and the date upon which the warranty or guarantee expires for products or equipment for which a warranty or guarantee is required.

3. Indicate the date for the start of the correction period specified in the General Conditions for each piece of equipment and the date on which the specified correction period expires.
4. Provide a copy of the warranty or guarantee under a tab indexed to the log.

#### 1.12 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.
- B. For Shop Drawings:
  1. Revise initial drawings or data and resubmit as specified for the original submittal.
  2. Highlight in yellow those revisions which have been made in response to the first review by the Engineer.
  3. Highlight in blue any new revisions which have been made or additional details of information that has been added since the previous review by the Engineer.
- C. For Samples:
  1. Submit new Samples as required for the initial Sample.
  2. Remove Samples which have been rejected.
- D. For mock-ups:
  1. Construct a new mock-up as initially required.
  2. Dispose of mock-ups which have been rejected.
- E. Pay for excessive review of Shop Drawings.
  1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
  2. Cost for additional review time will be billed to the Owner by the Engineer for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."
  3. Pay cost for the additional review to the Owner on a monthly basis as billed by the Owner.
  4. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

#### 1.13 ENGINEER'S DUTIES

- A. Review the submittals and return with reasonable promptness.
- B. Affix stamp, indicate approval, rejection, and the need for resubmittal.
- C. Distribute documents.

#### 2.00 PRODUCTS (NOT APPLICABLE)

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

**01 35 00 SPECIAL PROCEDURES**

**1.00 GENERAL**

**1.01 CONSTRUCTION SEQUENCE**

- A. Perform the Work as required to complete the entire Project within the contract time and in the sequence stipulated in the plans.
- B. Contractor shall comply with Item 502 “Barricades, Signs, and Traffic Handling” in the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges.
- C. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the Work.
- D. Perform the Work not specifically described in this Section as required to complete the entire Project within the contract time.

**1.02 CRITICAL OPERATIONS (NOT APPLICABLE)**

**1.03 OWNER ASSISTANCE**

- A. The Owner will assist the Contractor in draining the existing pipelines as much as possible through existing blow-off valves. The Contractor will be responsible for providing dewatering pumps, etc. required to completely dewater the facilities and handle any leakage past closed valves, gates or adjacent structures.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## **01 40 00      QUALITY REQUIREMENTS**

### **1.00    GENERAL**

#### **1.01    CONTRACTOR'S RESPONSIBILITIES**

- A. Control the quality of the Work and verify that the Work meets the standards of quality established in the Contract Documents.
  - 1. Inspect the Work of the Contractor, Subcontractors and Suppliers. Correct defective Work.
  - 2. Inspect products and materials to be incorporated into the Project. Ensure that Suppliers of raw materials, parts, components, assemblies, and other products have adequate quality control system to ensure that quality products are produced. Provide only products that comply with the Contract Documents.
  - 3. Provide and pay for the services of an approved professional materials testing laboratory acceptable to the Owner to insure that products proposed for use fully comply with the Contract Documents.
  - 4. Provide all facilities and calibrated equipment required for quality control tests.
  - 5. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.
  - 6. Perform tests as indicated in this and other sections of the Specifications. Schedule the time and sequence of testing with the Construction Manager. All quality control testing is to be observed by the Construction Manager or designated representative.
  - 7. Maintain complete inspection and testing records at the Site and make them available to Owner, Engineer and Construction Manager.
- B. Technical specifications govern if any requirements of this section conflicts with the requirements of the technical specifications.

#### **1.02    QUALITY ASSURANCE ACTIVITIES BY THE OWNER**

- A. Owner may perform its own quality assurance test independent of the Contractor's Quality Control Program or as otherwise described in the Contract Documents. Provide labor, materials, tools, equipment, and related items for testing by the Owner including, but not limited to temporary construction required for testing and operation of new and existing utilities. Assist the Owner, Engineer, Construction Manager, and testing organizations in performing quality assurance activities.
  - 1. Provide access to the Work and to the Supplier's operations at all times Work is in progress.
  - 2. Cooperate fully in the performance of sampling, inspection, and testing.
  - 3. Furnish labor and facilities to:
    - a. Provide access to the Work to be tested.
    - b. Obtain and handle Samples for testing at the Site or at the source of the product to be tested.

- c. Provide calibrated scales and measuring devices for the Owner's use.
  - d. Facilitate inspections and tests.
  - e. Provide adequate lighting to allow Owner observations.
  - f. Store and cure test Samples.
4. Furnish copies of the tests performed on materials and products.
  5. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.
  6. Give the Construction Manager adequate notice before proceeding with Work that would interfere with testing.
  7. Notify the Construction Manager and the testing laboratory prior to the time that testing is required. Lead time is to be adequate to allow arrangements to be made for testing.
  8. Do not proceed with any Work until testing services have been performed and results of tests indicate that the Work is acceptable.
  9. Provide complete access to the Site and make Contract Documents available.
  10. Provide personnel and equipment needed to perform sampling or to assist in making the field tests.
  11. Quality assurance testing performed by the Owner will be paid for by the Owner, except for verification testing performed by the Owner, which shall be paid for by the Contractor as described in Paragraph [1.06].
- B. Quality assurance activities of the Owner, Engineer or Construction Manager through their own forces or through contracts with materials testing laboratories and survey crews are for the purpose of monitoring the results of the Contractor's Work to see that it is in compliance with the requirements of the Contract Documents.
- C. Quality assurance activities of the Owner and Engineer or non-performance of quality assurance activities:
1. Do not relieve the Contractor of its responsibility to perform Work and furnish materials and products and constructed Work conforming to the requirements of the Contract Documents.
  2. Do not relieve the Contractor of its responsibility for providing adequate quality control measures.
  3. Do not relieve the Contractor of its responsibility for damage to or loss of the material, product or Work before Owner's acceptance.
  4. Do not constitute or imply Owner's acceptance.
  5. Do not affect the continuing rights of the Owner after Owner's acceptance of the completed Work.
- D. The presence or absence of the Owner's Resident Representative or Engineer does not relieve the Contractor from any contract requirement, nor is the Owner's Resident

Representative or Engineer authorized to change any term or condition of the Contract Documents without the Owner's written authorization in a Field Order or Change Order.

- E. Failure on the part of the Owner, Engineer or Construction Manager to perform or test products or constructed Works in no way relieves the Contractor of the obligation to perform Work and furnish materials conforming to the Contract Documents.
- F. All materials and products are subject to Owner's quality assurance observations or testing at any time during preparation or use. Material or products which have been tested or observed or approved by Owner at a supply source or staging area may be re-observed or re-tested by Owner before or during or after incorporation into the Work, and rejected if they do not comply with the Contract Documents.

#### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures" and shall include:
  - 1. A written Quality Management Plan that establishes the methods of assuring compliance with the Contract Documents. Submit this program as Record Data.
  - 2. A Statement of Qualifications for the proposed testing laboratory. The statement of qualifications is to include a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification and a list of recent projects for which testing has been performed with references for those projects.
  - 3. Test reports per Paragraph [1.07] of this Specification. Reports are to certify that products or constructed Works are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.
  - 4. Provide Certified Test Reports on materials or products to be incorporated into the Project. Reports are to indicate that material or products are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.

#### 1.04 STANDARDS

- A. Provide a testing laboratory that complies with the ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications."
- B. Perform testing per recognized test procedures as listed in the various sections of the Specifications, standards of the State Department of Highways and Public Transportation, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

#### 1.05 DELIVERY AND STORAGE

- A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures.

#### 1.06 VERIFICATION TESTING



- A. Provide verification testing when tests indicate that materials or the results of construction activities are not in conformance with Contract Documents.
- B. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.
- C. Tests must comply with recognized methods or with methods recommended by the testing laboratory and approved by the Engineer.

1.07 TEST REPORTS

- A. Test reports are to be prepared for all tests.
  - 1. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:
    - a. Name of the Owner, project title and number, equipment installer and general contractor.
    - b. Name of the laboratory, address, and telephone number.
    - c. Name and signature of the laboratory personnel performing the test.
    - d. Description of the product being sampled or tested.
    - e. Date and time of sampling, inspection, and testing.
    - f. Date the report was issued.
    - g. Description of the test performed.
    - h. Weather conditions and temperature at time of test or sampling.
    - i. Location at the Site or structure where the test was taken.
    - j. Standard or test procedure used in making the test.
    - k. A description of the results of the test.
    - l. Statement of compliance or non-compliance with the Contract Documents.
    - m. Interpretations of test results, if appropriate.
  - 2. Submit reports on tests performed by Contractor or his suppliers or vendors on the forms provided by the Engineer.
  - 3. Engineer will prepare test reports on test performed by the Engineer.
- B. Distribute copies of the test reports to the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Hard copies of test reports are to be distributed to individuals designated at the pre-construction conference:

Recipient	No. of Copies
Owner	2
Engineer	1
Construction Manager	1

Contractor	1
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- C. Payment for Work subject to testing may be withheld until the Contractor's quality control test reports of the Work are submitted to the Engineer or the Owner's Resident Representative.

#### 1.08 NON-CONFORMING WORK

- A. Immediately correct any Work that does not comply with the Contract Documents or submit a written explanation of why the Work is not to be corrected immediately and when corrective action to the Work will be performed.
- B. Payment for non-conforming Work shall be withheld until Work is brought into compliance with the Contract Documents.

#### 1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing consultation on the test performed and to an advisory capacity.
- B. The testing laboratory is not authorized to:
  - 1. Alter the requirements of the Contract Documents.
  - 2. Accept or reject any portion of the Work.
  - 3. Perform any of the duties of the Contractor.
  - 4. Stop the Work.

#### 1.10 QUALITY CONTROL PLAN

- A. Submit Contractor's Quality Control Plan that identifies personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the Quality Control Plan or acceptance of an interim plan applicable to the particular feature of Work to be started. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a Quality Control Plan or another interim plan containing the additional features of Work to be started.
- B. Content of the Quality Control Plan. The Quality Control Plan shall include, as a minimum, the following to address all construction operations, both on-site and off-site, including work by Subcontractors and Suppliers:
  - 1. A description of the quality control organization, including a chart showing lines of authority and acknowledgement that the quality control staff shall implement the quality control program for all aspects of the Work specified.
  - 2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a quality control function.
  - 3. A copy of the letter to the Quality Control Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Manager, including authority to stop Work which does not comply with the Contract Documents or will result in Work

that does not comply with the Contract Documents. The Quality Control Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Construction Manager.

4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Subcontractors and Suppliers.
  5. Control, verification, and acceptance testing procedures for each specific test is to include the test name, specification paragraph requiring test, feature of Work to be tested, test frequency, person responsible for each test, applicable industry testing standards and laboratory facilities to be used for the test.
  6. Procedures for tracking phases of quality control, verification, and acceptance tests including documentation.
  7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Indicate how documentation of the verification process for deficiencies will be made.
  8. Reporting procedures, including proposed reporting formats.
  9. The name of the proposed testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which similar testing has been performed with references from those projects.
- C. Notification of Changes. After submittal of the Quality Control Plan, the Contractor shall notify the Owner in writing of any proposed changes.
- D. Coordination Meeting. After the Pre-construction Meeting and before start of construction, the Contractor shall meet with the Owner, Engineer and Construction Manager to discuss the Contractor's Quality Control Plan. The Quality Control Plan shall be submitted a minimum of 14 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the Quality Control operations, testing, administration of the system for both on-site and off-site Work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance. Revise the Quality Management Plan to reflect comments and recommended changes resulting from this meeting.

1.11 QUALITY CONTROL ORGANIZATION (NOT APPLICABLE)

**2.00 PRODUCTS**

2.01 TESTING APPARATUS

- A. Furnish testing apparatus and related accessories necessary to perform the tests.

**3.00 EXECUTION**

3.01 QUALITY CONTROL PROGRAM

- A. Perform quality control observations and testing as required in each section of the Specifications and where indicated on the Drawings.

- B. Provide a quality control program that includes the following phases for each definable Work task. A definable Work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be Work by the same trade in a different environment.

1. Planning Phase:  
Perform the following  
before beginning each  
definable Work task:

- a. Review the contract drawings.
  - b. Review submittals and determine that they are complete in accordance with the Contract Documents.
  - c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
  - d. Examine the work area to assure that all required preliminary Work has been completed and complies with the Contract Documents.
  - e. Examine required materials, equipment, and sample Work to assure that they are on hand, conform to submittals, and are properly stored.
  - f. Review requirements for quality control inspection and testing.
  - g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the Work task.
  - h. Check that the portion of the plan for the Work to be performed incorporates submittal comments.
  - i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Quality Control Manager, the Construction Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the Work task. Instruct applicable workers as to the acceptable level of workmanship required in order to meet the requirements of the Contract Documents. Document the results of the preparatory phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.
  - j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
2. Work Phase: Complete this phase after the Planning Phase:
- a. Notify the Construction Manager at least 24 hours in advance of beginning the Work and discuss the review of the planning effort to indicate that requirements have been met.
  - b. Check the Work to ensure that it is in full compliance with the Contract Documents.
  - c. Verify adequacy of controls to ensure full compliance with Contract Documents. Verify required control inspection and testing is performed.
  - d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required sample panels as appropriate.

- e. Repeat the Work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.
- 3. Follow-up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements:
  - a. Make checks daily and record observations in the quality control documentation.
  - b. Conduct follow-up checks and correct all deficiencies prior to the start of additional Work tasks that may be affected by the defective Work. Do not build upon nor conceal non-conforming Work.
  - c. Conduct a review of the Work 1 month prior to the expiration of the correction period prescribed in the General Conditions with the Owner and Construction Manager. Correct defects as noted during the review.
- C. Conduct additional planning and Work phases if:
  - 1. The quality of on-going Work is unacceptable.
  - 2. Changes are made in applicable quality control staff, on-site production supervision or work crew.
  - 3. Work on a task is resumed after a substantial period of inactivity.
  - 4. Other quality problems develop.

### 3.02 CAST-IN-PLACE CONCRETE TESTING

- A. Test cast-in-place concrete in accordance with Section 03 30 00 "Cast-In-Place Concrete."

### 3.03 PROTECTIVE COATINGS (NOT APPLICABLE)

### 3.04 PIPING SYSTEMS

- A. Test Requirements:
  - 1. Perform test on piping systems including piping installed between or connected to existing pipe.
  - 2. Conduct tests on buried pipe to be hydrostatically tested after the trench is completely backfilled. If field conditions permit and if approved by the Engineer, partially backfill the trench and leave the joints open for inspection and conducting of the initial service leak test. Do not conduct the acceptance test until backfilling is complete.
  - 3. Pneumatically test the buried piping and expose joints of the buried piping for the acceptance test.
  - 4. Conduct the test on exposed piping after the piping is completely installed, including supports, hangers, and anchors, but prior to insulation and coating application.
  - 5. Do not perform testing on pipe with concrete thrust blocking until the concrete has cured at least 5 days.
  - 6. Determine and remedy the cause of the excessive leakage for any pipe failing to meet the specified requirements for water or air tightness.
  - 7. Tests must be successfully completed and reports filed before piping is accepted.

8. Submit a comprehensive plan and schedule for testing to the Engineer for review at least 10 days prior to starting each type of testing.
9. Remove and dispose of temporary blocking material and equipment after completion and acceptance of the piping test.
10. Repair any damage to the pipe coating.
11. Clean pipelines so they are totally free flowing prior to final acceptance.
12. Test piping independently from tests on structures.
13. Test method and test pressure depend upon the application of the piping.
  - a. Pressure pipe is defined as piping that is part of a pumped or pressurized system. Perform test for pressure pipe per the procedures indicated in Paragraph **[B]** of this section.
  - b. Gravity pipe is defined as piping that depends upon the force of gravity for flow through the pipe. Perform test for gravity pipe per the procedures indicated in Paragraph C of this section.

B. Pressure and Leakage Tests of Pressure Piping:

1. Perform hydrostatic pressure and leakage tests using methods, and per performance requirements of Section 5 of AWWA C600 regardless of pipe material tested.
- a. The pressure required for hydrostatic pressure test shall be at the pressure rating of the pipe.
- b. Provide temporary plugs and blocking necessary to maintain the required test pressure. Where piping is cast in the walls for a structure, brace the walls prior to testing as required to prevent load of test pressure from being imposed upon the structure.
- c. Provide corporation cocks at least 3/4 inch in diameter, pipe riser, and angle globe valves at each pipe dead-end in order to bleed air from the line.
- d. Duration of pressure test shall be at least 4 hours.
- e. Repair any visible leaks regardless of the total leakage shown by the test.
- f. Repair pipelines which fail to meet the test and retest as necessary until the results conform to the test requirements.
- g. Remove and replace defective materials, pipes, valves, and accessories.
- h. Test the pipelines in sections by shutting valves or installing temporary plugs as necessary.
- i. Fill the pipeline with water and remove the air.

- j. Maintain the test pressure in the pipe for the entire test period by means of a force pump.
- k. Accurately measure the water required to maintain the pressure. The amount of water required is a measure of the leakage.

2. The maximum allowable leakage is determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{F}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
P	Test pressure	pounds per square inch gauge
F	Pipe factor	
	Use 148,000 Ductile Iron Pipe and PVC Pipe.	
	Use 133,200 for all other pipe types.	

- a. Leakage is defined as the volume of water provided to maintain the test pressure after the pipe has been filled with water, the air expelled and the pipe brought to test pressure.
- b. Pipe with visible leaks or leakage exceeding the maximum allowable leakage is considered defective and must be corrected.

C. Hydrostatic Leak Test-Gravity Flow Sewer Lines:

1. Perform hydrostatic leak tests after backfilling.
2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2 feet or 2 feet above the ground water level whichever is higher and the head over the downstream crown is not more than 6 feet.
3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
4. Continue the test for 1 hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
5. Remove the jointing material, and remake the joint if any joint shows any visible leakage or infiltration.
6. Remove and replace any defective or broken pipes.
7. Determine the maximum allowable leakage or infiltration by the following formula:

$$L = \frac{CDS}{126720}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
C	Infiltration / exfiltration rate	
	Use 50 for C outside of 25 year floodplain.	
	Use 10 for C within 25 year floodplain.	

8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
  9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.
- D. Low Pressure Air Test- Gravity Flow Sewer Lines:
1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
  2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F1417 except for testing times. The following test times are required:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Long 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	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)



- a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
  - b. Pass air through a single control panel.
  - c. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.
  - d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
  - e. Provide an air compressor of adequate capacity for charging the system.
3. Perform air test only on lines less than 36 inches in diameter. Air tests for pipes larger than 36 inches may be air tested at each joint.
  4. Check connections for leakage with a soap solution. Release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test if leaks are found,.
  5. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

$$T = \frac{0.0850DK}{Q}$$

Equation Term	Represents	Measure
T	Time for the pressure to drop 1.0 pound per square inch gauge	seconds
K	Factor equal to 0.000419DL, but not less than 1.0	
D	Average inside diameter of the pipe	inches
L	Length of line of the same pipe size	feet
Q	Rate of loss. Use 0.0015 cubic feet per minute per square foot of internal surface	

E. Air Test for Individual Joints:

1. Lines 36 inches and larger may be tested at individual joints.
2. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.

F. Deflection Testing for Pipe:

1. Perform deflection tests on flexible and semi-rigid pipe in accordance with TCEQ requirements.
  - a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0 percent unless specified otherwise.
  - b. Conduct test after the final backfill has been in place a minimum of 30 days.
  - c. Thoroughly clear the lines before testing.

2. Perform test by pulling a properly sized mandrel through the line.
  3. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.
- G. Manhole Testing: Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods acceptable to TCEQ. Test manholes after installation with all connections (existing and/or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.
1. Vacuum Test – Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer’s recommendations. Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48-, 60-, and 72inch manholes with depths up to 30 feet is 2 minutes. Test times for manholes of greater size and depths will be determined by the Engineer.
  2. Manhole Repairs – Manholes will be accepted in accordance with the criteria above. Repair any manhole which fails the initial test with non-shrink grout or other suitable material as determine for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.
- H. Tests for Plumbing Drainage and Vent Systems:
1. Plug openings as necessary.
  2. Test drainage and venting systems by filling piping with water to the level of the highest vent stack for 30 minutes.
  3. Make the examination for leakage at joints and connections.
  4. Test fail if there is any drop in water level.

### 3.05 ELECTRICAL TESTING

- A. Qualifications:
1. Perform testing using qualified personnel with a minimum of 5 years’ experience installing and testing electrical equipment and machinery, unless otherwise specified.
  2. Use testing firms or individuals to perform tests that have not provided services or materials used on the Project or are otherwise related or affiliated with other Contractors or Suppliers for this Project unless permitted by the Owner.
- B. Report Forms: Complete appropriate test report neatly and in ink for the items being tested. Note listed data that is not applicable or cannot be obtained as “N/A” or document with an explanation for the omission. Incomplete test forms will not be witnessed by the Construction Manager. Repeat tests not accepted. Substitute forms recording similar data and test equipment as that specified may be used if approved by the Engineer.

C. Test Equipment:

1. Provide test equipment and materials necessary to perform the requested tests.
2. Test equipment and apparatus shall be appropriate for the full range and duration of the test to be performed.
3. Demonstrate that the test equipment is functioning properly, prior to the commencement of the test. Suspend the test and repair or replace the equipment if test equipment fails during any portion of a test. Repeat the test in its entirety or as otherwise required by the Construction Manager.
4. Provide a copy of the test equipment calibration certificate to the Construction Manager prior to the commencement of the test. Provide test equipment that has been calibrated within 6 months of the date of the test using methods approved by the National Institute of Standards and Technology.

D. Execution:

1. Make appropriate repairs or replacements if the circuit, equipment or machinery being tested does not pass. Repeat test as directed by the Construction Manager.
2. If test procedures or equipment conflicts occur between the various sections of the Specifications and/or Supplier's recommendations, the more rigid requirement prevails.

E. Electrical Cable:

1. Communication Cable and Conductors - Submit test forms to the Owner for approval prior to performing the following tests:
  - a. Test shielded pair, telephone, paging, signaling and computer cables for continuity, short circuits and grounds with a low voltage source, not to exceed the insulation rating of the conductors or jacket.
  - b. Test fiber-optic cable between terminating ends for each circuit per the Supplier's recommendation. Cables, splices (where permitted), and connectors shall be tested for continuity, band width (maximum), and attenuation losses.
2. 600-Volt Cable and Conductors:
  - a. Test power and control conductors rated at 600 volts with an insulation resistance tester at 1000 volts, with respect to ground, and at 1000 volts with respect to all other conductors in each circuit.
  - b. Verify suitable ground connections are provided and maintained throughout the test.
  - c. Perform tests and record results as required by the "600-Volt Cable Test Report" or form provided by the Engineer.
  - d. Test each circuit and record the results for continuity between terminating ends with a low voltage source.
3. 5-kV Cable and Conductors:
  - a. Perform insulation resistance test on 5-kV cable for insulation resistance tested at 2500 volts with respect to ground and at 2500 volts with respect to all other conductors in each circuit.

- b. H-Pot test 5-kV cables incrementally to 25 kV DC for 15 minutes per ANSI/IEE STD 400. Record leakage current in the spaces provided, at the time intervals shown, on the “Medium Voltage Cable Test Report.” Do not exceed the cable Supplier’s maximum test values or procedures.
  - c. Perform Individual conductor resistance tests and recorded results. Test each circuit for continuity between terminations ends and record the test results. Provide additional tests and checks as requested by the Supplier.
4. 15-kV Cable and Conductors:
- a. Perform insulation resistance test on 15-kV cable at 2500 volts with respect to all other conductors in each circuit.
  - b. H-Pot test 15-kV cable incrementally to 55 kV DC for 15 minutes per ANSI/IEE STD. 400. Record leakage current at the time interval, shown, on the “Medium Voltage Cable Test Report.” Do not exceed the cable Supplier’s recommended maximum test values or procedures. Perform individual conductor resistance tests and record the results. Test each circuit for continuity between terminating ends and record the results. Provide additional tests and checks as required by the Supplier.

F. Switchgear:

1. Test electrical switchgear and electrical devices and controls mounted on or in the switchgear in accordance with the “Switchgear Test Report” form.
2. Record the following information and attach to the test report:
  - a. Resistance reading across joints of each horizontal and vertical bus.
  - b. Verify proper operation of electrical, mechanical and keyed interlocking systems.
  - c. Operate devices at both their open and closed states. Operate stored energy devices mechanically and electrically as applicable. Operate remotely controlled devices from their remote location.
  - d. Verify proper operation of draw-out circuit breakers and switches. Remove and re-install each unit. Verify proper operation of shutters and barriers.
  - e. Disconnect electrical and electronic sensing and protective devices not rated to withstand insulation resistance test potentials. Reconnect the devices before energizing the switchgear.
  - f. Perform insulation resistance tests at the test voltages shown below for the following equipment. Do not exceed the Supplier’s recommended maximum test values or procedures.

Equipment Rating	Test Voltage
0-250 volts	500 volts
251-600 volts	1000 volts
601-5,000 volts	2500 volts
5,001-15,000 volts	2500 volts
15,001-39,000 volts	5000 volts

- g. Provide additional tests and checks as recommended by the Supplier before energizing.

- h. Energize switchgear. Measure and record instrument indications for no-load and connected-load conditions.

G. Transformers:

1. Test single and three-phase, liquid filled and dry transformers rated 5 KVA and larger in accordance with the “Transformer Test Report” form.
2. Record the following information and attach to the test report.
  - a. Verify proper operation of all fans, alarms, and other auxiliary and monitoring devices.
  - b. Verify “tap changer” operation, if applicable, in all positions. Set and secure “tap changer” to position recommended by the Construction Manager or Engineer.
  - c. Obtain insulating liquid sample from all liquid filled transformers. Submit sample to testing laboratory, approved by the Owner for analysis. Perform standard insulating liquid tests as required by the Construction Manager or Engineer. Deliver test results to the Owner within 30 days after sampling.
  - d. Perform insulation resistance tests at the test values shown below for the following equipment.
  - e. Perform tests from each winding to ground and winding to winding. Primary and secondary sections shall be tested separately.
  - f. Do not exceed the Supplier’s recommended maximum test values or procedures.

Transformer Coil Rating	Test Voltage
0-600 volts	1000 volts
601-5000 volts	2500 volts
5001-15,000 volts	5000 volts
15,001-39,000 volts	10,000 volts

- g. Provide additional tests and checks as recommended by the Supplier before energizing.
- h. Energize transformer. Measure and record primary and secondary volts and amps under no load and connected load conditions.

H. Motors:

1. Test electric motors in accordance with the “Motor Start-Up Report” form.
2. Check and record motor winding continuity phase to phase with a low voltage source.
3. Check and record motor winding insulation resistance, each phase with respect to ground, at the test values shown below for A.C. induction motors per REF. IEEE Standard 43.
4. Do not exceed the Supplier’s recommended maximum test values or procedures.

Motor Voltage Rating (Volts)	Test Voltage
250 V and below	500
Above 250 V	1000
2360 volt, three-phase	Per Manufacturer’s start-up instructions or as

	otherwise directed by the Engineer.
4160 volt, three-phase	Per Manufacturer's start-up instructions or as otherwise directed by the Engineer.

5. Check and record motor circuit voltage before starting motor.
6. Verify operation of motor space heater if applicable.
7. Provide additional tests and checks as recommended by the Supplier before energizing.
8. Start motor and verify immediately correct shaft rotation.
9. Check and record motor running volts and amps.
10. Verify correct operation of all interlocking and protective devices.

**END OF SECTION**

## **01 57 00      TEMPORARY CONTROLS**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- B. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.
- C. Provide a Storm Water Pollution Prevention Plan in accordance with TCEQ General Permit TXR150000, file required legal notices and obtain required permits prior to beginning any construction activity.
- D. Provide labor, materials, equipment, and incidentals necessary to prevent storm water pollution for the duration of the Project. Provide and maintain erosion and sediment control structures as required to preventive sediment and other pollutants from the Site from entering any storm water system, including open channels. Remove pollution control structures when no longer required to prevent storm water pollution.
- E. Cost for Temporary Controls as described in this Section and provided by Suppliers and Subcontractors as described in this Section are to be included in the Cost of Work.

#### **1.02    QUALITY ASSURANCE**

- A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and requiring minimal maintenance that will disrupt construction activities while providing adequate protection of the environment.
- B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

#### **1.03    SUBMITTALS**

- A. Provide copies of notices, records and reports required by the Contract Documents or regulations as Record Data in accordance with Section 01 33 00 "Submittal Procedures."
- B. Provide documents requiring approval by the Owner or Engineer as Shop Drawings in accordance with Section 01 33 00 "Submittal Procedures."

#### **1.04    STANDARDS**

- A. Provide a storm water pollution prevention plan that complies with Local, State, and Federal requirements. Comply with all requirements of the Texas Commission on Environmental Quality General Permit (TXR150000) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.

- B. Perform Work to comply with “Best Practice” as established by the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction or the local agency of jurisdiction.

#### 1.05 PERMITS

- A. Submit the following to the TCEQ and the Operator of any Municipal Separate Storm Sewer System (MS4) receiving storm water discharges from the Site:
  - 1. Notice of Intent (NOI) at least 48 hours prior to beginning construction activity. Construction activity may commence 24 hours after the submittal of an electronic NOI.
  - 2. Notice of Change (NOC) letter when relevant facts or incorrect information was submitted in the NOI, or if relevant information in the NOI changes during the course of construction activity.
  - 3. Notice of Termination (NOT) when the construction project has been completed and stabilized.
- B. Post a copy of the NOI at the Site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- C. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities for all projects.

#### 1.06 STORM WATER POLLUTION CONTROL

- A. Comply with the current requirements of TPDES General Permit No. TXR15000 (General Storm Water Permit) set forth by the Texas Commission on Environmental Quality for the duration of the Project:
  - 1. Develop a Storm Water Pollution Prevention Plan meeting all requirements of the General Storm Water Permit.
  - 2. Submit of a Notice of Intent to the Texas Commission on Environmental Quality.
  - 3. Develop and implement appropriate Best Management Practices as established by local agencies of jurisdiction.
  - 4. Provide all monitoring and/or sampling required for reporting to the Texas Commission on Environmental Quality.
  - 5. Submit reports to the Texas Commission on Environmental Quality as required as a condition of the permit.
  - 6. Submit copies of the reports to the Engineer as Record Data in accordance with Section 01 33 00 “Submittal Procedures.”
  - 7. Retain copies of these documents at the Site at all times for review and inspection by the Owner or regulatory agencies. Post a copy of the permit as required by regulations.
  - 8. Pay all costs associated with complying with the provisions of the General Storm Water Permit. Assume solely responsible for implementing, updating, and modifying the



General Storm Water Permit per regulatory requirements the Storm Water Pollution Prevention Plan and Best Management Practices.

- B. Use forms required by the Texas Commission on Environmental Quality to file the Notice of Intent. Submit the Notice of Intent at least 2 days prior to the start of construction. Develop the Storm Water Pollution Prevention Plan prior to submitting the Notice of Intent. Provide draft copies of the Notice of Intent, Storm Water Pollution Prevention Plan, and any other pertinent Texas Commission on Environmental Quality submittal documents to Owner for review prior to submittal to the Texas Commission on Environmental Quality.
- C. Return any property disturbed by construction activities to either specified conditions or pre-construction conditions as set forth in the Contract Documents. Provide an overall erosion and sedimentation control system that will protect all undisturbed areas and soil stockpiles/spoil areas. Implement appropriate Best Management Practices and techniques to control erosion and sedimentation and maintain these practices and techniques in effective operating condition during construction. Permanently stabilize exposed soil and fill as soon as practical during the Work.
- D. Assume sole responsibility for the means, methods, techniques, sequences, and procedures for furnishing, installing, and maintaining erosion and sedimentation control structures and procedures and overall compliance with the General Storm Water Permit. Modify the system as required to effectively control erosion and sediment.
- E. Retain copies of reports required by the General Storm Water Permit for 3 years from date of final completion.

#### 1.07 POLLUTION CONTROL

- A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
  - 1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.
  - 2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
  - 3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.
  - 4. Comply with local, State and Federal regulations regarding the disposal of pollutants.
- C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.

1. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.
2. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
3. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

#### **1.08 EARTH CONTROL**

- A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.
- B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of Site or other easements.

#### **1.09 MANAGEMENT OF WATER**

- A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.
- B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.
- C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.
- D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.
- E. Remove the temporary construction and restore the Site in a manner acceptable to the Engineer and to match surrounding material at the conclusion of the Work.

### **2.00 PRODUCTS**

#### **2.01 MATERIALS**

- A. Provide materials meeting regulatory requirements.

### **3.00 EXECUTION**

#### **3.01 CONSTRUCTING, MAINTAINING AND REMOVING TEMPORARY CONTROLS**

- A. Construct temporary controls in accordance with regulatory requirements.

- B. Maintain controls in accordance with regulatory requirements where applicable, or in accordance with the requirements of the Contract Documents.
- C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls before the point where they are no longer required.

**END OF SECTION**

## **01 57 23      TEMPORARY STORM WATER POLLUTION CONTROL**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary to provide storm water pollution prevention for the duration of the construction period including furnishing, installing, and maintaining erosion and sediment control structures and procedures and properly removing the features when no longer required.
- B. Develop, implement, and maintain a storm water pollution prevention plan in compliance with Local, State, and Federal requirements. Provide preventive measures to keep sediment and other pollutants from the construction activity from entering any storm water system, including open channels. Comply with the Texas Commission on Environmental Quality General Permit (TXR150000) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.
- C. This Section provides guidelines and Best Management Practices (BMPs) information for the Contractor to use in adhering to all Local, State, and Federal environmental regulations with respect to storm water pollution prevention during construction activity.

#### **1.02    QUALITY ASSURANCE**

- A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Drawings are not intended to be prescriptive but rather to convey the intent to provide complete slope protection, erosion control, and storm water pollution prevention for both the Owner's property and adjacent properties.
- B. The Contractor shall develop and implement a storm water pollution prevention plan in accordance with TCEQ General Permit TXR150000 prior to the beginning of construction activity.
- C. Storm water pollution prevention measures shall be established prior to the beginning of construction and maintained during the entire length of construction until final stabilization has been achieved for the area protected.
- D. All land-disturbing activities shall be planned and conducted to minimize the area to be exposed at any one time as well as time of exposure, off-site erosion, sedimentation, and adverse water quality impacts.
- E. Surface water runoff originating upgrade of an exposed area shall be managed to minimize erosion and sediment loss during the period of exposure.

- F. Install measures to control both the velocity and rate of release so as to minimize erosion and sedimentation of the receiving water body (i.e. , ditch, channel, stream) in accordance with regulatory requirements and as directed by the Owner, the Engineer, or the Owner's representative.
- G. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain adequate treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other storm water pollutants at the time of completion of the Work.

### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Submittals."
- B. Small Construction Activity ( $\geq 1$  Acre but  $< 5$  Acres):
  - 1. On small construction projects (disturbed area equal to or greater than 1 acre and less than 5 acres) submit a copy of the Construction Site Notice to the Operator of any Municipal Separate Storm Sewer System (MS4) receiving construction site discharge at least 2 days prior to beginning construction activity.
  - 2. Post a copy of the Construction Site Notice at the construction site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- C. Large Construction Activity ( $\geq 5$  Acres):
  - 1. On large construction projects (5 acres or more of disturbed area) submit the following to the TCEQ and the Operator of any Municipal Separate Storm Sewer System (MS4) receiving storm water discharge from the Site:
    - a. Notice of Intent (NOI) at least 7 days prior to beginning construction activity. When submitting an NOI electronically, construction activity may commence immediately upon receipt of confirmation from the TCEQ.
    - b. Notice of Change (NOC) letter within 14 days after the discovery that incorrect information was submitted in the NOI or if relevant information in the NOI changes during the course of construction activity.
    - c. Notice of Termination (NOT) within 30 days following a change in operational control or upon final stabilization and completion of the construction project.
  - 2. Post a copy of the NOI and a Construction Site Notice at the Site in a location where it is readily available for viewing by the general public and Local, State, and Federal

authorities prior to starting construction activities and maintain the posting until completion of the construction activities.

- D. For small and large projects, maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities.
- E. Schedule in accordance with Paragraph **[3.05]**.

#### 1.04 JOB CONDITIONS, CODES, AND ORDINANCES

- A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional storm water pollution prevention measures during construction beyond those required by State and Federal regulations, the Contractor shall provide such measures at no additional cost.

### 2.00 PRODUCTS

#### 2.01 MATERIALS

- A. All materials used for storm water pollution prevention shall meet the minimum design and specification requirements identified below for commonly used sediment loss prevention practices (referenced from the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction. ) The Contractor shall use appropriate control devices to protect against storm water pollution from construction site activity.
- B. Erosion control blankets (ECBs) to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following design criteria:
  - 1. The type and class of erosion control mat must be specified as appropriate for the slope of the area to be protected, the flow rate (sheet flow on cut/fill slopes) or velocity (concentrated flow in swales) of stormwater runoff in contact with the ECB, and the anticipated length of service.
  - 2. Erosion control blankets must meet the applicable Texas Department of Transportation (TxDOT) Minimum Performance Standards for TxDOT as provided in its Erosion Control Report and/or be listed on the most current annual Approved Products List for TxDOT applicable to TxDOT Item 169 Soil Retention Blanket and its Special Provisions.
- C. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following design criteria:

1. If 50 percent or less soil by weight passes the U.S. Standard sieve No. 200, select the apparent opening size (A.O.S.) to retain 85 percent of the soil.
2. If 85 percent or more of soil by weight passes the U.S. Standard sieve No. 200, silt fences shall not be used unless the soil mass is evaluated and deemed suitable by a soil scientist or geotechnical engineer concerning the erodibility of the soil mass, dispersive characteristics, and the potential grain-size characteristics of the material that is likely to be eroded.
3. Silt fence fabric must meet the following minimum criteria:
  - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds.
  - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds.
  - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi.
  - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min).
  - e. Ultraviolet Resistance, ASTM D4355. Minimum 70 percent.
4. Filter stone for an overflow structure shall be 1-1/2-inch washed stone containing no fine material. Angular shaped stone is preferable to rounded shaped stone.
5. Fence posts shall be galvanized steel or equivalent and may be T-section or L-section, 1.3 pounds per linear foot minimum, and 4 feet in length minimum. Wood posts may be used depending on anticipated length of service and provided they are 4 feet in length minimum and have a nominal cross-section of 2 inches by 4 inches for pine or 2 inches by 2 inches for hardwoods.
6. Silt fence shall be supported by galvanized steel wire fence fabric as follows:
  - a. 4-inch-by-4inch mesh size, W1.4/1.4, minimum 14-gauge wire fence fabric;
  - b. Hog wire, 12-gauge wire, small openings installed at bottom of silt fence;
  - c. Standard 2-inch-by-2-inch chain link fence fabric; or
  - d. Other welded or woven steel fabrics consisting of equal or smaller spacing as that listed herein and appropriate gauge wire to provide support.

D. Inlet protection used in new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following design criteria:

1. Filter fabric protection shall be designed and maintained in a manner similar to a silt fence.
  2. Where applicable, filter fabric, posts, and wire backing shall meet the material requirements specified in Paragraph **[2.01.C]**.
  3. Filter gravel shall be 3/4-inch washed stone containing no fines. Angular shaped stone is preferable to rounded shapes.
  4. Concrete blocks shall be standard 8-inch-by-8-inch-by-16-inch concrete masonry units.
  5. When organic filter tubes are used, the designer shall specify the type of material to be used (or excluded) on a particular site:
    - a. Straw filter material shall be Certified Weed Free Forage. The straw must be in good condition, air-dried, and not rotten or moldy.
    - b. Compost shall conform to the requirements for Erosion Control Compost in TxDOT Special Specification 1001 Compost (2004). Compost may provide some oil and grease removal; however, the large percentage of fines in compost will result in less filtering and more ponding of stormwater.
    - c. Wood chips shall be 100 percent untreated chips and free of inorganic debris, such as plastic, glass, metal, etc. Wood chip size shall not be smaller than 1 inch and shall not exceed 3 inches in diameter. Shavings shall not be more than 5 percent of the total mass.
  6. Bags used to secure inlet protection devices on pavement shall be filled with aggregate, filter stone, or crushed rock that is less likely than sand to be washed into an inlet if the bag is broken. Filled bags shall be 24 to 30 inches long, 16 to 18 inches wide, and 6 to 8 inches thick. Bags shall be polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 ounces per square yard and meet the following criteria:
    - a. Greater than 300 psi Mullen Burst Strength using ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
    - b. Greater than 70 percent UV Stability using ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.
- E. Stone outlet sediment traps (bermed or excavated) used in situations where flows are concentrated in a drainage swale or channel are subject to the following design criteria:
1. The embankment shall be placed on geotextile fabric meeting the following minimum criteria:



- a. Tensile Strength, ASTM D4632 Text Method for Grab Breaking Load and Elongation of Geotextiles, 250 pounds.
  - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 135 pounds.
  - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 420 psi.
  - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 20 (max).
2. Fill placed to constrict the swale for construction of the excavated stone outlet sediment trap and fill placed for the berm in the bermed stone outlet sediment trap shall consist of clay material, minimum Plasticity Index of 30, using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  3. The embankment shall be comprised of well graded stone riprap with a size range of 6 to 12 inches in diameter.
- F. Sediment basins used as treatment devices for sites with disturbed areas of 10 acres and larger that are part of a common drainage area are subject to the following design criteria:
1. The embankment shall be constructed with clay soil, minimum Plasticity Index of 30 using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  2. Texas Administrative Code Title 30, Chapter 299 (30 TAC 299), Dams and Reservoirs, contains specific requirements for dams that:
    - a. Have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet;
    - b. Have a height greater than 6 feet and a maximum storage capacity greater than or equal to 50 acre feet;
    - c. Are a high- or significant-hazard dam as defined in Chapter 299, regardless of height or maximum storage capacity; or
    - d. Are used as a pumped storage or terminal storage facility.
  3. If the size of the detention basin meets or exceeds the above applicability, the design must be in accordance with state criteria, and the final construction plans and specifications must be submitted to the TCEQ for review and approval.

- G. Check dams used for long drainage swales or ditches to reduce erosive velocities are subject to the following design criteria:
1. Use geotextile filter fabric under check dams exceeding 12 inches in height. The fabric shall meet the material specified for the Stone Outlet Sediment Trap discussed above.
  2. Loose, unconfined soil, wood chips, compost, and other material that can float or be transported by runoff shall not be used to construct check dams.
  3. Sand bags shall not be used for check dams, due to their propensity to break and release sand that is transported by the concentrated flow in the drainage swale or ditch.
  4. Rock Check Dams:
    - a. Stone shall be well graded with stone size ranging from 3 to 6 inches in diameter for a check dam height of 24 inches or less.
    - b. The stone size range for check dams greater than 24 inches is 4 to 8 inches in diameter.
  5. Rock Bag Check Dams Bags:
    - a. Fill material should be pea gravel, filter stone or aggregate that is clean and free of deleterious material.
    - b. Bag material shall comply with the requirements of Inlet Protection above.
  6. Sack Gabion Check Dams:
    - a. Sack gabions shall be wrapped in galvanized steel, woven wire mesh. The wire shall be 20 gauge with 1-inch diameter, hexagonal openings.
    - b. Stone shall be well graded with a minimum size range from 3 to 6 inches in diameter.
  7. Organic Filter Tube Check Dams:
    - a. Filter material used within tubes to construct check dams shall be limited to coir, straw, aspen fiber and other organic material with high cellulose content.
    - b. The material should be slow to decay or leach nutrients in standing water and comply with the requirements for Inlet Protection above.
- H. Stabilized construction exits used for sites in which significant truck traffic occurs on a daily basis are subject to the following design criteria:

1. The construction exit material shall be a minimum thickness of 6 inches. The stone or recycled concrete used shall be 3 to 5 inches in size with little or no fines.
2. The geotextile fabric must meet the following minimum criteria:
  - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 300 pounds.
  - b. Puncture Strength, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 120 pounds.
  - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 600 psi.
  - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 40 (max).
- I. Alternative pollution prevention measures selected by the Contractor shall be identified from one or more of the following reference sources, as appropriate for the region of the construction activity:
  1. City of Austin *Environmental Criteria Manual*.
  2. North Central Texas Council of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction.
  3. Harris County/Harris County Flood Control District/City of Houston Storm Water Management Handbook for Construction Activities.

### **3.00 EXECUTION**

#### **3.01 PREPARATION**

- A. Prepare a storm water pollution prevention plan (SWPPP) in accordance with applicable permit requirements for construction activity. Develop the SWPPP in conformance with TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities and any applicable Local requirements.
- B. Prepare and implement the SWPPP prior to the beginning of construction activity in accordance with Local, State, and Federal requirements.
- C. Owner's representative may require Contractor to install storm water pollution prevention devices and/or practices during construction in addition to those required under the approved storm water pollution plan. Contractor shall remain solely responsible for complying with all Local, State, and Federal requirements.

### 3.02 INSTALLATION

- A. Erosion control blankets to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following installation criteria:
1. Prior to the installation of any erosion control matting, all rocks, dirt clods, stumps, roots, trash, and any other obstructions that would prevent the mat from lying in direct contact with the soil shall be removed.
  2. Anchor trenching shall be located along the entire perimeter of the installation area, except for small areas with less than 2 percent slope.
  3. Installation and anchoring shall conform to the recommendations shown within the manufacturer's published literature for the erosion control blanket.
  4. Anchors (staples) shall be a minimum of 6 inches in length and 1 inch wide. They shall be made of 11-gauge wire, or equivalent, unless the ECB is intended to remain in place with final stabilization and biodegrade.
  5. Particular attention must be paid to joints and overlapping material. Overlap along the sides and at the ends of ECBs should be per the manufacturer's recommendations for site conditions and the type of ECB being installed. At a minimum, the end of each roll of ECB shall overlap the next roll by 3 feet and the sides of rolls shall overlap 4 inches.
  6. After installation, check blankets for uniform contact with the soil, security of the lap joints, and flushness of the staples with the ground.
- B. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following installation criteria:
1. Construct fences along a line of constant elevation (along a contour line if possible).
  2. Maximum drainage area shall be 0.25 acre per 100 linear feet of silt fence.
  3. Maximum flow to any 20 foot section of silt fence shall be 1 cfs.
  4. Maximum distance of flow to silt fence shall be 200 feet or less. If the slope exceeds 10 percent, the flow distance shall be less than 50 feet.
  5. Maximum slope adjacent to the fence shall be 2:1.
  6. Stone overflow structures or other outlet control devices shall be installed at all low points along the fence or spaced at approximately 300 feet if there is no apparent low point.
  7. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel to prevent

bypass of runoff under the fence. Fabric shall overlap at abutting ends a minimum of 3 feet and shall be joined such that no leakage or bypass occurs. If soil conditions prevent a minimum toe-in depth of 6 inches or installation of support post to depth of 12 inches, silt fences shall not be used.

8. Sufficient room for the operation of sediment removal equipment shall be provided between the silt fence and other obstructions in order to properly maintain the fence.
  9. The last 10 feet (or more) at the ends of a line of silt fence shall be turned upslope to prevent bypass of stormwater. Additional upslope runs of silt fence may be needed every 200 to 400 linear feet, depending on the traverse slope along the line of silt fence.
- C. Inlet protection for new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following installation criteria:
1. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), when installing inlet protection on publicly traveled streets or in developed areas. Ensure that inlet protection is properly designed, installed, and maintained to avoid flooding of the roadway or adjacent properties and structures.
  2. Maximum depth of flow shall be 8 inches or less.
  3. A 2-inch overflow gap or weir is required on all curb inlet protection devices.
  4. Positive drainage is critical in the design of inlet protection. If overflow is not provided for at the inlet, excess flows shall be routed through established swales, streets, or other watercourses to minimize damage due to flooding.
  5. Filter Fabric Protection:
    - a. Filter fabric protection is appropriate where the drainage area is less than 1 acre and the basin slope is less than 5 percent.
    - b. Filter fabric, posts, and wire mesh shall meet the material requirements specified in Paragraph **[2.01.C]**.
    - c. A 6 inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel. This entrenchment prevents any bypass of runoff under the fence.
    - d. Stone overflow structures shall be installed where flow to the inlet is concentrated and more than 1 cfs according to the criteria in Paragraph **[2.01]**.
  6. Block and Gravel Protection (Curb and Drop Inlets):

- a. Concrete blocks are to be placed on their sides in a single row around the perimeter of the inlet, with ends abutting.
  - b. Openings in the blocks should face outward, not upward. ½" x ½" wire mesh shall then be placed over the outside face of the blocks covering the holes.
  - c. Filter stone shall then be piled against the wire mesh to the top of the blocks with the base of the stone being a minimum of 18 inches from the blocks.
  - d. Alternatively, where loose stone is a concern (streets, etc.), the filter stone may be placed in appropriately sized geotextile fabric bags.
7. Excavated Impoundment Protection:
- a. Excavated impoundment protection is only applicable to drop inlets.
  - b. It should not be applied to Y inlets because it will undermine the concrete pad surrounding the inlet opening. Nor can it be used for inlets on pavement.
  - c. With this protection method, it is necessary to install weep holes to allow the impoundment to drain completely.
  - d. The impoundment shall be sized such that the volume of excavation is equal to or exceeds the runoff volume from the temporary control design storm (2-year, 24-hour) for the inlet's drainage area.
  - e. The trap shall have a minimum depth of one foot and a maximum depth of 2 feet as measured from the top of the inlet and shall have side slopes of 2:1 or flatter.
8. Organic Filter Tube Protection (Curb and Drop Inlets):
- a. Organic filter tubes may be used on paved or unpaved surfaces. On paved surfaces, tubes shall be secured in place by rock bags. On unpaved surfaces, the tubes shall be embedded in the ground a minimum of 3 inches and staked at 4 foot spacing.
  - b. Designer shall provide calculations and specify the diameter of tube to be used based on the inlet's drainage area and the flow rate of runoff to the inlet.
  - c. The minimum allowable diameter is 12 inches.
  - d. For curb protection, the diameter of the tube shall be at least 2 inches less than the height of the inlet opening. The tube should not be allowed to block the entire opening, since it will clog.
  - e. The tube shall be placed on 4-inch-by-4-inch or 2-inch-by-4-inch wire mesh to prevent the tube from sagging into the inlet. The tube should be long enough to extend a minimum of 12 inches past the curb opening on each side of the inlet.

- D. Stone outlet sediment traps (excavated or bermed) for situations where flows are concentrated in a drainage swale or channel are subject to the following installation criteria:
1. The maximum drainage area contributing to the trap shall be less than 10 acres for the excavated trap, and 5 acres or less for the bermed trap. For larger drainage areas a sediment basin shall be used.
  2. The minimum storage volume shall be the volume of runoff from the temporary control design storm (2-year, 24-hour) for the sediment trap's drainage area.
  3. The surface area of the design storage shall be 1 percent of the area draining to the device.
  4. The maximum embankment height shall be 6 feet as measured from the toe of the slope on the downstream side.
  5. Minimum width of the embankment at the top shall be 2 feet.
  6. Embankment slope shall be 1:5:1 or flatter.
  7. The embankment shall have a depressed area to serve as the outlet with a minimum width of 4 feet.
  8. A 6-inch minimum thickness layer of 1-1/2-inch filter stone shall be placed on the upstream face of the embankment when stormwater runoff contains fine silt and clay particles.
  9. The embankment shall consist of stone riprap or a combination of compacted fill with stone riprap. The stone may be enclosed in wire mesh or a gabion basket and anchored to the channel bottom to prevent washing away.
  10. Fill shall be placed in 8-inch loose lifts (maximum) and compacted to 95 percent Standard Proctor Density at optimum moisture content using ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  11. Geotextile fabric, covered with a layer of stone, shall extend past the base of the embankment on the downstream side a minimum of 2 feet.
  12. The outlet shall be designed to have a minimum freeboard of 6 inches at design flow.
- E. Sediment basins for treatment devices for sites with disturbed areas of 10 acres and larger that are part of a common drainage area are subject to the following installation criteria:
1. Design of the sediment basin should be coordinated with design of the permanent drainage infrastructure for the development. Sediment basin sizing and discharge volumes should be calculated using the NCTCOG iSWM Technical Manual or similar

technical manual in accordance with the design criteria of the locality where the basin is constructed.

2. Minimum capacity of the basin shall be the calculated volume of runoff from a 2-year, 24-hour duration storm event plus sediment storage capacity of at least 1000 cubic feet.
  3. The basin must be laid out such that the effective flow length to width ratio of the basin is a minimum of 4:1. The effectiveness of sediment basins may be increased by using baffles to prevent short-circuiting of flow through the basin.
  4. Top width of the embankment shall be determined by the Engineer based on the total height of the embankment as measured from the toe of the slope on the downstream side.
  5. Embankment side slopes shall be 3:1 or flatter.
  6. Clay soil for the embankment shall be placed in 8-inch lifts and compacted to 95 percent Standard Proctor Density at optimum moisture content using ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  7. The primary outlet shall have a minimum design dewatering time of 36 hours for the temporary control design storm (2-year, 24-hour).
  8. Whenever possible, the outlet shall be designed to drain the basin in less than 72 hours to minimize the potential for breeding mosquitoes.
  9. The basin's primary outlet and spillway shall be sized to pass the difference between the conveyance storm (25-year, 24-hour) and the temporary control design storm without causing damage to the embankment and structures.
  10. Unless infeasible, the primary outlet structure should withdraw water from the surface of the impounded water. Outlet structures that do this include surface skimmers, solid risers (non-perforated), flashboard risers, and weirs.
  11. The outlet of the outfall pipe (barrel) shall be stabilized with riprap or other materials designed using the conveyance storm flow rate and velocity. Velocity dissipation measures shall be used to reduce outfall velocities in excess of 5 feet per second.
  12. Risers used to discharge high flows shall be equipped with an anti-vortex device and trash rack.
  13. Spillways shall be constructed in undisturbed soil material (not fill) and shall not be placed on the embankment that forms the basin.
- F. Check dams for long drainage swales or ditches to reduce erosive velocities are subject to the following installation criteria:



1. Typically, the dam height should be between 9 inches and 36 inches, depending on the material of which they are made. The height of the check dam shall always be less than one-third the depth of the channel.
2. Dams should be spaced such that the top of the downstream dam is at the same elevation as the toe of the upstream dam. On channel grades flatter than 0.4 percent, check dams should be placed at a distance that allows small pools to form between each check dam.
3. The top of the side of the check dam shall be a minimum of 12 inches higher than the middle of the dam. In addition, the side of the dams shall be embedded a minimum of 18 inches into the side of the drainage ditch, swale or channel to minimize the potential for flows to erode around the side of the dam.
4. Larger flows (greater than 2-year, 24-hour design storm) must pass the check dam without causing excessive upstream flooding.
5. Check dams should be used in conjunction with other sediment reduction techniques prior to releasing flow offsite.
6. Rock Check Dams:
  - a. Rock check dams shall have a minimum top width of 2 feet with side slopes of 2:1 or flatter.
7. Rock Bag Check Dams:
  - a. Rock bag check dams should have a minimum top width of 16 inches.
  - b. Bag length shall be 24 inches to 30 inches, width shall be 16 inches to 18 inches and thickness shall be 6 inches to 8 inches and having a minimum weight of 40 pounds.
  - c. Minimum rock bag dam height of 12 inches would consist of one row of bags stacked on top of two rows of bag. The dam shall always be one more row wide than it is high, stacked pyramid fashion.
  - d. PVC pipes may be installed through the dam to allow for controlled flow through the dam. Pipe should be schedule 40 or heavier polyvinyl chloride (PVC) having a nominal internal diameter of 2 inches.
8. Sack Gabion Check Dams:
  - a. Sack gabion check dams may be used in channels with a contributing drainage area of 5 acres or less.

- b. Wire mesh shall be one piece, wrapped around the rock, and secured to itself on the downstream side using wire ties or hog rings.
  - c. Sack gabions shall be staked with ¾ inch rebar at a maximum spacing of 3 feet. Each wire sack shall have a minimum of two stakes.
9. Organic Filter Tube Check Dams:
- a. Organic filter tubes may be used as check dams in channels with a contributing drainage area of 5 acres or less.
  - b. Organic filter tubes shall be a minimum of 12 inches in diameter.
  - c. Staking of filter tubes shall be at a maximum of 4-foot spacing and shall alternate through the tube and on the downstream face of the tube.
- G. Stabilized construction exits for sites in which significant truck traffic occurs on a daily basis are subject to the following installation criteria:
1. Limit site access to one route during construction, if possible; two routes for linear and larger projects.
  2. Prevent traffic from avoiding or shortcutting the full length of the construction exit by installing barriers. Barriers may consist of silt fence, construction safety fencing, or similar barriers.
  3. Design the access point(s) to be at the upslope side of the construction site. Do not place construction access at the lowest point on the construction site.
  4. Stabilized Construction Exits are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on-Site with provisions for storage, proper filtration, and removal of wash water.
  5. The exit must be sloped away from the paved surface so that storm water is not allowed to leave the Site onto roadways.
  6. Minimum width of exit shall be 15 feet.
  7. Vehicles shall not be permitted to track or drop sediment onto paved roads, streets, or parking lots. When necessary, vehicles must be cleaned to remove sediment prior to exit onto paved areas. When washing is required, it shall be done on a constructed wheel wash facility that drains into an approved sediment trap or sediment basin or other sedimentation/filtration device.
  8. Minimum dimensions for the exit shall be as follows:

Tract Area	Minimum Width of Exit	Minimum Length of Exit
<1 Acre	15 feet	20 feet
≥ 1 acre but <5 Acres	25 feet	50 feet
≥5 Acres	30 feet	50 feet

H. Install pollution control devices in a manner consistent with their designed intent.

### 3.03 MAINTENANCE

- A. Maintain pollution prevention control structures and procedures in full working order at all times during construction. This shall include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment and other pollutants which accumulate in pollution control devices as necessary to maintain the intended design efficiency for the pollution prevention measure.
- B. Dispose properly of trash, debris, and other pollutants.
- C. Place sediment material in approved earth spoil areas or return the sediment material to the area from which it eroded.
- D. Maintain pollution prevention structures and procedures until construction is complete for the area protected and until the Site achieves final stabilization. Unless more stringently defined by Local, State, or Federal requirements, final stabilization is defined as achieving 70 percent of background vegetative cover or placement of permanent cover, such as concrete or asphalt.
- E. Upon completion of construction and achievement of final stabilization, properly remove the temporary pollutant control structures and complete the area as indicated. Pollution control devices made of organic materials designed to degrade naturally in place will not require removal, unless specifically required by the Owner, Engineer, or Owner’s representative.
- F. Erosion control blankets shall be inspected regularly (at least as often as required by the TPDES Construction General Permit) for bare spots caused by weather related events. Missing or loosened blankets must be replaced or re-anchored. Also check for excess sediment deposited from runoff. Remove sediment and/or replace blanket as necessary. In addition, determine the source of excess sediment and implement appropriate Best Management Practices (BMPs) to control the erosion.
- G. Silt fences shall be inspected regularly (at least as often as required by the TPDES Construction General Permit) for buildup of excess sediment, undercutting, sags, and other failures. Sediment should be removed when it reaches approximately one-half the height of the fence. In addition, determine the source of excess sediment and implement appropriate

Best Management Practices (BMPs) to control the erosion. If the fabric becomes damaged or clogged, it shall be repaired or replaced as necessary.

- H. Inlet protection shall be inspected regularly (at least as often as required by the TPDES Construction General Permit). Floatable debris and other trash caught by the inlet protection should be removed after each storm event. Sediment should also be removed from curb inlet protection after each storm event because of the limited storage area associated with curb inlets. Sediment collected at inlet protection should be removed before it reaches half the height of the protection device. Sediment should be removed from inlets with excavated impoundment protection before the volume of the excavation is reduced by 50 percent. In addition, the weep holes should be checked and kept clear of blockage. Concrete blocks, 2-inch-by-4-inch boards, stakes, and other materials used to construct inlet protection should be checked for damaged and repaired or replaced if damaged. When filter fabric or organic filter tubes are used, they should be cleaned or replaced when the material becomes clogged. For systems using filter stone, when the filter stone becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced.
  - 1. Because of the potential for inlet protection to divert runoff or cause localized flooding, remove inlet protection as soon as the drainage area contributing runoff to the inlet is stabilized. Ensure that all inlet protection devices are removed at the end of the construction.
- I. The stone outlet sediment trap should be inspected regularly (at least as often as required by the TPDES Construction General Permit) to check for clogging of the void spaces between stones. If the filter stone appears to be clogged, such that the basin will not completely drain, then the filter stone will require maintenance. If the filter stone is not completely clogged it may be raked with a garden rake to allow the water to release from the basin. If filter stone is completely clogged with mud and sediment, then the filter stone will have to be removed and replaced. Failure to keep the filter stone material properly maintained will lead to clogging of the stone riprap embankment. When this occurs, the entire stone rip-rap structure will need to be replaced. If the aggregate appears to be silted in such that efficiency is diminished, the stone should be replaced.
  - 1. Trash and debris should be removed from the trap after each storm event to prevent it from plugging the rock. Deposited sediment shall be removed before the storage capacity is decreased by one-third, or sediment has reached a depth of 1 foot, whichever is less. The removed sediment shall be stockpiled or redistributed in areas that are protected with erosion and sediment controls.
- J. Sediment basins should be inspected regularly (at least as often as required by the TPDES Construction General Permit) to check for damage and to insure that obstructions are not diminishing the effectiveness of the structure. Sediment shall be removed and the basin

shall be re-graded to its original dimensions when the sediment storage capacity of the impoundment has been reduced by 20 percent. The removed sediment may be stockpiled or redistributed onsite in areas that are protected by erosion and sediment controls.

1. Inspect temporary stabilization of the embankment and graded basin and the velocity dissipaters at the outlet and spillway for signs of erosion. Repair any eroded areas that are found. Install additional erosion controls if erosion is frequently evident.
- K. Check dams should be inspected regularly (at least as often as required by the TPDES Construction General Permit). Silt must be removed when it reaches approximately 1/3 the height of the dam or 12 inches, whichever is less. Inspectors should monitor the edges of the dam where it meets the sides of the drainage ditch, swale or channel for evidence of erosion due to bypass or high flows. Eroded areas shall be repaired. If erosion continues to be a problem, modifications to the check dam or additional controls are needed.
1. Care must be used when taking out rock check dams in order to remove as much rock as possible. Loose rock can create an extreme hazard during mowing operations once the area has been stabilized.
- L. Stabilized construction exits should be inspected regularly (at least as often as required by the TPDES Construction General Permit). The stabilized construction exit shall be maintained in a condition that prevents tracking or flow of sediment onto paved surfaces. Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the exit from diminishing. The rock shall be re-graded when ruts appear. Additional rock shall be added when soil is showing through the rock surface.
1. Additional controls are needed if inspections reveal a properly installed and maintained exit, but tracking of soil outside the construction area is still evident. Additional controls may be daily sweeping of all soil spilled, dropped, or tracked onto public rights-of-way or the installation of a wheel cleaning system.

### 3.04 FIELD QUALITY CONTROL

- A. In the event of conflict between the specified requirements and storm water pollution control laws, rules, or regulations, or other Local, State, or Federal agencies, the more restrictive laws, rules, or regulations shall apply.

### 3.05 SCHEDULES

- A. Prior to start of construction, submit schedules to the Owner and Engineer for accomplishment of temporary and permanent erosion control work in connection with required clearing and grubbing, grading, construction, and paving. Include a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials in the submittal.

**END OF SECTION**

## **01 60 00      PRODUCT REQUIREMENTS**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Provide products for this Project that comply with the requirements of this section. Specific requirements of the detailed equipment specification govern in the case of a conflict with the requirements of this Section.
- B. Comply with applicable specifications and standards.
- C. Comply with size, make, type, and quality specified or as modified per Section 01 31 13 "Project Coordination."

#### **1.02    QUALITY ASSURANCE**

- A. Design Criteria:
  - 1. Assume responsibility for the design of the products to include structural stability and operational capability.
  - 2. Design members to withstand all loads imposed by installation, erection, and operation of the product without deformation, failure, or adversely affecting the operational requirements of the product. Size and strength of materials for structural members are specified as minimums only.
  - 3. Design mechanical and electrical components for all loads, currents, stresses, and wear imposed by start-up and normal operations of the equipment without deformation, failure, or adversely affecting the operation of the unit. Mechanical and electrical components specified for equipment are specified as the minimum acceptable for the equipment.
- B. Coordination:
  - 1. Provide coordination of the entire Project, including verification that structures, piping, and equipment components to be furnished and installed for this Project are compatible.
  - 2. Determine that the equipment furnished for this Project is compatible with the Contract Document requirements and with the equipment and materials furnished by others.
  - 3. Electrical components provided for equipment shall comply with all provisions of the Contract Documents.
  - 4. Protective coatings and paints applied to equipment shall be fully compatible with the final coatings to be field applied in accordance with the Contract Documents.
- C. Adaptation of Equipment:
  - 1. Drawings and Specifications are prepared for the specified products. Make modifications to incorporate the products into the Project at no cost to the Owner, if a substitution for a product is requested and approved in accordance with Section 01 31 13 "Project Coordination."

2. Do not provide a product with a physical size that exceeds the available space. Consideration may be given to the acceptance of these products or equipment if the Contractor assumes all costs necessary to incorporate the item and the Engineer approves such revisions.
3. Coordinate electrical requirements for the products to be installed in the Project, including revisions in electrical equipment components wiring and other factors necessary to incorporate the component.

### 1.03 SUBMITTALS

- A. Provide Submittals in accordance with Section 01 33 00 "Submittal Procedures," and shall include:
  1. Certificates of Adequacy of Design, as described in Section 01 33 00 "Submittal Procedures."
  2. Equipment Installation Reports per Section 01 75 00 "Starting and Adjusting."
  3. Other documentation as required by detailed equipment specifications.

### 1.04 STANDARDS

- A. The applicable industry standards referenced in the Specifications shall apply as if written here in its entirety.
- B. Except where otherwise indicated, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction.

### 1.05 GUARANTEES AND WARRANTIES

- A. Guarantee and or Warranty products furnished by the Contractor under this Contract against:
  1. Faulty or inadequate design.
  2. Improper assembly or erection.
  3. Defective workmanship or materials.
  4. Leakage, breakage, or other failure.
- B. Guarantee and or Warranty the products installed under this Contract, including products furnished by the Owner, against leakage, breakage, or other failure due to improper assembly or erection and against improper installation of the equipment. The guarantee and or Warranty period shall be as defined in the General Conditions. Individual specification sections may have more stringent warranty requirements than stated in the General Conditions. The most stringent warranty will be required in the event of any difference in the two aforementioned locations.

## 2.00 PRODUCTS

### 2.01 MATERIALS



- A. Design, fabricate, assemble, deliver and install according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.
- B. Manufacture like parts of duplicate units to standard sizes and gages. Like parts are to be interchangeable.
- C. Two or more items of the same kind are to be identical and made by the same Supplier.
- D. Provide products suitable for the intended service.
- E. Adhere to the equipment capacities, sizes, and dimensions indicated by the Contract Documents.
- F. Do not use products for any purpose other than that for which it is designed.
- G. Provide new products unless previously used products are specifically allowed in the Contract Documents.
- H. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
- I. Materials shall be suitable for service conditions.
- J. Iron castings shall be tough, close-grained gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A48.
- K. Structural members shall be considered as subject to shock or vibratory loads.
- L. Unless otherwise indicated, steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4-inch thick. All edges are to be chamfered to preclude any sharp exposed edges.

## 2.02 ELECTRIC MOTORS

- A. Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following requirements:
  - 1. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.
  - 2. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.
  - 3. Unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice, motors shall be rated for continuous duty at 40 C ambient. Motor temperature rise above 40 C ambient on continuous operation at nameplate horsepower shall not exceed the NEMA limit.
  - 4. Motors shall be designed to start with appropriate starter or variable speed drive.
  - 5. Motor bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.
  - 6. Motors shall be sized for the altitude at the location where the equipment is to be installed.

7. Motors with 1.0 service factor shall not be loaded more than 87 percent of the nameplate horsepower. Motors with a 1.15 service factor shall not be loaded more than 100 percent of the nameplate horsepower.
  8. Where the detailed specifications call for encapsulated motor windings, the following process shall be used:
    - a. After stator assembly, the stator assembly shall be sealed vacuum-pressure impregnation (VPI) of epoxy resin. The stator shall receive two VPI treatments, each treatment consisting of a dip followed by an oven bake. After the final cure, the stator assembly shall receive a final (third) coating of a durable epoxy varnish to further protect against dust, moisture, and a chemical degradation. The windings shall comply with the latest applicable provisions of NEMA MG1.
  9. Motors shall have a clamp-type grounding terminal inside the motor conduit box.
  10. Motors with external conduit boxes shall have oversized conduit boxes.
  11. Maximum starting current shall be per NEMA MG1, Class H.
  12. Efficiency shall be per NEMA MG1 for **[High] [Premium]** efficiency motors.
  13. Minimum insulation shall be Type F.
  14. Motors shall be random wound with copper coils.
  15. Motors located in a hazardous location shall be rated for the appropriate classification.
- B. It is intended that the Supplier use his standard motor on integrally constructed motor driven equipment such as appliances, hand tools, etc., which would otherwise require redesign of the complete unit in order to provide a motor having the specified features.
- C. Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:
1. Below 1/2 HP:
    - a. 115-volt, 60-Hz, 1-phase.
    - b. Dripproof in clean and dry locations; TEPF in all other locations.
    - c. Permanently lubricated sealed bearings.
    - d. Built-in manual-reset thermal protector; or furnished with integrally mounted stainless steel enclosed manual motor-overload switch.
  2. 1/2 to 1 HP:
    - a. 230/460-volt, 60-Hz, 3-phase.
    - b. Dripproof in clean and dry locations; TEFC in all other locations.
    - c. Permanently lubricated sealed bearings.
  3. 1-1/2 HP and Above:
    - a. **[230/460] [208]**-volt, 60-Hz, 3-phase.
    - b. Dripproof in clean and dry locations; TEFC in all other locations.
    - c. Oil or grease lubricated anti-friction or oil lubricated sleeve bearings.

- d. Vertical motors shall have 15 year average life thrust bearings.
  - D. Motors with horsepower ratings of 15 horsepower or greater shall be provided with space heaters to operate on 120-volt single-phase service.
- 2.03 EQUIPMENT APPURTENANCES
- A. Cover belt or chain drives, fan blades, couplings, and other moving or rotating parts on all sides by a safety guard.
    - 1. Fabricate safety guards from 16 USS gage or heavier galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal.
    - 2. Design guards for easy installation and removal.
    - 3. Provide galvanized supports and accessories for each guard.
    - 4. Provide stainless steel bolts and hardware.
    - 5. Provide safety guards in outdoor locations designed to prevent the entrance of rain and dripping water.
- 2.04 ANCHOR BOLTS
- A. Provide suitable anchor bolts for each product.
  - B. Provide anchor bolts, with templates or setting drawings, sufficiently early to permit setting the anchor bolts when the structural concrete is placed.
  - C. Provide two nuts for each bolt.
  - D. Provide anchor bolts for products mounted on baseplates that are long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.
  - E. Provide stainless steel anchor bolts, nuts, and washers.
- 2.05 SPECIAL TOOLS AND ACCESSORIES
- A. Furnish tools, instruments, lifting and handling devices, and accessories necessary for proper maintenance and adjustment that are available only from the Product Vendor or are not commonly available.
- 2.06 EQUIPMENT IDENTIFICATION PLAQUES
- A. Provide a plaque for each piece of equipment in accordance with Section 40 05 53 "Identification for Process Piping and Equipment."
- 2.07 LUBRICATION SYSTEMS FOR EQUIPMENT
- A. Provide equipment lubricated by systems which:
    - 1. Require attention no more frequently than weekly during continuous operation.
    - 2. Do not require attention during start up or shutdown.
    - 3. Do not waste lubricants.

- B. Provide lubricants to fill lubricant reservoirs and to replace lubricant consumed during testing, start up, and operation prior to acceptance of equipment by the Owner.

2.08 INSULATION OF PIPING

- A. Insulate all piping on or related to equipment as required to prevent freezing under any condition. Insulate piping per the Supplier's written instruction or per Section 23 07 19 "HVAC Piping Insulation" whichever is more stringent.

**3.00 EXECUTION**

3.01 INSTALLATION

- A. Install equipment including equipment pre-selected or furnished by the Owner. Assume responsibility for proper installation, start-up and making the necessary adjustments so that the equipment is placed in proper operating condition per Section 01 75 00 "Starting and Adjusting."

3.02 LUBRICATION

- A. Lubricate all products provided or installed for this Project, including products furnished by the Owner, per the Supplier's written recommendations until the product is accepted by the Owner.

**END OF SECTION**

## **01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

#### **1.02 SUBMITTALS**

- A. Submit affidavits and releases on forms provided by the Engineer.

#### **1.03 SUBSTANTIAL COMPLETION**

- A. Submit written notification that the Work or designated portion of the Work is substantially complete to the Engineer when the Work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered to be complete.
- B. Engineer shall visit the Site to observe the Work within a reasonable time after notification is received to determine the status of completion.
- C. Engineer shall issue notification to the Contractor that the Work is either substantially complete or that additional Work must be performed before the Project may be considered substantially complete.
  - 1. Engineer shall notify the Contractor in writing of items that must be completed before the Project can be considered substantially complete.
    - a. Correct the noted deficiencies in the Work.
    - b. Issue a second written notice with a revised list of deficiencies when Work has been completed.
    - c. Engineer shall revisit the Site and the procedure shall begin again.
  - 2. Engineer shall issue a Certificate of Substantial Completion to the Owner when the Project is considered to be substantially complete. Certificate shall include a tentative list of items to be corrected before final payment.
    - a. Owner will review and revise the list of items and notify the Engineer of any objections or other items that are to be included in the list.
    - b. Engineer shall prepare and send to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.
    - c. Review the list and notify the Engineer in writing of any objections within 10 days of receipt of the Certificate of Substantial Completion.

#### **1.04 FINAL INSPECTION**

- A. Submit written certification in the form provided by the Engineer when the Project is complete and:

1. Contract Documents have been reviewed.
  2. Work has been completed in compliance with the Contract Documents.
  3. Equipment and systems have been tested per Contract Documents and are fully operational.
  4. Final Operations and Maintenance Manuals have been provided to the Owner and all operator training has been completed.
  5. Specified spare parts and special tools have been provided.
  6. Work is complete and ready for final inspection.
- B. Engineer shall make an inspection with the Owner and appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate.
- C. Engineer shall issue notice that the Project is complete or notify the Contractor that Work is not complete or is defective.
1. Submit the request for final payment with Closeout submittals described in Paragraph **[1.07]** if notified that the Project is complete and the Work is acceptable.
  2. Upon receipt of notification from the Engineer that Work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Engineer when Work has been completed or corrected.
  3. Engineer shall re-visit the Site and the procedure will begin again.

#### 1.05 REINSPECTION FEES

- A. Pay fees to the Owner to compensate the Engineer for reinspection of the Work required by the failure of the Work to comply with the claims of status of completion made by the Contractor.
- B. Owner may withhold the amount of these fees from the Contractor's final payment.
- C. Cost for additional inspections will be billed to the Owner by the Engineer for the actual hours required for the reinspection and preparation of related reports in accordance with the rates provided in the Supplemental Conditions.

#### 1.06 CLOSEOUT SUBMITTALS TO THE ENGINEER

- A. Record Drawings per Section 01 31 00 "Project Coordination."
- B. Keys and keying schedule.
- C. Warranties and bonds.
- D. Evidence of payment or release of liens on the forms provided by the Engineer and as required by the General Conditions.
- E. Consent from Surety to Final Payment.
- F. Equipment installation reports on equipment.
- G. Shop drawings, record data, Operations and Maintenance Manuals, and other submittals as required by the Contract Documents.

- H. Specified spare parts and special tools.
- I. Certificates of Occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the Work and access to services and utilities.
- J. Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.
- K. Final Photographs per Section 01 32 33 "Photographic Documentation."

#### 1.07 FINAL APPLICATION FOR PAYMENT REQUEST

- A. Submit a preliminary final Application for Payment. This application is to include adjustments to the Contract Amount for:
  - 1. Approved Change Orders.
  - 2. Allowances not previously adjusted by Change Order.
  - 3. Unit prices.
  - 4. Deductions for defective Work that has been accepted by the Owner.
  - 5. Penalties and bonuses.
  - 6. Deductions for liquidated damages.
  - 7. Deductions for reinspection payments per Paragraph **[1.05]**.
  - 8. Other adjustments.
- B. Engineer shall prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.
- C. Submit the final Application for Payment per the General Conditions, including the final Change Order.

#### 1.08 TRANSFER OF UTILITIES

- A. Transfer utilities to the Owner when the Certificate of Substantial Completion has been issued, final cleaning has been completed per Section 01 74 23 "Final Cleaning," and the Work has been occupied by the Owner.
- B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the Work.

#### 1.09 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01 33 00 "Submittal Procedures" or by the individual sections of the Specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.
- C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
  - 1. Each document is to be signed by the respective Supplier or Subcontractor.

2. Each document is to include:
  - a. The product or Work item description.
  - b. The firm, with the name of the principal, address, and telephone number.
  - c. Scope of warranty, bond or services agreement.
  - d. Date, duration, and expiration date for each warranty bond and service agreement.
  - e. Procedures to be followed in the event of a failure.
  - f. Specific instances that might invalidate the warranty or bond.
- D. Submit two copies of each document to the Engineer for review and transmittal to the Owner.
  1. Submit duplicate sets.
  2. Documents are to be submitted on 8-1/2 x 11 paper, punched for a standard three-ring binder.
  3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the Project name and the name of the Contractor are to be typed and affixed to the cover.
- E. Submit warranties, bonds and services agreements:
  1. At the time of final completion and before final payment.
  2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

#### 1.10 CLAIMS AND DISPUTES

- A. Claims and disputes must be resolved prior to recommendations of final Application for Payment. Acceptance and final payment by the Contractor will indicate that any outstanding claims or disputed issues have been resolved to the full satisfaction of the Contractor.

#### 2.00 PRODUCTS (NOT APPLICABLE)

#### 3.00 EXECUTION (NOT APPLICABLE)

**END OF SECTION**



## **01 73 29 CUTTING AND PATCHING**

### **1.00 GENERAL**

#### 1.01 SUMMARY

A. Section Includes:

1. Requirements and limitations for cutting and patching of Work.

#### 1.02 SUBMITTALS

A. Submit written request in advance of cutting or alteration, which affects:

1. Structural integrity of any element of Project.
2. Efficiency, maintenance, or safety of any operational element.
3. Visual qualities of sight exposed elements.
4. Work of Owner or separate contractor.

B. Include in request:

1. Identification of Project.
2. Location and description of affected Work.
3. Necessity for cutting or alteration.
4. Description of proposed Work, and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Date and time Work will be executed.

### **2.00 PRODUCTS**

#### 2.01 MATERIALS

A. Primary Products: Those required for original installation.

B. Product Substitution: For any proposed change in materials, submit request for substitution under provisions of Section 01 33 00 "Submittal Procedures."

### **3.00 EXECUTION**

#### 3.01 EXAMINATION

- A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, inspect conditions affecting performance of Work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

#### 3.02 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of the Project from damage.

### 3.03 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to complete Work.
- B. Fit products together, to integrate with other Work.
- C. Uncover Work to install ill-timed Work.
- D. Remove and replace defective or non-conforming Work.
- E. Provide openings in the Work for penetration of electrical Work.
- F. Protect the structure and other parts of the Work and provide adequate support to maintain the structural integrity of the affected portions of the Work. Provide devices and methods to protect adjacent Work and other portions of the Project from damage. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching Work.
- G. Execute cutting and demolition by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs.
- H. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- I. Restore Work which has been cut or removed. Install new products to provide completed Work per the Contract Documents.
- J. Patch finished surfaces and building components using new products specified for the original installation.
- K. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
  - 1. For continuous surfaces, refinish to the nearest intersection.
  - 2. For an assembly, refinish the entire unit.

### 3.04 PERFORMANCE

- A. Execute Work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- B. Restore Work with new products in accordance with requirements of Contract Documents.

**END OF SECTION**

## **01 74 23 FINAL CLEANING**

### **1.00 GENERAL**

1.01 This section specifies administrative and procedural requirements for final cleaning at Substantial Completion.

#### 1.02 WORK INCLUDED

- A. Perform a thorough cleaning of the Site, buildings, or other structures prior to Owner occupancy of the buildings, and prior to Final Completion. Leave the Project clean and ready for occupancy.

#### 1.03 SUBMITTALS

- A. Provide data for maintenance per Section 01 78 23 "Operation and Maintenance Data."

#### 1.04 QUALITY CONTROL

- A. Use experienced workmen or professional cleaners for final cleaning.

### **2.00 PRODUCTS**

#### 2.01 MATERIALS

- A. Furnish the labor and products needed for cleaning and finishing as recommended by the Manufacturer of the surface material being cleaned.
- B. Use cleaning products only on the surfaces recommended by the Supplier.
- C. Use only those cleaning products which will not create hazards to health or property and which will not damage surfaces.

### **3.00 EXECUTION**

#### 3.01 FINAL CLEANING

- A. Thoroughly clean the entire Site and make ready for occupancy.
  - 1. Remove construction debris, boxes, and trash from the Site.
  - 2. Remove construction storage sheds and field offices.
  - 3. Restore grade to match surrounding condition and remove excess dirt.
  - 4. Sweep all drives and parking lots clean of dirt and debris. Use water truck or hose down paved site to like new appearance.
- B. Clean floors and inspect for damage.
  - 1. Remove oil, grease, paint drippings, and other contaminants from floors, then mop repeatedly until thoroughly clean. Replace damaged flooring.

2. Clean resilient flooring with an approved cleaner and provide one coat liquid floor polish as recommended by the flooring Supplier. Polish to a buffed appearance with powered floor buffer.
  3. Vacuum all carpets with powered floor sweeper to remove dirt and dust. Remove glue or other substances from nap of carpet.
- C. Clean and polish inside and outside glass surfaces. Wash with window cleaner and water, apply a coat of high quality glass polish and wipe clean. Do not scratch or otherwise mar glass surfaces.
  - D. Clean wall surfaces to remove dirt or scuff marks. Remove excess adhesive along top edges of wall base. Remove adhesive from surfaces of vinyl wall coverings.
  - E. Align tile to fit properly in grid and replace cracked or damaged tile. Remove smear marks and other dirt from tile and clean surface of grid system.
  - F. Spot paint nicks and other damage. If spot-painting does not blend into the existing color and texture of the surrounding surfaces, repaint wall from inside corner to inside corner. Touch up damaged surfaces on factory finished equipment using special paint furnished by the Manufacturer.
  - G. Clean plumbing fixtures, valves, and trim. Clean toilet seats and covers. Remove labels and adhesive from fixtures. Remove floor drains and clean baskets or buckets. Polish strainers and exposed chrome or brass.
  - H. Remove dirt, oil, grease, dust and other contaminants from floors, equipment and apparatus in mechanical and electrical rooms with vacuum.
  - I. Clean and polish ceramic tile floors and wall surfaces to remove mildew or other stains. Tuck point defective joints.
  - J. Inspect exterior painted surfaces. Spot paint any damaged surfaces.
  - K. Clean permanent filters and replace disposable filters on heating, ventilating, and air conditioning systems. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - L. Clean roof areas of debris; flush roof drainage systems with water until clear.
  - M. Broom clean exterior paved surfaces and rake clean other surfaces of the grounds.
  - N. Clean and polish all electrical equipment and exposed conduits. Remove paint overspray. Provide a blemish free appearance on all exposed equipment and conduits.

**END OF SECTION**

PROJECT: N. BURLESON STREET  
IMPROVEMENTS  
LIMITS FROM: MILLER STREET  
TO: IH 35 SB FRONTAGE ROAD

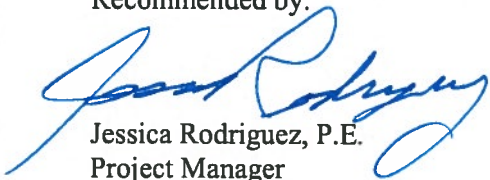
*Utility Status*

This is to certify that all utilities have been adjusted in accordance with the appropriate directives covering the adjustment of utilities, except those utilities listed below which will be adjusted in accordance with the appropriate directives.

Owner	Utility Line	Area/Limits	Cleared Date
Pedernales Electric Cooperative, Inc.	Electric	Miller to Marketplace	February 2018
Centerpoint Energy	Gas	Miller to Marketplace	July 16, 2018
Frontier Communications	Communication	Miller to Marketplace	August 30, 2018
Charter Spectrum	Communication	Miller to Marketplace	August 30, 2018

All of the utility companies have been contacted and it has been determined that the above listed dates are valid.

Recommended by:



Jessica Rodriguez, P.E.  
Project Manager  
May 22, 2018

# City of Kyle

## N. Burleson Street Improvements

### Technical Specifications

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*Rebecca Pittman* 05/22/18

TxDOT (Sodding for Erosion Control, Landscape Planting), City of Austin 437S, SP SS1S– Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

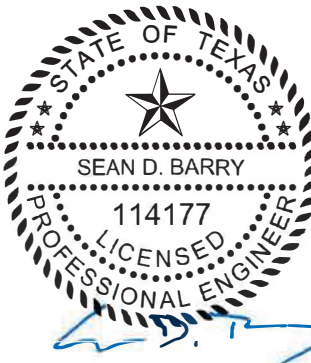
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05/22/2018

Division 32 (Irrigation) – Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

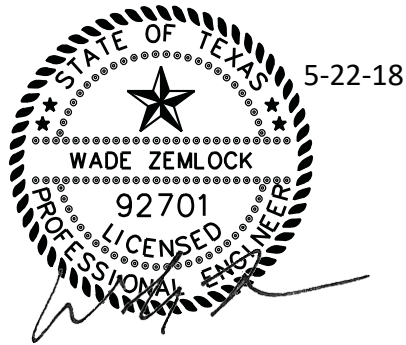
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5/22/2018

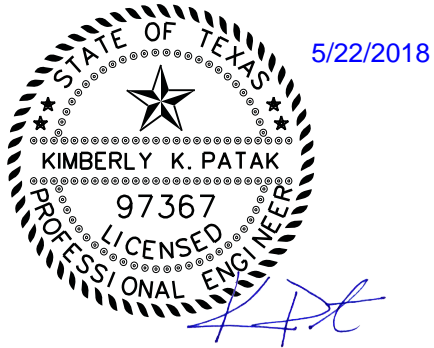
TxDOT (Roadway, General), TxDOT SS6120, TxDOT SS6789 – Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

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**Division 26 (Electrical)** – Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

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**TxDOT (Drainage), City of Austin (Drainage), SP 432, SP 551S, SP 591S, SS 02263, SS 02267** – Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

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**City of Austin (Water, Wastewater), SS 1000** – Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

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**DIVISION 26**



## **26 05 00 COMMON WORK RESULTS FOR ELECTRICAL**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary for complete and operational electrical systems, as specified herein.
- B. This Section, as well as Division 1, concerns all other Sections in Division 26, and shall be considered a part of each of those Sections as if written in their entirety.

#### **1.02 QUALITY ASSURANCE**

##### **A. ELECTRICAL CONTRACTORS' QUALIFICATIONS**

- 1. Use adequate numbers of skilled workmen, trained and experienced in their crafts, and who are familiar with the specifications and methods of performing the work in this Division. A licensed Journeyman shall be on site at all times when electrical work is being performed. Electrical work shall be performed under the direct supervision of a Master Electrician who holds a valid license in the State of Texas. The Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. The report shall be signed by the Master Electrician and include the data and time the Master Electrician was on site.

##### **B. WORKMANSHIP**

- 1. Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance with its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the project site. Locations for materials or equipment requiring an exact fit shall be field measured. Conduit and motors shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems.

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:
  - 1. Component catalog number and manufacturing data sheet, indicating pertinent data and identifying each component by the item number and nomenclature as specified.
  - 2. Component drawings showing dimensions, mounting, and external connection details in AutoCAD format.

3. Operation and maintenance manuals shall contain the shop drawings, submittals, spare part lists, schematics, final wiring diagrams with any changes made during construction, start-up and maintenance procedures.
4. The Contractor shall:
  - a. Prepare, and keep up-to-date, the Record Drawings and detailed construction drawings;
  - b. Record the exact locations of each of these differences, sizes and details of the Construction Work as executed, with cross-references to and other requirements on the Record Drawings.
  - c. Keep the Record Drawings on the Work Site;
  - d. Upon completion of the Work, or at such other time as may be determined by the Engineer, submit the Record Drawings and copies to the Owner's Representative in accordance with the Owner's Requirements.
  - e. Provide revised drawings in AutoCAD noting any changes made to equipment during construction and start-up.

1.04 STANDARDS

- A. Electrical work shall be executed in accordance with local, State and national codes, ordinances and regulations which have jurisdiction or authority over the work. If the standards and codes conflict with each other, the most stringent shall apply. The applicable provisions of the following standard shall apply as if written here in their entirety:

National Electrical Manufacturer Association (NEMA)
American Society for Testing and Materials (ASTM)
National Fire Protection Association (NFPA)
National Electrical Safety Code (NESC)
Institute of Electrical and Electronic Engineers (IEEE)
National Electrical Code (NEC)
Underwriters' Laboratories (UL)
American National Standards Institute (ANSI)
Uniform Building Code (UBC)

Occupational Safety and Health Administration (OSHA)
Local utility companies
Local Electrical Ordinance
Rural Electrification Association (REA)
Insulated Power Cable Engineers Association (IPCEA)
International Electrical Testing Association (NETA)
National Electrical Contractors Association (NECA)
Association Edison Illuminating Companies (AEIC)

**1.05 DELIVERY AND STORAGE**

- A. Follow the Manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Major electrical equipment shall be stored indoors and space heaters energized where applicable. Coordinate with equipment manufacturer for storage requirements. Damaged equipment shall not be acceptable. Upon installation, protect the materials until the work is completed and accepted by the Owner.

**1.06 JOB CONDITIONS**

- A. Permits, licenses and inspections shall be secured and paid for as required by law for the completion of the work. Certificates of approval shall be secured, paid for, and delivered to the Owner before receiving the final acceptance of the work.
- B. The location of materials, equipment, devices and appliances indicated are approximate and subject to revisions at the time the work is installed. Final location shall be as proposed by the Contractor and approved by the Engineer.
- C. Should project conditions require any rearrangement of work, or if equipment or accessories can be installed to a better advantage than the general arrangement of work on the plans, the Contractor shall before proceeding with the work prepare and submit plans of the proposed rearrangement for the Engineer's review and approval.
- D. All enclosures for equipment unless specifically identified otherwise shall be NEMA 3R for exterior locations not exposed to a hazardous location.

**2.00 PRODUCTS (NOT USED)**

**3.00 EXECUTION**

3.01 INSTALLATION

- A. Coordinate routing of all conduit with site civil features such as pavement, curbs, traffic signalization and right-of-ways.

3.02 CLEAN AND ADJUST

- A. Remove shipping labels, dirt, paint, grease, and stains from equipment. Remove debris as it accumulates. Upon completion of work, clean electrical equipment and the entire electrical installation.

**END OF SECTION**

**26 05 19      LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES**

**1.00    GENERAL**

**1.01    WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install and test 600 volt wires and cables. Electrical work shall be in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

**1.02    QUALITY ASSURANCE: TESTING**

- A. Megger test circuits for continuity and ground. Verify phasing at connection points. Torque test conductor connections and terminations to the Manufacturer's recommended values. Megger tests shall be performed by a testing company with a minimum of 10 years experience.

**1.03    SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:
  - 1. Low voltage wire
  - 2. Ground wire
  - 3. Terminations and Connections

**1.04    STANDARDS**

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

ICEA S-19-81/NEMA WC-3	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
ICEA S-61-402/NEMA WC-5	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NFPA 70	National Electrical Code
ANSI/TIA/EIA 606A	Standard for Telecommunications Infrastructure
UL 83	Thermoplastic Insulated Wires and Cables

UL 1063	Machine Tool Wires and Cables
ASTM B3	Soft or Annealed Copper Wires
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium, Hard, Soft

**1.05 DELIVERY AND STORAGE**

- A. Deliver cable and wire to the project site in the original packages. Conductors with damaged insulation or exposed nylon jacketing shall not be permitted.
- B. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable.
- C. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel.
- D. Do not drop reels from any height.
- E. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.
- F. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.
- G. Provide moisture protection by using manufacturer’s standard procedure or heat shrinkable self-healing end caps applied to both ends of cable. Do not remove end caps until cables are ready to be terminated.

**2.00 PRODUCTS**

**2.01 GENERAL**

- A. Wires and cables shall be soft-drawn, annealed copper with a conductivity of not less than that of 98% pure copper, UL83 and UL1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 Celsius in dry locations and 75 Celsius in wet locations
- B. Conductors #8 AWG or larger shall be stranded and conductors #10 to #14 AWG shall be stranded. Utilize single conductors.
- C. Except for control circuits and as specifically indicated on the plans the minimum conductor permitted is #12 AWG.

#### D. WIRE MARKING

1. Wire marking shall be in accordance with the National Electrical Code Article 310 and shall be printed on the wire insulation at 2 foot intervals. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.
2. Wire marking shall include the U.L. label and necessary identification, including the Manufacturer, the number of conductors, size, XHHW-2 conductors, sun-resistance, and other pertinent information.

#### 2.02 CONDUCTORS AND CABLES

- A. SINGLE CONDUCTOR CABLES: Conductor with thermoplastic insulation rated at 600 volts and insulated with type XHHW-2 insulation. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association. Wire in light fixture channels and other special locations shall be as specifically noted for temperature in NEC Article 300. Conductors 38 or larger and conductors #14 shall be stranded. Wire shall be manufactured by Southwire, Okonite, General Cable, or Houston Wire & Cable.
- B. GROUND WIRE: Ground wire shall be Class B stranded wire with green insulation as specified for low voltage wire.

#### 2.03 WIRE CONNECTIONS AND DEVICES

- A. CONNECTORS, COMPRESSION, COPPER, 600 VOLT: As manufactured by Burndy, Thomas & Betts, or Ideal Industries; of the appropriate hole sizes and spacing which are in accordance with NEMA standards; two (2) holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the circuit breakers in the lighting and/or receptacle panels. All compression connectors shall be long-barrel type, no exceptions.
- B. 600 VOLT PLASTIC TAPE: Minnesota Mining & Manufacturing Company, No. 35.
- C. WIRENUTS: Silicone-based pre-filled spring wire connecting devices with plastic covering; UL listed for damp and wet locations. Wirenut shall meet requirements of UL 486D for Sealed Wire Connector Systems and shall be manufactured by Ideal Industries, Inc model 63, or as manufactured by ITT or Panduit. Wirenut shall be spring insulated, properly sized and resistant to vibration may be used for No.12 through No.10 solid gauge conductor for lighting and branch circuits only.
- D. SPLIT BOLTS: Kearney, Burndy, or IlSCO; shall be usable for connecting conductors which are both copper, both aluminum or one copper and one aluminum. Split bolts shall have a spacer between the two conductors, which it connects.

- E. MECHANICAL SET SCREW CONNECTOR: Blackburn HPS, ADR-ALCUL, GP or GT, Burndy or IlSCO; consisting of an aluminum body which has openings on opposite ends for insertion of the conductors. Conductors inserted into these holes shall each be clamped by two set screws. Connectors shall be suitable for use with copper conductors.
- F. RUBBER TAPE: Scotch 2210.
- G. VINYL TAPE: Scotch 88.
- H. INSULATING RESIN: Scotch 3576, 3577, or 3578.
- I. POWER DISTRIBUTION BLOCKS: Mersen, IlSCO or Allen-Bradley; rated for 600 VAC and termination of copper conductors. Individual poles shall be constructed of tin plated aluminum and mounted on an insulating base.

### **3.00 EXECUTION**

#### **3.01 PREPARATION**

- A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

#### **3.02 INSTALLATION**

##### **A. GENERAL**

1. Install raceway first as a complete system without conductors. Do not install pull wires and conductors until the raceway system is in place in accordance with the NEC and these specifications.
2. Installed unapproved wire shall be removed and replaced at the Contractor's expense.
3. Neatly train wiring inside boxes, equipment and panelboards. Pull conductors into a raceway at the same time and use U.L. listed, wire pulling lubricant for pulling No. 4 AWG and larger wire.
4. Except for hand-pulled conductors into raceways, all wire and cable installation shall be installed with tension-monitoring equipment. Where conductors are found to have been installed without tension-monitoring, the conductors and cables shall be immediately removed from the raceways, permanently identified as rejected material, and removed from the jobsite. New conductors and cables shall be reinstalled, tagged and raceways resealed, all at the Contractor's expense.
5. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.



6. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.
7. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bundle and secure in an acceptable manner. Cap spare conductors and conductors not terminated, with the UL listed end caps.
8. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.
9. For conductors that will be connected by others, provide at least 6 feet spare conductors in free standing panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.

#### B. SPLICES

1. Power Conductors: Splice in junction boxes or at outlets only for lighting and receptacle branch circuits. Splices for all other circuits shall be disallowed. Any required splices due to project conditions are subject to the Engineer's approval. Obtain approval from Engineer before installing any splices.
2. Condulet type fittings shall not contain splices. Under no condition shall conductors of a different color be spliced together.
3. For No. 10 and smaller, connect conductors with a twist-on spring wirenut. Splices below grade or in below grade pull boxes, junction boxes or manholes shall not be allowed.

#### C. TERMINATIONS

1. Conductors terminated on a screw termination shall have a crimp on type spade connector applied on the wire end, Panduit PanTerm or approved equal.
2. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.
3. Use crimp connectors on all stranded conductors.
4. Soldered mechanical joints insulated with tape will not be acceptable.
5. SINGLE CONDUCTORS: Sufficient wire shall be left at hand-holes of street lighting poles to make final connections.

#### D. GROUNDING

1. Conduits and other raceway shall contain an equipment grounding conductor whether the raceway is metallic or not. Conduits, poles, outlets, and other equipment shall be properly grounded in accordance with National Electrical Code requirements. Where ground wire is exposed to mechanical damage, install wire in rigid steel conduit. Make connections to equipment with solderless connections. All connections to ground rods shall be of the fused type utilizing an exothermic welding process.
2. Ground metallic material, including but not limited to metallic raceway, metallic boxes and metallic enclosures. Where metallic material is not connected by raceway to a solid ground, connect the metallic material to the largest equipment grounding conductor, which it houses. Clean the metal surface under the grounding lug to bright metal. Grounding connections to motors shall be to the grounding stud, which shall be threaded into the stationary frame; Use Burndy KC Servit, or approved equal. The ground wire shall not be lugged to a mounting bolt.
3. Ground wire shall be insulated wire with green insulation as specified for low voltage wire. Provide and size bonding conductors in accordance with the National Electrical Code.

#### E. WIRE AND CABLE TAGGING

1. Circuits shall be tagged at terminations (both ends), in pull/junction boxes, cabinets, and terminal strips enclosures as follows:
  - a. Tags relying on adhesives or taped-on markers are not acceptable.
  - b. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black marking, Raychem TMS sleeves or approved equal.
  - c. Provide tags for cables and for conductors No. 8 AWG and larger consisting of permanent nylon marker plates with legible designations hot stamped on the plate. Attach these marker plates to conductors and cables with plastic wire wraps. Tags shall be Raychem TMS-CM cable markers or approved equal.
  - d. For multi-conductor cables, both the individual conductors and the overall cable shall be tagged. Conductors that are part of a multi-conductor cable shall reference the cable identification number they are a part of, as well as a unique conductor number within the cable.
  - e. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards.

- f. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).
2. Color coding of cables shall comply with the local city codes. In the absence of a local color coding requirement, the following shall be used:
  - a. For 480Y/277V, 3-phase wiring:
    - 1). Phase A - Brown
    - 2). Phase B - Orange
    - 3). Phase C - Yellow
    - 4). Neutral - Gray
    - 5). Equipment Grounding Conductor - Green

- b. For 208Y/120V or 240/120V, 3-phase wiring:
  - 1). Phase A - Black
  - 2). Phase B - Red
  - 3). Phase C - Blue
  - 4). Neutral - White
  - 5). Equipment Grounding Conductor – Green
- c. For 120/240, 1-phase wiring:
  - 1). Leg A - Black
  - 2). Leg B - Red
  - 3). Neutral - White
  - 4). Equipment Grounding Conductor - Green
- 3. Colored, vinyl marking tape shall be allowed only on conductors greater than 8 AWG. Under no condition shall conductors of a different color be spliced together. Application of tape shall be in accordance with the Manufacturer’s recommendations.

**F. TESTING**

- 1. Perform tests and inspections and prepare test reports and submit to the Owner/Engineer prior to final inspection.
- 2. Tests and Inspections:
  - a. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - b. Perform each visual and mechanical inspection and electrical tests stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - c. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

## **26 05 2F      GROUNDING & BONDING FOR ELECTRICAL SYSTEMS**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC) as shown on the drawings or as specified herein. Electrical work shall be in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

#### **1.02    SUBMITTALS**

- A. Submittal shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:
  - 1. Grounding materials, equipment and processes including but not limited to:
    - a. Ground Rods
    - b. Ground Conductors
    - c. Connectors
  - 2. Product Data: For each type of product supplied.
  - 3. Field quality-control test reports.

#### **1.03    QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Measure the ground grid resistance with the earth test megger and install additional ground rods and conductors as required until the resistance to the ground conforms to National Electrical Code requirements. Ground resistance measurement shall not exceed 5 ohms. Add ground rods as required to bring resistance to 5 ohms and connect to grounding system.
- D. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

## **2.00 PRODUCTS**

### **2.01 MATERIALS**

- A. GROUND RODS: Copper-clad, having a diameter of 3/4" and a minimum length of 10'.
- B. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- C. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  4. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- D. CONDUIT GROUND FITTINGS: Fittings for bonding ground cable to the conduit shall be FCI Burndy Corp., type NE or Thomas & Betts No. 3951 series.
- E. GROUND ROD BOXES: Precast Box with cast iron lid. Lid shall read "ground rod" on lid. Brooks Precast Model. "3-RT" or approved equal.
- F. EXOTHERMIC WELDING PROCESS: CADWELD MATERIALS – as manufactured by ERICO products or approved equal.
- G. CONNECTORS
  1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
  2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  3. Pipe Connectors: Clamp type, sized for pipe.
  4. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

### **2.02 PROCESSES**

- A. All grounding system connections to building steel and ground rods shall be exothermically welded including all cable connections, and cable steel terminations.
- B. All materials involved must be from the same sources to insure compatibility. Connections made from this process shall meet the requirements of IEEE Standards 80 and 837 and as listed in MIL 419 and other standards, National Electrical Code, etc.

## 2.03 GROUNDING SYSTEM

- A. Provide a grounding system that includes all connections and the testing of ground rods, ground cables, ground buses, conduits, fittings, anchor supports, thermite process materials and equipment and other materials required for a complete installation. Grounding system shall be installed and sized in accordance with the National Electrical Code.

## 3.00 EXECUTION

### 3.01 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.

### 3.02 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
  - 2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

3. Ground rod shall be installed such that the top of the ground rod is 6" below grade and enclosed by a ground rod box.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted/clamp type connectors.
  2. Underground Connections: Exothermically welded connectors, except as otherwise indicated.
  3. Connections to Structural Steel: Exothermically welded connectors.
- E. Ground electrical work in accordance with the National Electrical Code Article 250 and local codes.
- F. Install ground cables in conduits above grade or directly buried in earth to a depth of not less than 30" below grade. Installation to provide sufficient mechanical protection so as not to break ground cables or connections.
- G. Install ground cables continuously between connections. Splices shall not be permitted, except where indicated on the plans. Where ground cables pass through floor slabs, buildings, etc., and when not in metallic enclosures, provide a sleeve of approved, non-metallic materials.
- H. Install a green-colored, equipment grounding conductor in raceways. Size conductors in accordance with NEC Article 250.
- I. Metal conduits stubbed up into electrical equipment shall be terminated with insulated grounding bushings and connected to the equipment ground bus. Size the grounding wire in accordance with applicable sections of the National Electrical Code.
- J. Provide exothermic weld connection for extension to existing stub-up ground conductors.
- K. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Provide grounding and bonding jumpers as required per the NEC.



2. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- L. All equipment enclosures, motor and transformer frames, conduit systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC. Provide grounding and bonding jumpers as required per the NEC.
- M. Where exothermic bonding is used, molds shall be of the appropriate size for the wire and rod used. All bonds shall remain exposed for inspection of the Owner's Representative.

### 3.03 INSPECTION

- A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use Bidle Direct Reading Earth Resistance Tester or equivalent to measure resistance to ground of the system. Perform testing in accordance with the test instrument manufacturer's recommendation using the fall of potential method.
- C. All test equipment provided under this section shall be approved by the Engineer.
- D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.
- E. Testing shall be performed before energizing the distribution system.
- F. A separate test shall be conducted for each building or system.
- G. Notify the Engineer immediately if the resistance to ground for the system is greater than five ohms. Provide additional ground rods and conductors as required to bring the resistance to five ohms.

### 3.04 FIELD QUALITY CONTROL

- A. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
- B. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
2. Perform tests by fall-of-potential method according to IEEE 81.

**END OF SECTION**

## **26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install a complete conduit system for each type of electrical system. Electrical work shall be in accordance with Division 26.

#### **1.02 DEFINITIONS**

- A. Retain abbreviations that remain after this Section has been edited.
  - 1. RNC: Rigid nonmetallic conduit.
  - 2. RMC: Rigid metallic conduit

#### **1.03 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### **2.00 PRODUCTS**

#### **2.01 METAL CONDUIT AND TUBING**

- 1. AFC Cable Systems, Inc.
- 2. Alflex Inc.
- 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
- 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
- 5. Electri-Flex Co.
- 6. Manhattan/CDT/Cole-Flex.
- 7. Maverick Tube Corporation.

8. O-Z Gedney; a unit of General Signal.
  9. Wheatland Tube Company.
- B. RMC: Rigid Metal Conduit
1. Rigid Steel Conduit: Heavy wall, mild steel tube with metallic, corrosion-resistant coating on interior and exterior, hot-dipped, galvanized steel, free from defects; manufactured in accordance with Fed. Spec. WW-C-581, ANSI C80.1 standards, and U.L. listed.
  2. Aluminum Rigid Conduit: Heavy wall, aluminum alloy 6063; low temper number, tube, free from defects and manufactured in accordance with ANSI C80.5 standards and U.L. listed.
- C. PVC-Coated Metal Conduit: PVC-coated rigid steel conduit
1. PVC COATED RIGID STEEL: Meeting the requirements of rigid steel conduit; 40 mil PVC exterior coating and 2 mil urethane interior coating. PVC coated rigid steel conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard. Acceptable Manufacturers shall be Rob Roy Plastibond Red, Perma-Cote and Ocal.
- D. Fittings for Conduit: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

## 2.02 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arnco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.

8. Electri-Flex Co.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
- B. RNC: Rigid Non-Metallic Conduit
1. Schedule 40 high impact, polyvinylchloride, in accordance with Fed. Spec. W-C-1094 and U.L. listed.
  2. Conduit shall be rated for use with 90° C conductors, UL Listed. Material shall comply to NEMA Specification TC-2 (Conduit), TC-3 (Fittings) and UL 651 (Conduit) and 514b (Fittings).
  3. Conduit and fittings shall carry a UL label on each 10 foot length; Fittings - stamped or molded on each fitting.
  4. The conduit and fittings shall be homogeneous plastic free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could mar conductors or cables.
  5. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- D. Fittings for LFNC: UL 514B.

### 2.03 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Hinged-Cover Enclosures: NEMA 250, with continuous-hinge cover with flush latch, finished inside and out with manufacturer's standard enamel; Type 3R (or as specified on the plans), galvanized-steel box with removable interior panel and removable lockable front for exterior locations.

### **3.00 EXECUTION**

#### **3.01 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit
  2. Concealed Conduit, Aboveground: Rigid steel conduit
  3. Underground Conduit: RNC, Type EPC-40PVC, direct buried.
  4. Transition from underground to above ground or where conduit penetrates slabs: PVC Coated Rigid Steel Conduit to 6" each direction.
- B. Minimum Raceway Size: 3/4-inch trade size above grade and 1-inch trade size conduit below grade.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- D. Do not install aluminum conduits in contact with concrete.

### 3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Complete raceway installation before starting conductor installation.
- C. Install no more than the equivalent of three 90-degree bends in any conduit run.
- D. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- E. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- F. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

### 3.03 SIZING AND INSTALLATION OF WIREWAYS, PULL BOXES AND JUNCTION BOXES

- A. The CONTRACTOR shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.
- B. Install Products in accordance with manufacturer's instructions.
- C. Use screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- E. Wireway Supports: Per manufacturer's recommendations. The Contractor shall support the wireway rigidly to the building structures using hardware bolted or screwed to the structure. Supporting wireways from corrugated metal structures shall not be allowed.
- F. Close ends of wireway and unused conduit openings.

### 3.04 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and enclosures are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.05 ROUTING

- A. Use the conduit route where shown on the plans. Route conduits that do not have a specified route in the most direct path between the two points. Concealed conduits on the plans shall be below grade.
- B. Install conduit at locations which avoid interference with other work. Avoid crossing other work.

### 3.06 TERMINATIONS

- A. Use threaded hubs for termination of conduits. Locknut termination of conduits shall not be used on this project.

**END OF SECTION**



## **26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### **1.02 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

### **2.00 PRODUCTS**

#### **2.01 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. All markings to labels, schedules, tags or nameplates shall be machine printed only. Hand printing is prohibited. Circuits shall be tagged at terminations (both ends), in pull boxes, cabinets, and enclosures as follows:

1. Tags relying on adhesives or tapes-on markers are not acceptable.
2. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black marking, Raychem TMS sleeves or approved equal.
3. Provide tags for cables and for conductors No. 8 AWG and larger consisting of permanent nylon marker plates with legible designations hot stamped on the plate. Attach marker plates to conductors and cables with plastic wire wraps. Tags shall be Raychem TMS-CM cable markers or approved equal.
4. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards.
5. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).

## 2.02 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches wide.

## 2.03 UNDERGROUND-LINE WARNING TAPE

### A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

### B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

## 2.04 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal size, 7 by 10 inches.
- D. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.05 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Attach plates to equipment with stainless steel screws. Provide an O-ring for screws on NEMA 4X enclosures, O-rings shall maintain the integrity and NEMA 4X rating for enclosures. Minimum letter height shall be 3/8 inch.

## 3.00 EXECUTION

### 3.01 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with stainless steel mechanical fasteners appropriate to the location and substrate.

- F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

### 3.02 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot (10-m) maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208Y/120-V Circuits:
      - 1). Phase A: Black.
      - 2). Phase B: Red.
      - 3). Phase C: Blue.
      - 4). Neutral: White
    - c. Colors for 480Y/277-V Circuits:
      - 1). Phase A: Brown.
      - 2). Phase B: Orange.
      - 3). Phase C: Yellow.

- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power and lighting,
  - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. Warning Labels for Indoor Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
- G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, and control panels of each system.
  - 1. Labeling Instructions:

- a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
  - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
  - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - d. Contactors.
  - e. Monitoring and control equipment.

**END OF SECTION**

## **26 24 16.02 LIGHTING AND BRANCH PANELBOARDS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install lighting and branch panelboards. Electrical work shall be in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

#### **1.02 QUALITY ASSURANCE - ACCEPTABLE MANUFACTURERS**

- A. Panelboards shall comply with the specifications and shall be by the following Manufacturers:
  - 1. General Electric
  - 2. Square D
  - 3. Eaton-Cutler Hammer.
  - 4. All others shall submit qualifications to the Owner and the Engineer for review and approval prior to bid submittal no later than one week after bid advertisement date. Any submittals after this time period shall not be evaluated. Qualifications shall include equipment manufacturer who have had at least 10 years of successful experience in providing equipment for similar projects with a generator and pump station configurations. Qualifications shall include a list of similar projects within the last 5 years with the name of the project and contact information of the Owner.

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00, Submittal Procedures and shall include:
  - 1. Shop Drawings:
    - a. Bill of Material
    - b. Front Elevation with dimensions
    - c. Assembly ratings including short circuit ratings, continuous current and voltage
    - d. Cut sheet on circuit breakers
    - e. Master drawing index
    - f. Top view with dimensions
    - g. Nameplate schedule
    - h. UL Listing
    - i. Conduit entry/exit locations with dimensions
    - j. Assembly ratings including short circuit ratings, continuous current and voltage
    - k. Major component ratings including voltage, continuous current ratings and interrupting ratings

- I. Descriptive bulletins
- m. Cable terminal sizes

#### 1.04 STANDARDS

- A. Circuit breakers, molded case, and branch circuit shall be in accordance with the applicable provisions of the following standards as if written here in their entirety:
  - 1. Fed. Spec. W-C-375
  - 2. NEMA AB1 Molded Case Circuit Breakers and their application.
  - 3. NEMA PB1 Panelboards
  - 4. UL 67 Panelboards

#### 1.05 DELIVERY AND STORAGE

- A. Equipment shall be handled and stored in accordance with the manufacturer's instructions. Equipment shall be protected from damage.

#### 1.06 WARRANTY

- A. The manufacturer shall warrant the equipment to be free from defects.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturer shall be ISO 9001 2000 or later certified.
- B. Manufacturer shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

### 2.00 PRODUCTS

#### 2.01 PANELBOARDS

- A. Panelboards shall consist of a box, front, interior and circuit protective devices and shall be manufactured in accordance with NEMA PB1 and bearing the applicable U.L. labels.
- B. Panelboards shall be four wire, three phase as scheduled or required. Panelboards shall be NEMA 1 and suitable for surface mounting. Panelboards shall contain sequence style busing and full capacity neutral, composed of an assembly of bolt-on, molded case, automatic breakers with thermal and an instantaneous, magnetic trip in each pole and a trip-free position separate from either the "On" and the "Off" positions. Two (2) and three (3) pole circuit breakers shall simultaneously open all poles. Circuit breakers, molded case and branch circuits shall be in accordance with Fed. Spec. W-C-375.
- C. The voltage rating, phase, number of wires and ampere rating shall be as indicated and scheduled on the plans.
- D. The panelboard box shall be fabricated of code gauge, galvanized sheet steel in accordance with U.L. standards and have turned edges around the front for rigidity and frontal clamping. Provide standard knockouts on the panel enclosures.



- E. The panelboard front shall be fabricated of sheet steel and finished with a baked on gray enamel over a rust inhibitor. Each front shall have a door mounted on semi-concealed hinges with a cylinder lock, an index card and a card holder. Panelboard locks shall be master keyed, with two (2) keys furnished for each panel board. Index cards shall be properly typewritten.
- F. The interior of the panelboard shall consist of a factory-assembled, rigid frame supporting the rectangular bus, the mains and the neutral bar.
- G. Busings shall be tin-plated copper and arranged for sequential phasing throughout. The bus bar shall be sized so that the temperature rise is limited in accordance with NEMA standards. The insulated neutral bar shall be located at the opposite end of the structure from the mains.
- H. Panelboards shall have either solderless lugs or a main circuit protective device as scheduled. Each enclosure shall have grounding lugs and uninsulated equipment grounding terminals.

## 2.02 CIRCUIT BREAKERS

- A. Panelboards shall be equipped with circuit breakers.
- B. Circuit breakers shall be molded case, bolt in type.
- C. Single pole circuit breakers serving fluorescent lighting loads shall have the SWD marking. Circuit breakers serving air conditioning branch loads shall be U.L. listed as type HACR.
- D. Each circuit breaker used in 120/208 Volt Panelboards shall have an interrupting capacity of not less than 42,000 Amps, RMS symmetrical unless indicated otherwise. Series rating of panelboard and circuit breakers shall not be acceptable.
- E. Circuit breakers shall be manufactured by the panelboard manufacturer.
- F. The panelboard and circuit breaker interrupting capacities and rating shall be equal to or greater than the fault currents available to each panelboard. Series rating of breakers shall not be permitted.

## 2.03 SURGE PROTECTION DEVICES

### A. Main Incoming Section

1. Surge Protection Device Description: IEEE C62.41-compliant, externally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, third edition Type 1, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
  - a. All surge suppression components shall be individually fused and rated to allow maximum specified surge current capacity and with an interrupting rating greater of 200kAIC. The overcurrent protection must be part of all testing (ANSI/UL and surge testing). Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Replaceable fusing is unacceptable. The SPD shall be tested and shipped as a complete unit as tested by ANSI/UL.
  - b. Fabrication using bolted compression lugs for internal wiring.

- c. Integral disconnect switch/circuit breaker.
  - d. Redundant suppression circuits.
  - e. Redundant replaceable modules.
  - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  - g. LED indicator lights for power and protection status.
  - h. Audible alarm, with silencing switch, to indicate when protection has failed.
  - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
  - j. Four-digit, transient-event counter set to totalize transient surges.
2. Surge Current Capacity – Service Entrance SPDs shall be ANSI/UL Listed Type 1 SPD with a 250 kA Surge Rating per Mode, with field replaceable surge modules. Surge Current Capacity –Distribution or Branch panels shall be UL Listed Type 1 SPDs with a 160 kA Surge Rating per Mode
  3. Protection modes and UL 1449 3rd edition VPR for grounded wye circuits with 480Y/277V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral, Line to Ground, Neutral to Ground: 1200 V for 480Y/277.
    - b. Line to Line: 2000 V for 480Y/277.
  4. Protection modes and UL 1449 3rd edition VPR for grounded wye circuits with 208Y/120V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral 800 V
    - b. Line to Ground 900V
    - c. Neutral to Ground: 700 V
    - d. Line to Line: 1200 V
  5. The SPD shall be life cycle tested to withstand 10kA (8x20 $\mu$ s), 20kV (1.2x50 $\mu$ s), IEEE C62.41 Category C3 surge current with less than 5% degradation of clamping voltage. The service entrance and main distribution panel SPDs shall withstand a minimum of 15,000 Category C3 Surges per Mode. Branch panel SPDs shall withstand a minimum of 8,000 Category C3 Surges per mode.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install the panelboard in accordance with applicable codes at each location indicated on the plans. Provide filler plates for unused spaces in the panelboard. All labeling shall be in accordance to Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL and 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

- B. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Comply with NECA 1.
- D. Install panelboards and accessories according to NEMA PB 1.1.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The stainless steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- G. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges per Specification Section 26 05 73.01 ELECTRICAL POWER SYSTEM STUDIES.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground per Specification Section 26 05 26 GROUNDING & BONDING FOR ELECTRICAL SYSTEMS. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.

### 3.02 NAMEPLATES:

- A. For indoor applications with Air Conditioning: Plastic, white 1" letters on black background, on the front of each door on the switchgear; identifying the compartment contents for each compartment.
- B. All other applications: Plastic, black 1" letters on white background, on the front of each door on the switchgear; identifying the compartment contents for each compartment.
- C. Attach nameplates with a stainless steel screw and nut at each end of the nameplate. Adhesive backed nameplates shall not be installed.

### 3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door. Directory shall be typed and laminated.
- C. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### 3.04 FIELD QUALITY CONTROL

- A. Testing: All testing required shall be per Specification 26 01 26 Testing of Electrical Systems. Testing Agency: Engage a qualified NETA Certified testing agency to perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers, low voltage insulated case/molded case circuit breakers, and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6.1.1 and 7.6.1.2 for Circuit Breakers and Paragraph 7.19.1 for Surge Arrestors, Low-Voltage. Perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Submit under Specification 26 01 26 Testing of Electrical Systems.

**END OF SECTION**

## SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 GENERAL

#### 1.1 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to install disconnects. Electrical work shall be in accordance with Div. 26 specifications.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPST: Single pole, single throw.
- D. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings.
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM PTW32 or ETAP electronic format.
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed switches.

- b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM PTW32 or ETAP electronic format.
- D. Spares: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 140 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

### 2.2 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB Inc.
  - 2. Eaton.
  - 3. General Electric Company.
  - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty:
  - 1. Single throw.

2. Three pole.
3. 600-V ac.
4. 200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

## 2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

## 2.4 ENCLOSURES

A. Enclosed Switches: NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location

- B. Enclosure Finish: The enclosure shall be a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.
- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the disconnect switch is ON and to prevent turning the disconnect switch ON when the enclosure cover is open.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### **3.2 PREPARATION**

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Owner's written permission.
  - 4. Comply with NFPA 70E.

### **3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS**

- A. Enclosed Switches: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 4X, 304 stainless steel or NEMA 250, Type 4X, 316 stainless steel.
  - 2. Outdoor Locations: NEMA 250, Type 4X, 304 stainless steel or NEMA 250, Type 4X, 316 stainless steel.

### **3.4 INSTALLATION**

- A. Coordinate layout and installation of switches and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.



- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

### 3.5 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    - h. Verify correct phase barrier installation.
    - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
  - 2. Electrical Tests:
    - a. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    - c. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- C. Enclosed switches will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
  - 1. Test procedures used.
  - 2. Include identification of each enclosed switch tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

### 3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

**END OF SECTION**

## **26 56 00      EXTERIOR LIGHTING**

### **1.00    GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02    SUMMARY**

- A. This Section includes the following:
  - 1. Exterior lighting fixtures, lamps, ballasts, and drivers.
  - 2. Poles and Accessories.
  - 3. Lighting fixture supports.

#### **1.03    DEFINITIONS**

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. LED: Light emitting diode.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.

#### **1.04    SUBMITTALS**

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. LED drivers.
  - 3. Energy-efficiency data.
  - 4. Life, output, and energy-efficiency data for lamps.
  - 5. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

C. Warranties: Special warranties specified in this Section.

#### 1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

#### 1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and poles with other construction.

#### 1.07 WARRANTY

A. Warranty Period for LED fixtures, including LED drivers: Five years from date of Substantial Completion.

### 2.00 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in Lighting Fixture Schedule.

#### 2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 90 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

#### 2.03 DRIVERS FOR LED FIXTURES

- A. Electronic Driver for LED Fixtures: Comply with UL 1310 Class 2 requirements for dry and damp locations. Include the following features unless otherwise indicated:
1. Rated for 100,000 hours of life, unless otherwise noted.
  2. Sound Rating: Class A.
  3. Total Harmonic Distortion Rating: <15 percent.
  4. Current Crest Factor: 1.5 or less.
  5. 0-10V dimming, standard (no step dimming).
  6. Field replaceable.

#### 2.04 LED FIXTURES

- A. Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.
- B. Include the following features unless otherwise indicated:
1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
  2. Each luminaire shall be rated for a minimum operational life of 100,000 hours utilizing a minimum ambient temperature of (25°C).
  3. Light Emitting Diodes shall be tested under LM-79 and LM-80 Standards for a minimum of 12,000 hours.
  4. Color Rendering Index (CRI) of 82 at a minimum.
  5. Color temperature 4000 K, unless otherwise indicated.
  6. Rated lumen maintenance at 70% lumen output for 100,000 hours, unless otherwise indicated.
  7. Fixture efficacy of 60 Lumens/Watt, minimum.

8. 5 year luminaire warranty, minimum.
  9. Photometry must comply with IESNA LM-79.
  10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.
  11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.
  12. Ingress rating: optics shall be rated to IP65 against water and dirt infiltration.
  13. Luminaire Construction: shall be round in design, material shall be low copper cast aluminum for corrosion resistance and long life. Damp location listed.
  14. Listings: shall be DLC Listed. CSA or UL.
  15. Luminaire shall have safety cord attached to driver door and ease of access to electrical components. Latches shall be stainless steel.
  16. Finish shall be polyester powder coat after a pretreatment process. Finish shall exceed 5000 hour salt spray test.
  17. Luminaire shall be rated for ANSI Category C (10kV/5kA) surge protection.
- C. Technical Requirements:
1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.
  2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 277 VAC to 480 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
  3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.
  4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.
  5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.
- D. Thermal Management
1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

2. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
4. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

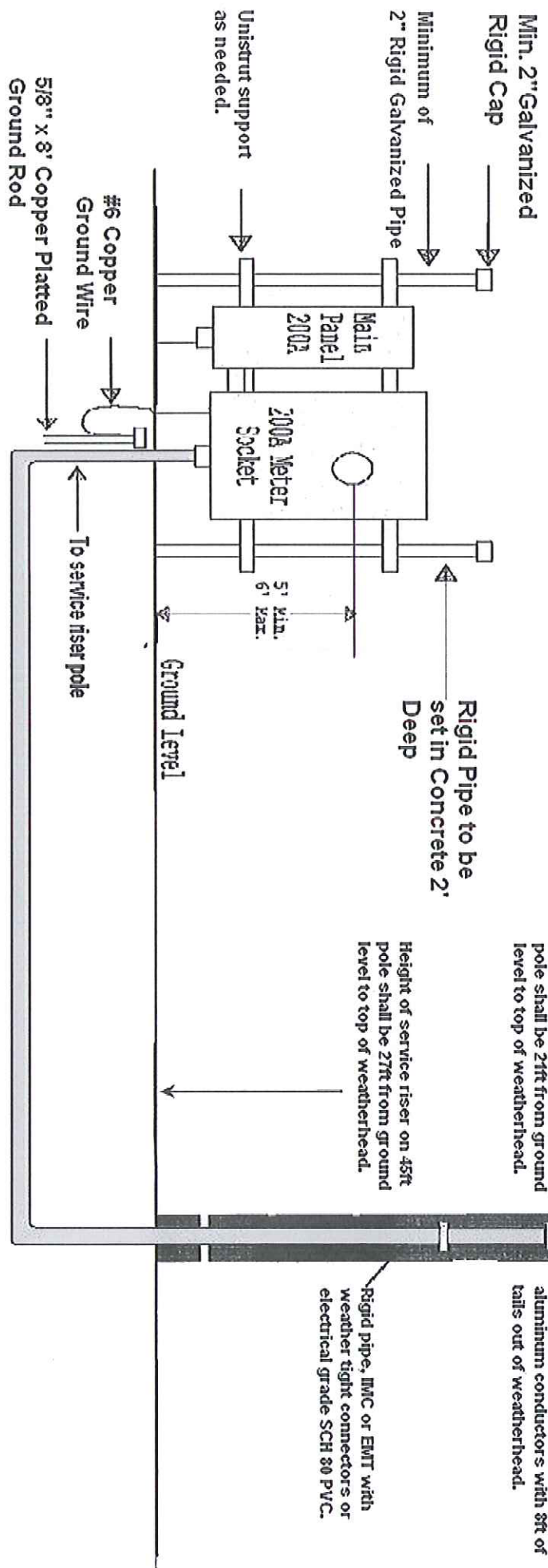
- A. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### **3.02 FIELD QUALITY CONTROL**

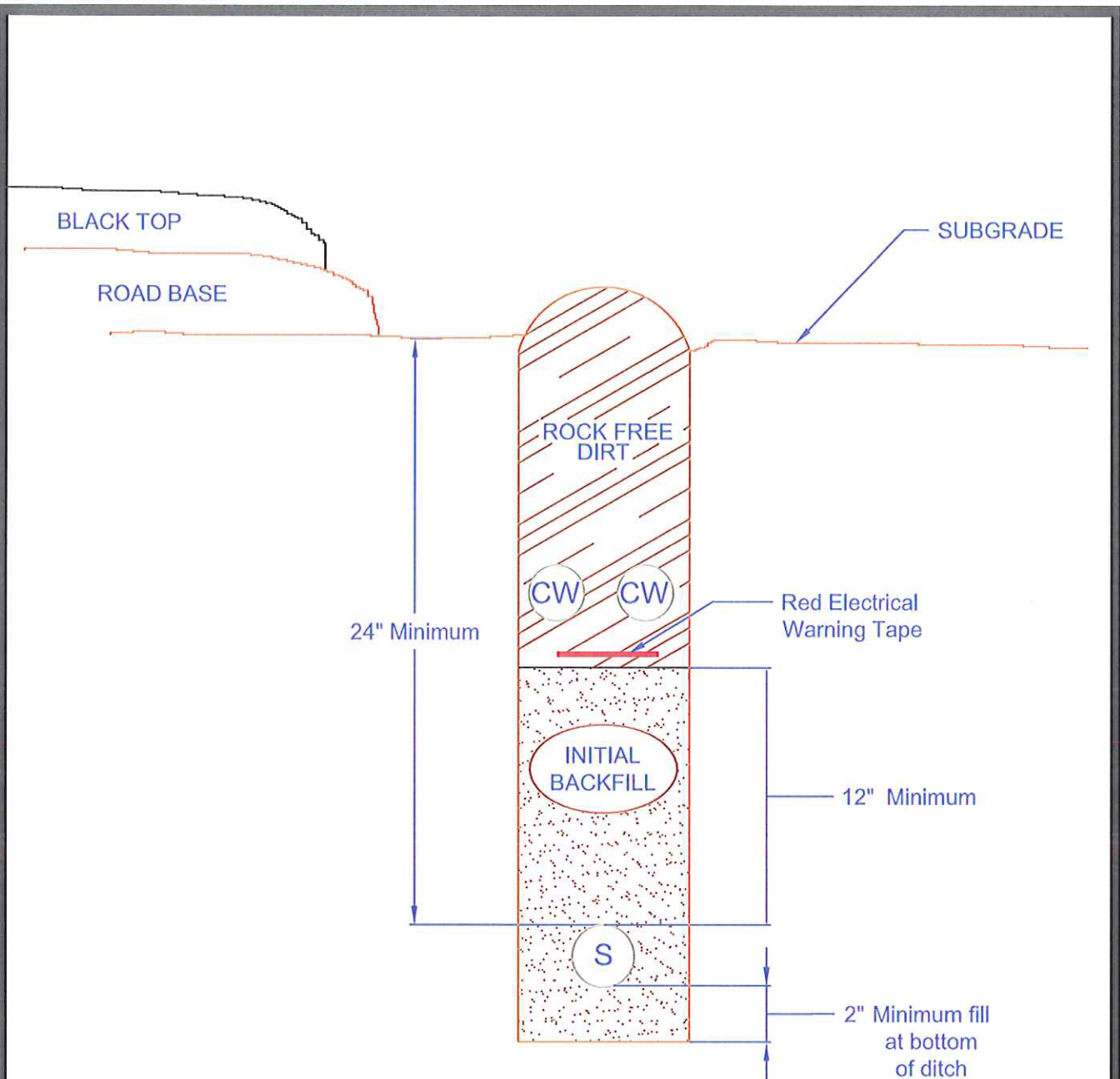
- A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

**END OF SECTION**

# 200amp Rack with Riser Pole







Reference Drawing  
 510-009-0911 for  
 Typical Trench Details



PEDERNALES ELECTRIC  
 COOPERATIVE, INC.  
 URD DEVELOPER'S SPECIFICATIONS

1Ø Conduit Arrangement  
 for Service  
 0 to 600 Volts

drawn:	approved	date:	drawing number:
JBS	MJB	December 12, 2011	510-016-0911

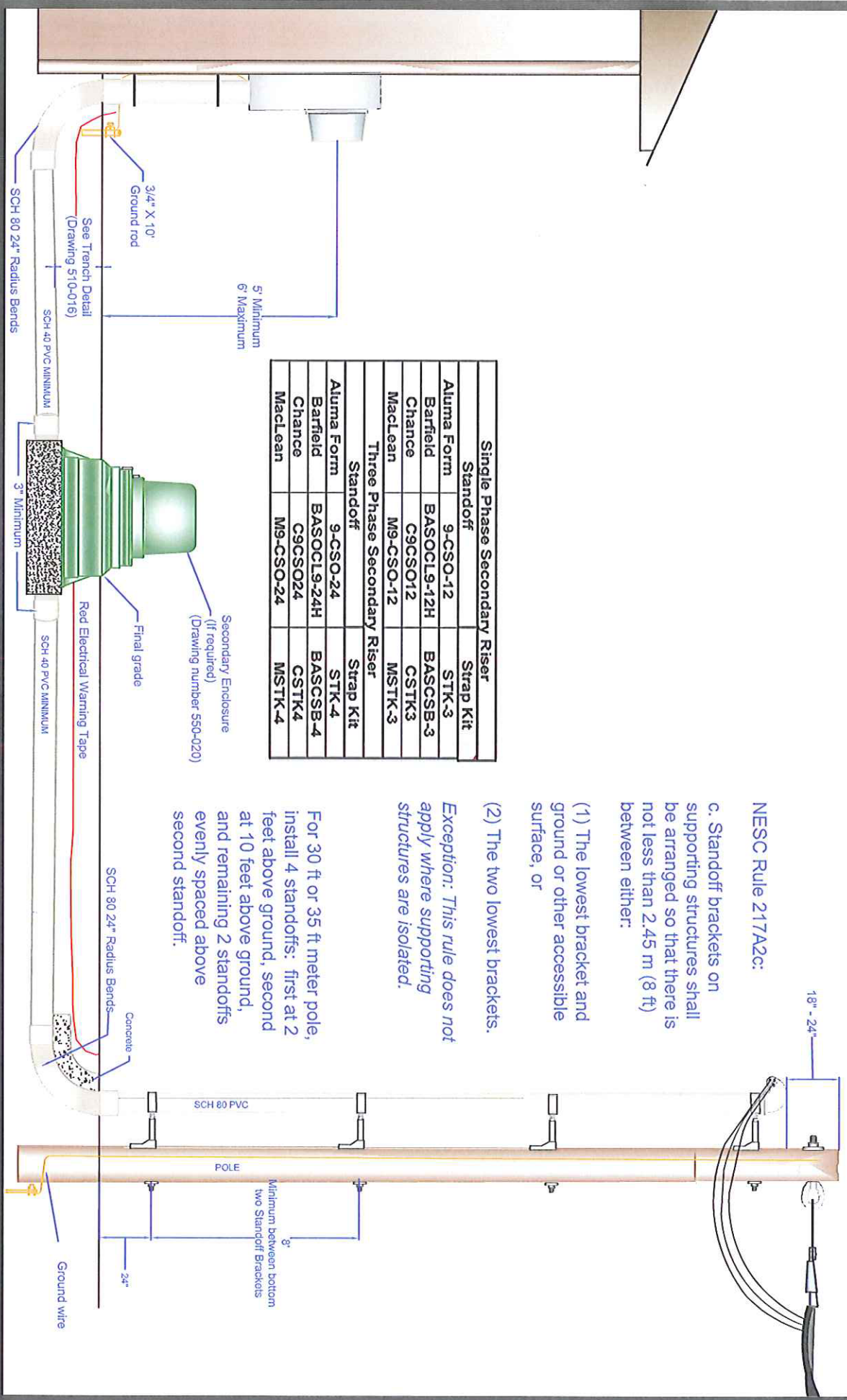


PEDERNALES ELECTRIC  
COOPERATIVE, INC. CONSTRUCTION  
URD DEVELOPER'S SPECIFICATIONS

# Secondary Riser with Standoffs

drawn: **REB** approved: **MJB** date: August 15, 2014

560-050-0814



Single Phase Secondary Riser		Three Phase Secondary Riser	
Standoff	Strap Kit	Standoff	Strap Kit
Aluma Form	9-CSO-12	9-CSO-24	STK-4
Barfield	BASOCL9-12H	BASOCL9-24H	BASCSE-4
Chance	C9CSO12	C9CSO24	CSTK4
MacLean	M9-CSO-12	M9-CSO-24	MSTK-4

NEESC Rule 217A2c:  
c. Standoff brackets on supporting structures shall be arranged so that there is not less than 2.45 m (8 ft) between either:

- (1) The lowest bracket and ground or other accessible surface, or
- (2) The two lowest brackets.

*Exception: This rule does not apply where supporting structures are isolated.*

For 30 ft or 35 ft meter pole, install 4 standoffs: first at 2 feet above ground, second at 10 feet above ground, and remaining 2 standoffs evenly spaced above second standoff.

**DIVISION 32**

## 32 84 23 LANDSCAPE IRRIGATION

### 1.00 GENERAL

#### 1.01 WORK INCLUDED

- A. Provide skilled labor, materials, and equipment for a complete operable landscape irrigation system as specified herein, and as indicated on the contract drawings. Provide a landscape irrigation system design by a TCEQ licensed *Landscape Irrigator*.
- B. Provide design and installation of a landscape irrigation system for trees, turf and ground cover indicated on the Landscape drawings. Provide two root water zone watering systems per tree. Provide 6 inch pop up bodies with matched precipitation rotary gear nozzles (MPR stream rotors) for turf and 12 inch pop up bodies with matched precipitation nozzles (MPR Stream) for landscape ground cover, and Rainbird subsurface drip for areas indicated on the drawings.
- C. Provide controllers and irrigation products per the city of Kyle Texas standards.
- D. Provide Dig Leit ambient light type controllers mounted in meter boxes unless otherwise required by city standards.
- E. Provide connections to city water mains and backflow preventers as required by the city standards and TCEQ.
- F. Coordinate taps with new water main installations prior to beginning construction.

#### 1.02 QUALITY ASSURANCE

- A. Acceptable manufacturers: Manufacturers of irrigation specialties shall be experienced in the production of this type of equipment. Substitutions shall conform to Section 01 33 00 "Submittal Procedures." Recognized manufacturers are as follows:
  - 1. Hunter Industries.
  - 2. Rainbird Corporation.
  - 3. Weathermatic, Division of Telsco Industries .
  - 4. L.R. Nelson Corp.
  - 5. Dig Leit
- B. Installer's Requirements:
  - 1. Contractor and installers shall be licensed by the Texas Commission on Environmental Quality (TCEQ). At least one licensed landscape irrigator, or licensed landscape irrigation technician shall be on the jobsite during construction at all times and shall provide their TCEQ irrigators card when requested by the Owner, or Architect/Engineers (A/E) representative.
  - 2. Design of the irrigation shall be performed by a licensed landscape irrigator, holding a current license in good standing by the TCEQ. A TCEQ licensed technician shall be on site at all times during construction and supervised by a licensed TCEQ Installer.
  - 3. Design of the pipe system shall be based on a 5 feet per second (fps) maximum velocity.

4. Pop-up spray sprinklers shall be a minimum 6-inch body, unless otherwise indicated.
5. The system shall be multi-zoned and fully automatic.
6. Provide manual drain valve at low points in mainline.
7. Provide automatic drain valves for each zone.
8. **The landscape irrigation contractor is required by this performance based specification to provide a complete design and installation of the system. The requirements of the Texas Administrative Code, Title 30, ENVIRONMENTAL QUALITY; Chapter 344, LANDSCAPE IRRIGATION; shall be strictly complied with, including but not limited to Rule 344.61:**

“(a) An irrigator shall prepare an irrigation plan for each site where a new irrigation system will be installed. A paper or electronic copy of the irrigation plan must be on the job site at all times during the installation of the irrigation system. A drawing showing the actual installation of the system is due to each irrigation system owner after all new irrigation system installations. During the installation of the irrigation system, variances from the original plan may be authorized by the licensed irrigator if the variance from the plan does not:

- (1) diminish the operational integrity of the irrigation system;
- (2) violate any requirements of this chapter; and
- (3) go unnoted in red on the irrigation plan.

(b) The irrigation plan must include complete coverage of the area to be irrigated. If a system does not provide complete coverage of the area to be irrigated, it must be noted on the irrigation plan.

(c) All irrigation plans used for construction must be drawn to scale. The plan must include, at a minimum, the following information:

- (1) the irrigator's seal, signature, and date of signing;
- (2) all major physical features and the boundaries of the areas to be watered;
- (3) a North arrow;
- (4) a legend;
- (5) the zone flow measurement for each zone;
- (6) location and type of each:
  - (A) controller;
  - (B) sensor (for example, but not limited to, rain, moisture, wind, flow, or freeze);
- (7) location, type, and size of each:
  - (A) water source, such as, but not limited to a water meter and point(s) of connection;
  - (B) backflow prevention device;

(C) water emission device, including, but not limited to, spray heads, rotary sprinkler heads, quick-couplers, bubblers, drip, or micro-sprays;

(D) valve, including, but not limited to, zone valves, master valves, and isolation valves;

(E) pressure regulation component; and

(F) main line and lateral piping.

(8) the scale used; and (9) the design pressure.”

9. Pop-up spray sprinklers in turf shall be a minimum 6" body, unless otherwise indicated.
10. The system shall be multi-zoned and fully automatic.
11. Provide manual drain valve at low points in mainline. Provide a turf box and a minimum of 20 lbs. of pea gravel at the base of the drain box.
12. Provide automatic drain valves for each zone. Provide a turf box and a minimum of 20 lbs. of pea gravel at the base of the drain box.
13. Provide freeze and rainstats for entire system. Rainstats shall be non-clog type, with override by-pass switch or restraints. Provide wind stat where the prevailing wind exceeds 15 mph. ET based Weather stations are acceptable as an integrated system in lieu of individual rain, freeze and wind stats.
14. The sprinklers shall be spaced no further than manufacturer's current specification.
15. Irrigation system shall be compatible to and coordinated with new or existing turf, landscape and irrigation system, where applicable.
16. Layout and spacing of spray heads shall take into consideration the prevailing wind conditions. Low angle trajectory sprays shall be used for prevailing winds exceeding 10 mph where recommended by the manufacturer.
17. Part-circle or adjustable arc heads shall be used on borders at streets, walks, fences and buildings (unless otherwise indicated). Overspray shall be minimized. Spray onto entrances and windows is prohibited and spray onto buildings should be avoided.
18. Nozzles shall be selected from manufacturer's specifications that provide matched precipitation rates.
19. Precipitation rates for heads covering common turf or landscaping shall be similar. Zone rotary, turfgrass and shrub areas separately. Rotary and spray heads shall not be on the same zone.
20. Evapotranspiration (ET) based controllers, including on site weather stations shall be manually overridden during the establishment of newly planted landscaping materials. As soon thereafter as the landscape contractor indicates that their materials are established, change the controller over to automatic site based ET control.
21. Where smart controllers are not provided and programmed, controller watering schedule shall first be set to establish newly planted landscape materials. As soon thereafter as the landscape contractor indicates that the landscape materials are established, set the station watering schedule to provide water to landscaping in accordance with the landscape products. Turf shall be set to provide one inch of water per week during the driest growing season. Train the owner to operate the water saving

- features of controllers to wholesale reduction or increase the watering schedule as needed for unusual circumstances.
22. Application rate shall be the optimum condition for the soil type, accomplished by the nozzle style and/or the controller timing and sequencing.
  23. The installation of drip Irrigation systems shall comply with the manufacturer's requirements.
  24. Power wiring to the controller shall be installed by a licensed master electrical contractor, and is the responsibility of this contractor.
  25. Each controller shall be connected to a separate, unswitched circuit with its own ground fault circuit breaker.
  26. Wire size for power supply shall be in accordance with the National Electrical Code.
  27. Wiring of controllers, weather stations and valves shall comply with the manufacturer's instructions and NEC. Bury conductors to the weather station from the controller in conduit. Thermostat wire shall not be used for valves.
  28. Provide thrust blocks or restraints on all pressure mains exceeding 85psig at 90 degree elbows and bullhead tees.
  29. Provide metal location tape on all sleeves beneath concrete drives and walks. Provide threaded caps on both ends of sleeves installed for future use. Extend sleeves a minimum of 12" beyond concrete on both sides.
  30. System shall be zoned and timed at non-peak water periods (e.g. early morning before 6:00 a.m. and after 7:00 pm depending on the operations of the facility). ET based systems shall obtain the available watering window from the Owner and integrate that period into the controller programming.
  31. Polyethylene tubing used for pop up sprinklers, bubblers, rotary gear driven sprinklers shall not exceed 12 inches in length from rigid pipe. Provide no more than one poly flex tube per sprinkler.
  32. Pipe and Poly tubing shall be buried beneath the compacted soil. Mulch layers are not acceptable bury material. Pipe and tubing shall be buried below the frost line and no shallower than 12 inches beneath compacted soil.
  33. Products of like nature shall be of the same manufacturer in the following categories:
    - a. Controllers
    - b. Weather stations
    - c. Valves
    - d. Sprinklers
    - e. Drain valves
    - f. Freeze wind and rainstats
    - g. Turf boxes, valve or meter boxes

### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures" and shall include:
  1. Manufacturer's product data for the following:

- a. Controller(s):
  - b. Sprinkler heads and nozzles.
  - c. Electric, manual and drain valves.
  - d. Rain, freeze, or wind stats and moisture sensors, and weather stations.
  - e. Pipe and fittings.
  - f. Wiring, watertight connectors, conduit, ground-fault circuit breakers, pull boxes.
  - g. Turf and valve vaults or boxes.
  - h. Backflow preventers.
  - i. Operation and Maintenance Manuals for all products.
  - j. Controller scheduling.
- B. Shop drawings include the following:
- 1. A scale drawing (minimum 1 inch = 20 feet) indicating:
    - a. Sprinkler heads with nozzle styles, arcs and radius.
    - b. Controller location, type and weather station input data.
    - c. Valve locations, with zone identification for electric globe valves.
    - d. Pipe (and sleeve) locations with sizes, provide flow capacities in gallons per minute (gpm) and velocities in feet per second (fps) for all sprinkler pipe.
    - e. Rainstats, freezestat and windstat locations with mounting details.
    - f. Wiring routing, details of wet connections in valve boxes.
    - g. Landscape features; e.g. trees, shrub and turfed areas, perennials and annual beds.
    - h. All site features affecting the irrigation system; e.g. transformers, walks, drives, structures, curbs, easements, utilities.
    - i. The direction of true north, and the prevailing wind in miles per hour.
    - j. Proof of coordination of the system between the Licensed Irrigator and the City representative.
- C. As-built drawings shall be true, scaled drawings with every deviation from the shop drawings legibly indicated, including all amendments, addendums and change orders. All pipe and main components shall be exactly to scale or dimensioned from a fixed measuring point.
- D. Provide a copy of the current TCEQ Irrigators License card for every person that will be on site or designing, installing or supervising the installation with the shop drawings.

#### 1.04 STANDARDS AND REFERENCES

- A. Regulatory Requirements:
- 1. Comply with the regulations, codes and ordinances of the Authority Having Jurisdiction.
  - 2. All fees, permits and inspections shall be secured by and paid by the contractor.



3. Comply with the requirements of the Texas Administrative Code, Title 30.Part 1, Chapter 344, Subchapter D.
- B. References: Materials and methods of the following referenced standards and specifications of the latest edition form a part of this Section as applicable:
  1. Manufacturers Standardization Society of the Valves and Fittings Industry (MSS) Standards.
  2. American National Standards Institute (ANSI).
  3. American Society for Testing and Materials (ASTM).
  4. American Water Works Association (AWWA) Standards.

#### 1.05 DELIVERY AND STORAGE

- A. Deliver manufactured products to the site in the original cartons or other protective coverings. Products shall remain packaged until ready for installation. Store piping on wood runners raised above grade. Security and protection from the elements are the contractor's responsibility.

#### 1.06 JOB CONDITIONS

- A. Existing Utilities: Verify, on the jobsite, the exact location of all existing underground utilities before beginning construction. Contact the utility companies prior to excavation for line locations and notification. Hand excavate trenches and valve box vaults near existing utilities. Repair or pay for repairs to damaged utilities without cost to the Owner.
- B. System Layout: Layout the system prior to installation. Drive surveyor's flags or stakes in the ground to indicate the location of the sprinkler heads. Stakes or flags with color-coded tops shall be used to identify location of mains and risers. In the event that layout conflicts with trees or other obstructions, adjust as necessary.

#### 1.07 GUARANTEES, OR WARRANTIES

- A. Materials, equipment and workmanship furnished under this contract shall be guaranteed for a period of 1 year from the date of acceptance. The Installer is responsible to submit warranty cards on the behalf of the Owner for products. Provide a copy of the warranty cards submitted with a certification that the cards and warranties have been submitted.
- B. The guaranty shall include but not be limited to the following:
  1. Materials and workmanship of the irrigation system.
  2. Compliance with the manufacturer's design and installation recommendations.
  3. Filling and repairing depressions and replacing landscape plantings due to settlement of irrigation trenches for 1 year following acceptance of project.
- C. Upon receipt of notice from the Owner or his authorized representative of failure of any part of the guaranteed equipment, material or workmanship during the guaranty period, the affected part or parts shall be replaced promptly with new parts, by and at the expense of the contractor. The contractor shall acknowledge his responsibility under these guaranty provisions by letter, stating that the equipment, materials and workmanship referred to

herein are guaranteed and stating the inclusive dates of the guaranty period, and contact information for emergency repairs. The warranty period begins on the date of written acceptance of the irrigation system by the Owner, or their representative.

- D. All work under this contract shall not be finally accepted until expiration of the guaranty period. During this period, the irrigation contractor is responsible for the work until final acceptance.

**2.00 PRODUCTS**

**2.01 PIPE AND FITTINGS**

- A. General: Pipe shall be permanently marked with the ASTM classification No., pipe size and manufacturer’s name.
- B. PVC (Polyvinyl Chloride) Pipe and Fittings:
  - 1. SDR-PR (ASTM D2241) SDR2, Class 200 (Class 315 for 1/2-inch pipe) Type 1.
  - 2. Fittings, and Schedule 40 PVC Pipe, (ASTM D1785) and (ASTM D2466), solvent cement joint (ASTM D2467). Threaded fittings, schedule 80 PVC (ASTM D2464).
  - 3. Elastomeric Gasket Joint: Pipe shall be to dimensional requirements of ASTM D1785, Schedule 40 with joints meeting the requirements of 150 psi working pressure, 200 hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure	Minimum Hydrostatic Pressure
21	120	160
17	150	200
13.5	200	266

- C. Copper Tubing: ASTM B88, type K, hard drawn. Fittings: ANSI/ASTM B32, solder Grade 95 TA, or AWS A5.8, B cup silver braze.
- D. Joints shall be made up using purple primer and clear solvent cement meeting the requirements of ASTM D2564; the joint assembly shall be made in accordance with ASTM D2588 and manufacturer’s recommendations.

**2.02 BACKFLOW PREVENTERS**

- A. Provide Backflow preventers in accordance with the AHJ requirements of the project; manufacturers of acceptable products follow.
  - 1. Double Check:
    - a. Double check backflow preventer 2 inches and smaller: ANSI/ASSE 1015; complete unit of two independently acting check valves, two ball valves, strainer and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C506.
      - 1). Acceptable manufacturers and models::

- a). Cla Val Co.: D 2 (1 1/2 inches and smaller).
    - b). Watts: 700.
    - c). Hersey: FDC.
    - d). Febco: 805Y.
    - e). Wilkins: 550.
  - b. Double check backflow preventer 2-1/2 inches and larger: ANSI/ASSE 1015; complete unit of two independently acting check valves, two ball gate valves, and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C506.
    - 1). Acceptable manufacturers and models::
      - a). Cla Val Co.: D (2 inches and larger).
      - b). Watts: 700.
      - c). Hersey: 2.
      - d). Febco: 805Y.
      - e). Wilkins: 550.
- B. Reduced Pressure:
- 1. Reduced pressure backflow preventer 2-1/2 inches and larger: ANSI/ASSE 1013; complete unit of two independently acting check valves together with an automatically operating pressure relief valve, two gate valves, and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C506.
    - a. Acceptable manufacturers and models::
      - 1). Cla Val Co.: RP-1 (2 inches and larger).
      - 2). Watts: 900.
      - 3). Hersey: 6CM.
      - 4). Febco: 825.
      - 5). Wilkins: 575.
  - 2. Reduced pressure backflow preventer 2 inches and smaller: ANSI/ASSE1013; complete unit of two independently acting check valves together with an automatically operating pressure relief valve, two ball valves, strainer, and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C506.
    - a. Acceptable manufacturers and models::
      - 1). Cla Val Co.: RP-2 (2 inches and smaller).
      - 2). Watts: 900.
      - 3). Hersey: FRP-II.
      - 4). Febco: 825Y.

5). Wilkins: 575.

## 2.03 VALVES

### A. Gate Valves:

1. Gate valves 3 inches and less: MSS-SP-70, rated 175 lb. minimum water pressure, brass or bronze construction screw-in bonnet, rising stem, solid wedge disc, threaded or soldered connections.
  - a. Acceptable manufacturers and models:
    - 1). Crane: 438, 1334.
    - 2). Nibco: T-III, SIII.
    - 3). ITT Grinnell: 3010, 3010SJ.
    - 4). Milwaukee: 148, 149.
2. Gate valves 2-1/2 inches and greater: rated 150 lb. minimum water pressure, iron body construction, bronze mounted, bolted bonnet, outside screw and yoke, solid wedge disc, threaded connections.
  - a. Acceptable manufacturers and models:
    - 1). Crane: 465-1/2.
    - 2). ITT Grinnell: 6020A.
    - 3). Milwaukee: F-2885.
    - 4). Nibco: F617-0.

### B. Ball Valves:

1. Ball valves 2 inches and less: rated 175 lb. minimum water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections.
  - a. Acceptable manufacturers and models:
    - 1). Crane: 9302, 9322.
    - 2). ITT Grinnell: 3500, 3500 SJ.
    - 3). Milwaukee: BA-200, BA-250.
    - 4). Watts: B-6000, B-6001.
    - 5). Nibco: T-580 & S-580.
2. Ball valves 2-1/2 inches and greater, 150 lb. minimum water, oil, air and gas pressure, bronze or carbon steel construction, seat material as recommended by manufacturer for material conveying, lever handle, flanged connections.
  - a. Acceptable manufacturers and models:
    - 1). Crane: 941-TF.
    - 2). Apollo: 88-100.

3). Jamesbury: D150F.

C. Control Valves (Zone Valves):

1. Control (zone) valves shall have glass filled poly-propylene body cover with stainless steel spring and nylon exhaust fitting. Diaphragm shall be nylon reinforced Buna N molded with heavy Buna N seat to form an integral unit. Valve shall be packless, without sliding seals, and completely serviceable without removing body from pipeline, with bolted (stainless steel bolts) top. Design shall be "normally closed", requiring solenoid to be energized to open valve, thereby causing automatic closure in event of power failure. Solenoid shall comply with Class II National Electric Code and when operating require a maximum of 0.23 amperes, 3.0 watts at 24 volts AC. Solenoid shall be integrally mounted in valve cover and molded in epoxy to form a corrosion and moisture proof unit with exposed metal components of non-corrosive material. Flow control shall be brass with O-ring seal and adjustable from outside the valve for permanent throttling or complete closing of valve.

a. Plastic Valves, less Flow Control:

1). Acceptable manufacturers and models::

- a). Hunter: ICV.
- b). Toro: 252.
- c). Weathermatic: 21000 Series.
- d). Rainbird: PGA Series.
- e). Nelson: 7901/7916.

b. Plastic Valves, Flow Control:

1). Acceptable manufacturers and models::

- a). Hunter: ICV.
- b). Toro: 252.
- c). Weathermatic: 21000 series.
- d). Rainbird: 100 DV SS F.
- e). Nelson: 7911/7917.

c. Plastic Valves, Contamination Resistant:

1). Acceptable manufacturers and models::

- a). Hunter: ICV - (XXX) – FS.
- b). Weathermatic: 11000CR.
- c). Rainbird: 100 PES B.

2. Automatic Drain Valve: Machined brass with monel screens on both ends, and a 5-ounce phosphor-bronze spring.

a. Acceptable manufacturers and models::

1). Buckner: 40,000.

- 2). Champion: DV.
- 3). Weathermatic: 910.
- 3. Bronze globe valves with renewable disks, specially designed for lawn sprinkler installation, tee-handle key operated.
  - a. Acceptable manufacturers and models::
    - 1). Champion Irrigation Products: 100-100.

#### 2.04 IRRIGATION SPECIALTIES

- A. Evapotranspiration (Et) Based Controller: Surface or pedestal mounted weatherproof solid state non - volatile memory automatic sprinkler controller capable of operating 24-VAC electric remote control valves via an integral transformer. Water Efficient, ET programming central controller. Controller shall be capable of calculating daily evapotranspiration values and able to adjust the station run times commensurate with the landscaping requirements. ET Based Controller systems shall include an automatic local weather station as a part of the package. Data from appropriate sensors shall be used to calculate daily reference evapotranspiration ( $ET_0$ ). Daily  $ET_0$  which is multiplied by an appropriate crop factor ( $K_c$ ) to provide an estimate of daily crop evapotranspiration ( $ET_c$ ) – enabling the controller to predict the date of the next irrigation. The required method to calculate  $ET_0$  is the Penman-Monteith approach which requires weather stations to be fitted with measurement sensors for solar radiation, air temperature (maximum and minimum), relative humidity, and wind speed.
  - 1. Acceptable manufacturers:
    - a. Rainbird.
    - b. Hunter.
    - c. Rainmaster.
- B. Controller (Electric Power) weatherproof solid state non - volatile memory automatic sprinkler controller capable of operating 24-VAC electric remote control valves via an integral transformer. Controller shall be equipped with a 365-day calendar, 24-hour programmable clock; each station capacity shall be adjustable up to 60 minutes each. Changes to station timing and program start time shall be easily made without interfering with the set program. Multi-cycle programming with a minimum of four independent programs, independent day schedule options, seasonal adjustment from 10 to 150 percent minimum. Controller shall be equipped with a manual start program for activation of a semi-automatic watering cycle. Provide rain sensor override. Controller housing shall be weatherproof injection molded hi-impact plastic with locking hinged cover.
  - 1. Acceptable Manufacturer's – Steel or Cast Aluminum Cabinet:
    - a. Acceptable manufacturers and models::
      - 1). Solid state, commercial, steel or cast aluminum cabinet, rainproof housing, total water management, best quality.
        - a). Hunter: ICC.
        - b). Weathermatic: Mark "400" series.

- c). Irritrol: IBOC series.
- d). Toro: System C.
- e). L.R.Nelson: Smartzone series (8536, 8586).

2. Acceptable Manufacturer's – Plastic or Steel Aluminum Cabinet:

a. Acceptable manufacturers and models::

- 1). Solid state, commercial, plastic, or steel aluminum cabinet, good quality, competitive.
  - a). Weathermatic: LM "Lawnmate" series.
  - b). Toro: Vision II series.
  - c). Rainbird: HP series.
  - d). L.R. Nelson: Smartzone EZ Series.

3. Acceptable Manufacturer's – ElectroMechanical Controller:

a. Acceptable manufacturers and models:

- 1). Electromechanical Controller.
  - a). Toro: VT or 170 series.
  - b). Weathermatic: RM series.
  - c). Garden America (Richdel): 412 series.
  - d). Rainbird: RC series.

C. CONTROLLER – AMBIENT LIGHT SENSING. OR SOLAR POWERED

1. Programmable, self contained, advance ambient light powered water-management irrigation controller. Non-volatile memory, liquid crystal display, power provided by an internal, ultrahigh efficiency photovoltaic module and microelectronic energy management system fueled by ambient light.

a. Acceptable Manufacturers:

Leit Model X, 4000, XRC

b. Provide the following compatible manufacturers appurtenances with this controller:

- 1). Leit Model LEITWWS wireless weather station
- 2). LEMA 1600HE Solenoid (for each valve) with internal bleed manual valve.

2.05 SPRINKLERS, SPRAY NOZZLES AND QUICK COUPLERS

A. Rotary Stream; rotary type, multi-stream, multi-trajectory rotating stream sprinkler. Part circle sprinkler shall have an infinitely adjustable arc. Full circle sprinklers shall irrigate a full 360°. 45° to 105° models shall not require head to head coverage from adjacent sprinklers closer than 3' from the head. Full or part circle sprinklers shall be capable of up to 25% radius reduction using a stainless steel radius adjustment screw. Part circle sprinklers shall have arc adjustment capabilities This same ratcheting action shall allow the orientation of the left edge of the variable arc when installed on a fixed riser or in a popup body. This is

independent of and in addition to any ratchet that may exist in a popup body. Provide detachable filters.

- B. Acceptable Manufacturers:
  - 1. Hunter MPR (basis of design)
  - 2. Rainbird
- C. Tree Root Water Zone Assembly:
  - 1. Pre-assembled, 18 inch height, with plastic mesh tube with a removable, perforated end cap, internal baffle system, integral 0.25 GPM pressure compensated bubbler on a ½-inch, male threaded swing joint. Provide optional filter fabric sleeve
- D. Bubblers: Heavy duty high impact ABS plastic body with integral pressure regulator, and integral ABS nozzle. 6-inch pop-up height with a heavy duty stainless steel retraction spring and removable filter screen. Nozzles to be interchangeable between bodies and of the same manufacture as the body.
  - 1. Acceptable manufacturers and models:
    - a. Hunter: MSBN 25Q (basis of design)
    - b. Rainbird
- E. Swing-Joint Riser: PVC construction ASTM D2464 Type I double joint “O” ring and buttress threads at each swivel joint, inlet/outlet socket threads ASTM D2467/D 2464.
  - 1. Acceptable manufacturers and models:
    - a. Hunter: SJ Series.
    - b. Rainbird: TSJ Series (Basis of Design)
    - c. Spears: 5800 Series.
- F. Polyethylene “Cut-Off” Risers: Polyethylene “cut-off” risers; 1/2 inch by 3 inches, 1/2 inch by 6 inches or 3/4 inch by 3 inches, 3/4 inch by 6 inches with 1/2-inch cut-offs.
  - 1. Acceptable manufacturers:
    - a. Toro.
    - b. Hunter.
    - c. Rainbird riser CO6 (Basis of design).
- G. Polyethylene Tubing: Flexible in 20-inch, 50-inch and 100-inch coils, with adapters compatible to the tubing.
  - 1. Acceptable manufacturers and models:
    - a. Toro: “Funny Pipe” Series 850 including fittings.
    - b. Hunter: HFT-100, including HSBE fittings.
    - c. Rainbird: “Swing Pipe”, Series SP-20, including fittings.
    - d. Irritrol: “Super Blue Flex Pipe”, EHD1295-010-D or EHF1295-010-D.
- H. Drip Tubing:



1. Flexible, copper-colored polyethylene tubing, factory installed pressure-compensating, inline emitters spaced evenly. 0.6 gallons per hour (GPH) when inlet pressure is between 8.5 and 60 psi flow rate from each installed inline emitter.
  2. Inline emitter diaphragm shall have a pressure-regulating diaphragm with self-rinse if there is a plug at the outlet hole. The inline emitter shall have copper shield technology installed to protect the emitter from root intrusion. The inline emitter inlet shall be raised on the inside tube wall to minimize dirt intrusion.
  3. Acceptable Manufacturer:
    - a. Rainbird XFS (basis of design)
- I. Drip Emitters:
1. 0.05 GPH single spot drip emitter;
    - a. Acceptable Manufacturer:
      - 1). Rainbird
      - 2). Hunter
- J. Sensors and Weather Stations:
1. Rain Sensor: Aluminum or PVC mounting bracket, thermoplastic housing, interrupts circuit to common or pump relay in controller. Adjustable in 1/8-inch increments, automatic reset, 5-year warranty, 24 VAC.
    - a. Acceptable manufacturers and models:
      - 1). Weathermatic: Figure 950.
      - 2). Glen Hilton: Mini-Clik II.
      - 3). Rainbird: Rain-Check.
      - 4). Toro: 850-74 Rainswitch.
  2. Freeze Sensor: Aluminum or PVC mounting bracket and housing. Temperature setpoint 39 F with a temperature differential of plus 1 C, 5-year warranty, 24 VAC.
    - a. Acceptable manufacturers and models:
      - 1). Glen Hilton: Mini-Clik Model 401.
  3. Wireless Rain/Freeze Sensor: Aluminum or PVC mounting bracket, thermoplastic housing, interrupts circuit to common or pump relay in controller. Adjustable in 1/8-inch increments, automatic reset. Temperature set-point 39 F with a temperature differential of plus 1 F. Provide with receiver. Five-year warranty, 24 VAC.
    - a. Acceptable manufacturers and models:
      - 1). Irritrol: RFS1000.
      - 2). Rainbird: WRFC.
  4. Soil Moisture Sensor System: 24-VAC override, microelectronic sensor system including moisture control panel, probes, bedding compound, wire splice kits.
    - a. Acceptable manufacturers and models:

- 1). Toro: 91-0190 "Moist-O-Matic"
  - 2). Rainbird: Aquamiser.
  - 3). Garden America.
5. High-flow sensor: High-flow sensor shuts down system if an overflow condition occurs. Provided with interface panel, which is not required for IMMS controllers.
- a. Acceptable manufacturers and models:
    - 1). Hunter: Flow-Clik.
    - 2). Rainbird: G-FS series.
6. Sensor By-Pass Switch: LED active status switch, U.L. approved for exterior weatherproof applications.
- a. Acceptable manufacturers.
    - 1). Toro.
    - 2). Rainbird.
    - 3). Weathermatic.
7. Weather Stations: Accurately measures, wind, rain, temperature, solar radiation, and relative humidity and computes Evapotranspiration (ET) to 0.01 inch, compatible with controller, weather computer scans sensors and recalculates weather changes every second, all electronic weather station design with non-volatile memory which retains configuration and weather data across power outages, diagnostic port and computer LEDs for troubleshooting and configuration and plug & Play; Factory programmed site specific configuration.
- a. Acceptable manufacturers:
    - 1). Rainbird
    - 2). Rainmaster
    - 3). Hunter
    - 4). Approved Equal
      - a). Note: Furnished with the controller and certified by the Controller manufacturer to be compatible.
- K. High-Flow Shut-Off Valve: High-flow shut-off valve, 1/2 inch or 3/4 inch, PVC with threaded inlet/outlet maximum 0.5 psig operating pressure loss.
1. Acceptable manufacturers and models:
    - a. Toro: HSFO.
    - b. Hendrickson Bros.: Fld540.
    - c. Corona, CA.

## 2.06 VALVE BOXES, BACKFLOW PREVENTER BOXES AND ENCLOSURES

- A. Heavy Traffic Weight Pre-Cast Concrete Vault for Backflow Preventer: 4500 psi precast concrete meter vault (ASTM C858) with traffic weight concrete cover with cast-iron hinged lid 13 inches by 24 inches by 12 inches.
  - 1. Acceptable manufacturers and models:
    - a. Brooks Products: Series 38.
    - b. Dalworth Quickset.
- B. Cast-Iron Meter Vault for Backflow Preventer: Heavy-duty gray cast-iron (ASTM A48) uniform in quality, free from blow holes, porosity, shrinkage, defects and cracks. Factory coat with bituminous paint, 14 inches by 22 inches by 10 inches.
  - 1. Acceptable manufacturers and models:
    - a. McKinley Iron Works: Type MB 14.
- C. Plastic Backflow Preventer Boxes:
  - 1. Polyolefin and fibrous compound box with green lid, provide manufactured extension from bottom of pipe as required. (ASTM D638, D790 - D695, D2240).
    - a. Acceptable manufacturers:
      - 1). Ametek.
      - 2). Brooks Products.
      - 3). Carson.
  - 2. Structural foam, injection molded box. 15 inches by 21 inches by 12 inches with extensions as required.
    - a. Acceptable manufacturers:
      - 1). Ametek.
      - 2). Brooks Products.
- D. Valve Boxes: Injection molded foam or polyolefin enclosure, 6-inch diameter for 1-inch control valves, 10-inch diameter for 1-1/2-inch and above valves.
  - 1. Acceptable manufacturers:
    - a. Ametek.
    - b. Brooks Products.
    - c. Carson.
- E. Above Ground Backflow Preventer Enclosure: Reinforced, corrosion resistant aluminum, or fiberglass construction with access doors or lids, and completely removable for maintenance. Thermostatic Control UL listed heater for freeze proofing set at 0 F. Provide UL listed ground fault breaker.
  - 1. Acceptable manufacturers and models:
    - a. V.I.T. Products: "Strong Box."

## 2.07 MISCELLANEOUS MATERIALS

- A. Location Tape: Plastic, 2 inches wide with a foil liner for location by means of a magnetic locator, such as "Terra-foil" Model D as manufactured by Griffolyn Company; Houston, Texas. Color shall be blue, having lettering which reads "WATER LINE BELOW". To be installed above main line.
- B. Wire Connections: All wire connections to be installed in valve boxes only. Do not bury any splices without a valve box. All wire connections shall be with proper size wire nut and sealed with 3M #DBY-6 Scotchcast kit. All wire splice kits must be UL approved.
- C. Direct Bury, Low Voltage Electrical Wire: Type UF 314 single stand copper with 4/64-inch thick PVC insulation, U.L. approved for direct burial. Minimum wire shall be #14GA.
- D. Pea Gravel: ASTM D448, ASTM C33, and M SHTO M43, minimum diameter of 1/8 inch and maximum of 3/4 inch, no more than 3 percent of pea gravel shall pass through a No. 3 sieve.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Trenching shall be such that pipe is buried below the frost line, or a minimum of 18 inches below grade; over excavate 28 inches minimum for rock, and backfill with clean sand bed before laying pipe. Lay pipe to allow for expansion and contraction. Backfill with compacted clean sandy loam, and the remainder, rock free excavation material and topsoil. Mechanically tamp trench to 90 percent proctor to 2 inches above surrounding grade. Bury subsurface drip tube in accordance with manufacturer's instructions.
- B. Excavation for backflow preventer shall be 18 inches minimum to the top of the backflow preventer. Provide 12 inches of washed pea gravel beneath backflow preventer. Provide brick supports to hold backflow preventer and valve box, rest brick on undisturbed soil. Valve box shall not rest on pipe entering or exiting, provide 3-inch minimum clearance all around pipe. Valve box shall be level with the surrounding grade.
- C. Cut pipe clean with pipe cutters, remove burrs or foreign matter from pipe before assembly. Apply colored primer to both the pipe and fitting and then apply compatible PVC cement to the pipe. Home pipe to the fitting and hold in place for a minimum of 45 seconds until pipe has set in place. Replace pipe and fittings which slide during this time, do not re-use fittings.
- D. Install each electrical globe valve and series of wire splices in a separate turf box. Bury box level with surrounding grade, install valves level and plumb.
- E. Each branch sprinkler supply system shall be automatically drainable at the low point, with a spring-loaded ball drip valve, designed for lawn sprinkler service, and draining into a 12-inch excavation containing pea gravel. Dry well and gravel shall be provided by the Contractor. Top of gravel shall be below valve at drain point.
- F. Provide manual drain valves on main lines, with opening for drain into a 12-inch pea gravel sump. Manual drain valves shall be in a valve box with the top flush with finished grade.
- G. Installation of Sprinklers and Risers:
  - 1. Install sprinkler heads flush with the finish grade elevation. On sloping sites, position the heads to match the slope of the finish grade, otherwise set heads plumb. Sprinkler heads shall follow a uniform pattern and individual head placement shall not vary more than 2 inches from a straight line established by the other heads in either direction. Six-

inch and 12-inch pop-ups shall be set perpendicular to grade, equally aligned when in the operating position.

2. Make piping to individual sprinkler heads to allow adjustments in heights of heads and to permit weights to be applied to the sprinkler without placing stress on the lateral piping. This may be achieved by installing the sprinkler head on a flexible polyethylene riser, or swing joints for QCV (quick couplers) or “funny pipe” with proper fittings.
3. Shrub risers are not permitted, provide pop up bodies.
4. Electrical Wiring:
  - a. Install a separate colored wire from the automatic controller to each solenoid valve. Run a common neutral from the controller to each solenoid valve common wire shall be continuous white color. Provide 12-inch expansion coils in each valve box.
  - b. Make splices with 3M DBY or DBR-6 wire connection kits. Strip end of wire, twist together, twist wire nuts in place and install into sealant container. All splices must be installed in valve boxes.
  - c. Install wiring in trenches alongside the piping. Provide a minimum of 12 inches of coverage for wiring installed in separate trenches. Where several wires are installed in close proximity to each other, bundle the wiring and tape securely at 10-foot intervals. Wiring installed under driveways, parking lots or pavements, shall be in PVC sleeves.
  - d. Refer to Section 26 05 26 “Grounding and Bonding for Electrical Systems” for installation of grounding system. Install a valve box over all ground rods to allow for testing.
  - e. Measure the ground grid resistance with the earth test megger and install additional ground rods and conductors as required until the resistance to the ground conforms to the requirements of the irrigation control manufacturer.
5. Installation of the Irrigation Controller: Hard wire 120-VAC wires into control box. Weatherproof all exterior connections. All wiring above ground to be installed in conduit. Mount controller 48 inches AFG. Mount freeze and rain sensors per manufacturer’s recommendations. All 120-VAC wiring shall be installed by a licensed electrical contractor per Division 26 specifications.

### 3.02 FLUSHING AND TESTING

- A. Flushing: After sprinkler piping is in place, prior to installing heads, flush out piping and tubing by running water through the piping to remove debris and extraneous matter. Cemented joints shall be set and cured for 12 hours prior to beginning tests.
- B. Testing and Operation:
  1. Before piping is pressure tested, sufficient backfill shall be installed around the piping to contain the piping under pressure. Tests shall be made in the presence of the Engineer. The entire piping system shall be placed under full pressure and left for 24 hours with pressure gauge attached, then pipe joints shall be examined for leaks. Cut out and remake any defective joint and re-test until the system performs without leaks or loss of pressure in excess of 5 percent.

2. Place the system into operation and test each section individually. Examine the operation of spray heads, and during a time when wind velocity is normal, observe the pattern of water produced by the heads. The complete system shall give full and adequate coverage to the area being watered.
- C. Adjustments:
1. Check each sprinkler head for proper operation and spray pattern.
  2. Adjust pressure on adjustable pressure valves by attaching a pressure gauge assembly to the solenoid valve pressure regulator, and adjust pressure as necessary.
  3. Adjust all components so that water runoff and overspray is reduced.
  4. The irrigation contractor shall personally notify the Architect or Engineer, Owners representative and general contractor at least 72 hours in advance of all final testing and inspections. The system will be tested, pressurized and adjusted by the irrigation contractor before calling for final testing and inspection. The system will not be considered complete without certification by the Engineer.
  5. At time of final inspection, all hydrostatic tests must have been satisfactorily completed. The entire system shall then be operated in the presence of the engineer's authorized representative, and must operate in a satisfactory manner, with uniform coverage of the areas which are to be sprinkled.
  6. All conditions of the contract documents shall be met before calling for final testing. All costs for re-testing due to failure to meet these conditions will be borne by the irrigation contractor including time and materials of the required inspection team.
  7. Dripline and Emitter Lateral Flushing Procedures.
    - a. Flush the system and check the water that is flushed out for cleanliness. Flush the system completely after any repairs are made and monitor system operation closely under regular system flushing schedule.
  8. Recommended Dripline and Emitter Lateral Leakage Testing Procedures.
    - a. Subject installed dripline tubing and emitter lateral piping to water pressure equal to specified operating pressure for ten (10) minutes. Test with control zone components and dripline flush valve components installed.
    - b. Partially backfill buried pipe and tubing to prevent movement under pressure. Expose couplings, fittings, and valve components.
    - c. Visually inspect valve assemblies and fittings for leakage and replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until test segment is free from leaks. Cement or caulking to seal leaks is prohibited. Recommended Dripline and Emitter Lateral Operational Testing Procedures.
    - d. Activate each dripline and emitter lateral control zone valve in sequence from controller. Provide either one additional person with radio or use handheld remote to activate remote control valves from controller. Manually activating remote control valve using manual bleed mechanism at remote control valve is not an acceptable method of activation. Owner's Representative will visually observe operation, water application patterns, and leakage.

- e. Replace or adjust defective valve, fitting, dripline segment, emitter lateral segment, or appurtenance to correct operational and coverage uniformity deficiencies.
- f. Repeat test(s) until each dripline or emitter lateral test segment passes testing procedures. Repeat tests, replace components, and correct deficiencies at no additional cost to Owner and/or Owner's Representative.

### 3.03 MAINTENANCE

- A. In addition to the installation of the irrigation system, furnish a period of maintenance for the system equal to the warranty period. Maintenance will consist of the following:
  - 1. After the lawn has been established and grass achieved a good stand, return to the site and adjust height of sprinkler heads to conform to grass height.
  - 2. Clean and adjust heads two separate times 3 months apart the first year.
  - 3. After 11 months, return to site and adjust height of shrubbery risers to conform to plant growth.
  - 4. Demonstrate and provide written instructions to the Owner, the regular flushing procedures for maintenance for drip tubing systems from the manufacturer of the drip system.

### 3.04 IRRIGATION WATER SCHEDULES

- A. For manually adjusted controllers the Contractor shall furnish an estimated water schedule for the irrigation system for the entire year, each month. The report shall include estimated operating time, days and frequency of watering for each zone, total run time per week and total water usage per week. This report should be based on 1 inch of precipitation per week, based on information obtained in Toro pamphlet 490-1358 "Evapotranspiration", or an auditors recommendations.
- B. ET based controllers shall be programmed to automatically operate within the window of opportunity provided by the owner, and automatically function.

### 3.05 OWNER TRAINING

- A. Prior to final acceptance, contractor shall provide a minimum of 4 hours or as long as required by the Owner to demonstrate to the Owner the proper operation of all irrigation system equipment and controls provided under this Section.
- B. After completion of the demonstration, submit to the Architect/Engineer a "Demonstration Certificate of Completion" signed by the Owner and the Contractor indicating that the demonstration of the irrigation system equipment and controls has been completed.

**END OF SECTION**

**CITY OF AUSTIN STANDARD SPECIFICATIONS**



## ITEM NO. 402S - CONTROLLED LOW STRENGTH MATERIAL 11-13-07

### 402S.1 - Description

This item governs Controlled Low Strength Material (CLSM) used for trench backfill and for filling abandoned culverts, pipes, other enclosures, and for other uses as indicated on the drawings, Standard Details or as approved by the Engineer or designated representative. CLSM is a low strength, self-compacting, flowable, cementitious material used in lieu of soil backfill. It is intentionally prepared at low strength to allow for future removal using conventional excavation equipment.

The CLSM shall be composed of Portland cement or fly ash, or both, filler aggregate and water. The CLSM, specified for use in filling abandoned culverts, pipes, or other enclosures, shall contain a settlement compensator, in addition to the other ingredients, to minimize settlement of the CLSM within the enclosure.

Normal Set CLSM shall be specified whenever the material will remain uncovered or will not be subjected to traffic or other loads within 24 hours after placement. Fast Set CLSM shall be specified whenever the material will be covered, subjected to traffic or other loads within 24 hours, or needed to expedite construction.

CLSM can be used for permanent subgrade repairs below the base layer, but shall not be used for permanent pavement repairs. For temporary traffic applications, a minimum 2 inch (50 mm) cap composed of Hot Mix-Cold Laid Asphaltic Concrete (TxDOT Standard Specification Item 334) shall be placed on the CLSM.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

### 402S.2 - Submittals

The submittal requirements of this specification item include:

- A. A mix design submittal including the results of unconfined compressive strength tests, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop and corresponding Penetrometer tests.
- B. Certifications and test results for the cement fly ash, and admixtures.
- C. Particle-size gradation and specific gravity tests on the filler aggregate.

### 402S.3 - Materials

#### A. Cement.

Portland cement shall conform to ASTM C 150, Type I (General Purpose).

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

#### B. Fly Ash

Fly ash shall conform to the requirements of Standard Specification Item No. 405, "Concrete Admixtures" and TxDOT Specification Item 437.

#### C. Filler Aggregate.

Filler aggregate shall consist of sand, stone screenings, pavement milling cuttings or other granular material that is compatible with the other mixture components. The filler aggregate shall be fine enough to stay in suspension to the extent required for proper flow without segregation, and, in the case of filling of enclosures, for minimal settlement. Filler aggregate shall have a Plasticity Index (TxDOT Test Method Tex-106-E) less than 15 and shall conform to the following gradation:

Sieve Designation	US	(SI)	Percent Passing
	No. 200	(75µm)	0—10

D. Mixing Water.

Mixing water shall conform to the requirements of Standard Specification Item No. 403, "Concrete for Structures".

E. Settlement Compensator

An air entraining admixture with a higher than usual dosage, which meets the requirements of Standard Specification Item No. 405, "Concrete Admixtures", shall be used as a settlement compensator. The settlement compensator may be introduced to the CLSM at the job site by placement of prepackaged admixture in capsules or bags in the mixing drum in accordance with the admixture manufacturer's recommendations.

402S.4 - Mix Design

The proportioning of CLSM shall be the responsibility of the Contractor. The Contractor shall furnish a mix design conforming to the requirements herein, for review and approval by the Engineer or designated representative. The mix design shall be prepared by a qualified commercial laboratory and then reviewed and signed by a registered Professional Engineer licensed in the State of Texas.

The Mix Design submittal must include:

- A. Test results for unconfined compressive strength, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop (ASTM C-360) and corresponding Penetrometer tests (with a concrete pocket penetrometer),
- B. Certifications and test results for the cement, fly ash, and admixtures, and
- C. Results of particle-size gradation and specific gravity tests on the filler aggregate. The submittal shall include Penetrometer tests performed every thirty minutes until the Ball Drop test shows a 2-inch (50 mm) indentation, as well as the predicted Penetrometer reading that corresponds to a 3-inch (75 mm) Ball Drop indentation. Particle-size gradation shall be determined using a series of sieves that gives no fewer than five uniformly spaced points for graphing the entire range of particle sizes larger than a No. 200 sieve (75-µm).

The Contractor shall perform the work required to substantiate the design at no cost to the City, including all testing. Approved mix designs shall be valid for one year, provided there are no changes in the type, source, or characteristics of the materials during that year.

At the end of one year, the mix design may be submitted for renewal, provided that:

- A. field tests of the CLSM during the year have been satisfactory,
- B. there have been no changes in type or source of the materials of the mix, and

C. the characteristics of the materials have not changed significantly since the original submittal.

The Contractor shall also submit certifications and test results for the cement, fly ash and admixtures, and particle-size gradation and specific gravity test results for the filler aggregate. The Contractor shall compare results of tests made on the filler aggregate at the end of the year to the results of tests reported in the original submittal. Gradation changes less than ten percent in percent passing any sieve and specific gravity changes less than five percent shall not be considered significant.

#### 402S.5 - Strength

The CLSM mix designs shall meet the unconfined compressive strength requirements outlined in the table below. The compression tests shall be conducted in accordance with TxDOT Method Tex-418-A, using approved unbonded caps on specimens with four-inch (100 mm) diameter and eight-inch (200 mm) height [or three-inch (75 mm) diameter by six-inch (150 mm) high specimens if a smaller capacity loading device gives more accurate results].

Unconfined Compressive Strength, psi (mPa)		
Age	Normal Set CLSM	Fast Set CLSM
3 hours	—	35 (0.24) minimum
24 hours	35 (0.24) minimum	—
28 days	300 (2.1) maximum	300 (2.1) maximum

#### 402S.6 - Flow Consistency

Flow consistency shall be established in tests involving the use of a six-inch (150 mm) length by three-inch (75 mm) diameter open-ended straight tubing made of steel, plastic or other non-absorbent material that is non-reactive with cement or fly ash. The tube shall be placed with one end on a horizontal flat surface and held in a vertical position. The tube shall then be filled to the top with CLSM. The top surface shall be struck off with a suitable straight edge and any spillage shall be removed from the base of the tube. Within five seconds thereafter the tube shall be raised carefully, using a steady upward lift with no lateral or torsional motion. The entire test, from the start of filling until removal of the tube, shall be completed within 1½ minutes without interruption.

After removal of the tube, the spread of the CLSM shall be measured immediately along two diameters that are perpendicular to one another. The average of those two measurements is defined as the flow consistency of the mix. The flow consistency of the CLSM shall be considered satisfactory if a circular-type spread of the mix occurs without segregation and a flow consistency (average diameter of spread) of 8 inches (200 mm) or more is achieved.

#### 402S.7 - Air Entrainment

Air entraining admixture shall be added as a settlement compensator, whenever the CLSM will be used to fill an enclosure (Section 402S-1). The dosage shall be sufficient to result in an air content of 15 to 25 percent (as determined by TxDOT Method Tex-416-A) at the time of placement of the CLSM.

#### 402S.8 - Field Strength Tests

Ball Drop or Penetrometer tests shall be used to determine, when the CLSM has developed sufficient strength to be covered or subjected to traffic or other loads as approved by the Engineer or designated representative.

The Ball Drop test shall be performed according to the latest version of ASTM C-360. An indentation diameter of three inches (75 mm) or less, and the absence of a sheen or any visible surface water in the indentation area shall indicate that the CLSM has achieved the desired strength. Because trench width and depth may affect the test results, the Contractor may perform this test on a control sample of CLSM in a two-foot (600 mm) square by six-inch (150 mm) deep container.

Penetrometer tests using a hand-held, spring reaction-type device commonly called a concrete pocket penetrometer, shall be performed on the surface of the CLSM. A Penetrometer reading, equal to or greater than the value established in the mix design (Section 402S.4) for a Ball Drop test indentation of 3-inches (75 mm), shall indicate that the CLSM has achieved the desired strength.

#### 402S.9 - Construction Methods

##### A. General

The height of free fall placement of the CLSM shall not exceed four feet (1.2 meters). Since CLSM is considered to be self-compacting, a vibrator shall not be allowed. The CLSM shall not be covered with any overlying materials or subjected to traffic or other loads until the Ball Drop test or the Penetrometer test shows acceptable results (Section 402S.8) or until the CLSM has been in place a minimum of 24 hours for Normal Set CLSM and a minimum of 3 hours for Fast Set CLSM. Curing of the CLSM will not be required.

##### B. Utility Line Backfill

After the utility pipe has been placed and the proper bedding material placed in accordance with the details on the drawings, the trench may be immediately backfilled with the CLSM to the subgrade level shown on the drawings, Standard Details 1100S-6A, B, C & D, 430S-4, 511S-13A and 511S-13B or as directed by the Engineer or designated representative.

##### C. Culvert Backfill

Care shall be taken to prevent movement of the structure. If the pipe or structure moves either horizontally or vertically, the CLSM and the structure shall be immediately removed and the pipe or structure re-laid to proper line and grade.

##### D. Other Backfill

CLSM may be used for backfill material in lieu of soil as shown on the drawings, Standard Details or as approved by the Engineer or designated representative.

##### E. Filling Abandoned Culverts, Pipe, or other Enclosures

The CLSM shall be placed in a manner that allows all air or water, or both, to be displaced readily as the CLSM fills the enclosure.

#### 402S.10 - Acceptance Testing During Construction

The Engineer or designated representative may perform flow consistency, air entrainment, and unconfined compressive strength tests to determine if the CLSM meets the specification requirements. The number and frequency of acceptance tests will be determined by the Engineer or designated representative.

#### 402S.11 - Measurement and Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used.

When specified in the contract bid form as a separate pay item, the item will be paid for at the contract unit bid price(s) for "Controlled Low Strength Material". The bid prices shall include full compensation for all Work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under the following:

<b>Pay Item No. 402S-A:</b>	Controlled Low Strength Material	Per Cubic Yard
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**End**

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 402S, "Controlled Low Strength Material"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
430S-4	Concrete Backfill Under Curb & Gutter
506S-14	Control or Mini Manhole
511S-13A	Water Valve Box Adjustment to Grade W/Full Depth Concrete
511S-13B	Water Valve Box Adjustment to Grade W/Concrete and H.M.A.C.
1100S-6A	Narrow Excavation Next to C&G - Trench Width 0.3 M (12") & Less
1100S-6B	Narrow Excavations - Trench Width 0.3 M (12") & Less
1100S-6C	Excavation Next to C&G - Trench Width Greater than 0.3 M (12")
1100S-6D	Excavations - Trench Width Greater than 0.3 M (12")
<u>City of Austin Standard Specification Items</u>	

<u>Designation</u>	<u>Description</u>
Item No 403S	Concrete for Structures
Item No 405S	Concrete Admixtures
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 334	Hot Mix-Cold Laid Asphaltic Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 437	Concrete Admixtures

<b><u>RELATED CROSS REFERENCE MATERIALS</u></b>	
<u>Standard Specification Item 402S, "Controlled Low Strength Material"</u>	
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-106-E	Method Of Calculating the Plasticity Index of Soils
Tex-416-A	Air Content of Freshly Mixed Concrete By The Pressure Method
Tex-418-A	Compressive Strength of Cylindrical Concrete
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>

ASTM C 150	Portland Cement
ASTM C 360	Ball Penetration in Fresh Portland Cement Concrete
ASTM C 403	Time of Setting of Concrete Mixtures by Penetration Resistance
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 504S	Adjusting Structures
Item No. 506S	Manholes
Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 510	Pipe

ITEM NO. 437S - PAVER GRATE FRAMES/TREE GRATES AND FRAMES 12-9-08

437S.1 - Description

This item shall govern paver grate frames, tree grates and frames purchased or constructed and installed as herein specified at locations shown on the drawings or as established by the Engineer or designated representative. The grate installation shall consist of either a paver frame/grate, tree frame with grate or a grate with lighting openings as shown in the Drawings. The grates/frames shall be constructed and installed as shown in City of Austin Standards 437S-1 and 437S-2.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

437S.2 - Submittals

The submittal requirements of this specification item may include:

Test results for each of the materials described herein when specifically identified on the Drawings and/or referenced in associated standard specification items and standard details.

A foundry certification shall be furnished stating that cast-iron grate samples representing each lot have been tested, inspected, and are in accordance with this specification.

Certification prior to supplying castings that there is an acceptable quality control program at the cast-iron grate producing foundry,

Confirmation that the paver grate frames are capable of supporting 90 lbs per sq. ft. (4.31 kPa) of dead load and 110 lbs. per sq. ft. (5.27 kPa) of live load.

Confirmation that the paver grate frames have been constructed in accordance with this specification and associated Standard Details.

437S.3 - Materials

A. Cast Iron

Unless otherwise indicated, the Tree Grate shall be gray iron castings, manufactured from iron conforming to ASTM A48, Class 35B, as noted in section 3.1 of AASHTO M306. The material must be resistant to corrosion.

Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects. Castings shall be ground smooth and well cleaned by shot blasting. As-cast dimensions may vary within accepted foundry tolerances as outlined in the Iron Castings Handbook published by the American Foundry Society, Inc. Nominally, casting dimensional tolerances shall be  $\pm 1/16$  " per foot (0.5 cm per meter).

B. Steel

Unless otherwise indicated, steel shall conform to ASTM A 36 as detailed in Item 720, "Metal for Structures".

C. Reinforcing Steel

Reinforcement shall conform to Specification Item No. 406S, "Reinforcing Steel" or Specification Item No. 407S, "Fibrous Concrete".

437S.4 - Construction Methods



A. Paver Grate Frames

The paver grate frames shall be designed according to current American Institute of Steel Construction criteria and shall be capable of supporting 90 lbs per sq. ft. (4.31 kPa) of dead load and 110 lbs. per sq. ft. (5.27 kPa) of live load.

The paver grate frame shall be fabricated in conformance with Item 721, "Steel Structures" and Item 723,"Structural Welding" to the dimensions shown in Standard 437S-1. The completed frames shall be installed as shown in Standard 437S-1. The frames shall be securely bolted to the supporting concrete surround using 3/8-inch (9.5 mm) diameter expansion bolt anchors, or approved equivalent.

B. Tree Grates and Frames

The paver grate frame shall be fabricated in conformance with Item 721, "Steel Structures" and Item 723,"Structural Welding" to the dimensions shown in Standard 437S-2, sheet 2.

The cast-iron tree grates shall be fabricated to the dimensions shown in Standard 437S-2, sheets 1 and 3,

The completed tree grate/frame shall be installed as shown in Standard 437S-2.

437S.5 - Measurement

Accepted work performed as prescribed by this item will be paid per each paver grate and/or tree grate. Each grate installation shall include a grate frame as detailed in Standards 437S-1, Sheet 1 and 437S-2, sheet 2.

437S.6 - Payment

The work performed as prescribed by this item will be paid for "per each" for paver frame/grate, tree grate with frame or tree grate with lighting openings with frame.

The work performed for Tree Wells as prescribed by Item 432S will be paid for "per each" under Pay Item 432S-SAC-7A, 432S-SAC-7B, 432S-SAC-7C, 432S-SAC-7D, 432S-SAC-7E, and 432S-SAC-7F.

This price shall be full compensation for furnishings, fabricating, transporting, erecting and installing each tree grate and grate frame, complete in place, including all material, labor, tools, equipment, barricading and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item No. 437S-A:</b>	Paver frame and grate	Per Each.
<b>Pay Item No. 437S-B:</b>	Tree grate and frame	Per Each.
<b>Pay Item No. 437S-C:</b>	Tree grate, lighting option with frame	Per Each.

End

<u><b>SPECIFIC CROSS REFERENCE MATERIALS</b></u>
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Standard Specification Item Number P437S, "Paver Grate Frames/Tree Grates and Frames"

American Society for Testing And Materials, ASTM

Designation

Description

A 48

Specification for Gray Iron Castings

American Association of State Highway and Transportation Officials (AASHTO)

Designation

Description

M306

Drainage Structure Castings

City of Austin Standard Specifications

Designation

Description

Item No. 406S

Reinforcing Steel

Item No. 407S

Fibrous Concrete

Item No. 721

Steel Structures

Item No. 723

Structural Welding"

City of Austin Standard Details

Designation

Description

Item No. 437S-1

1.8 m (6') Paver Grate Frame

Item No. 437S-2

1.8 m (6') Cast Iron Tree Grate and Frame

**RELATED CROSS REFERENCE MATERIALS**

Standard Specification Item Number P437S, "Paver Grate Frames/Tree Grates and Frames"

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No 403S	Concrete for Structures
Item No. 480S	Concrete Paving Units

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 432S-7A	New Trees Planted Within Sidewalk 3.6m (12') or Greater-Clay Soils
No. 432S-7B	New Trees Planted Within Sidewalk 3.6m (12') or Greater - Granular Soils
No. 432S-7C	Tree Well for New Trees Planted Within Concrete Sidewalk -3.6m (12') or Greater
No. 432S-7D	Above Grade Tree Planter
No. 432S-7E	Tree Well with Seat
No. 432S-7F	Tree Well without Grate

## ITEM NO. 501S - JACKING OR BORING PIPE 9-26-12

### 501S.1 - Description

This item shall govern furnishing and installing of encasement pipe by methods of jacking or boring as indicated on the Drawings and in conformity with this specification. This item shall also include, but not be limited to other constructions activities such as traffic control measures, excavation, removal of all materials encountered in jacking or boring pipe operations, disposal of all material not required in the work, grouting, end seal installation, backfilling and re-vegetation.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

### 501S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Shop drawings identifying proposed jacking or boring method complete in assembled position
- B. Trench Safety Plan including pits, trenches and sheeting or bracing if necessary,
- C. Design for jacking or boring head,
- D. Installation of jacking or boring supports or back stop,
- E. Arrangement and position of jacks and pipe guides, and
- F. Grouting plan,

### 501S.3 - Materials

#### A. Pipe

Carrier pipe and encasement pipe shall conform to Standard Specification Item Nos. 505S, "Concrete Encasement and Encasement Pipe" and 510, "Pipe" and shall be size, type materials, thickness and class indicated on the Drawings, unless otherwise specified.

#### B. Grout

Grout for void areas shall consist of 1 part Portland cement and 4 parts fine, clean sand mixed with water.

### 501S.4 - Construction Methods

#### A. General

The Contractor is responsible for:

1. Adequacy of jacking and boring operations,
2. Installation of support systems as indicated on the Drawings,
3. Provision of encasement and carrier pipe, and
4. Execution of work involving the jacking operation, the wet or dry method of boring and the installation of encasement pipe simultaneously.

The Contractor shall have sole responsibility for the safety of the jacking and boring operations and for persons engaged in the work. The Contractor's attention is directed to the Construction Industry Occupational Safety and Health Administration (OSHA) Standards (29 FR 1926/1920) as published in U.S. Department of Labor publication OSHA 2207, latest revision, with particular attention to

Subpart S. The Contractor shall conform to the requirements in accordance with Standard Specification Item 509S, "Trench Safety System" and shall provide an appropriate Trench Safety Plan.

When the grade of the pipe at the jacking or boring end is below the ground surface, suitable pits or trenches shall be excavated to provide sufficient room to conduct the jacking or boring operations and for placement of end joints of the pipe. In order to provide a safe and stable work area, the excavated area shall be securely sheeted and braced to prevent earth caving in accordance with the Trench Safety Plan.

The location of the work pit and associated traffic control measures required for the jacking or boring operations shall conform to the requirements of the City of Austin Transportation Criteria Manual and TxDOT Manual on Uniform Traffic Control Devices.

Where installation of pipe is required under railroad embankments, highways, streets, or other facilities by jacking or boring methods, construction shall be undertaken in such a manner that it will not interfere with operation of any railroad, street, highway, utility or other facility and shall not weaken or damage any embankment or structure. All appropriate permits shall be acquired prior to the initiation of the work.

During construction operations, and until the work pits are backfilled and fill material compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor. The Contractor shall submit the proposed pit location and traffic control plan for review by the Engineer or designated representative. The Review by the Engineer or designated representative, however, will not relieve the Contractor of the responsibility to obtain specified results in a safe, professional manner.

When grade of pipe at jacking or boring end is below ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking or boring operations and for joining pipe. Work shall be securely sheeted and braced as indicated on the Trench Safety Plan to prevent earth caving and to provide a safe and stable work area.

The pipe shall be jacked or bored from the low or downstream end, if possible. Minor lateral or vertical variation in the final position of pipe from line and grade established by Engineer or designated representative will be permitted at the discretion of Engineer or designated representative provided that such variation is regular and occurs only in one direction and that the final grade of the flow line conforms to the specified direction.

When conforming to details indicated on the drawings, but the bottom of the work pit is unstable or excessively wet or the installation of water and wastewater pipe will result in less than 30 inches (750 mm) of cover, the Contractor shall notify the Engineer or designated representative. The Engineer or designated representative may require the Contractor to install a concrete seal, cradle, cap or encasement or other appropriate action.

Immediately after jacking or boring is complete and the encasement pipe is accurately positioned and approved for line and grade, the clear space between the pipe and the surrounding excavated material shall be completely filled by pressure grouting for entire length of installation if the encasement pipe is 36 inches or larger in diameter.

After placement of the carrier pipe is complete, the ends of the encasement pipe shall be sealed with end seals meeting SPL WW-575A.

As soon as possible after the carrier pipe(s) and end seals are completed, the work pits or trenches, which are excavated to facilitate these operations, shall be backfilled. The backfill in the street ROW shall be compacted to not less than 95 percent of the maximum density conforming to TxDOT Test Method Tex-114-E, "Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soil". Field density measurements will be made in accordance with

TxDOT Test Method Tex-115-E, "Field Method for Determination of In-Place Density of Soils and Base Materials".

Where the characteristics of soil, size or size of proposed pipe dictate that tunneling is more satisfactory than jacking or boring, a tunneling method may be submitted for acceptance by Engineer or designated representative.

#### B. Jacking

Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating the jacks, an even pressure shall be applied to all jacks used so that the pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The complete jacking assembly shall be placed in order to line up with the direction and grade of the pipe. In general, the embankment material shall be excavated just ahead of the pipe, the material removed through the pipe and the pipe forced through embankment by jacking, into the space thus provided.

The excavation for the underside of the pipe, for at least 1/3 of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of no more than 2 inches (50 mm) may be provided for the upper half of the pipe. This clearance shall be tapered to zero at the point where excavation conforms to contour of pipe.

The distance that excavation shall extend beyond the end of the pipe depends on the character of material encountered, but it shall not exceed 2 feet (0.6 meter) in any case. This distance shall be decreased, when directed by the Engineer or designated representative, if the character of the material being excavated makes it desirable to keep the advance closer to the end of the pipe.

The Contractor may use a cutting edge of steel plate around head end of the pipe extending a short distance beyond the end of pipe with inside angles or lugs to keep cutting edge from slipping back onto the pipe.

When jacking of the pipe is begun, all operations shall be carried on without interruption, insofar as practical, to prevent the pipe from becoming firmly set in the embankment.

Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at its entire expense.

#### C. Boring

The boring shall proceed from a work pit provided for the boring equipment and workers. Excavation for the work pits and the installation of shoring shall be as outlined in the Trench Safety Plan. The location of the pit shall be approved by the Engineer or designated representative. The boring shall be done mechanically using either a pilot hole or the augur method.

In the pilot hole method an approximate 2 inch (50 mm) pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.

When the augur method is used, a steel encasement pipe of the appropriate diameter equipped with a cutter head to mechanically perform the excavation shall be used. Augurs shall be of sufficient diameter to convey the excavated material to the work pit.

Excavated material will be removed from the working pit and disposed of properly. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Water jetting will not be permitted.

In unstable soil formations, a gel-forming colloidal drilling fluid, that consists of at least 10 percent of high grade carefully processed bentonite, may be used to consolidate the drill cuttings, seal the walls of the hole and furnish lubrication to facilitate removal of the cuttings from the bore.

D. Tunneling

Where the characteristics of the soil, the size of the proposed pipe, or the use of monolithic sewer would make the use of tunneling more satisfactory than jacking or boring; or when indicated on the drawings, a tunneling method may be used, with the approval of the Engineer or designated representative.

E. Joints

If reinforced concrete pipe is used, the joints shall be in accordance with TxDOT Specification Item 464, "Reinforced Concrete Pipe".

501S.5 - Measurement

Jacking or boring pipe will be measured by the linear foot (meter: 1 meter equals 3.281 feet) of pipe complete in place. Such measurement will be made between the ends of the pipe along the central axis as installed.

501S.6 - Payment

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid price per linear foot for "Jacking or Boring Pipe" as the case may be, of type, size and class of encasement pipe indicated on the Drawings. The price shall include full compensation for furnishing, preparing, hauling and installing required materials, encasement pipe, end seals, for grouting and for labor, tools, equipment and incidentals necessary to complete work, including excavation, backfilling and disposal of surplus material.

The Carrier pipe shall be paid at the unit price bid for Standard Specification Item 510, "Pipe".

Payment when included as a contract pay item, will be made under one of the following:

<b>Pay Item No. 501S:</b>	Jacking or Boring _____ In. Pipe, Class _____	Per Linear Foot.
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**End**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<u>Specification Item 501S, "Jacking or Boring Pipe"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>

Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 509S	Trench Safety Systems
Item No. 510	Pipe
<u>TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 464	Reinforced Concrete Pipe
<u>TxDOT Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials
<u>TxDOT Manual on Uniform Traffic Control Devices (MUTCD)</u>	
<u>Designation</u>	<u>Description</u>
MUTCD Part VI	Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations
MUTCD Section 6C	Channelizing Devices
MUTCD Section 6C-8	Barricade Design



MUTCD Section 6C-9	Barricade Application
MUTCD Section 6E	Lighting Devices
MUTCD Section 6F	Control of Traffic Through Work Areas
<u>City of Austin Transportation Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 8	Traffic Control
Section 8.5.5.E	Typical Applications/Bore Pits

<b><u>RELATED CROSS REFERENCE MATERIALS</u></b>	
<u>Specification Item 501S, "Jacking or Boring Pipe"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Detail 501S-1	Encasement Detail w/ Casing Spacers
<u>TxDOT Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item 476	Jacking, Boring or Tunneling Pipe
Item 502	Barricades, Signs and Traffic Handling

## ITEM NO. 505S - CONCRETE ENCASEMENT AND ENCASEMENT PIPE 2-24-10

### 505S.1 - Description

This item shall govern the furnishing of materials and the methods of constructing a Portland cement concrete encasement or encasement pipe in a trench.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

### 505S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type, of pipe, construction methods and sequence,
- B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix,
- C. Proposed proportioning of materials for the mortar mix.

### 505S.3 - Materials

#### A. Portland Cement Concrete

The Portland cement concrete shall conform to Class D Concrete, Item No. 403, "Concrete for Structures."

#### B. Pipe

Portland Cement concrete pipe shall conform to ASTM C-76, Class III or better.

Corrugated Metal Pipe (CMP) shall conform to Section 510. 2 (8)(o) of the City of Austin Standard Specification Item No. 510, "Pipe."

Steel Pipe shall conform to ASTM A134 with a minimum thickness of 3/8 inch (9.5 mm) for pipe with a diameter of 16 inches (400 mm) and greater.

#### C. Grout

Grout shall consist of not less than 6 sacks Portland cement per cubic yard (335 kilograms Portland cement per cubic meter) and clean washed sand mixed with water. The grout shall have a consistency such that the grout will flow into and completely fill all voids. If allowed by the Engineer or designated representative, an air entraining admixture may be added to facilitate placement.

### 505S.4 - Construction Methods

When indicated on the Drawings or acceptable to an Engineer or designated representative, a concrete encasement shall be placed to protect the pipe. Pipe or bedding shall not be placed where:

- (a) the top of the pipe would have less than 30 inches (750 mm) of cover from finish grade,
- (b) the ground water invades the trench, or
- (c) the trench bottom is of unstable material.

If either of these conditions is encountered, the Engineer or designated representative shall be notified and may direct the Contractor to:

- (a) encase the pipe with concrete,

- (b) change pipe material, or
- (c) use a higher strength class of pipe.

Concrete encasement shall extend from 6 inches (150 mm) below to 6 inches (150 mm) above the outer projections of the pipe over the entire width of the trench in accordance with the City of Austin Standard Detail 501S-1, "Encasement Detail w/ Casing Spacers."

The ends of the encasement pipe shall be bulkheaded (Standard Specification Item No. 507S) with concrete blocks, bricks or stones, dry-stacked without mortar, sufficient to prevent the intrusion of trench backfill material into the encasement, but fitted loosely enough to facilitate the escape of water from the encasement should carrier pipe leakage or failure occur.

**505S.5 - Measurement**

Concrete encasement will be measured by the lineal foot (meter: 1 meter equals 3.281 feet), for size of pipe being encased, complete in place. The measurement will be made between ends of the encasement, along the central axis as installed.

Encasement pipe installed by open cut will be measured by size of encasement installed, complete in place. The measurement will be made between the ends of the pipe, along the central axis as installed

**505S.6 - Payment**

Work performed and materials furnished as prescribed by this item will be included in a unit price bid item from Standard Specification Item No. 510, "Pipe" unless included as a separate pay item in the contract. When included for payment, it shall be measured as provided under "Measurement" and will be paid at the unit bid price per lineal foot for "Concrete Encasement" or "Encasement Pipe" of the size indicated on the Drawings. The unit bid price shall include full compensation for furnishing all materials, pipe for all preparation, hauling, installation and for all labor, tools, equipment and incidentals necessary to complete the work, including bench excavation and disposal of surplus material.

Payment, when included as a contract Pay Item, will be made under one of the following:

<b>Pay Item No. 505S-A:</b>	Concrete Encasement for _____ Dia. Pipe	Per Lineal Foot.
<b>Pay Item No. 505S-B:</b>	Encasement Pipe _____ Dia., Type _____ ,	Per Lineal Foot.

**End**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<u>Standard Specification Item No. 505S, "Encasement and Encasement Pipe"</u>	
<u>City of Austin Standard Specification Items</u>	

<u>Designation</u>	<u>Description</u>
Item 403	Concrete For Structures
Item 507S	Bulkheads
Item 510	Pipe
Section 510.2(8)(o)	Corrugated Metal Pipe (CMP)
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Detail 501S-1	Encasement Detail w/ Casing Spacers
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
A-134	Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over)
C-76/C-76M	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

<u><b>RELATED CROSS REFERENCE MATERIALS</b></u>	
<u>Standard Specification Item No. 505S, "Encasement and Encasement Pipe"</u>	
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item 421	Portland Cement Concrete
Section 421.9	Quality of Concrete
Section 421.2(8)	Mortar and Grout
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 501S	Jacking or Boring Pipe
Item No. 506	Manholes
Section 510.2(8)(c)	Concrete pipe
Section 510.2(8)(m)	Steel Pipe
Item No. 593S	Concrete Retards

## ITEM NO. 506 - MANHOLES 3-15-11

### 506.1 - Description

This item governs construction of pre-cast and cast-in-place wastewater manholes, storm water manholes, storm water junction boxes and cast-in-place wastewater junction boxes, complete in place, including excavation, installation, backfilling and surface restoration; required items including rings, covers, coatings, and appurtenances; and incidental work such as pumping and drainage necessary to complete the work. Contractor-performed acceptance testing is required for wastewater manholes.

### 506.2 - Qualifications

Applicators of coatings to the interior surfaces of wastewater manholes, as specified in 506S.4.R and 506S.5.J, shall be listed on Standard Products List WW-511.

### 506.3 - Project Submittals

#### A. Products and Materials

The Contractor shall submit descriptive information and evidence that the materials the Contractor proposes for incorporation in the Work are of the kind and quality that satisfy the requirements in the Contract Documents. The City of Austin Water Utility Standard Products Lists are considered a part of the Specifications for the Work. The Contractor shall use products from the SPLs for all water and wastewater construction unless alternative products are shown on the Drawings; called for in the specifications; or specified in the Bidding Requirements, Contract Forms and Conditions of the Contract.

The products included in the Standard Products Lists current at the time of plan approval shall govern; unless a specific product or products on the lists have subsequently been removed from those SPLs because of quality or performance issues. Products and materials that are not covered by SPLs shall meet the requirements in the contract documents.

Submittals for the products and materials covered by this specification shall include manufacturer catalog sheets, technical data sheets, shop drawings, product or material test results, requirements listed below, and any other information needed to adequately describe the product or material. For products covered by SPLs, the submittal shall include a copy of the applicable SPL with the proposed product identified. An SPL by itself is not considered an adequate submittal.

The submittal requirements of this specification item include:

1. For pre-cast manholes and junction boxes: shop drawings for each structure showing, at a minimum, the Project and Contractor's name; manufacturer's name and plant location; applicable specifications; list of materials (such as adjusting rings, boots, gaskets, and pre-cast sections) by type and quantity; elevation view showing diameter or size, ring and cover size and elevation, ring type (bolted or unbolted, flared top or flared bottom) wall thickness, elevations of transitions from large diameter sections to smaller diameter sections, base width and thickness, total depth, size of openings, reinforcement, and length of each pre-cast section; structure identification number and station location; pipe line identification; pipe material and size; pipe flowline elevations; plan view showing azimuthal orientation (based on 360 degrees clockwise) of the pipes relative to the outflow pipe; technical data sheets covering pipe-to-manhole or pipe-to-junction box connectors, and gaskets
2. For cast-in-place manholes and junction boxes: formwork drawings sealed by a registered Professional Engineer licensed in the State of Texas with documented experience in formwork design for wall pours that exceed 4 feet in height and slabs that are not ground supported
3. For hydraulic cement concrete; mix components and proportions, material sources, materials test results

4. For mortar: mix components and proportions, material sources, materials test results
5. For non-shrink grout: technical data sheet indicating ASTM type and containing instructions on surface preparation, mixing, placing, and curing procedures
6. For wastewater manhole coatings and linings: technical data sheets that include instructions on surface preparation, mixing, placing, and curing procedures

B. Acceptance Test Records

Submittal of acceptance test records is required for wastewater manholes and shall include as a minimum the following items:

Name of the manhole manufacturer

Interior surface coating type and application method

Model and manufacturer of vacuum tester

Date tested/date re-tested

Indication of whether test passed or failed and statement of corrective action taken if test failed

Test Method Used

Location/station of manhole

Type of base: Precast/cast-in-place

Type of repairs made to the joints

The test records shall also be included as part of the Project records turned in with the acceptance package.

506.4 - Materials

A. Concrete

All cast-in-place concrete shall conform to City of Austin Standard Specification Item No. 403S, "Concrete for Structures." Cast in place concrete shall be Class A or as specified on the Drawings. Concrete used in precast concrete manhole base sections, riser sections and appurtenances shall conform to the requirements of Texas Department of Transportation Item 421, Hydraulic Cement Concrete. Concrete for backfill of over-excavated areas shall be City of Austin Class A, or Class J (City of Austin Standard Specification Item 403S, Concrete For Structures) or Controlled Low Strength Material (City of Austin Standard Specification Item 402S) as indicated on the Drawings.

B. Mortar

Mortar shall be composed of one part Portland cement, one part masonry cement (or ¼ part hydrated lime), and sand equal to 2½ to 3 times the sum of the volumes of the cements and lime used. The sand shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403S "Concrete For Structures." Mortar shall not be used for any purpose on the inside of wastewater manholes.

C. Grout

Grout shall be the non-shrink type conforming to ASTM C 1107, Packaged, Dry, Hydraulic Cement Grout (Nonshrink), Grade C. Grout shall be used as packaged, with the mixed ingredients requiring only the addition of water.

D. Reinforcement



The reinforcing steel shall conform to the requirements of Standard Specification Item No. 406S, "Reinforcing Steel." Secondary, non-structural steel in cast-in-place stormwater manholes may be replaced by collated fibrillated polypropylene fibers, if approved by the Engineer or designated representative.

E. Brick

The brick for ring adjustment courses and for stormwater manholes shall be of first quality, sound, hard burned, perfectly shaped brick conforming to the requirements of ASTM C 62, Grade SW, or concrete brick meeting the requirements of ASTM C 55, Grade N-1.

F. Rings and Covers

Rings and covers shall conform to the requirements of City of Austin Standard Specification Item No. 503S, "Frames, Grates, Rings and Covers."

1. Replacement Rings and Covers, 24 in Diameter Lids

This ring and cover shall be used for the replacement of broken rings and covers, minor manhole adjustment, or as otherwise directed by the Engineer or designated representative.

2. Rings and Covers, 32 in. Diameter Lids

This ring and cover shall be used for all new manhole construction, except as otherwise directed by the Engineer or designated representative.

G. Bulkheads

Bulkheads shall meet the requirements of City of Austin Standard Specification Item No. 507S "Bulkheads."

H. Precast Base Sections, Riser Sections, Flat-top Slabs and Cones

Precast concrete base sections, riser sections, flat-top slabs, and cones shall conform to the requirements of ASTM C 478. The width of the invert shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three fourths of the diameter of the pipe, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes larger than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be at least equal to the full pipe diameter. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. The manhole invert grade shall 1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or 2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or 3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Where wastewater lines enter a manhole above the flowline of the outlet, the invert shall be filleted to prevent splashing and solids deposition.

Joints for wastewater base sections, riser sections, and cones shall conform to the requirements of ASTM C 443. Additionally, joint dimensions for 48-inch inside diameter wastewater manhole sections and cones shall comply with City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section." Joint dimensions for wastewater manhole sections and cones larger than 48-inch inside diameter shall comply with City of Austin Standard No. 506S-12, "O-Ring Joint Detail Precast Manhole Section" or City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section". Precast bases for 48 inch inside diameter manholes shall have preformed inverts. Inserts acceptable to the Engineer or designated representative shall be embedded in the concrete wall of the manhole sections to facilitate handling; however, through-wall holes for lifting will not be permitted.

I. Precast Junction Boxes

Precast junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer or designated representative.

J. Pipe-to-Manhole and Pipe-to-Junction-Box Connectors

Resilient connectors, ring waterstops, and seals at connections of wastewater pipes to pre-cast and cast-in-place manholes and junction boxes shall be watertight, flexible, resilient and non-corrosive, conforming to ASTM C 923. Metallic mechanical devices for securing the connectors, ring waterstops, and seals in place shall be Type 304 stainless steel.

K. Precast Flat-Slab Transition/Junction Box Lids

Precast slab transitions and lids shall be designed to safely resist pressures resulting from loads which might result from any combination of forces imposed by an HS-20 loading as defined by the American Association of State Highway and Transportation Officials (AASHTO). The joints of precast slab transitions and of lids for wastewater applications shall conform to the requirements of ASTM C443.

L. Precast-Prefabricated Tee Manholes

Tee manholes shall be allowed only where indicated on the Drawings or as directed by the Engineer or designated representative. The main pipe section shall conform to the requirements of City of Austin Standard Specification Item No. 510, "Pipe." The vertical manhole portion (tee) above the main pipe shall conform to the requirements of the precast components.

The manhole tee shall have a minimum inside diameter of 48 inches and shall rise vertically centered or tangent to the main pipe, as indicated on the Drawings or as directed by the Engineer or designated representative. An access hole less than 48-inches in diameter shall be cut into the main pipe to allow a ledge for support of access ladders. Unless otherwise specified on the Drawings, the main pipe portion of the tee manhole shall be included in the unit price bid for the unit tee manhole price.

M. Precast Grade Rings

Rings shall be reinforced Class A concrete

1. Precast Grade Rings, 24½ inches Inside Diameter

This adjustment ring shall be used only for adjusting existing manholes with 24 inch diameter lids and for Wastewater Access Device. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 3 inches to 6 inches.

2. Precast Grade Rings, 35 inches Inside Diameter

This adjustment ring shall be used for all new manhole construction with 32 inch diameter lids. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 2 inches to 6 inches.

N. High Density Polyethylene Grade Rings

Plastic grade (adjusting) rings shall be injection molded from high density polyethylene identified according to ASTM D4976. Reprocessable and recyclable ethylene plastic materials are allowed. Manufacturers of HDPE adjusting rings shall be listed on SPL WW-703.

O. Controlled Low Strength Material

Controlled low strength material (CLSM) shall meet Standard Specification Item 402S, Controlled Low Strength Material.

P. Cement Stabilized Sand

Cement stabilized sand for bedding or backfilling shall contain 2 bags of Portland cement per cubic yard. The sand shall meet the requirements for "Fine Aggregate" in Standard Specification Item 403S, Concrete for Structures.

Q. Waterproofing Joint Materials

O-rings and wedge seals for the joints of all wastewater manholes, and for stormwater manholes when indicated on the Drawings, shall conform to the requirements of ASTM C443. Cold applied preformed plastic gaskets for stormwater manholes shall be as specified in City of Austin Standard Specification Item No. 510, "Pipe." Plastic seals wrapped around manholes at joints, and hydrophillic waterstops installed in joints, shall be listed on SPL WW-146A. PVC waterstops installed in joints and waterproofing compounds applied to the exterior surfaces of manholes and junction boxes shall be as specified in the Contract Documents.

R. Interior Surface Coatings for Wastewater Manholes

Interior surface coatings for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511, which lists acceptable products, uses and applicators.

S. Structural Lining Systems for Wastewater Manholes

Structural lining systems for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511A.

## 506.5 - Construction

A. General

A minimum horizontal separation of 12 inches shall be maintained between adjacent pipes inside and outside a manhole or junction box. Pipe ends within the base section or junction box walls shall not be relied upon to support overlying manhole dead and live load weights. All wastewater branch connections to new or existing mains shall be made at manholes, with the branch pipe crown installed at an elevation no lower than the elevation of the effluent pipe crown. Changes in flow direction in the inverts shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. Where wastewater lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be sloped upward in a U-shaped channel three-fourths of the diameter of the incoming pipe to receive the flow, thus preventing splashing or solids deposition. A drop pipe shall be provided for a wastewater pipe entering a manhole whenever the invert cannot be constructed to prevent splashing and solids deposition. Construction of extensions to existing systems shall require placement of bulkheads at locations indicated or directed by the Engineer or designated representative.

Unless otherwise indicated on the Drawings, stormwater manholes shall have eccentric cones and wastewater manholes shall have concentric cones, except on manholes over large mains where an eccentric cone shall be situated to provide access to an invert ledge. Eccentric cones may be used where conflicts with other utilities dictate. Flat-slab tops may be used only where clearance problems are encountered or where specified on the Drawings. Cast-in-place wastewater junction boxes shall be allowed only where indicated on the Drawings or where accepted by the Engineer or designated representative.

B. Foundation Support

Manholes shall be founded at the established elevations on uniformly stable subgrade. Unstable subgrade shall be over-excavated a minimum of 12 inches and replaced with a material acceptable to the Engineer or designated representative. Precast base units shall be founded and leveled on a 6

inch thick layer of coarse aggregate bedding. A pipe section with a prefabricated tee manhole and half the length of the adjoining pipe sections on each side shall be founded on a minimum of 6 inch thick layer of unreinforced Class A concrete (City of Austin Standard Specification Item No. 403S, "Concrete For Structures"). The cast-in-place concrete cradle shall be placed against undisturbed trench walls up to the pipe's springline.

C. Cast-in-Place Concrete

Structural concrete work shall conform to Standard Specification Item No. 410S, Concrete for Structures. Forms shall be used for all slabs that are not ground supported and for all vertical surfaces above the foundation level. Formwork shall be designed according to American Concrete Institute ACI 347, Guide to Formwork for Concrete. Outside forms on vertical surfaces may be omitted where concrete can be cast against the surrounding earthen material that can be trimmed to a smooth vertical face.

D. Manhole Bases

Pre-cast bases shall conform to requirements in 506.4.H.

Cast-in-place bases shall have a minimum thickness of 12 inches at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three-fourths of the pipe diameter, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes greater than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be equal to the full pipe diameter. The manhole invert grade shall 1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or 2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or 3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, large-radius sweeps to prevent splashing, turbulence, and eddies. The lowermost riser section may be set in the Portland cement concrete, while still plastic, after which the base shall be cured a minimum of 24 hours prior to proceeding with construction of the manhole up to 12 feet in depth. The base shall be cured an additional 24 hours prior to continuing construction above the 12-foot level.

Wastewater manholes having cast-in-place bases may be constructed over existing wastewater pipes and the top half of the pipe removed to facilitate invert construction, except where the existing pipe is PVC, in which case, the entire pipe shall be removed from inside the manhole. The manhole floor shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inch of run (8 percent slope). The floors of stormwater manholes, also, shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inches of run (8 percent slope).

Wastewater manholes with lines larger than 18 inches shall require pre-cast bases; manholes constructed over in-service mains however, may be built on cast-in-place bases if the flow cannot be interrupted.

E. Pipe Connections to Manholes and Junction Boxes

Wastewater pipe connections to manholes and junction boxes shall be made using flexible, resilient, and non-corrosive watertight boot connectors or ring waterstops acceptable to the Engineer and conforming to the requirements of ASTM C-923. Any voids in the annular space between the pipe and boot connector or ring waterstop and the inside of the manhole wall shall be filled with non-shrink grout to prevent solids collection.

F. Pipe Connections to Existing Manholes and Junction Boxes

Wastewater pipe connections to existing manholes and junction boxes shall be made by removing the wall section by coring or alternative method approved by the Engineer or designated representative; installing flexible, resilient, and non-corrosive boot connectors or ring waterstops acceptable to the Engineer or designated representative and conforming to the requirements of ASTM C-923; filling any voids in the annular space between the pipe and boot connector or ring waterstop and the inside of the manhole or junction box wall with non-shrink grout; rebuilding the invert to conform to Section 506S.5.D; rehabilitating the interior walls with structural lining material listed on SPL WW-511A, and coating the interior of the manhole with material listed on SPL WW-511.

#### G. Waterproofing

PVC waterstops, hydrophillic waterstops, joint wrapping, and waterproofing compounds shall be installed as specified. Material wrapped around manholes at joints shall be listed on SPL WW-146A regardless of whether installation of the material is required by the Contract for waterproofing or is volunteered by the Contractor for ensuring acceptance of the manhole joints.

#### H. Backfilling

Backfilling of manholes shall conform to the density requirements of City of Austin Standard Specification Item No. 510, Pipe. Manhole construction in roadways may be staged to facilitate pavement base construction. Manholes constructed to interim elevations to facilitate interim construction shall be covered with steel plates that conform to the requirements of City of Austin Standard 804S-4, sheets 5, 6 and 7, Steel Plating. Steel plates on wastewater manholes shall be set in mortar to minimize inflow of storm water runoff. Manholes shall be completed to finish elevation prior to placement of the roadway's finish surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed. The excavation for completion of manhole construction shall be backfilled in accordance with City of Austin Standards for Trench Repair.

#### I. Height Adjustment of Manholes

##### 1. General

All adjustments shall be completed prior to the placement of the final roadway surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed.

Brick shall not be used in making height adjustments to wastewater manholes. Mortar shall not be used for any purpose on the inside of wastewater manholes.

Manhole components to be reused shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its expense.

If the adjustment involves lowering the top of a manhole, a sufficient depth of pre-cast concrete rings or brick courses shall be removed to permit reconstruction. Existing mortar shall be cleaned from the top surface remaining in place and from all brick or concrete rings to be reused and the manhole rebuilt to the required elevation. The manhole ring and cover shall then be installed with the top surface conforming to the proposed grade.

If the adjustment involves raising the elevation of the top of the manhole in accordance with "Minor Manhole Height Adjustment," the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

After rings and covers are set to grade, the inside and outside of the precast concrete grade rings shall be wiped with non-shrink grout to form a durable surface and water-tight joints. The grouted surface shall be smooth and even with the manhole cone section. Grout shall not be placed when the atmospheric temperature is at or below 40°F. If a sudden drop in temperature

below 40°F occurs or temperatures below 40°F are predicted, the grouted surfaces shall be protected against freezing for at least 24 hours.

2. Minor Manhole Height Adjustment (New and Existing Manholes)

Minor manhole height adjustments shall be performed as indicated on City of Austin Standard 506S-4, "Minor Manhole Height Adjustment", and shall consist of adding precast reinforced concrete rings to adjust new and existing manholes to final grade. Brick shall not be used in making height adjustments to wastewater manholes.

If the adjustment involves raising the elevation of the top of the manhole, the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

For new manhole construction, the maximum allowable throat or chimney height, including the depth of the ring casting, shall be limited to 21 inches of vertical face on the interior surface. For adjustments of existing manholes that fall within the limits of overlay and street reconstruction projects, the maximum vertical allowable height, including the depth of the ring casting, shall be limited to 27 inches of vertical face on the interior surface. All other existing manholes shall have a maximum allowable throat or chimney height adjustment, including the depth of the ring casting, of 12 inches of vertical face on the interior surface. Any adjustment that will exceed these requirements shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment and as described below. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

3. Major Manhole Height Adjustment (Existing Manholes Only)

Any adjustment that exceeds the requirements of Minor Manhole Adjustments, shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment, and shall consist of any combination of removing the concrete rings, and/or the manhole cone section, and/or the straight riser section of the manhole in order to bring the manhole to final grade. Major manhole adjustments shall apply only to existing manholes. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

J. Interior Coatings of Wastewater Manholes and Junction Boxes

The interior surfaces of all Portland cement concrete wastewater manholes and junction boxes shall be coated with products specified either on the Drawings, designated in writing by the Engineer or representative, or listed on SPL WW-511. Product selection shall conform to usage described in that SPL. Surface preparation shall follow the product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents. The Contractor shall measure the coating thickness according to ASTM D 6132, Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage. Thickness measures shall be made at locations designated by the Engineer or designated representative. All thickness measurements shall be witnessed by the Engineer or designated representative.

K. Structural Linings of Existing Wastewater Manholes

The interior surfaces of existing wastewater manholes and junction boxes at locations shown in the Drawings or as designated by the Engineer shall be strengthened by application of structural lining systems either as specified on the Drawings, directed in writing by the Engineer or designated representative, or listed on SPL WW-511A. Selection of products for coating the interior of existing manholes shall be based on the condition of the manholes. Surface preparation shall follow the

product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents.

#### L. Abandonment of Existing Manholes

Manholes designated on the Drawings for abandonment, shall be removed to a level not less than four feet below grade. Two-foot long sections of the inlet and outlet pipes shall be cut and removed on the outside of the manhole, the ends of the remaining pipe and the pipe sections penetrating the manhole wall shall be securely plugged, and the structure filled with material in accordance with Standard 506S-15 or as directed by the Engineer or designated representative.

#### 506.6 - Acceptance Testing of Wastewater Manholes

Manholes shall be tested separately and independently of the wastewater lines.

##### A. Test by the Vacuum Method

A vacuum test shall be performed by the Contractor prior to backfilling those manholes that fall within the right-of-way that require detouring of vehicular traffic. A second vacuum test will not be required after backfilling and compaction is complete unless there is evidence that the manhole has been damaged or disturbed subsequent to the initial vacuum test.

For manhole installations which do not require detouring of vehicular traffic, the vacuum method is recommended and may be used by the Contractor prior to backfilling the manhole to insure proper installation so that defects may be located and repaired; however, a vacuum test shall be performed after backfilling, and compaction are complete. Testing after backfill and compaction are complete will be the basis for acceptance of the manhole.

##### 1. Equipment

- a) The manhole vacuum tester shall be a device approved for use by the Engineer or designated representative.
- b) Pipe sealing plugs shall have a load resisting capacity equal to or greater than that required for the size of the connected pipe to be sealed.

##### 2. Procedures - applicable to new 48-inch diameter manholes

- a) Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before installation or unless it is applied at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.
- b) After cleaning the interior surfaces of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer. Plugs and the ends of pipes connected by flexible boots shall be blocked to prevent their movement during the vacuum test.
- c) The vacuum test head shall be placed on the top of the cone section or, inside of the top of the manhole cone section, and the compression seal band inflated to the pressure recommended by its manufacturer. The vacuum pump shall be connected to the outlet port with the valve open. When a vacuum of 10 inches of mercury (-5 psig) has been attained, the valve shall be closed and the time noted. Tampering with the test equipment will not be allowed.

- d) The manhole shall have passed the test if the vacuum does not drop below 9 inches of mercury (-4.5 psig) within 3 minutes of the time the valve was closed. The actual vacuum shall be recorded at the end of the 3 minutes during which the valve was closed.
- e) When the standard vacuum test cannot be performed because of design or material constraints (examples: T-Type manholes, T-Lock Liners, or other reasons acceptable to the Engineer or designated representative), testing of individual joints shall be performed as directed by the Engineer or designated representative.

#### B. Test by the Exfiltration Method

At the discretion of the Engineer or designated representative, the Contractor may substitute the Exfiltration Method of testing for the Vacuum test described in Section 506.6. A. above. This method may only be used when ground water is not present. If ground water is present a Vacuum Test shall be used unless otherwise directed by the Engineer or designated representative. All backfilling and compaction shall be completed prior to the commencement of testing.

The procedures for the test shall include the following:

1. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before field assembly, or at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.
2. After cleaning the interior surface of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer.
3. Concrete manholes shall be filled with water or otherwise thoroughly wetted for a period of 24 hours prior to testing.
4. At the start of the test, the manhole shall be filled to the top with water. The test time shall be 1 hour. The Construction Inspector must be present for observation during the entire time of the test. Permissible loss of water in the 1-hour test time is 0.025 gallons per diameter foot, per foot of manhole depth. For a 4-foot diameter manhole, this quantity converts to a maximum permissible drop in the water level (from the top of the manhole cone) of 0.1 inches per foot of manhole depth or 1.0 inches for a 10-foot deep manhole.

#### C. Failure to Pass the Test - Records of Tests

If the manhole fails to pass the initial test method as described in (A) Test by the Vacuum Method and, if allowed, (B) Test by the Exfiltration Method, or if visible groundwater leakage into the manhole is observed, the Contractor shall locate the leak, if necessary by disassembly of the manhole. The Contractor shall check the gaskets and replace them if necessary. The Contractor may re-lubricate the joints and re-assemble the manhole, or the Contractor may install an acceptable exterior joint sealing product (see City of Austin Standard Products List Item SPL WW-146A) on all joints and then retest the manhole. If any manhole fails the vacuum and/or exfiltration test twice, the Contractor shall consider replacing that manhole. If the Contractor chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole testing shall be made available to the Engineer or designated representative at the close of each working day, or as otherwise directed by the Engineer or designated representative. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

#### D. Inspection

The Engineer or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection



shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of Engineer or designated representative.

#### 506.7 - Measurement

A "Junction Box" and "Box Manholes" will be measured by each structure of the indicated size regardless of depth.

A "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", "Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base", "Centered Tee Manhole", or "Tangent Tee Manhole" will be measured by each structure of the indicated size for the first 8 feet of depth.

An "Extra Depth Manhole" will be measured by linear vertical foot of Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole of the indicated size in excess of eight feet of depth. Manhole depth will be measured from the invert flow line to the finished surface elevation.

"Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be measured by each unit for the indicated size. Only existing manholes will be measured for minor or major manhole height adjustment.

"Connection to Existing Manhole or Junction Box" will be measured per each for the indicated type of structure and location.

"Structural Lining" will be measured by the linear vertical foot for the indicated structure.

New manholes constructed to interim elevations to facilitate stage construction shall be measured as one unit regardless of the number of interim elevations constructed. All labor, materials and other expenses necessary for the stage construction shall be included in the unit price bid for the completed unit. Cost of abandonment of existing manholes shall be included in the unit price bid for the completed unit, unless Pay Item No. 506 AB is indicated on the Drawings and identified in Standard Contract Bid Form 00300U.

#### 506.8 - Payment

Payment for completed junction boxes and manholes of the type indicated on the Drawings shall be made at the appropriate unit bid price. The unit bid price shall include all labor, equipment, materials, (including but not limited to frames and grates, rings and covers, adjusting rings, cone sections, riser sections, gaskets, drop piping and fittings, bases, pipe-to-manhole connectors, concrete, reinforcing steel, non-shrink grout, mortar, joint wrap where specified, and, for wastewater manholes, interior coatings), time and incidentals necessary to complete the work.

Payment for a "Junction Box" and "Box Manhole" will be made at the unit price bid for the indicated size, complete in place.

Payment for the first 8 feet of a "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", "Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base", "Centered Tee Manhole", or "Tangent Tee Manhole" will be made at the unit price bid for the indicated type and size, complete in place.

Payment for that portion of a Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole in excess of 8 feet in depth will be made at the unit price bid for "Extra Depth Manhole" of the indicated type and size, complete in place.

Payment for "Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be made at the unit bid price, complete in place.

Payment for "Structural Lining" will be made at the unit price per linear vertical foot, which will include surface preparation, environmental adjustments, lining application, and curing, as required.

Payment for "Connection to Existing Manhole or Junction Box" shall be made at the unit price per connection and will include removing the wall section by coring or alternative method approved by the Engineer or designated representative, rehabilitating the interior walls, rebuilding the invert, and preparing and coating the interior surfaces of the structure.

When indicated in the Drawings, abandonment of existing manholes shall be made at the unit price for abandonment.

The intended use of each item shall be designated by a two-letter code (Wastewater = WW; Stormwater = SW) in the spaces provided after the pay item number:

<b>Pay Item No. 506S</b> <b>M</b> _____:	Standard Pre-cast Manhole w/Pre-cast Base, _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>M1</b> _____:	Standard Pre-Cast Manhole w/CIP Base, _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>S</b> _____:	Special Manhole, _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>D</b> _____:	Drop Manhole w/Pre-cast Base, _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>D1</b> _____:	Drop Manhole w/CIP Base, _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>C</b> _____:	Centered Tee Manhole, _____ Dia. × _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>T</b> _____:	Tangent Tee Manhole, _____ Dia. × _____ Dia.	Per Each.
<b>Pay Item No. 506S</b> <b>J</b> _____:	Junction Box, _____ Ft. × _____ Ft.	Per Each.
<b>Pay Item No. 506S</b> <b>B</b> _____:	Box Manhole _____ Ft. × _____ Ft.	Per Each.
<b>Pay Item No. 506S</b>	Major Manhole Height Adjustment, _____	Per Each.

2 _____:	Dia.	
Pay Item No. 506S 4 _____:	Minor Manhole Height Adjustment, _____ Dia.	Per Each.
Pay Item No. 506S AB _____:	Abandonment of existing Manholes:	Per Each.
Pay Item No. 506S EDM _____	Extra Depth of Manhole, _____ Dia.	Per Linear Vert. Foot.
Pay Item No. 506S SL _____:	Structural Lining of _____:	Per Linear Vert. Foot.
Pay Item No. 506S CN _____:	Connection to Existing _____:	Per Each.

**End**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 403S	Concrete For Structures
Item 406S	Reinforcing Steel
Item 402S	Controlled Low Strength Material
Item 410S	Concrete Structures
Item 503S	Frames, Grates, Rings and Covers

Item 504S	Adjusting Structures
Item 507S	Bulkheads
Item 510	Pipe

Texas Department of Transportation Standard Specifications For Construction and Maintenance of Highways, Streets and Bridges

<u>Designation</u>	<u>Description</u>
Item 421	Hydraulic Cement Concrete

City of Austin Utilities Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 2.8.0	Abandonment of Facilities
Subsection 2.8.2	Manholes

City of Austin Water Utility Documents

<u>Designation</u>	<u>Description</u>
SPL WW-146A	Manhole Seals, Plastic, Watertight
SPL WW-511	Lining System for Wastewater Manholes
SPL WW-511A	Structural Lining System for Wastewater Manholes
SPL WW-703	Adjusting (grade) rings for manhole chimney sections

City of Austin Standard

<u>Designation</u>	<u>Description</u>
506S-2	Major Manhole Height Adjustment
506S-4	Minor Manhole Height Adjustment
506S-15	Abandoned Manhole
506S-12	O-Ring Joint Detail, Precast Manhole Section
506S-13	Wedge Seal Joint Detail, Precast Manhole Section Adjustment
506S-15	Abandoned Manhole
804S-4, 5, 6 and 7 of 9	Steel Plating

City of Austin Standard Contract

<u>Designation</u>	<u>Description</u>
00300U	Bid Form (Unit Prices)

American Society for Testing and Materials (ASTM)

<u>Designation</u>	<u>Description</u>
ASTM C 55	Specification for Concrete Building Brick
ASTM C 62	Specification for Building Brick Solid Masonry Units Made from Clay or Shale
ASTM C478/C478M	Standard Specification for Precast Concrete Manhole

ASTM C443/C443M	Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C923/C923M	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures Pipes
ASTM C1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D6132	Specification for Polyethylene Plastics Molding and Extrusion Materials
D4976	Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coating Over Concrete Using an Ultrasonic Gage
<u>American Concrete Institute</u>	
<u>Designation</u>	<u>Description</u>
Item 347	Guide to Formwork for Concrete

<b><u>RELATED CROSS REFERENCE MATERIALS</u></b>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 2	Water and Wastewater Design Criteria
<u>City of Austin Standards</u>	

<u>Designation</u>	<u>Description</u>
1100S-1	Casting Adjustments
503S-4S	Storm Sewer Manhole Ring and 32" Cover
503S-4W	Sanitary Sewer Manhole Ring and 32" Cover
503S-5S	Bolted Storm Sewer Manhole Ring and 32" Cover
503S-5W	Watertight Manhole Ring and 32" Cover (W&WW)
506S-1	Manhole Invert Plan
506S-5	Typical Box Manhole 30" and Larger Pipe
506S-7	Precast Manhole with Drop Inlet on Cast in Place Foundation
506S-8	Precast Manhole with Drop Inlet on Precast Base
506S-9	Precast Manhole On Cast-In-Place Foundation
506S-10	Wastewater Manhole on Precast Base
506S-11	Storm Sewer Manhole Details
<u>American Association of State Highway and Transportation Officials (AASHTO)</u>	
<u>Designation</u>	<u>Description</u>
M306	Standard Specifications for Drainage Structure Castings

## ITEM NO. 508S - MISCELLANEOUS STRUCTURES AND APPURTENANCES 2-24-10

### 508S.1 - Description

This item governs the construction of miscellaneous structures and appurtenances, complete in place or to the stage detailed and/or indicated in the Drawings, using the materials specified herein, including the excavation, installation, backfilling, placement of the concrete and when required, the furnishing and installation of frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated on the Drawings.

This specification is applicable for projects or work involving either SI or inch-pound units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses

### 508S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type of structure and appurtenances (inlets, headwalls, frames, grates, energy dissipators, etc.), construction methods and sequence (precast, cast in place), materials (bolts, nuts, plates, angles, etc.)
- B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.
- C. Proposed proportioning of materials for the mortar mix.
- D. Analysis and thickness calculations for temporary steel covers.

### 508S.3 - Types

The various types of structures and appurtenances such as inlets, headwalls, energy dissipators, etc., are designated on the Drawings by letter or by number for the particular design of structure to be constructed in accordance with the details indicated on the Drawings. Unless otherwise indicated on the Drawings, the Contractor may have the option of furnishing cast in place or precast structures.

### 508S.4 - Materials

#### A. Portland Cement Concrete

The Portland cement concrete shall conform to Item No. 403S, "Concrete For Structures", with the following classes:

Cast in Place Concrete Class A

Precast Concrete Class C

#### B. Mortar

Mortar shall be composed of 1 part Portland cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Standard Specification Item No. 403S, "Concrete for Structures" for fine aggregate. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight (mass) of the total dry mix.

#### C. Reinforcement and Steel

Reinforcing Steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

Structural Steel shall conform to Standard Specification Item No. 720S, "Metal for Structures".

#### D. Frames, Grates, Rings and Covers



Frames, grates, rings and covers shall conform to City of Austin Standard Specification Item No. 503S, "Frames, Grates, Rings and Covers".

E. Safety End Treatment for Structures

The safety end treatment for structures shall conform to TxDOT Specification Item No. 467, "Safety End Treatment".

1. Bolts and Nuts. All bolts, nuts and associated hardware shall meet the specifications of ASTM A 307.
2. Plates and Angles. All plates and similar angles and brackets shall meet the specifications of ASTM A 36.
3. Pipe Runners. Pipe Runners shall conform to the requirements of ASTM A53, Grade B.
4. Galvanizing. All hardware including nuts, bolts and plates listed above shall be galvanized conforming to ASTM A 123 or A 153.

F. Miscellaneous Items

Cast iron for supports, steps and inlet units shall conform to the shape and dimensions indicated on the Drawings. The casting shall be clean and perfect, free from sand or blowholes or other defects. Cast iron castings shall meet the requirements of ASTM A 48, Class 30. Steel for temporary covers when used with stage construction shall be adequate for the loads imposed.

508S.5 - Construction Methods

All concrete work shall be performed in accordance with Standard Specification Item No.410S, "Concrete Structures". Forms will be required for all cast-in-place concrete walls, except where the nature of the surrounding material is such that it can be trimmed to a smooth vertical face (the outside form for concrete bases). Where cast in place concrete is used in wall construction of storm sewers, the steps shall be cast into the wall when the concrete is placed.

The construction inlets shall be completed, as soon as is practicable after installation is complete of the sewer lines in the inlet. All sewer line shall be cut neatly at the inside face of the walls of the inlet and pointed up with mortar.

Bases for cast in place inlets may be placed prior to or at the Contractor's option after the sewer is constructed.

Bases for box sewers shall be cast as an integral part of the sewer. The manholes may be constructed prior to backfilling or if the Contractor so elects, the manhole opening may be covered temporarily with a steel plate to facilitate the compaction of backfill for the sewer as a whole. Thereafter, required excavation for the inlet shall be made and the inlet constructed and backfilled.

The inverts passing out or through an inlet shall be shaped and grouted across the floor of the inlet as indicated on the Drawings. This shaping may be accomplished by adding shaping mortar or concrete after the base is cast or by placing the required additional material with the base.

All miscellaneous structures shall be completed in accordance with the details indicated on the Drawings. Backfilling to original ground elevation shall be in accordance with the provisions of the appropriate items and as directed by the Engineer or designated representative.

Energy dissipators and headwalls shall be constructed in accordance with City of Austin Standard Detail 508S-13.

508S.6 - Measurement

All miscellaneous structures and safety end treatments satisfactorily completed as indicated on the Drawings will be measured as completed units per each.

Concrete removal, excavation and backfill, riprap, pipe, headwalls, wing walls, collars and apron slabs will not be measured under this item but will be included in the unit price bid for the item of construction in which this item is used.

Frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated will not be measured and paid for but shall be included in the unit price bid of one of the pay items identified in the contract bid form.

508S.7 - Payment

A. Inlets

Payment for Inlets of the type indicated in place in accordance with these specifications and measured as prescribed above will be made at the unit bid price for each Inlet, of the type specified.

B. Energy Dissipators and Headwalls

Payment for special complete structures will be made at the unit price bid per each.

C. Safety End Treatment

Payment for Safety End Treatment, complete in place, will be made at the unit bid price for each unit of the type indicated on the Drawings.

Payment will be made under one of the following:

<b>Pay Item No. 508S-E:</b>	Energy Dissipators, _____ In. Dia.	Per Each.
<b>Pay Item No. 508S-H:</b>	Headwalls, Type _____ , _____ In. Dia. Pipe	Per Each.
<b>Pay Item No. 508S-IG:</b>	Inlet, Grated	Per Each.
<b>Pay Item No. 508S-SET</b>	Safety End Treatment, Type _____ Size _____	Per Each.
<b>Pay Item No. 508S-I5R:</b>	Inlet, Recessed	Per Each.
<b>Pay Item No. 508S-I10R:</b>	Inlet, Recessed	Per Each.
<b>Pay Item No. 508S-I15R:</b>	Inlet, Recessed	Per Each.
<b>Pay Item No. 508S-I20R:</b>	Inlet, Recessed	Per Each.
<b>Pay Item No. 508S-I5S:</b>	Inlet, Standard	Per Each.
<b>Pay Item No. 508S-I10S:</b>	Inlet, Standard	Per Each.

<b>Pay Item No. 508S-I15S:</b>	Inlet, Standard	Per Each.
<b>Pay Item No. 508S-I20S:</b>	Inlet, Standard	Per Each.

**End**

<u><b>SPECIFIC CROSS REFERENCE MATERIALS</b></u>	
<u>Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete For Structures
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 720	Structural Steel
Item No. 503S	Frames, Grates, Rings and Covers
<u>TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 467	Safety End Treatment
<u>American Society for Testing and Materials (ASTM)</u>	

<u>Designation</u>	<u>Description</u>
ASTM A36/36M	Specification for Structural Steel
ASTM A48	Specification for Gray Iron Castings
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	Specifications for Carbon Steel Externally Threaded Standard Fasteners
ASTM C913	Specifications for Precast Concrete Water and Wastewater Structures

**RELATED CROSS REFERENCE MATERIALS**

Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"

City of Austin Drainage Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 6.6.0	Energy Dissipators

City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 501S	Jacking or Boring Pipe
Item No. 504S	Adjusting Structures

Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
508S-13	Standard Headwall and Energy Dissipators
510S-1	Concrete Trench Cap
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Section 421.2(5)	Fine Aggregate
Item 424	Precast Concrete Structures (Fabrication)
Item 440	Reinforcing Steel
Item 466	Headwalls and Wingwalls
Item 467	Safety End Treatment
Item 471	Frames, Grates, Rings and Covers
Item 529	Concrete Curb, Gutter and Combined Curb and Gutter



## ITEM NO. 509S - EXCAVATION SAFETY SYSTEMS 9-26-12

### 509S.1 - Description

This item shall govern the designing, furnishing, installing, maintaining and removing or abandoning of temporary Excavation Safety Systems consisting of trench shields, aluminum hydraulic shoring, timber shoring, trench jacks, tied-back or braced sheeting, tied-back slurry walls, soil nailing, rock bolting, tied-back or braced soldier piles and lagging, and other systems for protecting workers in excavations. This item shall also govern the designing and constructing of sloping and benching systems for protecting workers in excavations.

At a minimum, the Excavation Safety Systems shall conform to United States Department of Labor Rules 29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation (hereinafter called OSHA).

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

### 509S.2 - Definitions

**COMPETENT PERSON** shall mean one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The **COMPETENT PERSON** shall be capable of interpreting the manufacturer's data sheets and interpreting and implementing the Excavation Safety System Plan.

An **EXCAVATION** shall mean any cut, cavity, trench, or depression in an earth surface, formed by earth removed by the Contractor. The Contractor shall provide an Excavation Safety System for all excavations except when 1) the excavation is in stable rock as determined by the Texas-licensed Professional Engineer who prepared the Contractor's Excavation Safety System Plan or 2) the excavation is less than 5 feet (1.52 m) in depth and examination of the ground by the Contractor's competent person provides no indication of a potential cave-in.

**TRENCH (TRENCH EXCAVATION)** shall mean any narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth shall be greater than the width, but the trench (measured at the bottom) shall not be wider than 15 feet (4.56 m). Excavation Safety Systems for such trenches shall be defined as Trench Excavation Safety Protective Systems.

If the Contractor installs or constructs forms or other structures in an excavation such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.6 m) or less (measured at the bottom of the excavation), those excavations shall also be defined as a **TRENCH** if workers must enter it. Excavation Safety Systems for such **TRENCHES** shall also be defined as **TRENCH EXCAVATION SAFETY PROTECTIVE SYSTEMS**.

### 509S.3 - Excavation Safety System Plan Submittal

- A. The Notice to Proceed with construction may be issued by the Owner before the Contractor has submitted the necessary Excavation Safety Plan(s); however, excavation shall not proceed until the Owner has received the Contractor's Excavation Safety Plan(s) for the Project.
- B. Prior to Starting Excavation  
Prior to starting any Excavation, the Contractor shall submit to the Owner:
  1. A certificate indicating that the Contractor's Competent Person(s) has completed training in an excavation safety program based on OSHA regulations within the past 5 years.

2. Manufacturer's tabulated data or other tabulated data for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project.

Manufacturer's tabulated data shall meet the requirements in OSHA and shall describe the specific equipment to be used on the Project. Tabulated data must bear the seal of the licensed professional engineer who approved the data. Manufacturer's tabulated data shall be an attachment to the Contractor's Excavation Safety System Plan described below.

#### 509S.4 - Excavation Safety System Plan Review

The Contractor shall prepare an Excavation Safety System Plan (hereafter called the "Plan") specifically for the Project. The Contractor shall retain a Texas-licensed Professional Engineer to prepare the Plan. On City-funded projects, the Contractor must follow qualifications-based procedures to procure the required Professional Engineering services, according to Chapter 2254 of the Texas Government Code.

The Contractor shall be responsible for obtaining geotechnical information necessary for design of the Excavation Safety System. If geotechnical information for design of the Project has been acquired by the Owner or designated representative, it shall be provided to the Contractor for information purposes subject to the provisions of City of Austin Standard Contract Section 00220, "Geotechnical Data."

- A. The Plan for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project shall include:
  1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the required load carrying capacity, dimensions, materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).
  2. Drawings, notes, or tables clearly detailing the specific areas of the Project in which each Excavation Safety System shall be used, the permissible size of the excavation, the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal of the system.
  3. Recommendations and limitations for using the Excavation Safety Systems.
  4. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contract Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least \$1,000,000.
- B. The Plan for Excavation Safety Systems consisting of tied-back or braced sheeting, tied-back or braced soldier piles and lagging, slurry walls, soil nailing, rock bolting or other protective systems that are designed specifically for the Project shall include:
  1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the design assumptions, design criteria, factors of safety, applicable codes, dimensions, components, types of materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).
  2. Detailed technical specifications for the Excavation Safety System addressing the properties of the materials, construction means and methods, quality control and quality assurance testing, performance monitoring, and monitoring of adjacent features, as appropriate.



3. Drawings that clearly detail the specific areas of the Project in which each type of system shall be used and showing the Special Shoring in plan and elevation (vertical profile) views.
4. Drawings, notes or tables clearly detailing the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal or abandonment of the system or parts thereof.
5. Recommendations and limitations for using the Excavation Safety Systems.
6. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contract Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least \$1,000,000.

#### 509S.5 - Excavation Safety System Submittal Review

Review of the Excavation Safety System submittal conducted by the Owner or designated representative shall only relate to conformance with the requirements herein. The Owner's failure to note exceptions to the submittal shall not relieve the Contractor of any or all responsibility or liability for the adequacy of the Excavation Safety System. The Contractor shall remain solely and completely responsible for all Excavation Safety Systems and for the associated means, methods, procedures, and materials.

#### 509S.6 - Contractor's Responsibility

The Contractor shall be responsible for implementing the Excavation Safety System Plan and for confirming that the Excavation Safety System(s) used on the Project meets the requirements of the Plan.

The Contractor's Competent Person(s) shall be on the Project whenever workers are in an excavation meeting the definitions of a Trench given in 509S.2.

#### 509S.7 - Construction Methods

The Contractor's Competent Person(s) shall maintain a copy of appropriate OSHA regulations on-site and shall implement OSHA excavation safety regulations at the work site. The Contractor shall perform all excavation in a safe manner and shall maintain the Excavation Safety Systems to prevent death or injury to personnel or damage to structures, utilities or property in or near excavation.

If evidence of possible cave-ins or earthen slides is apparent or an installed Excavation Safety System is damaged, the Contractor shall immediately cease work in the excavation, evacuate personnel from any potentially hazardous areas and notify the Owner. Personnel shall not be allowed to re-enter the excavation until necessary repairs or replacements are completed and are inspected and approved by the Contractor's Competent Person(s). Repair and replacement of damaged Excavation Safety System shall be at the Contractor's sole expense.

#### 509S.8 - Changed Conditions

When changed conditions require modifications to the Excavation Safety System, the Contractor shall provide to the Owner or designated representative a new design or an alternate Excavation Safety System Plan that is proposed by the Contractor's Excavation Safety System Engineer to address the changed conditions. Copies of the new design or alternate system shall be provided to the Owner or designated representative in accordance with the requirements of section 509S.3, "Excavation Safety System Plan Submittals." A copy of the most current Excavation Safety System Plan shall be maintained on site and made available to inspection and enforcement officials at all times.

Any changes to the Excavation Safety System Plan that are initiated by the Contractor for operational efficiency or as a result of changed conditions, that could be reasonably anticipated, will not be cause for

contract time extension or cost adjustment. When changes to the Excavation Safety System Plan are necessitated by severe and uncharacteristic natural conditions or other conditions not reasonably within the control of the Contractor, the Contractor may make a written request to the Owner for a Change Order to address the anticipated work. The Contractor shall notify the Owner in writing within 24 hours of the occurrence of changed conditions that the Contractor anticipates the submittal of a claim for additional compensation. Under "Changed Conditions" the work deemed immediately necessary by the Contractor to protect the safety of workers and public, equipment or materials may only be accomplished until the Owner or designated representative has a reasonable opportunity to investigate the Contractor's written request for a Change Order and respond in writing to the request.

**509S.9 - Measurement**

Trench Excavation Safety Protective Systems will only be measured and paid for those trenches that workers would reasonably be expected to enter.

Trench Excavation Safety Protective Systems for Trenches excavated to a final width (measured at the bottom of the excavation) not exceeding 15 feet (4.56 m) shall be measured by the linear foot (meter: 1 meter equals 3.281 feet) through manholes, bore pits, receiving pits, and other appurtenances along the centerline of the trench. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

Trench Excavation Safety Protective Systems for Trenches created by installation or construction of forms or other structures in an excavation whose width is greater than 15 feet (4.56 m) such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.56 m) or less (measured at the bottom of the excavation) shall be measured by the linear foot along the centerline of the Trench. Where forms or structures create multiple Trenches in one excavation, each Trench shall be measured separately. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

**509S.10 - Payment**

Payment for Trench Excavation Safety Protective Systems, measured as prescribed above, will be made at unit bid price per centerline linear foot of Trench. The unit bid price shall include full compensation for designing, furnishing, installing the system; for dewatering, and for maintaining, replacing, repairing and removing the Trench Excavation Safety Protective System and for sloping, special clearing, and excavation necessary to safely implement the Excavation Safety System Plan. No payment will be made for Trench Excavation Safety Protective Systems made necessary by the Contractor's selection of an optional design or sequence of work that creates the need for the Trench Excavation Safety Protective System

Payment will be made under the following:

<b>Pay Item No. 509S-1:</b>	Trench Excavation Safety Protective Systems (all depths)	Per Linear Foot.
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**END**

**SPECIFIC CROSS REFERENCE MATERIALS**

Standard Specification Item No. 509S, "Excavation Safety Systems"

City of Austin Standard Contract Documents

<u>Designation</u>	<u>Description</u>
Section 00020	Invitation for Bids
Section 00220	Geotechnical Data
Section 00650	Certificate of Insurance
Section 00700, Article 6.11	Safety and Protection
Section 810	Supplemental General Conditions

29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation

Texas Health and Safety Code Title 9 Chapter 756 Subchapter C

Texas Government Code Chapter 2254

**RELATED CROSS REFERENCE MATERIALS**

Standard Specification Item No. 509S, "Excavation Safety Systems"

Texas Department of Transportation: Standard Specifications For Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item 104	Removing Concrete
Item 110	Excavation
Item 402	Trench Excavation Protection

City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 402S	Controlled Low Strength Material
Item No. 501S	Jacking or Boring Pipe
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 504S	Adjusting Structures
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 506	Manholes

Item No. 507S	Bulkheads
Item No. 510	Pipe
Item No. 511S	Water Valves
Item No. 593S	Concrete Retards
Item No. 594S	Gabions and Revet Mattresses

## ITEM NO. 510 - PIPE 10-3-13

### 510.1 - Description

This item governs the furnishing and installing all pipe and/or materials for constructing pipe mains, sewers, laterals, stubs, inlet leads, service connections, culverts, temporary service lines and temporary diversion lines, including all applicable Work such as excavating, bedding, jointing, backfilling materials, tests, concrete trench cap, concrete cap and encasement, etc., prescribed under this item in accordance with the provisions of the Edwards Aquifer Protection Ordinance, when applicable, and City of Austin Utility Criteria Manual, Section 5, "Working in Public Rights-of-Way." The pipe shall be of the sizes, types, class and dimensions indicated or as designated by the E/A and shall include all joints or connections to new or existing mains, pipes, sewers, manholes, inlets, structures, etc., as may be required to complete the Work in accordance with specifications and published standard practices of the trade associations for the material specified and to the lines and grades indicated. This item shall include any pumping, bailing, and drainage when indicated or applicable. Unless otherwise provided, this item shall consist of the removal and disposition of trees, stumps and other obstructions, old structures or portions thereof such as house foundations, old sewers, masonry or concrete walls, the plugging of the ends of abandoned piped utilities cut and left in place and the restoration of existing utilities damaged in the process of excavation, cutting and restoration of pavement and base courses, the furnishing and placing of select bedding, backfilling and cement or lime stabilized backfill, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated.

### 510.2 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work are of the kind and quality that satisfies the specified functions and quality. Austin Water Utility Standard Products Lists (SPL) form a part of the Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the E/A is still required. Should the Contractor elect to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal. This will expedite the review process in which the E/A, and, if necessary, the Austin Water Utility Standard Products Committee, decides whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project. The purpose of the SPL's is to expedite review, by the E/A and, if necessary, the Austin Water Utility Standard Products Committee, of Contractor product submittals. The SPL's shall not be considered as being a pre-approved list of products necessarily meeting the requirements of the Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A in conjunction with the Austin Water Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

(1) Concrete

Concrete shall conform to Item No. 403S, "Concrete for Structures".

(2) Coarse Aggregate

Coarse aggregate shall conform to Item No. 403S, "Concrete for Structures" or one of the following:

(a) Pipe Bedding Stone

Pipe bedding stone shall be clean gravel, crushed gravel or crushed limestone, free of mud, clay, vegetation or other debris, conforming to ASTM C 33 for stone quality. Size gradation shall conform to ASTM C-33 No. 57 or No. 67 or the following Table:

SIEVE SIZE	% RETAINED BY WEIGHT
1½"	0
1"	0—10
½'	40—85
#4	90—100
#8	95—100

(b) Foundation Rock

Foundation rock shall be well graded coarse aggregate ranging in size from 2 to 8 inches.

(c) Flexible Base

Flexible base shall conform to Item No. 210S, "Flexible Base".

(3) Fine Aggregate

(a) Concrete and Mortar Sand

Fine aggregate shall conform to Item No. 403S, "Concrete for Structures".

(b) Bedding Sand

Sand for use as pipe bedding shall be clean, granular and homogeneous material composed mainly of mineral matter, free of mud, silt, clay lumps or clods, vegetation or debris. The material removed by decantation TxDOT Test Method Tex-406-A, plus the weight of any clay lumps, shall not exceed 4.5 percent by weight.

The resistivity shall not be less than 3000 ohms-cm as determined by TxDOT Test Method Tex-129-E. Size gradation of sand for bedding shall be as follows:

GRADATION TABLE	
SIEVE SIZE	% RETAINED BY WEIGHT
¼"	0
#60	75—100
#100	95—100

(c) Stone Screenings

Stone screenings shall be free of mud, clay, vegetation or other debris, and shall conform to the following Table:

SIEVE SIZE	% PASSING
3/8 "	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

All screenings shall be the result of a rock crushing operation.

(4) Controlled Low Strength Material

Controlled Low Strength Material (CLSM) shall conform to Item 402S, "Controlled Low Strength Material.

(5) Pea Gravel

Pea gravel bedding shall be clean washed material, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris. Stone quality shall meet ASTM C 33. Size gradation shall be as follows:

SIEVE SIZE	% RETAINED BY WEIGHT
3/4"	0
1/2"	0—25
1/4"	90—100



(6) Select Backfill or Borrow

This material shall consist of borrow or suitable material excavated from the trench. It shall be free of stones or rocks over 8 inches and shall have a plasticity index of less than 20. The moisture content at the time of compaction shall be within 2 percent of optimum as determined by TxDOT Test Method Tex-114-E. Sandy loam borrow will not be allowed unless shown on the Drawings or authorized by the E/A.

All suitable materials from excavation operations not required for backfilling the trench may be placed in embankments, if applicable. All unsuitable materials that cannot be made suitable shall be considered surplus excavated materials as described in 510.3(13). The Contractor may, if approved by the engineer, modify unsuitable materials to make them suitable for use. Modification may include drying, removal or crushing of over-size material, and lime or cement treatment.

(7) Cement Stabilized Backfill

When indicated or directed by the E/A, all backfill shall be with cement-stabilized backfill rather than the usual materials. Unless otherwise indicated, cement stabilized backfill material shall consist of a mixture of the dry constituents described for Class J Concrete. The cement and aggregates shall be thoroughly dry mixed with no water added to the mixture except as may be directed by the E/A.

(8) Pipe

General

Fire line leads and fire hydrant leads shall be ductile iron. Domestic water services shall not be supplied from fire service leads, unless the domestic and fire connections are on separately valved branches with an approved backflow prevention device in the fire service branch. All wastewater force mains shall be constructed of ductile iron pipe Pressure Class 250 minimum for pipe greater than 12-inch size and Pressure Class 350 for pipe 12-inch size and smaller. Wastewater pipe shall be in accordance with Austin Water Utility's Standard Products List SPL WW-534 and shall have a corrosion resistant interior lining acceptable to the Owner.

All water pipe within utility easements on private property shall be Ductile Iron Pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and Pressure Class 250 minimum for pipe greater than 12-inch size wrapped as indicated. For sizes over 24 inches, Concrete Pressure Pipe, steel cylinder type, conforming to the requirements of AWWA C-301 will be acceptable.

There may be no service connections to Concrete Pressure Pipe installed in utility easements on private property. Approved service clamps or saddles shall be used when tapping ductile iron pipe 12 inch size and smaller. All service tubing ( $\frac{3}{4}$  inch thru 2 inches) installed in utility easements on private property shall be 150 psi annealed seamless Type K copper tubing with no sweat or soldered joints.

All reclaimed water mains shall be constructed of ductile iron pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and pressure class 250 for pipe greater than 12-inch size. For mains 12-inch size and smaller, PVC pipe, conforming to the requirements of AWWA C-900, DR 14 shall be acceptable. Reclaimed water pipe shall be manufactured purple, painted purple, or wrapped in purple polyethylene film wrap.

Manufacturers of concrete pipe and pipe larger than 24-inch diameter shall have a quality control program consisting of one or more of the following: 1) a quality management system certified by the American National Standards Institute (ANSI) or National Sanitation Foundation (NSF) to comply with ISO 9001:2000, 2) a quality management system certified by the QCast

Program following the requirements of the ACPA Plant Certification Manual, 3) a quality management system certified by the National Precast Concrete Association 4) a quality control program approved by the OWNER prior to submittal of bids for the PROJECT, or 5) an independent, third party quality control testing and inspection firm for testing and inspecting pipe produced for the PROJECT and approved by the OWNER prior to submittal of bids for the PROJECT. All such quality control programs shall be paid for by the manufacturer. It is the intent of this requirement that the manufacturer will document all appropriate tests and inspections with sampling and inspection criteria, frequency of testing and inspection, date of testing and inspection and date on which every piece was manufactured. Required testing and inspection, including that by an independent, third party, shall be performed full-time during production of pipe for the PROJECT. When requested by the OWNER, the manufacturer will provide copies of test data and results and inspection reports with the shipment of pipe for the PROJECT. Test data and results and inspection reports shall be traceable to specific pipe lots or pieces. Owner approval of the manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval in order to retain listing on the applicable SPL. Owner approval of the Concrete Pipe manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval.

The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by the E/A at the pipe manufacturing plant and at the project site prior to and during installation. Plant inspections shall be conducted at the discretion of the City Representative. Only manufacturers having a quality control program of the type described above will be considered as approved providers of concrete pipe and pipe products as listed in the Standard Products List (SPL).

All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc., or shall be Factory Mutual approved for fire service. All water pipe and related products shall be registered by the National Sanitation Foundation as having been certified to meet NSF/ANSI Standard 61.

- (a) Reserved
- (b) Iron Pipe

Iron pipe shall be ductile iron pipe meeting all requirements of standards as follows:

- For push-on and mechanical joint pipe: AWWA C-151
- For flanged pipe: AWWA C-115

Barrels shall have a nominal thickness required by Table 1 of AWWA C-115, which thickness corresponds to Special Class 53 in sizes through 54 inch, and Class 350 in 60 and 64-inch sizes. Flanges shall be ductile iron (gray iron is not acceptable); they shall be as shown in ANSI/AWWA C115/A21.15 and shall conform to dimensions shown in Table 2 and Figure 1 of AWWA C115. These flanges are the same in all respects as flanges shown in ANSI/AWWA C110/A21.10 for fittings and are standard for all flanges used with pipe, valve, and equipment units in the City of Austin water distribution and wastewater force main systems. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S. manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by the Austin Water Utility will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.

- Linings and Coating:

Interior surfaces of all iron potable or reclaimed water pipe shall be cement-mortar lined and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater line and force main pipe shall be coated with a non-corrosive lining material as indicated on Austin Water Utility's Standard Products List SPL WW-534. Pipe exteriors shall be coated as required by the applicable pipe specification. The type and brand of interior lining shall be clearly marked on the outside of the pipe and fittings. Except as authorized by the E/A, only one type and brand of pipe lining shall be used on a given project.

Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile iron pipe shall be minimum Class 250 as defined by ANSI/AWWA C150/A21.50-current; all ductile iron pipe and flanges shall meet the following minimum physical requirements:

Grade 60-42-10:

- Minimum tensile strength: 60,000 psi (414 mPa).
- Minimum yield strength: 42,000 psi (290 mPa).
- Minimum elongation: 10 percent.

The flanges for AWWA C115 pipe may be also be made from:

Grade 70-50-05:

- Minimum tensile strength: 70,000 psi (483 mPa).
- Minimum yield strength: 50,000 psi (345 mPa).
- Minimum elongation: 5 percent.

1. Ductile Iron Fittings:

Fittings shall be push-on, flanged or mechanical joint as indicated or approved and shall meet all requirements of standards as follows:

- Sizes 4 inch through 24 inch: AWWA C-110 or AWWA C-153
- Sizes larger than 24 inch: AWWA C-110.
- Lining and Coating:

Interior surfaces of all iron potable/reclaimed water pipe fittings shall be lined with cement-mortar and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater and force main fittings shall be coated with a non-corrosive lining material acceptable to Owner. Fitting exteriors shall be coated as required by the applicable pipe specification.

2. Joint Materials

Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C-111.

Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used and applicable recommendations of the manufacturer shall be followed.

Gaskets for flanged joints shall be continuous full face gaskets, of 1/8 inch minimum thickness of natural or synthetic rubber, cloth-reinforced rubber or neoprene material,

preferably of deformed cross section design and shall meet all applicable requirements of ANSI/AWWA A21.11/C-111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flanges.

Tee-head bolts, nuts and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile iron conforming to ASTM A 536; either shall be fabricated in accordance with ANSI/AWWA A21.11/C-111.

Hex head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449 SAE Grade 5 plain, and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.

Either Tee-Head or Hex-Head bolts, nuts and washers as required, shall be protected with bonded fluoro-polymer corrosion resistant coating where specifically required by the E/A.

All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable.

### 3. Polyethylene Film Wrap

All iron pipe, fittings and accessories shall be wrapped with standard 8 mil (minimum) low density polyethylene film or 4-mil (minimum) cross laminated high-density polyethylene conforming to AWWA C-105, with all edges overlapped and taped securely with duct tape to provide a continuous wrap to prevent contact between the piping and the surrounding backfill. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling. Polyethylene film wrap for reclaimed water pipe shall be purple.

### 4. Marking

Each pipe joint and fitting shall be marked as required by the applicable AWWA specification. This includes in all cases: Manufacturer's identification, Country where cast, year of casting, and "DUCTILE" or "DI". Barrels of flanged pipe shall show thickness class; others shall show pressure class. The flanges of pipe sections shall be stamped with the fabricators identification; fittings shall show pressure rating, the nominal diameter of openings and the number of degrees for bends. Painted markings are not acceptable.

### 5. Warning Tape

Warning tape for identifying restrained joint pipe and fittings shall be yellow and shall have black lettering at least 2 inches high that reads "Restrained Joint / Junta de Restriccion" at intervals not exceeding 24 inches. The warning tape shall be polypropylene having a minimum thickness of 2 mils, a minimum width of 3 inches, and adhesive backing on the side opposite the lettering.

## (c) Concrete

### 1. General

Pipe shall conform to ASTM C 76 for Circular Pipe. Concrete pipe smaller than 12 inches in diameter shall conform to ASTM C 14, Extra Strength. All pipe shall be machine made or cast by a process which will provide uniform placement of the

concrete in the form and compaction by mechanical devices, which will assure a dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete shall not be acceptable for use in precast pipe. The pipe shall be Class III or the class indicated. Storm sewer pipe shall be of the tongue and groove or O-ring joint design. Wastewater pipe shall be of the O-ring joint design; it shall be acceptably lined for corrosion protection.

2. Marking

Each joint of pipe shall be marked with the pipe class, the date of manufacture, the manufacturer's name or trade mark, diameter of pipe and orientation, if required.

Pipe marking shall be waterproof and conform to ASTM C 76.

3. Minimum Age for Shipment

Pipe shall be considered ready for shipment when it conforms to the tests specified in ASTM C 76.

4. Joint Materials

When installing storm sewers (or storm drains), the Contractor shall have the option of using joints with preformed flexible joint sealants or with rubber gaskets. Preformed flexible joint sealants for storm drain joints shall comply with ASTM C990, and rubber gaskets for storm drain joints shall comply with ASTM C 1619. Mortar shall not be used to seal pre-fabricated joints. Pipe manufacturer shall be responsible for submitting to the Owner a detailed design of the joint upon request. The pipe manufacturer shall be responsible for submitting to the Owner a complete list of joint sizes showing the minimum size of material to be used with each size joint, along with complete instructions on recommended installation procedures. Quality control testing at the manufacturing plant shall be in accordance with Texas Department of Transportation (TxDOT) Departmental Materials Specifications (DMS) 7310, "Reinforced Concrete Pipe And Machine-Made Precast Concrete Box Culvert Fabrication And Plant Qualification". The pipe manufacturer shall be verified as compliant with TxDOT DMS 7310 at time of pipe delivery to the jobsite.

a. Mortar

Mortar for joints shall meet the requirements set forth below in "Mortar".

b. Cold Applied Preformed Plastic Gaskets

Cold Applied Plastic Gaskets shall be suitable for sealing joints of tongue and groove concrete pipe. The gasket sealing the joint shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The gasket joint sealer shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength and shall be supplied in extruded rope form of suitable cross section. The size of the plastic gasket joint sealer shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out around the joint. The gasket joint sealer shall be protected by a suitable removable wrapper that may be removed longitudinally without disturbing the joint sealer to facilitate application.

The chemical composition of the gasket joint sealing compound as shipped shall meet the following requirements:

Composition (% by weight)	Test Method	Typical Analysis
Bitumen (petroleum plastic content)	ASTM D 4	50-70
Ash-inert Mineral Water	Tex-526-C	30-50
Volatile Matter (at 325 F)	Tex-506-C	2.0 Maximum

The gasket joint sealing compound when immersed for 30 days at ambient room temperature separately in 5 percent solution of caustic potash, a mixture of 5 percent hydrochloric acid, a 5 percent solution of sulfuric acid and a saturated H2S solution shall show no visible deterioration.

The physical properties of the gasket joint sealing compound as shipped shall meet the following requirements:

Property	Test Method	Typical Analysis	
		Minimum	Maximum
Specific Gravity at 77 F	ASTM D 71	1.20	1.35
Ductility at 77F (cm) Minimum	Tex-503-C	5.0	
Softening point	Tex-505-C	275 F	
Penetration:			
32 F (300 g) 60 sec	Tex-502-C	75	
77 F (150 g) 5 sec	Tex-502-C	50	120
115 F (150 g) 5 sec	Tex-502-C		150
Flashpoint C.O.C. F	Tex-504-C	600 F	
Fire Point C.O.C. F	Tex-504-C	625 F	

When constructing wastewater lines, the Contractor shall use O-ring gasket joints conforming to ASTM C 443. Just before making a joint, the ends of the pipe shall be clean, dry, free of blisters or foreign matter and shall be wire brushed. For O-ring joints, the gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound to facilitate assembly of the joint. The rubber O-ring gasket shall be stretched uniformly in the joint. Wedge seal type ("Forsheda" pre-lubricated) gaskets may be used if joint details submitted are approved; installation of such gaskets shall be in strict accordance with the manufacturer's recommendations, and shall be the sole element depended upon to make the joint flexible and watertight.

In wastewater lines no horizontal or vertical angles in the alignment of pipes shall be permitted unless indicated. The spigot shall be centered in the bell, the pipe pushed uniformly home and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint.

#### 5. Bends

When horizontal or vertical angles in the alignment of storm sewers are indicated, the bend or angle shall be constructed by cutting on a bias one or both pipes as may be required for the alignment indicated. The pipe cut shall be sufficiently long to allow exposing the reinforcement, which shall be bent, welded and incorporated into the pipe bend and reinforced concrete collar to maintain the structural integrity. The collar shall be 6 inches minimum, reinforced with #4 bars on a 1 foot center both directions. Builder's hardware cloth may be used on the outside of the joint to aid in holding cementing materials in place. Plywood, fiberboard or other materials placed on the inside of the pipe as formwork shall be removed as soon as the joint materials have obtained initial set, after which the inside surface of the pipe joint shall be finished smooth and true to the line and grade established. The Contractor may use prefabricated bends meeting the specification requirements in lieu of field fabricated bends. All bends shall be watertight, have a smooth flow line and be equal or greater in strength to the adjacent pipe.

Horizontal or vertical changes in alignment in wastewater lines shall be accomplished by use of manholes. With the E/A's approval, horizontal changes in alignment may be made by the "Joint Deflection" method. Joint deflection is limited by regulations of the Texas Commission on Environmental Quality (TCEQ) to 80 percent of the maximum recommended by the manufacturer; such deflection may not exceed 5 degrees at any joint. Changes in alignment using pipe flexure shall not be allowed.

#### 6. Sulfide and Corrosion Control

All concrete pipe used for wastewater installations shall be protected from sulfide and corrosion damage by using limestone aggregate.

#### (d) Concrete Steel Cylinder (CSC) Pipe

##### 1. General Requirements

The Contractor shall submit to the E/A for approval along with other required data a tabulated layout schedule with reference to the stationing and grade lines to be used.

The manufacturer shall furnish all fittings and special pieces required for closures, bends, branches, manholes, air valves, blow offs and connections to main line valves and other fittings as indicated.

Each pipe length, fitting and special joint shall have plainly marked on the bell end of the pipe, the head condition for which it is designed. In addition, marking shall be required to indicate the location of each pipe length or special joint in the line and such markings will be referenced to the layout schedules and drawings and submitted for approval.

Concrete steel cylinder fittings shall be tested as required by the applicable AWWA Standards.

## 2. Design and Inspection

Where not otherwise indicated, concrete steel cylinder pipe shall be Class 150, designed to withstand a vacuum of not less than 28 feet of water. Valve reducers, tees and outlets from a pipe run shall be designed and fabricated so that all stresses are carried by the steel forming the fitting or outlet.

Concrete steel cylinder pipe shall meet one of the following specifications:

AWWA C-301 - Any Size

AWWA C-303 - 24-inch maximum size

All pipe flanges shall conform to AWWA C-207, requirements for standard steel flanges of pressure classes corresponding to the pipe class.

Pipe to be installed in a tunnel or encasement shall be manufactured with 1 inch thick by 24-inch wide skid bands of mechanically impacted mortar in addition to the normal coating.

All concrete steel cylinder fittings shall be constructed of steel plate of adequate strength to withstand both internal pressure and external loading. Rod reinforcing shall not be used to figure the required steel area. The fittings shall have a concrete lining and 1 inch minimum coating of cement mortar, except that centrifugally spun lining need not be reinforced.

Minimum lining thickness shall be  $\frac{1}{2}$  inch for 16-inch pipe and  $\frac{3}{4}$  inch for sizes larger than 16-inch pipe. Where it is impractical to place such concrete protection on interior surfaces of small outlets, 2 coats of "Bitumastic Tank Solution" shall be applied.

No fitting shall be made by cutting of standard pipe, except that outlets of less than 75 percent of the pipe diameter may be placed in a standard pipe. Beveled spigots may be placed on standard pipe.

## 3. Joint Materials

Joints shall be of the rubber gasket type conforming to the applicable standards. The inside and outside recesses between the bell and spigot shall be completely filled with Cement Grout in accordance with the pipe manufacturer's recommendations. Grout materials for jointing such pipe, unless otherwise indicated, shall be as described herein.

(e) Reserved

(f) Polyethylene Tubing

### 1. General

All polyethylene (PE) tubing shall be high density, high molecular weight plastic tubing meeting ASTM D2737; it shall be pressure rated at 200 psi working pressure and



must bear the National Sanitation Foundation seal of approval for potable water service. Pipe manufacturers shall be listed on SPL WW-65.

2. Materials

Polyethylene plastics shall be Designation PE3408 (Grade P34 with hydrostatic design stress of 800 psi).

3. Markings

Permanent marking on the tubing shall include the following at intervals of not more than 5 feet:

Nominal tubing size.

Type of plastic material, i.e., PE 3408.

Dimension Ratio (SDR) and pressure rating in psi for water at 73.4 F (e.g., SDR-9, 200 psi).

ASTM D 2737 designation.

Manufacturer's name or trademark, code and seal of approval (NSF mark) of the National Sanitation Foundation.

Polyethylene tubing for reclaimed service lines shall be purple.

4. Tube Size

PE tubing shall be standard copper tube size outside diameter, with Standard Dimension Ratio (SDR) of 9.

(g) Copper Tubing

All copper service tubing shall be annealed seamless Type K water tube meeting ASTM B88 and rated at 150 psi working pressure. The tubing shall be homogenous throughout and free from cracks, holes, crimping, foreign inclusions or other defects. It shall be uniform in density and other physical properties. Copper tubing for reclaimed water shall be wrapped in purple polyethylene film wrap. Pipe manufacturers shall be listed on SPL WW-613.

(h) Service Connection Fittings

All fittings used in customer service connection - tapping mains, connecting meters, etc. - must be currently listed on the applicable Water and Wastewater Standard Products List (SPL WW-68), or called for in the City of Austin Standard Details (520 - series).

(i) Brass Goods

All brass valves, couplings, bends, connections, nipples and miscellaneous brass pipe fittings and accessories used in meter connections, service lines, air release piping assemblies, and wherever needed in the water distribution system, shall conform to the City of Austin Standards, Austin Water Utility Standard Products Lists, and AWWA C-800, except as herein modified or supplemented.

Unless otherwise noted, the goods described herein shall be fabricated of standard Red Brass (Waterworks Brass) meeting ASTM B62 or B584, alloy 83600, consisting of 85 percent copper and 5 percent each of tin, lead and zinc.

Exposed threads shall be covered with plastic caps or sheeting to protect the threads.

Brass goods of each type and class shall be compatible with other fittings in common usage for similar purposes. Where not otherwise indicated, all such materials shall meet the following requirements:

Inlet threads of corporation valves shall be AWWA iron pipe (IP) thread (male); outlets of service saddles shall be tapped with AWWA IP thread (female). AWWA IP threads shall conform to ANSI/ASME B1.20.1 as required by AWWA C800 for "General Purpose (Inch) Pipe Threads". For ¾" and 1" sizes only, corporation valve inlet threads, and the internal threads of saddles may be the AWWA taper thread conforming to AWWA C800 Figure 1 and Table 6. External threads of corporation valve inlet must be compatible with internal threads of the service saddle.

Connections of all new tubing, and of tubing repairs wherever possible, shall be by compression fittings. Compression connections shall be designed to provide a seal and to retain the tubing, without slippage, at a working water pressure of 150 psig.

Flanges shall conform to ANSI B16.1, Class 125, as to dimensions, drillings, etc. Copper tubing, when used, shall be Type K tubing having dimensions and weights given in Table A.1 of AWWA C800.

Brass pipe shall conform to the weights and dimensions for Extra Strong pipe given in Table A.2 of AWWA C800.

All fittings shall be suitable for use at hydrostatic working pressures up to 150 psig (hydrostatic testing of installed systems is at 200 psig).

- (j) Reserved
- (k) Polyvinyl Chloride Potable/Reclaimed Water Pipe

1. General

All polyvinyl chloride (PVC) potable/reclaimed water pipe shall be of the rigid (UNPLASTICIZED) type and must bear the National Sanitation Foundation seal of approval for potable water pipe. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe shall be pressure rated at 200 psi (SDR-14).

Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells with rubber gasket joints. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction. Concrete thrust blocking shall be placed behind bends and tees. Concrete support cradles or blocking shall be required for support of all fire hydrants, valves and AWWA C110 fittings; such support shall be provided for AWWA C153 fittings when required by the E/A.

2. Applicable Specifications

Except as modified or supplemented herein, PVC pipe shall meet the following standards:

AWWA C-900, or SDR 14 for PVC Pressure Pipe, in 4, 6, 8 and 12 inch nominal sizes, having Cast Iron Pipe size outside diameters.

Fittings used with PVC Pressure pipe shall be AWWA C-110 or AWWA C-153 compact ductile iron fittings.

All pipe 4 inches and larger must be approved Underwriter's Laboratories for use in buried water supply and fire protection systems.

3. Material Requirements

All pipe and fittings shall be made from clean, virgin, NSF certified, Class 12454B PVC. Clean reworked materials generated from the manufacturers own production may be used within the current limits of the referenced AWWA C-900.

4. Marking

PVC for reclaimed piping shall be purple or wrapped in purple polyethylene film wrap.

Permanent marking on each joint of pipe shall include the following at intervals of not more than 5 feet:

Nominal pipe size and OD base (e.g., 4 CIPS).

Type of plastic material (e.g., PVC 12454B).

Standard Dimension Ratio and the pressure rating in psi for water at 73 F (e.g., SDR 18, 150 psi).

AWWA designation with which the pipe complies (e.g., AWWA C-900).

Manufacturer's name or code and the National Sanitation Foundation (NSF) mark.

5. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(I) Polyvinyl Chloride (PVC) Pipe (Nonpressure) and Fittings

1. General

PVC sewer and wastewater pipe and fittings 6 through 15 inch diameter shall conform to ASTM D 3034. Pipe shall have minimum cell classification of 12364 or 12454. Fittings shall have cell classification of 12454 or 13343. Pipe stiffness shall be at least 115 psi as determined by ASTM D 2412. Pipe manufacturers shall be on SPL WW-227, and fitting manufacturers shall be on SPL WW-227B.

PVC sewer and wastewater pipe and fittings 18 through 27 inch diameter shall conform to ASTM F 679. Pipe shall have minimum cell classification of 12364 or 12454. Pipe stiffness shall be at least 72 psi as determined by ASTM D 2412. Pipe manufacturers shall be on SPL WW-227A, and fitting manufacturers shall be on SPL WW-227B.

2. Joints

PVC pipe and fitting shall have elastomeric gasket joints conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

3. Pipe Markings

Pipe meeting ASTM D 3034 shall have permanent marking on the pipe that includes the following at intervals of not more than 5 feet:

Manufacturer's name and/or trademark and code.

Nominal pipe size.

PVC cell classification per ASTM D 1784.

The legend "SDR-\_\_ PVC Sewer Pipe" (SDR 26, 23.5. or less is required)

The designation "ASTM D 3034"

Pipe meeting ASTM F 679 shall have permanent marking that includes the following at intervals of not more than 5 feet:

Manufacturer's name or trademark and code

Nominal pipe size

PVC cell classification per ASTM D 1784

Pipe stiffness designation "PS \_\_ PVC Sewer Pipe" (PS of at least 72 is required)

The designation "ASTM F 679"

#### 4. Fitting Markings

Fittings meeting ASTM D 3034 shall have permanent marking that includes the following:

Manufacturer's name or trademark

Nominal size

The material designation "PVC"

The designation, "ASTM F 679"

Fittings meeting ASTM F 679 shall have permanent marking that includes the following:

Manufacturer's name or trademark and code

Nominal size

The material designation "PVC"

The designation "ASTM F 679"

#### 5. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(m) Steel Pipe

1. Standard Weight  
ASTM A 53, Schedule 40.
2. Extra Heavy Weight  
Seamless ASTM A 53, Schedule 80.
3. Encasement Pipe
  - a. For direct-bury installations, pipe shall conform to ASTM A134 with minimum thickness of 3/8 inch (9.5 mm).
  - b. For jacked installations, pipe shall conform to requirements on drawings.
4. Fittings  
Nipples and fittings extra strong Federal Specification WW-N 351 or WW-P 521.
5. Coatings  
Black or galvanized as indicated.

(n) Welded Steel Pipe and Fittings for Water-Pipe

1. General Reference Standards Specification.  
Specifications of the American Water Works Association (AWWA) listed below shall apply to this Section.  
  
C-200 Steel Water Pipe 6 inches and larger.  
  
C-205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 inches and larger, Shop Applied.  
  
C-206 Field Welding of Steel Water Pipe.  
  
C-207 Steel Pipe Flanges for Waterworks Services, Sizes 4 inches through 144 inches.  
  
C-208 Dimensions for Steel Water Pipe Fittings.  
  
C-602 Cement-Mortar Lining of Water Pipelines, 4 inches and larger in Place.
2. Submittals  
Furnish Shop Drawings, product data, design calculations and test reports as described below:
  - a. Certified copies of mill tests confirming the type of materials used in steel plates, mill pipe flanges and bolts and nuts to show compliance with the requirements of the applicable standards.
  - b. Complete and dimensional working drawings of all pipe layouts. Shop Drawings shall include the grade of material, size, wall thickness of the pipe and fittings, type and location of fittings and the type and limits of the lining and coating systems of the pipe and fittings.
  - c. Product data to show compliance of all couplings, supports, fittings, coatings and related items.
3. Job Conditions

- a. The internal design pressure of all steel pipe and fittings shall be as indicated.
  - b. The interior of all steel pipe for potable water, 4 inches and larger, shall be cement-mortar lined.
4. Manufacturing
- a. Description
    - Pipe shall comply with AWWA C-200.
    - (1) Circumferential deflection of all pipe in-place shall not exceed 2.0 percent of pipe diameter.
    - (2) Diameter
      - Nominal pipe diameter shall be the inside diameter of lining or pipe barrel, unless otherwise designated in Job Conditions.
  - b. Wall Thickness
    - (1) Steel pipe wall thickness shall be designed for the internal and external loads specified in this section. The cylinder thickness needed to resist internal pressure shall be based on an allowable stress in the steel equal to  $\frac{1}{2}$  the minimum yield stress of the material used.
5. Fittings
- a. Welded
    - Fabricated steel fittings shall be of the same material as pipe and shall comply with AWWA C-208.
6. Flanges
- a. Flanges shall comply with the requirements of AWWA C-207, Class D or Class E. The class shall be based on operating conditions and mating flanges of valves and equipment.
  - b. Gaskets shall be cloth-inserted rubber, 1/8 inch thick.
  - c. Flanges shall be flat faced with a serrated finish.
7. Pipe Joints
- a. Lap Joints for Field Welding
    - (1) Lap joints for field welding shall conform to AWWA C-206. This item applies only to pipes 72 inches in diameter and larger.
    - (2) The bell ends shall be formed by pressing on a hydraulic expander or a plug die. After forming, the minimum radius of curvature of the bell end at any point shall not be less than 15 times the thickness of the steel shell. Bell ends shall be formed in a manner to avoid impairment of the physical properties of the steel shell. Joints shall permit a lap at least 1  $\frac{1}{2}$  inches when assembled. The longitudinal or spiral weld on the inside of the bell end and the outside of the spigot end on each section of pipe shall be ground flush with the plate surface. The inside edge of the bell and the outside edge of the spigot shall be scarfed or lightly ground to remove the sharp edges or burrs.
  - b. Bell and Spigot Joints with O-Ring Gasket
    - (1) Bell and spigot joints with rubber gasket shall conform to AWWA C-200.

- (2) The bell and spigot ends shall be so designed that when the joint is assembled, it will be self-centered and the gasket will be confined to an annular space in such manner that movement of the pipe or hydrostatic pressure cannot displace it. Compression of the gasket when the joint is completed shall not be dependent upon water pressure in the pipe and shall be adequate to ensure a watertight seal when subjected to the specified conditions of service. Bell and spigot ends shall be welded on preformed shapes. The bell and spigot ends shall conform to the reviewed Shop Drawings.

8. Interior and Exterior Protective Surface Coatings

- a. Exterior Surface to be mortar coated shall conform to AWWA C-205 for shop application and AWWA C-602 for field application. Pipe materials shall be the product of an organization, which has had not less than 5 years successful experience manufacturing pipe materials, and the design and manufacture of the pipe, including all materials, shall be the product of one company.
- b. All surfaces except as noted in c and d below shall receive shop application of mortar lining and coating.
- c. Field Welded Joints. After installation, clean, line and coat unlined or uncoated ends adjacent to welded field joints, including the weld proper, as specified for pipe adjacent to the weld. Potable water only shall be used in the preparation of any cement, mortar, or grout lining.
- d. Machined Surfaces. Shop coat machined surfaces with a rust preventative compound. After jointing surfaces, remaining exposed surfaces shall be coated per a) and b) above.

(o) Corrugated Metal Pipe

1. General

Pipe shall be corrugated continuous lock or welded seam helically corrugated pipe. Corrugated metal pipe may be galvanized steel, aluminized steel or aluminum conforming to the following:

Galvanized Steel AASHTO M 218

Aluminized Steel AASHTO M 274

Aluminum AASHTO M 197

Where reference is made herein to gage of metal, the reference is to U.S. Standard Gage for uncoated sheets. Tables in AASHTO M 218 and AASHTO M 274 list thickness for coated sheets in inches. The Tables in AASHTO M 197 list thickness in inches for clad aluminum sheets.

Sampling and testing of metal sheets and coils used for corrugated metal pipe shall be in accordance with TXDOT Test Method Tex-708-I.

Damaged spelter coating shall be repaired by thoroughly wire brushing the damaged area and removing all loose, cracked or weld-burned spelter coating. The cleaned area shall be painted with a zinc dust-zinc oxide paint conforming to Federal Specifications TT-P 641b. Damaged pipe shall be rejected and removed from the project.

Damaged aluminized coating shall be repaired in accordance with the manufacturer's recommendations.

The following information shall be clearly marked on each section of pipe:

Thickness and corrugations

Trade Mark of the manufacturer

Specification compliance

2. Fabrication

a. Steel Pipe

Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I or Type II as indicated.

It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with continuous helical lock seam or ultra high frequency resistance butt-welded seams.

b. Aluminum Pipe

Pipe shall conform to AASHTO M 196, Type I, circular pipe or Type II, pipe arch as indicated. It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with a continuous helical lock seam.

Portions of aluminum pipe that are to be in contact with high chloride concrete or metal other than aluminum, shall be insulated from these materials by a coating of bituminous material. The coating applied to the pipe or pipe arch to provide insulation between the aluminum and other material shall extend a minimum distance of 1 foot beyond the area of contact.

3. Selection of Gages

The pipe diameter, permissible corrugations and required gauges for circular pipe shall be as indicated on the drawings.

For pipe arch, the span, rise, gage, corrugation size and coating thickness shall be as shown on the drawings. A tolerance of plus or minus 1 inch or 2 percent of equivalent circular diameter, whichever is greater, will be permissible in span and rise, with all dimensions measured from the inside crests of the corrugations.

4. Joint Material

Except as otherwise indicated, coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to AASHTO M 36 for steel pipe and AASHTO M 196 for aluminum pipe. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of soil material during the life of the installation.

Coupling bands shall be not more than 3 nominal sheet thickness lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inch for steel or 0.048 inch for aluminum.

Coupling bands shall be made of the same base metal and coating (metallic or otherwise) as the pipe.

Coupling bands shall lap equally on each of the pipes being connected to form a tightly closed joint after installation.



Pipes furnished with circumferential corrugations shall be field jointed with corrugated locking bands. This includes pipe with helical corrugations, which has reformed circumferential corrugations on the ends. The locking bands shall securely fit into at least one full circumferential corrugation on each of the pipe ends being coupled. The minimum width of the corrugated locking bands shall be as shown below for the corrugation which corresponds to the end circumferential corrugations on the pipes being joined:

10½ inches wide for 2 2/3 inches × ½-inch corrugations.

12 inches wide for 3 inches × 1 inch or 5 inches × 1-inch corrugations.

Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join a new pipe to an existing pipe, which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at the ends shall be field jointed with either helically corrugated bands or with bands with projections or dimples. The minimum width of helically corrugated bands shall conform to the following:

12 inches wide for pipe diameters up to and including 72 inches.

14 inches wide for 1 inch deep helical end corrugations.

Bands with projections shall have circumferential rows of projections with one projection for each corrugation. The width of bands with projections shall be not less than the following:

12 inches wide for pipe diameters up to and including 72 inches.

The bands shall have 2 circumferential rows of projections.

16¼ inches wide for pipe diameters of 78 inches and greater.

The bands shall have 4 circumferential rows of projections.

Unless otherwise indicated, all bolts for coupling bands shall be ½-inch diameter. Bands 12 inches wide or less shall have a minimum of 2 bolts and bands greater than 12 inches wide shall have a minimum of 3 bolts.

Galvanized bolts may be hot dip galvanized conforming to AASHTO M 232, mechanically galvanized to provide the same requirements as AASHTO M 232 or electro-galvanized per ASTM A 164 Type RS.

## 5. Additional Coatings or Linings

### a. Bituminous Coated

Bituminous Coated pipe or pipe arch shall be as indicated both as to base metal and fabrication and in addition shall be coated inside and out with a bituminous coating which shall meet the performance requirements set forth herein. The bituminous coating shall be 99.5 percent soluble in carbon bisulphide. The pipe shall be uniformly coated inside and out to a minimum thickness of 0.05 inch, measured on the crests of the corrugations.

The bituminous coating shall adhere to the metal tenaciously, shall not chip off in handling and shall protect the pipe from deterioration as evidenced by samples prepared from the coating material successfully meeting the Shock Test and Flow Test in accordance with Test Method Tex-522-C.

b. Paved Invert

Where a Paved Invert is indicated, the pipe or pipe arch, in addition to the fully coated treatment described above, shall receive additional bituminous material of the same specification as above, applied to the bottom quarter of the circumference to form a smooth pavement with a minimum thickness of 1/8 inch above the crests of the corrugations.

c. Cement Lined

(1) General

Except as modified herein, pipe shall conform to AASHTO M 36 for lock seam or welded helically corrugated steel pipe. Pipe shall be of full circle and shall be fabricated with two annular corrugations for purposes of joining pipes together with band couplers. Lock seams shall develop the seam strength as required in Table 3 of AASHTO M 36. Concrete lining shall conform to the following:

Composition

Concrete for the lining shall be composed of cement, fine aggregate and water that are well mixed and of such consistency as to produce a dense, homogeneous, non-segregated lining.

Cement

Portland Cement shall conform to AASHTO M 85.

Aggregate

Aggregates shall conform to AASHTO M 6 except that the requirements for gradation and uniformity of gradation shall not apply.

Mixture

The aggregates shall be sized, graded, proportioned and thoroughly mixed with such proportions of cement and water as will produce a homogenous concrete mixture of such quality that the pipe will conform to the design requirements indicated. In no case, however, shall the proportions of Portland Cement, blended cement or Portland Cement plus pozzolanic admixture be less than 470 lb/cu. yd of concrete.

Thickness

The lining shall have a minimum thickness of 1/8 inch above the crest of the corrugations.

Lining Procedures

The lining shall be plant applied by a machine traveling through a stationary pipe. The rate of travel of the machine and the rate of concrete placement shall be mechanically regulated so as to produce a homogenous nonsegregated lining throughout.

Surface Finish

The lining machine shall also mechanically trowel the concrete lining as the unit moves through the pipe.

## Certification

Furnish manufacturer's standard certification of compliance upon request of the purchaser.

## Joints

Pipe shall be joined together with coupling bands made from steel sheets to an indicated thickness of 0.064 inch (12 ga.). Coupling bands shall be formed with two corrugations that are spaced to provide seating in the third corrugation of each pipe end without creating more than ½ inch ± annular space between pipe ends when joined together.

Bands shall be drawn together by two ½ inch galvanized bolts through the use of a bar and strap suitably welded to the band.

When O-ring gaskets are indicated they shall be placed in the first corrugation of each pipe and shall be compressed by tightening the coupling band. Rubber O-ring gaskets shall conform to Section 5.9, ASTM C 361.

### (2) Causes for Rejection

Pipe shall be subject to rejection on account of failure to conform to any of the indications. Individual sections of pipe may be rejected because of any of the following:

Damaged ends, where such damage would prevent making satisfactory joint.

Defects that indicate poor quality of work and could not be easily repaired in the field.

Severe dents or bends in the metal itself.

If concrete lining is broken out, pipe may be rejected or at the discretion of the E/A, repaired in the field in accordance with the manufacturer's recommendation.

Hairline cracks or contraction cracks in the concrete lining are to be expected and does not constitute cause for rejection.

### d. Fiber Bonded

Where fiber bonded pipe is indicated, the pipe or pipe arch shall be formed from sheets whose base metal shall be as indicated. In addition, the sheets shall have been coated with a layer of fibers, applied in sheet form by pressing them into a molten metallic bonding. If a paved invert is indicated it shall be in accordance with the procedure outlined above. The test for spelter coating above is waived for fiber bonded pipe.

## 6. Slotted Drain Storm Sewers

The pipes for the slotted drain and slotted drain outfall shall be helically corrugated, lock seam or welded seam pipe. Materials and fabrication shall be in accordance with the above. The metal thickness shall be a minimum 16 gage.

The chimney assemblies shall be constructed of 3/16 inch welded plate or machine formed 14 gage galvanized steel sheets. The height of the chimney required shall be

as indicated. Metal for the welded plate slot shall meet the requirements of ASTM A 36 and the completed plate slot shall be galvanized after fabrication in accordance with ASTM A 123.

Weld areas and the heat affected zones where the slot is welded to the corrugated pipe shall be thoroughly cleaned and painted with a good quality asphalt base aluminum paint.

7. Mortar

Mortar shall be composed of 1 part Type I Portland Cement and 2 parts clean, sharp mortar sand suitably graded for the purpose and conforming in other respects to the provisions for fine aggregate of Item No. 403, "Concrete for Structures". Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight of the total dry mix.

(9) Geotextile Filter Fabric for Pipe Bedding Material

Geotextile filter fabric for pipe bedding material shall be Hanes Geo Components - TerraTex NO4.5 (AOS US Standard Sieve 70) geotextile fabric or approved equal.

### 510.3 - Construction Methods

(1) General

Prior to commencing this Work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in "General Conditions". Clearing the site shall conform to Item No. 102S, "Clearing and Grubbing". Maintenance of environmental quality protection shall comply with all requirements of "General Conditions" and Item No. 601S, "Salvaging and Placing Topsoil".

The Contractor shall Work such that a reasonable minimum of disturbance to existing utilities will result. Particular care shall be exercised to avoid the cutting or breakage of all existing utilities. If at any time the Contractor's operations damage the utilities in place, the Contractor shall immediately notify the owner of the utility to make the necessary repairs. When active wastewater sewer lines are cut in the trenching operations, temporary flumes shall be provided across the trench while open and the lines shall be restored when the backfilling has progressed to the original bedding lines of the sewer so cut.

The Contractor shall inform utility owners sufficiently in advance of the Contractor's operations to enable such utility owners to reroute, provide temporary detours or to make other adjustments to utility lines in order that the Contractor may Work with a minimum of delay and expense. The Contractor shall cooperate with all utility owners concerned in effecting any utility adjustments necessary and shall not hold the City liable for any expense due to delay or additional Work because of conflicts arising from existing utilities.

The Contractor shall do all trenching in accordance with the provisions and the directions of the E/A as to the amount of trench left unfilled at any time. All excavation and backfilling shall be accomplished as indicated and in compliance with State Statutes.

Where excavation for a pipe line is required in an existing City street, a street cut permit is required and control of traffic shall be as indicated in accordance with the Texas Manual on Uniform Traffic Control Devices.

Wherever existing utility branch connections, sewers, drains, conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the owner of the utility, structure or obstruction involved. In those instances

where their relocation or reconstruction is impractical, a deviation from line and grade will be ordered by the E/A and the change shall be made in the manner directed.

Adequate temporary support, protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished by, and at the expense of, the Contractor and as approved by the E/A.

Where traffic must cross open trenches, the Contractor shall provide suitable bridges in conformance with Standard 804S-4. Adequate provisions shall be made for the flow of sewers; drains and watercourses encountered during construction and any structures, which may have been disturbed, shall be satisfactorily restored upon completion of Work.

When rainfall or runoff is occurring or is forecast by the U.S. Weather Service, the Contractor shall not perform or attempt any excavation or other earth moving Work in or near the flood plain of any stream or watercourse or on slopes subject to erosion or runoff, unless given specific approval by the E/A. When such conditions delay the Work, an extension of time for working day contracts will be allowed in accordance with "General Conditions".

(2) Water Line/New Wastewater Line Separation

Separation between water, reclaimed water, and wastewater lines shall be provided as shown in the Drawings.

Crossings of water, reclaimed water, and wastewater lines shall conform to details in the Drawings.

Wastewater manholes within 9 feet of water and reclaimed water lines shall be made watertight according to details in the Drawings.

(3) Utility and Storm Sewer Crossings

When the Contractor installs a pipe that crosses under a utility or storm sewer structure and the top of the pipe is within 18 inches of the bottom of the structure, the pipe shall be backfilled as shown in the Drawings. When the Contractor installs a pipe that crosses under a utility or storm sewer structure that is not shown in the Drawings, the pipe shall be backfilled as directed by the Engineer. Payment for backfilling pipe at utility or storm sewer structures not shown in the Drawings shall be by Change Order.

(4) Trench Excavation

Excavation in a paved street shall be preceded by saw cutting completely through any asphaltic cement concrete or Portland cement concrete surface, base, or subbase to the underlying subgrade. This requirement shall not apply to excavations made with trenching machines that use a rotating continuous belt or chain for cutting and removing of material.

Underground piped utilities shall be constructed in an open cut in accordance with Federal regulations, applicable State Statutes conforming to Item No. 509S, "Excavation Safety Systems" and with a trench width and depth described below. When pipe is to be constructed in fill above the natural ground, Contractor shall construct embankment to an elevation not less than one foot above the top of the pipe, after which trench is excavated. Required vertical sides shall be sheeted and braced as indicated to maintain the sides of the required vertical excavation throughout the construction period. Adequacy of the design of sheeting and bracing shall be the responsibility of the Contractor's design professional. The Contractor shall be responsible for installation as indicated. After the pipe has been laid and the backfill placed and compacted to 12 inches above the top of the pipe, any sheeting, shoring and bracing required may be removed with special care to insure that the pipe is not disturbed. As each piece of sheeting is removed, the space left by its removal must be thoroughly filled and compacted with suitable material and provisions made to prevent the sides of the trench from caving until the

backfill has been completed. Any sheeting left in place will not be paid for and shall be included in the unit price bid for pipe.

(5) Trench Width

Trenches for water, reclaimed, and wastewater lines shall have a clear width on each side beyond the outside surfaces of the pipe bell or coupling of not less than 6 inches nor more than 12 inches.

Trenches for Storm Sewers up to 42 inches shall have a width of 1 foot on each side beyond the outside surfaces of the pipe. Pipes more than 42 inches shall have a trench width not to exceed 18 inches on each side beyond the outside surfaces of the pipe.

If the trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density as determined by TxDOT Test Method Tex-114-E and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short lengths of pipe and/or bend fittings if necessary.

For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made.

(6) Trench Depth and Depth of Cover

All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.

(a) Where not otherwise indicated, all potable/reclaimed water piping shall be laid to the following minimum depths:

1. Potable/reclaimed water piping installed in undisturbed ground in easements of undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 36 inches of cover.
2. Potable/reclaimed water piping installed in existing streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finish grade.
3. Unless approved by the E/A, installation of potable/reclaimed water piping in proposed new streets will not be permitted until paving and drainage plans have been approved and the roadway traffic areas excavated to the specified or standard paving subgrade, with all parkways and sidewalk areas graded according to any applicable provisions of the drainage plans or sloped upward from the curb line to the right-of-way line at a minimum slope of  $\frac{1}{4}$  inch per foot. Piping and appurtenances installed in such proposed streets shall be laid with at least 36 inches of cover below the actual subgrade.

(b) Where not otherwise indicated, all wastewater piping shall be laid to the following minimum depths:

1. Wastewater piping installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.
2. Wastewater piping installed in existing streets, roads or other traffic areas shall be laid with at least 66 inches of cover.
3. Wastewater piping installed in such proposed streets shall be laid with at least 48 inches of cover below the actual subgrade.

(7) Classification of Excavation

Excavation will not be considered or paid for as a separate item of Work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum Contract prices for the various items of Work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

(8) Dewatering Excavation

Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.

In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of Class B concrete, conforming to Item No. 403, "Concrete for Structures", with a minimum depth of 3 inches.

(9) Trench Conditions

Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.

Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.

Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:

All unstable soils shall be removed to a depth of a minimum 2 feet below bottom of piped utility or as required to stabilize the trench foundation. Such excavation shall be carried out for the entire trench width.

All unstable soil so removed shall be replaced with a concrete seal, foundation rock or coarse aggregate materials placed across the entire trench width in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which shall provide a stable foundation for the utility.

Forms, sheathing and bracing, pumping, additional excavation and backfill required in unstable trench conditions shall be included in the unit price bid for pipe.

(10) Blasting

All blasting shall conform to the provisions of the "General Conditions" and/or "Public Safety and Convenience".

(11) Removing Old Structures

When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan

provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the E/A. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

(12) Lines and Grades

Grades, lines and levels shall conform to the General Conditions and/or "Grades, Lines and Levels". Any damage to the above by the Contractor shall be re-established at the Contractor's expense. The Contractor shall furnish copies of all field notes and "cut sheets" to the City.

The location of the lines and grades indicated may be changed only by direction of the E/A. It is understood that the Contractor will be paid for Work actually performed on the basis of the unit Contract prices and that the Contractor shall make no claim for damages or loss of anticipated profits due to the change of location or grade.

All necessary batter boards or electronic devices for controlling the Work shall be furnished by, and at the expense of, the Contractor. Batter boards shall be of adequate size material and shall be supported substantially. The boards and all location stakes must be protected from possible damage or change of location. The Contractor shall furnish good, sound twilled lines for use in achieving lines and grades and the necessary plummets and graduated poles.

The Contractor shall submit to the E/A at least 6 copies of any layout Drawings from the pipe manufacturer for review and approval. The Contractor shall submit the layout Drawings at least 30 days in advance of any actual construction of the project. The E/A will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the E/A for his acceptance. Prior to commencement of the Project, reviewed layout Drawings will be sent to the Contractor marked for construction.

Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractor's procedures modified to the satisfaction of the E/A. No additional compensation shall be paid for the removal and relaying of pipe required above.

(13) Surplus Excavated Materials

Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the E/A and shall become the property of the Contractor to dispose of off site at a permitted fill site, without liability to the City or any individual. Such surplus material shall be removed from the Work site promptly following the completion of the portion of the utility involved.

(14) Pipe Bedding Envelope

Pipe shall be installed in a continuous bedding envelope of the type shown on the drawings or as described herein. The envelope shall extend the full trench width, to a depth of at least 6 inches (150 mm) below the pipe and to a depth of the springline of storm water pipe and at least 12 inches (300 mm) above water, reclaimed, and wastewater pipe.

(a) Standard Bedding Materials

USE/PIPE	Cement	Natural or	Pea	PIPE BEDDING STONE
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MATERIAL	Stabilized Backfill	Mf'd Sand	Gravel	Uncrushed Gravel	Crushed Gravel	Crushed Stone	Stone Screenings
<b>WATER and RECLAIMED WATER</b>							
Welded Steel	X					X	
Service Tubing ¾" to 2½"		X	X				X
<b>WATER and RECLAIMED WATER (Ductile Iron)</b>							
Up to 15 Inch ID		X	X	X			X
Larger Than 15 Inch ID			X	X			
<b>WATER and RECLAIMED WATER (PVC only) and WASTEWATER</b>							
Up to 15 Inch ID		X	X	X	X	X	X
Larger Than 15 Inch ID			X	X	X	X	
<b>STORMWATER</b>							
Concrete		X	X	X	X	X	X
Metal		X	X	X			X

(b) General requirements and limitations governing bedding selection.

- (1) Crushed gravel or crushed stone shall not be used with polyethylene tubing or polyethylene film wrap.
- (2) Uncrushed gravel may be used with polyethylene film wrap in trenches up to 6 feet deep and in deeper trenches where ample trench width, a tremmie, or conditions will allow controlled placement of the gravel without damaging the polyethylene wrap.

- (3) Bedding shall be placed in lifts not exceeding 8 inches loose thickness and compacted thoroughly to provide uniform support for the pipe barrel and to fill all voids around the pipe.
  - (4) Pea Gravel or bedding stone shall be used in blasted trenches.
- (c) Requirements to prevent particle migration.

Bedding material shall be compatible with the materials in the trench bottom, walls and backfill so that particle migration from, into or through the bedding is minimized. The E/A may require one or more of the following measures to minimize particle migration: use of impervious cut-off collars; selected bedding materials, such as pea gravel or bedding stone mixed with sand; filter fabric envelopment of the bedding; cement stabilized backfill; or other approved materials or methods. Measures to minimize particle migration will be shown on the Drawings or designated by the E/A, and, unless provisions for payment are provided in the contract documents, the cost of these measures shall be agreed by change order. The following limitations shall apply.

- (1) Sand, alone, shall not be used in watercourses, in trenches where groundwater is present, or in trenches with grades greater than 5 percent.
- (2) Pea gravel or bedding stone, alone, shall not be used in the street right-of-way within 5 feet of subgrade elevation in trenches that are 3 feet or wider.
- (3) Each gravel or bedding stone, alone, shall not be used where the trench bottom, sides, or backfill is composed of non-cementitious, silty or sandy soils having plasticity indices less than 20, as determined by the E/A.
- (4) Sand, alone, shall not be used for installation of concrete storm water pipe unless the bedding envelope is wrapped with a geotextile membrane and the joints of the stormdrain conduit are wrapped to prevent the migration of fines into the bedding envelope and into the stormdrain conduit.
- (5) For concrete storm water pipe, if pea gravel, uncrushed gravel, crushed gravel, crushed stone, or combination thereof is used for pipe bedding material, a geotextile filter fabric shall be placed around the perimeter of the joint.

(15) Laying Pipe

No pipe shall be installed in the trench until excavation has been completed, the bottom of the trench graded and the trench completed as indicated.

Laying of corrugated metal pipes on the prepared foundation shall be started at the outlet end with the separate sections firmly joined together, with outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides. Any metal in joints, which is not protected by galvanizing, shall be coated with suitable asphaltum paint. Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trench without damaging the pipe or disturbing the prepared foundation and the sides of the trench. Any pipe which is not in alignment or which shows any undue settlement after laying or damage, shall be taken up and re-laid without extra compensation.

Multiple installations of corrugated pipe or arches shall be laid with the centerlines of individual barrels parallel. When not otherwise indicated, clear distances of 2 feet between outer surfaces of adjacent pipes shall be maintained.

No debris shall remain in the drainways or drainage structures.

All recommendations of the manufacturer shall be carefully observed during handling and installation of each material. Unless otherwise indicated, all materials shall be delivered to the project by the manufacturer or agent and unloaded as directed by the Contractor. Each piece shall be placed facing the proper direction near to where it will be installed.

The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times and stored in a manner that will protect them from damage. Stockpiled materials shall be stacked so as to minimize entrance of foreign matter.

The interior of all pipeline components shall be clean, dry and unobstructed when installed.

Piping materials shall not be skidded or rolled against other pipe, etc. and under no circumstances shall pipe, fittings or other accessories be dropped or jolted.

During handling and placement, materials shall be carefully observed and inspected and any damaged, defective or unsound materials shall be marked, rejected and removed from the job site. Minor damage shall be marked and repaired in a manner satisfactory to the E/A. Joints, which have been placed, but not joined, backfilled, etc., shall be protected in a manner satisfactory to the E/A.

(16) Assembling of Pipe

Angular spacing of all joints shall meet the manufacturer's recommendations for the pipe and accessories being used. Side outlets shall be rotated so that the operating stems of valves shall be vertical when the valves are installed. Pressure pipe shall be laid with bell ends facing the direction of pipe installation. Pipe end bells shall be placed upgrade for all wastewater lines.

Orientation marks, when applicable, shall be in their proper position before pipe is seated.

Before joining any pipe, all foreign matter, lumps, blisters, excess coal tar coating, oil or grease shall be removed from the ends of each pipe and the pipe ends shall then be wire brushed and wiped clean and dry. Pipe ends shall be kept clean until joints are made.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing or other materials shall be placed in the pipe.

(17) Joints

(a) Mortar (Storm Drain joints only)

Pipe ends shall be clean, free of asphalt or other contaminants, which will inhibit the bond of the mortar to the pipe. The pipe ends shall be moistened immediately prior to placing the mortar in the joint.

(b) Cold Applied Preformed Plastic Gaskets (Storm Drain joints only)

The pipe ends shall be clean and the joint material applied to the dry pipe. In cold weather, the joint material shall be heated to facilitate the seal of the joint.

(c) O-Ring and Push-on Joints

Just before making a joint the ends of the pipe shall be clean, dry, free of any foreign matter, lump blisters, excessive coal tar coating and grease or oil and shall be wire brushed. The gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound (Flax Soap) to facilitate telescoping the joints. The rubber gasket if not factory installed shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the groove. The spigot shall be centered in the bell, the pipe pushed home uniformly and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint. Care should be taken to prevent dirt or foreign matter from entering the joint space.

(d) Bolted Joints

All flanged, mechanical or other bolted joints shall be joined with nuts and bolts and be coated as indicated above in Iron Pipe.

(e) Storm Drain Joints

Storm drain joints sealed with preformed flexible joint sealants shall be provided and installed in compliance with ASTM C990. Storm drain joints sealed with rubber gaskets shall comply with ASTM C443. Install joint sealants in accordance with the pipe and joint sealant manufacturers' recommendations. Place the joint sealer so that no dirt or other deleterious materials come in contact with the joint sealing material. Pull or push home the pipe with enough force to properly seal the joint with the final joint opening (gap) on the inside of the installed pipe being less than or equal to the pipe manufacturer's recommended dimensions. Protrusion of joint material greater than 1/8 " into the interior of the pipe will not be accepted. Excess joint material will be removed to within 1/8 " of pipe surface. Observe joint sealant manufacturer's recommendations for installation temperature of the joint sealant. Apply joint sealant to pipe joint immediately before placing pipe in trench, and then connect pipe to previously laid pipe.

If inspection (video or other means) reveal C-990 joints that show signs of backfill infiltration, or where joints or conduits exhibit excessive joint gap or are otherwise defective, then the contractor has the following options:

1. Conduits less than 36-inches in any dimension: pour a concrete collar around the joint or wrap joint with a wrap meeting requirements of ASTM C-877 or approved equal.
2. Conduits greater than or equal to 36-inches in all dimensions: repair joints using joint repair techniques recommended by the manufacturer to achieve a completed system that meets all Contract requirements.

(18) Pressure Pipe Laying

(a) Grout for Concrete Steel Cylinder Pipe (CSC) and Welded Steel Pipe

Aggregate, cement, etc., shall be as indicated in "Mortar" herein. Potable water shall be used in the preparation of any cement, mortar, or grout lining.

Grout shall be poured into the recess between the bell and spigot on the outside of the pipe and contained by a joint wrapper ("diaper") recommended by the pipe manufacturer. The wrapper shall have a minimum width of 7 inches for 30 inch and smaller and 9 inches for larger pipe, secured to the pipe by "Band Iron" steel straps. The grout shall be poured in one continuous operation in such manner that after shrinkage and curing the joint recess shall be completely filled.

Mortar for the inside recess shall be of the consistency of plaster. The inside recess between the bell and spigot shall be filled with mortar after the pipe joint on either side of the recess has been backfilled and well tamped with no less than one pipe joint installed ahead of the pipe forming the recess. The mortar shall completely fill the recess and shall be trowelled and packed into place and finished off smooth with the inside of the pipe.

The Contractor shall inspect the joint after the mortar has set and make repairs of any pockets, cracks or other defects caused by shrinkage to the satisfaction of the E/A. The inside surface shall be cleared of any mortar droppings, cement, water, slurry, etc., before they have become set and shall be cleared of any other foreign matter. The inside surface of the pipe shall be left clean and smooth.

Pipe shall be handled at all times with wide non abrasive slings, belts or other equipment designed to prevent damage to the coating and all such equipment shall be kept in such repair that its continued use is not injurious to the coating. The use of tongs, bare pinch-bars, chain slings, rope slings without canvas covers, canvas or composition belt slings with protruding rivets, pipe hooks without proper padding or any other handling equipment, which the E/A deems to be injurious to the coating, shall not be permitted. The spacing of

pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the cement mortar lining.

(19) Placing Pipe in Tunnels

Piping installed as a carrier pipe in a tunnel, encasement pipe, etc., shall have uniform alignment, grade, bearing and conform to the reviewed Shop Drawings. All necessary casing spacers, bedding material, grout cradle or paving, bracing, blocking, etc., as stipulated by the Contract or as may be required to provide and maintain the required pipe alignment and grade, shall be provided by the Contractor at no cost except as provided by the Bid Items. This shall include casing spacers acceptable to the Owner attached to the carrier pipe in accordance with the manufacturer's recommendations. The insertion pushing forces shall not exceed the pipe manufacturer's recommendation. Such carrier piping shall have flexible bolted or gasketed push-on joints or Concrete Steel Cylinder pipe installed as follows:

(a) 21 Inch Pipe and Smaller

Prior to placing the pipe in the tunnel, the inside joint recess at the bell shall be buttered with cement mortar.

After the joint is engaged, the excess mortar shall be smoothed by pulling a tight fitting swab through the joint. Cement mortar protection shall then be placed in the normal manner to the exterior of the joint and allowed to harden sufficiently to avoid dislodgment during installation. If time is of the essence, a quick setting compound may be used.

(b) 24 Inch Pipe and Larger

Each length of pipe shall be pushed into the tunnel as single units. A flexible mastic sealer shall be applied to the exterior of the joint prior to joint engagement. The surfaces receiving the mastic sealer shall be cleaned and primed in accordance with the manufacturer's recommendation. Sufficient quantities of the mastic sealer shall be applied to assure complete protection of all steel in the joint area. The interior of the joint shall be filled with cement mortar in the normal manner after the pipe is in its final position within the tunnel.

(20) Temporary Pipe Plugs, Caps, Bulkheads and Trench Caps

Temporary plugs, caps or plywood bulkheads shall be installed to close all openings of the pipe and fittings when pipeline construction is not in progress.

All temporary end plugs or caps shall be secured to the pipe as provided under Item No. 507, "Bulkheads".

Trench caps shall be reinforced Class D concrete as indicated.

(21) Corrosion Control

(a) Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other iron or steel components buried and in contact with earth or backfill shall be wrapped with 8-mil (minimum) polyethylene film meeting ANSI/AWWA C-105 to provide a continuous wrap.

(22) Pipe Anchorage, Support and Protection

Pressure pipeline tees, plugs, caps and bends exceeding 22½ degrees; other bends as directed shall be securely anchored by suitable concrete thrust blocking or by approved metal harness. Unless otherwise indicated, on 24 inch or larger piping, all bends greater than 11 ¼ degrees shall be anchored as described herein.

Storm sewers on steep grades shall be lugged as indicated.

(a) Concrete Thrust Blocking

Concrete for use as reaction or thrust blocking shall be Class B conforming to Item No. 403, "Concrete for Structures".

Concrete blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as indicated or directed by the E/A. The blocking shall, unless otherwise indicated, be so placed that the pipe, fittings and joints will be accessible for repair.

The trench shall be excavated at least 6 inches outside the outermost projections of the pipe or appurtenance and the trench walls shaped or undercut according to the detail Drawings or as required to provide adequate space and bearing area for the concrete.

The pipe and fittings shall be adequately weighted and laterally braced to prevent floating, shifting or straining of the pipeline while the concrete is being placed and taking initial set. The Contractor shall be solely responsible for the sufficiency of such restraints.

(b) Metal Thrust Restraint

Fabricated thrust restraint systems such as those described below may be approved for use instead of concrete blocking. To obtain approval, the project Drawings must include sufficient drawings, notes, schedules, etc., to assure that the proposed restraints as installed will be adequate to prevent undesirable movement of the piping components. Such restraint systems may only be used where and as specifically detailed and scheduled on approved Project Drawings.

1. Thrust Harness

A metal thrust harness of tie rods, pipe clamps or lugs, turnbuckles, etc., may be approved. All carbon steel components of such systems, including nuts and washers, shall be hot-dip galvanized; all other members shall be cast ductile iron. After installation, the entire assembly shall be wrapped with 8-mil polyethylene film, overlapped and taped in place with duct tape to form a continuous protective wrap.

2. Restrained Joints

Piping or fitting systems utilizing integral mechanically restrained joints may be approved. All components of such systems shall be standard manufactured products fabricated from cast ductile iron, hot-dip galvanized steel, brass or other corrosion resistant materials and the entire assembly shall be protected with a continuous film wrap as described for 1. above. Manufacturers of pipe with restrained joints integral to the pipe shall be listed on SPL WW-27F. All pipe and fitting systems with restrained joints shall be identified by applying an adhesive-backed warning tape to the top of the pipe and for the full length of the pipe, regardless of the type of pipe. For plastic pipes the warning tape shall be applied directly to the top of the pipe. For metal pipes and fittings the warning tape shall be applied to the top of the polyethylene film wrap. The warning tape shall conform to 510.2(8)(b)5.

Location, configuration and description of such products shall be specifically detailed on the Drawings. (Add-on attachments such as retainer glands, all-thread rods, etc., are not acceptable.)

(c) Concrete Encasement, Cradles, Caps and Seals

When trench foundation is excessively wet or unstable or installation of water or wastewater pipe will result in less than 30 inches of cover, Contractor shall notify E/A. E/A may require Contractor to install a concrete seal, cradle, cap, encasement or other appropriate action.

All concrete cap, etc., shall be continuous and begin and end within 6 inches of pipe joints. Concrete cap, cradle and encasement shall conform to City of Austin Standard No. 510S-1, "Concrete Trench Cap". The pipe shall be well secured to prevent shifting or flotation while the concrete is being placed.

(d) Anchorage Bulkheads

Concrete bulkheads keyed into the undisturbed earth shall be placed as indicated to support and anchor the pipe and/or backfill against end thrust, slippage on slopes, etc. Concrete material and placement shall be Class A, Item No. 403, "Concrete for Structures".

(e) Trench Caps, Concrete Rip-Rap and Shaped Retards

Where called for by the Contract or as directed by the E/A, concrete trench caps, concrete rip-rap and/or shaped retards shall be placed as detailed by the Drawings as protection against erosion. Concrete material and placement shall be Class B, Item No. 403, "Concrete for Structures".

(23) Wastewater Connections

(a) Connections to Mains 12 Inches and Smaller

All branch connections of new main lines shall be made by use of manholes.

Service stubs shall be installed as indicated. Minimum grade shall be 1 percent downward to main and minimum cover shall be 4½ feet at the curb. Standard plugs shall be installed in the dead end before backfilling.

Where a service connection to a main 12 inches or smaller is indicated, a wye, tee or double wye shall be installed.

Where a service connection to a main 15 inches or larger is indicated, a field tap may be made with the pipes installed crown to crown. The tap should be made conforming to the pipe manufacturer's recommendations with the E/A's approval.

Where not otherwise indicated, (wastewater) service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

(b) Connections to the Existing System

Unless otherwise specified by the E/A, all connections made to existing mains shall be made at manholes with the crown of the inlet pipe installed at the same elevation as the crown of the existing pipe. Service stubs installed on the existing system shall be installed by use of tapping saddles unless otherwise approved by the E/A. Extreme care shall be exercised to prevent material from depositing in the existing pipe as the taps are being made.

When connections to existing mains are made, a temporary plug approved by the E/A must be installed downstream in the manhole to prevent water and debris from entering the existing system before Final Completion. These plugs shall be removed after the castings are adjusted to finish grade or prior to Final Completion.

(c) Connecting Existing Services to New Mains

Where wastewater services currently exist and are being replaced from the main to the property line, those services shall be physically located at the property line prior to installing any new mains into which the services will be connected. Where wastewater services currently exist but are not being replaced to the property line, those services shall

be physically located at the point of connection between the new and existing pipes prior to installing any new mains into which the services will be connected.

(24) Potable or Reclaimed Water System Connections

All necessary connections of new piping or accessories to the existing potable or reclaimed water system shall be made by, and at the expense of, the Contractor. To minimize any inconvenience from outages, the Contractor shall schedule all such connections in advance and such schedule must be approved by the E/A before beginning any Work.

(a) Shutoffs

The City will make all shutoffs on existing potable or reclaimed water mains. The Contractor shall be required to notify the Owner's Representative in writing a least twenty five (25) Calendar Days prior to the anticipated date for a wet-connection. The Owner's Representative is defined as the City Inspector. The Owner's Representative will notify any affected utility customers at least 48 hours prior to the shutoff. Austin Water (AW) will make the shutoff after ensuring that all appropriate measures have been taken to protect the potable or reclaimed water system, customers and employees.

The City will operate all valves to fill existing mains. Where a newly constructed main has not been placed in service and has only one connection to the potable or reclaimed system, the Contractor may operate one valve to fill the main after approval has been obtained from AW. The operation of the valve is to be conducted under the immediate supervision of the Owner's Representative.

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(b) Wet Connections to Existing Potable or Reclaimed Water System

The Contractor shall make all wet connections called for by the Contract or required to complete the Work. Two connections to an existing line performed during the same shutout, at the same time and at a distance less than 50 linear feet apart, will be considered one wet connection. Two connections to an existing line performed during the same shutout, at the same time and at a distance equal to, or greater than 50 linear feet will be considered two wet connections. A wet connection shall include draining and cutting into existing piping and connecting a new pipeline or other extension into the existing pressure piping, forming an addition to the potable or reclaimed water transmission and distribution network.

The Contract price for wet connections shall be full payment for all necessary shutoffs, excavation, removing plugs and fittings, pumping water to drain the lines, cutting in new fittings, blocking and anchoring piping, bedding and backfilling, placing the lines and service and all site cleanup.

No water containing detectable amounts of chlorine may be drained, released or discharged until specific planning and appropriate preparations to handle, dilute and dispose of such chlorinated water are approved in advance by the City and the disposal operations will be witnessed by an authorized representative from the City.

(c) Pressure Taps to Existing Potable or Reclaimed Water System

The Contractor shall make all pressure taps called for by the Contract Documents or required to complete the Work. A pressure tap shall consist of connecting new piping to the existing potable or reclaimed water system by drilling into the existing pipe while it is carrying water under normal pressure without taking the existing piping out of service.



Unless otherwise provided by the Contract, the Contractor shall, at the Contractor's expense, perform all necessary excavation, furnish and install the tapping sleeve, valve and accessories, provide the tapping machine, drill the tap and shall block, anchor and backfill the piping, valve and all accessories, place the new piping in service and perform all site cleanup. When the City makes the tap, City forces are not obligated or expected to perform any Work except to provide tapping machine and drill the actual hole. If City crews are to make the tap, fiscal arrangements must be made in advance at the Taps Office, Waller Creek Center, 625 East 10th Street.

If a private Contractor makes the tap, an AW Inspector must be present. "Size on size" taps will not be permitted, unless made by use of an approved full bodied mechanical joint tapping sleeve. Concrete blocking shall be placed behind and under all tap sleeves 24 hours prior to making the wet tap.

(d) Service Connections

Service connection taps into PVC or AC pipe or into CI or DI pipe 12 inches or smaller shall be made using either a service clamp or saddle or a tapping sleeve as recommended by the pipe manufacturer and as approved by the E/A. Direct tapping of these pipes will not be permitted.

All potable or reclaimed water service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

Precautions should be taken to ensure that the tapping saddle or sleeve is placed on the pipe straight to prevent any binding or deformation of the PVC pipe. The mounting chain or U-bolt strap must be tight.

Tapping shall be performed with a sharp shell type cutter so designed that it will smoothly penetrate heavy walled PVC DR14 and 200 psi AC and will retain and extract the coupon from the pipe.

(25) Backfilling

(a) General

Special emphasis is placed upon the need to obtain uniform density throughout the backfill material. The maximum lift of backfill shall be determined by the compaction equipment selected and in no case shall it exceed 18 inches, loose measurement.

No heavy equipment, which might damage pipe, will be allowed over the pipe until sufficient cover has been placed and compacted. All internal pipe bracing installed or recommended by the manufacturer shall be kept in place until the pipe bedding and trench backfill have been completed over the braced pipe section. Testing of the completed backfill in streets and under and around structures shall meet the specified density requirements. Initial testing shall not be at Contractor's expense and shall conform to the "General Conditions."

(b) General Corrugated Metal Pipe

After the corrugated metal pipe structure has been completely assembled on the proper line and grade and headwalls constructed where indicated; selected material free from rocks over 8 inches in size from excavation or borrow, as approved by the E/A, shall be placed along both sides of the completed structures equally, in uniform layers not exceeding 6 inches in depth (loose measurement), sprinkled if required and thoroughly compacted between adjacent structures and between the structures and the sides of the trench.

Backfill material shall be compacted to the same density requirements as indicated for the adjoining sections of embankment in accordance with the governing specifications thereof. Above the  $\frac{3}{4}$  point of the structure, the fill shall be placed uniformly on each side of the pipe in layers not to exceed 12 inches, loose measure.

Prior to adding each new layer of loose backfill material, until a minimum of 12 inches of cover is obtained over the crown of the pipe, an inspection will be made of the inside periphery of the corrugated metal structure to determine if any floating, local or unequal deformation has occurred as a result of improper construction methods.

(c) Backfill Materials

The E/A may approve any of the following well graded materials:

1. Select trench material
2. Sand
3. Crushed rock cuttings
4. Rock cuttings
5. Foundation Rock
6. Blasted material with fines and rock
7. Cement stabilized material
8. Borrow

Within the 100-year flood plain, sand will not be permitted for backfilling. The E/A will approve the topsoil for areas to be seeded or sodded.

(d) Backfill in Street Right of Way

Placement of backfill under existing or future pavement structures and within 2 feet of any structures shall be compacted to the required density using any method, type and size of equipment, which will give the required compaction without damaging the pipe or bedding. Placement of backfill greater than 2 feet beyond structures in Right of Way shall be conform to (g) below. The depth of layers, prior to compaction, shall depend upon the type of sprinkling and compacting equipment used and the test results thereby obtained. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept level to insure uniform compaction over the entire layer. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

Each layer of backfill must provide the density as required herein. Swelling soils (soils with plasticity index of 20 or more) shall be sprinkled as required to provide not less than optimum moisture nor more than 2 percent over optimum moisture content and compacted to the extent necessary to provide not less than 95 percent nor more than 102 percent of the density as determined in accordance with Test Method Tex-114-E. Non-swelling soils (soils with plasticity index less than 20) shall be sprinkled as required and compacted to the extent necessary to provide not less than 95 percent of the density as determined in accordance with Test Method Tex-114-E.

After each layer of backfill is complete, tests may be made by the E/A. If the material fails to meet the density indicated, the course shall be reworked as necessary to obtain the indicated compaction and the compaction method shall be altered on subsequent Work to obtain indicated density.

At any time, the E/A may order proof rolling to test the uniformity of compaction of the backfill layers. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

Should the backfill, due to any reason, lose the required stability, density or finish before the pavement structure is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent backfill layer or granular material. Excessive loss of moisture shall be construed to exist when the subgrade soil moisture content is more than 4 percent below the optimum of compaction ratio density. Backfill shall be placed from the top of the bedding material to the existing grade, base course, subgrade or as indicated. The remainder of the street backfill shall be Flexible Base, Concrete or Hot Mix Asphalt Concrete as indicated or to be replaced in kind to the surface removed to construct the pipe.

(e) Backfill in County Street or State Highway Right of Way

All Work within the right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the County when their requirements are more stringent. Prior to the start of construction, the Contractor shall be responsible for contacting the appropriate TxDOT office or County Commissioner's Precinct Office and following the operating procedures in effect for utility cut permits and pavement repair under their jurisdiction. Approval for all completed Work in the State or County right-of-way shall be obtained from the appropriate Official prior to final payment by the Owner.

(f) Backfill in Railroad Right-of-Way

All Work within the railroad right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the Railroad Owner when their requirements are more stringent. Approval for all completed Work in the railroad right of way shall be obtained from the Railroad prior to Final Completion.

(g) Backfill in Easements

Where not otherwise indicated, Contractor may select whatever methods and procedures may be necessary to restore entire Work area to a safe, useful and geologically stable condition with a minimum density of 85 percent or a density superior to that prior to construction.

In and near flood plain of all streams and watercourses, under or adjacent to utilities, structures, etc. all backfill shall be compacted to a density of not less than 95 percent conforming to TxDOT Test Method Tex-114-E, unless otherwise directed by E/A.

All soil areas disturbed by construction shall be covered with top soil and seeded conforming to Item No. 604, "Seeding for Erosion Control". All turf, drainways and drainage structures shall be constructed or replaced to their original condition or better. No debris shall remain in the drainways or drainage structures.

(h) Temporary Trench Repair/Surfacing

If details of temporary trench repair/surfacing are not provided in the contract documents, the Contractor shall submit for approval of the E/A (1) a plan for temporary trench repair for areas that will be open to traffic but will be excavated later for full depth repair, and (2) a proposed method for covering trenches to maintain access to properties. The temporary surfacing shall afford a smooth riding surface and shall be maintained by the Contractor the entire time the temporary surface is in place.

(i) Permanent Trench Repair

The Contractor shall install permanent trench repairs conforming to details in the drawings.

(26) Quality Testing for Installed Pipe

(a) Wastewater Pipe Acceptance Testing

After wastewater pipe has been backfilled, the Contractor shall perform infiltration tests, exfiltration tests, or low pressure air tests as determined by the E/A. In addition, the Contractor shall perform deflection tests and shall assist OWNER'S personnel, as directed, in performing pipeline settlement tests. The Contractor shall be responsible for making appropriate repairs to those elements that do not pass any of these tests.

(b) Exfiltration Test

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

Exfiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Exfiltration testing shall conform to requirements of the Texas Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(c) Infiltration Test

Infiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Infiltration testing shall conform to requirements of the Texas Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(d) Pipeline Settlement Test

During the infiltration test or after the exfiltration test, the pipe will be TV inspected for possible settlement. When air testing has been used, water shall be flowed into the pipe to permit meaningful observations. Any pipe settlement which causes excessive ponding of water in the pipe shall be cause for rejection. Excessive ponding shall be defined as a golf ball (1 5/8 " dia.) submerged at any point along the line.

(e) Low Pressure Air Test of Gravity Flow Wastewater Lines

(1) General

Wastewater lines up to 33-inch diameter shall be air tested between manholes. Wastewater lines 36-inch in diameter and larger shall be either air tested between manholes or at pipe joints. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous, test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

(2) Ground Water

Since the presence of ground water will affect the test results, test holes shall be dug to the pipe zone at intervals of not more than 100 feet and the average height of ground water above the pipe (if any) shall be determined before starting the test.

(3) Test Procedure

The E/A may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi and an accuracy of 0.0625 psi. (One ounce per square inch.) All air used shall pass through a single control panel. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

Add air slowly to the section of sewer being tested until the internal air pressure is raised to 3.5 psig greater than the average back pressure of any ground water that may submerge the pipe. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average backpressure of any ground water that may submerge the pipe.

For pipe less than 36-inch diameter, compare the time recorded with the time computed using the following equation:

$$T = (0.0850 \times D \times K) \div Q, \text{ where}$$

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds;

K =  $0.000419 \times D \times L$ , but not less than 1.0

D = nominal inside diameter, in inches, as marked on the pipe;

L = length of line of same pipe size in feet; and

Q = rate of loss, 0.0015 cubic feet per minute per square foot of internal surface area (ft<sup>3</sup>/min/ft sq) shall be used.

Because a K value of less than 1.0 shall not be used, there are minimum test times for each pipe diameter as shown in the following table:

Table For Low Pressure Air Testing of Pipe

Pipe Diameter (inches)	Minimum Time (seconds)	Minimum Time Applies to All Pipes Shorter than (feet)	Time for Longer Pipes (seconds)
8	454	298	$1.520 \times L$
10 (See Note 1)	567	239	$2.374 \times L$
12	680	199	$3.419 \times L$

15	850	159	$5.342 \times L$
18	1020	133	$7.693 \times L$
21	1190	114	$10.471 \times L$
24	1360	100	$13.676 \times L$
30	1700	80	$21.369 \times L$

Note 1. 10-inch diameter pipe to be used only by AW maintenance personnel.

Note 2. The test parameter for pipes larger than 30-inch diameter shall be shown on the construction plans.

Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above equation or table shall be cause for rejection. When the line tested includes more than one size pipe, the minimum time shall be that given for the largest size pipe included.

When joint testing, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch gauge during a joint test, regardless of pipe size, shall be twenty (20) seconds. A drop in pressure from 3.5 psig to 2.5 psig (adjusted for groundwater level) in less than twenty seconds shall be cause for rejection.

Manholes must be tested separately and independently. All manholes must be hydrostatically tested with a maximum loss allowance of 0.025 gallon per foot diameter per foot of head per hour.

When lines are air tested, manholes are to be tested separately by exfiltration or vacuum method (see Standard Specification Item No. 506S, "Manholes").

(f) Deflection Test

Deflection tests shall be performed by the Contractor on all flexible and semi-rigid wastewater pipes. The tests shall be conducted after the final backfill has been in place at least 30 days. Testing for in-place deflection shall be with a pipe mandrel at 95% of the inside diameter of the pipe. A second test of flexible and semi-rigid wastewater pipes 18 inch size and larger, also with a pipe mandrel sized at 95% of the inside diameter of the pipe, shall be conducted by the Contractor 30 days before the warranty expires on the Contractor's Work.

Contractor shall submit proposed pipe mandrels to the E/A or the E/A's designated representative for concurrence prior to testing the line.

Test(s) must be performed without mechanical pulling devices and must be witnessed by the E/A or the E/A's designated representative.

Any deficiencies noted shall be corrected by the Contractor and the test(s) shall be redone.

(g) Inspection of Installed Storm Drain Conduits

(1) General

All storm drain conduits (pipe and box culvert) shall be inspected for conformance to the requirements of this specification. Smart Housing, low/moderate income housing, and projects that are 100-percent privately funded are exempt from the cost of the initial video inspection. All deficiencies revealed by inspection shall be corrected. Video re-inspection meeting the requirements of this specification shall be provided at the Contractor's expense to show that deficiencies have been corrected satisfactorily. Further, the contractor shall provide video in complete segments (manhole to manhole) versus specific deficiency locations.

Projects that are not exempt from the cost of the initial video inspection are also subject to the following constraints:

- All inspectors utilized by the Contractor for video inspection shall be NASSCO-PACP certified for a minimum of 3 years.
- The Contractor will be required to inspect, assess, and record the condition of the storm drain pipe using National Association of Sewer Service Companies (NASSCOs) Pipeline Assessment Certification Program (PACP) coding standards.

(2) Video Inspection of Installed Storm Drain Conduits

Contractor shall provide all labor, equipment, material and supplies and perform all operations required to conduct internal closed-circuit television and video recording of all storm drain conduits. Video recording of each storm drain conduit section shall be conducted after the trench has been backfilled and prior to placement of permanent pavement repairs or permanent pavement reconstruction. The video recording shall be provided to the Owner for review. Contractor shall not place permanent pavement repairs or permanent pavement reconstruction over the storm drain conduit until Owner has reviewed the video and agrees that there are no defects in the storm drain conduit installation shown in the video submitted by the Contractor or shown in any video acquired by the Owner through other means. Placement of permanent pavement repair or permanent pavement reconstruction over the installed storm drain conduit before the Owner acknowledges no defects shall be at the Contractor's risk. Any defects revealed by the video inspection shall be corrected at the Contractor's expense and a new video submitted to the Owner for review prior to acceptance of the conduit.

All video work shall be conducted under the direct full-time supervision of a NASSCO-PACP certified operator.

The conduit inspection camera shall have the capability of panning plus/minus 275 degrees and rotating 360 degrees. The television camera shall be specifically designed and constructed for such use. The camera shall be operative in 100% humidity conditions. Camera shall have an accurate footage counter that displays on the monitor the exact distance of the camera (to the nearest tenth of a foot) from the centerline of the starting manhole or access point. Camera shall have height adjustment so that the camera lens is always centered within plus/minus 10% of the center axis of the conduit being videoed. Camera shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. Camera shall be equipped with a remote iris to control the illumination range for an acceptable picture. Geometrical distortion of the image shall not exceed one percent (1%). The video image produced by each camera shall be calibrated using a Marconi Resolution Chart No. 1 or equivalent.

Lighting for the camera shall be sufficient to allow a clear picture of the entire periphery of the conduit without loss of contrast, flare out of picture or shadowing. A reflector in front of the camera may be required to enhance lighting in dark or large sized conduit. The video camera shall be capable of showing on the digital display the Owner's name, Project name, Contractor name, date, line size and material, conduit identification, and ongoing footage counter. The camera, television monitor, and other components of the video system shall be capable of producing a picture quality satisfactory to the satisfaction of the Owner. The recording of the internal condition of the storm drain conduit shall be clear, accurate, focused and in color. If the recording fails to meet these requirements, the equipment shall be removed and replaced with equipment that is suitable. No payment will be made for an unsatisfactory recording.

If during video inspection, water is encountered inside the conduit, the conduit shall be dewatered by the Contractor. The storm drain section must be dry. Video recording conducted while the camera is floating is not acceptable unless approved by the Owner.

If during video inspection, debris is encountered that prohibits a proper inspection of the conduit, the Contractor shall remove the debris before proceeding.

All video shall be documented using a data logger and reporting system that are PACP compliant and which use codes as established by the National Association of Sewer Service Companies (NASSCO)s - Pipeline Assessment and Certification Program (PACP).

Computer printed location records shall be kept by the Contractor and shall clearly show the location and orientation of all points of significance such as joints, conduit connections, connections at manholes and inlets, and defects. Copy of all records shall be supplied to the Owner. Noted defects shall be documented as color digital files and color hard copy print-outs. Photo logs shall accompany each photo submitted.

The video recording shall supply a visual and audio record of the storm drain conduits that may be replayed. Video recordings shall include an audio track recorded by the video technician during the actual video work describing the parameters of the storm drain conduit being videoed (i.e. location, depth, diameter, pipe material), as well as describing connections, defects and unusual conditions observed during the video work. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Once videoed, the CDs/DVDs shall be labeled and become the property of the Owner. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Owner while the project is under construction.

Post-installation video shall not be completed until all work is completed on a section of storm drain conduit. Post-installation video work shall be completed by the Contractor in the presence of the Owner. The post-installation video work shall be completed to confirm that the storm drain conduits are free of defects. Provide a color video showing the completed work. Prepare and submit video logs providing location of storm drain conduit along with location of any defects. Manhole and inlet work shall be complete prior to post-installation video work.

For post-installation video, exercise the full capabilities of the camera equipment to document the completion and conformance of the storm drain installation work with the Contract Documents. Provide a full 360-degree view of conduit, all joints, and all connections. The camera shall be moved through the storm drain conduit in either direction at a moderate rate, stopping and slowly panning when necessary to permit proper documentation of the conduit condition at each pipe connection, joint, and



defect. In no case shall the camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the storm drain conditions shall be used to move the camera through the storm drain conduit. When manually operated winches are used to pull the camera through the conduit, telephones or other suitable means of communication shall be set up between the two access points of the conduit being videoed to insure good communication between members of the video crew.

Distance measurements shall be provided to an accuracy of one tenth of a foot.

Video shall be continuous for each storm drain conduit segment. Do not show a single segment on more than one CD/DVD, unless specifically allowed by the Owner.

Contractor shall submit to Owner the following:

- A. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) certification of operators who will be performing video work.
  - B. Compact Disc (CD) or Digital Video Disc (DVD) of recording of storm drain conduits (concrete storm water pipe or box culvert).
    - a. The color CD or DVD shall include a digital color key map in a format acceptable to the Owner with each segment of storm drain conduit labeled with the appropriate inspection ID on the map.
    - b. The file folder for each segment of the storm drain conduit shall have a unique name based on the Owner's approved inspection naming convention and shall contain the following:
      - i. Video files
      - ii. Video inspection logs with information coded in accordance with the PACP
      - iii. Photo logs
      - iv. A report summarizing the results of the video inspection
      - v. A proposed method of repair for any defects discovered.
- (3) Time commitments from City for projects that are exempt from the cost of the initial video inspection

Projects that are exempt from the cost of the initial video inspection are afforded the following time commitments from the City.

- A. Initial inspection - contractor must inform the City of Austin construction inspector assigned to the project in writing that all stormdrain infrastructure for the project has been completed according to the permit and is ready for inspection. The inspector will then notify the Watershed Protection Department (WPD) in writing that the all of the stormdrain infrastructure for the project has been completed and is ready for inspection. The WPD is allowed 15-days to complete inspection from written notification by the inspector. The outcome of this item does not impact the one-year warranty requirements.
- B. Video re-inspection by the contractor for deficient installed stormdrain infrastructure. The contractor must submit the video inspection data as defined in this specification to the City of Austin construction inspector assigned to the project along with a written letter of transmittal certified by a professional engineer stating that all identified stormdrain infrastructure installation

deficiencies for the project have been corrected. The inspector will then notify the Watershed Protection Department (WPD) in writing and convey the video inspection data to the WPD. The WPD is allowed 15-days to complete review of the data from the date of delivery by the inspector.

(27) Pressure Pipe Hydrostatic Testing

After the pipe has been installed and backfilled and all service laterals, fire hydrants and other appurtenances installed and connected, a pressure test, followed by a leakage test, will be conducted by the City. The City will furnish the pump and gauges for the tests. The Contractor shall be present and shall furnish all necessary assistance for conducting the tests. The specified test pressures will be based on the elevation of the lowest point of the line or section under test. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points.

All drain hydrant and fire hydrant leads, with the main 6-inch gate valve open, the hydrant valve seats closed and no nozzle caps removed, shall be included in the test.

(a) Pressure Test

The entire project or each valved section shall be tested, at a constant pressure of 200 psi for a sufficient period (approximately 10 minutes) to discover defective materials or substandard work. The Contractor assumes all risks associated with testing against valves. Repairs shall be made by the Contractor to correct any defective materials or substandard work. The Contractor shall pre-test new lines before requesting pressure tests by City Forces. The Contractor shall have new lines pressurized to a minimum of 100 psi, on the date of testing, prior to arrival of City Forces.

(b) Leakage Test

A leakage test will follow the pressure test and will be conducted on the entire project or each valved section. The Contractor assumes all risks associated with testing against valves. The leakage test shall be conducted at 150 psi for at least 2 hours. The test pressure shall not vary by more than  $\pm 5$  psi for the duration of the test.

(1) Allowable Leakage

Leakage shall be defined as the quantity of water that must be supplied into any test section of pipe to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

No pipe installation will be accepted if leakage exceeds the amount given by the following formula:

$$\text{Allowable leakage (gal/hr)} = [L \times D] \div 10,875$$

Where L = length of pipe tested, in feet  
D= nominal pipe diameter, in inches, as marked on the pipe

(2) Location and Correction of Leakage

If such testing discloses leakage in excess of this specified allowable, the Contractor, at the Contractor's expense, shall locate and correct all defects in the pipeline until the leakage is within the indicated allowance.

All visible leakage in pipe shall also be corrected by Contractor at the Contractor's expense.

(28) Service Charges for Testing

Initial testing performed by City forces for the Contractor will be at the City's expense. Retesting, by City forces, of Contractor's work that fails initial testing will be at the Contractor's expense. The City's charge for retests will be a base fee plus an hourly rate published in the current AW Fee Schedule. On City-funded projects, the charges incurred by the City for retesting will be deducted from funds due the Contractor. On non-City-funded projects, the charges incurred by the City for retesting will be billed to the Contractor. The City will withhold acceptance of the Contractor's work until the Contractor has paid the City for the retesting costs.

(29) Disinfection of Potable Water Lines

Prior to performing any disinfection of potable water lines, the Contractor shall submit a Disinfection Plan (Plan) and obtain approval in accordance with COA specification 01300, Submittals. The Plan shall comply with AWWA C651 (Disinfecting Water Mains) and AWWA C655 (Field Dechlorination), latest editions, and shall be developed using one of the following templates, unless otherwise approved by the Engineer and/or AW: Disinfection Plan for Tablet/Granule Method, or Disinfection Plan for Continuous-Feed Method. Templates for these two methods are located at <http://www.austintexas.gov/department/construction-standards>. The Contractor shall decide which disinfection method to use for a given project. The Slug Method and Spray Method are also acceptable if better suited for disinfection. The initial plan shall be submitted for review a minimum of 60 calendar days prior to when the water main is scheduled to be placed into service, or at the preconstruction conference if the project requires that the waterline be placed in service in less than 60 days, as indicated in the Contractor's Construction Schedule. If any appurtenances are required for injection, sampling, or flushing purposes that are not shown in the original plan/profile sheets, then the Contractor shall include the appurtenances in the project Record Drawings. The Contractor shall disinfect potable water lines only in accordance with an approved Plan.

(a) Preventing Contamination

The Contractor shall protect all piping materials from contamination during storage, handling and installation. Prior to disinfection, the pipeline interior shall be clean, dry and unobstructed. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work.

(b) Cleaning

Prior to disinfection the Contractor shall clean the pipeline to remove foreign matter. For pipelines 16" in diameter or smaller, cleaning shall consist of flushing the pipeline. For pipelines greater than 16" in diameter, cleaning shall be performed by operating hydrants and blow-offs located at low points in the pipeline, or by mechanical means (sweeping or pigging). Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(c) Procedure and Dosage

For pipelines 16" or smaller in diameter, the Contractor may use either the AWWA C-651 "Tablet/Granular Method" or the "Continuous Feed Method" for disinfecting the pipeline. The Contractor, at its expense, will supply the test gauges and the Sodium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 5 percent to fifteen percent available chlorine, and will submit for approval a written plan for the disinfection process. Calcium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 65 percent available chlorine by weight, may be used in granular form or in 5 g tablets for 16" diameter or smaller lines, if it is included as part of the written plan of disinfection that is approved by the City of Austin. The Contractor, at its expense, shall provide all other equipment, supplies and the necessary labor to perform the disinfection under the general supervision of the City.

One connection to the existing system will be allowed with a valve arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The valve shall be kept closed and locked in a valve box with the lid painted red. No other connection shall be made until the disinfection of the new line is complete and the water samples have met the established criteria. The valve shall remain closed at all times except when filling or flushing the line and must be staffed during these operations. As an option, backflow prevention in the form of a reduced pressure backflow assembly may be provided if the valve is left unattended. The new pipeline shall be filled completely with disinfecting solution by feeding the concentrated chlorine and approved water from the existing system uniformly into the new piping in such proportions that every part of the line has a minimum concentration of 25 mg/liter available chlorine.

The disinfecting solution shall be retained in the piping for at least 16 hours and all valves, hydrants, services, stubs, etc. shall be operated so as to disinfect all their parts. After this retention period, the water shall contain no less than 10 mg/liter chlorine throughout the treated section of the pipeline.

For pipelines larger than 16" in diameter, the Contractor may use the AWWA C-651 "Slug Method" for disinfecting the pipeline. Chlorine shall be fed at a constant rate and at a sufficient concentration at one end of the pipeline to develop a slug of chlorinated water having not less than 100 mg/liter of free chlorine. The Contractor shall move the slug through the main so that all interior surfaces are exposed to the slug for at least three (3) hours. The chlorine concentration in the slug shall be measured as it moves through the pipeline. If the chlorine concentration drops below 50 mg/liter, the Contractor shall stop the slug and feed additional chlorine to the head of the slug to restore the chlorine concentration to at least 100 mg/liter before proceeding. As the slug flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

Unless otherwise indicated, all quantities specified herein refer to measurements required by the testing procedures included in the current edition of "Standard Methods". The chlorine concentration at each step in the disinfection procedure shall be verified by chlorine residual determinations.

(d) Final Flushing

The heavily chlorinated water shall then be carefully flushed from the potable water line by a dechlorination process until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system. This is necessary to insure that there is no injury or damage to the public, the water system or the environment. The plans and preparations of the Contractor must be approved by the City before flushing of the line may begin. The Contractor will supply the Dechlorination chemical conforming to ANSI/AWWA C655. Additionally the flushing must be witnessed by an authorized representative of the City.

Approval for discharge of the diluted chlorine water or heavily chlorinated water into the wastewater system must be obtained from AW. The line flushing operations shall be regulated by the Contractor so as not to overload the wastewater system or cause damage to the odor feed systems at the lift stations. The City shall designate its own representative to oversee the work.

Daily notice of line discharging must be reported to the AW Dispatch office.

(e) Bacteriological Testing

After disinfection and final flushing, samples shall be collected per one of the two options. Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours. Both sets of samples must pass for the main

to be approved for release. Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release. The two (2) sets of water samples from the line will be tested for bacteriological quality by the City and must be found free of coliform organisms before the pipeline may be placed in service. Each set shall consist of one (1) sample that is drawn from the end of the main, at least one from each branch greater than one pipe length, and additional samples that are collected at intervals of not more than 1,200 feet along the pipeline. All stubs shall be tested before connections are made to existing systems.

The Contractor, at its expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

Samples for bacteriological analysis will only be collected from suitable sampling taps in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from hoses or unregulated sources. The City, at its expense, will furnish the sterile sample bottles and may, at its discretion, collect the test samples with City personnel.

If the initial disinfection fails to produce acceptable sample test results, the disinfection procedure shall be repeated at the Contractor's expense. Before the piping may be placed in service, two (2) consecutive sets of acceptable test results must be obtained.

An acceptable test sample is one in which: (1) the chlorine level is similar to the level of the existing distribution system; (2) there is no free chlorine and (3) total coliform organisms are absent. An invalid sample is one, which has excessive free chlorine, silt or non-coliform growth as defined in the current issue of the "Standards Methods." If unacceptable sample results are obtained for any pipe, the Contractor may, with the concurrence of the Inspector, for one time only flush the lines and then collect a second series of test samples for testing by the City. After this flushing sequence is completed, any pipe with one or more failed samples must be disinfected again in accordance with the approved disinfection procedure followed by appropriate sampling and testing of the water.

The City of Austin Water Quality Laboratory will notify the assigned City of Austin Inspector in writing of all test results. The Inspector will subsequently notify the Contractor of all test results. The Water Quality Laboratory will not release test results directly to the Contractor.

### (30) Cleanup and Restoration

It shall be the Contractor's responsibility to keep the construction site neat, clean and orderly at all times. Cleanup shall be vigorous and continuous to minimize traffic hazards or obstructions along the streets and to driveways. Trenching, backfill, pavement repair (as necessary), and cleanup shall be coordinated as directed by the City. The E/A will regulate the amount of open ditch and may halt additional trenching if cleanup is not adequate to allow for orderly traffic flow and access.

Materials at the site shall be stored in a neat and orderly manner so as not to obstruct pedestrian or vehicular traffic. All damaged material shall be removed from the construction site immediately and disposed of in a proper manner. All surplus excavated materials shall become the property of the Contractor for disposal at the Contractor's expense. After trenching, the Contractor shall immediately remove all excavated materials unsuitable for or in excess of, backfill requirements. Immediately following the pipe laying Work as it progresses, the Contractor shall backfill, grade and compact all excavations as provided elsewhere. The backfill placed at that time shall meet all compaction test requirements. The Contractor shall immediately clean up and remove all unused soil, waste and debris

and restore all surfaces and improvements to a condition equal or superior to that before construction began and to an appearance which complements the surroundings. The Contractor shall grade and dress the top 6 inches of earth surfaces with soil or other material similar and equal to the surrounding, fill and smooth any visible tracks or ruts, replace and re-establish all damaged or disturbed turf or other vegetation and otherwise make every effort to encourage the return of the entire surface and all improvements to a pleasant appearance and useful condition appropriate and complementary to the surroundings and equal or similar to that before construction began.

Placement of the final lift of permanent pavement, if a pavement is required, shall begin immediately after all testing of each segment of piping is satisfactorily completed.

(31) Valve Turn Walk-through

As part of the acceptance of Water or Reclaimed Water pressure pipe, an AW Valve Walk-through will be performed after an initial inspection by the Owner's Representative to identify any deficient items. If deficient items are present during the AW Valve Walk-Through and the project fails acceptance, a re-inspection fee will apply and must be paid before a re-inspection is scheduled to confirm correction of deficient items. See AW Fee Schedule for the current Distribution Walk-Through Re-inspection Fee.

(32) 2-inch Jumper Hose

During connections to the water distribution system, the Contractor may be required to install a temporary jumper hose between the unpressurized water segment and an adjacent pressurized water segment for the purpose of maintaining water service to customers who can't operate without water service during the connection. The jumper shall include an approved backflow preventer and be of adequate size and pressure rating to maintain service to the customer. It shall be polyethylene tubing meeting the requirements of COA SPL WW-65. The jumper hose and other components in the temporary service shall be disinfected, and bacteriological samples will be taken and pass before the temporary service is provided to the customer. Contractor shall provide adequate protection for the jumper hose in vehicular traffic areas at all times during use.

Source: [Rule No. R161-17.05](#), 5-31-2017; Rule No. [R161-17.19](#), 11-28-2017.

#### 510.4 - Measurement

Pipe will be measured by the linear foot for the various types, sizes and classes. Parallel lines will be measured individually.

Where a line ties into an existing system, the length of the new line will be measured from the visible end of the existing system at the completed joint. Unless otherwise indicated, the length of water, reclaimed, and wastewater lines will be measured along pipe horizontal centerline stationing through fittings, valves, manholes, and other appurtenances.

Ductile iron fittings, whether standard mechanical joint or integral factory restrained joint type, will be measured by the ton and paid for in accordance with the schedule in Standard Products List WW-27C. Bolts, glands and gaskets will not be measured for payment. Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be measured separately and are included in the unit price for the respective pipe bid items.

Factory restrained joint pipe meeting the requirements of Standard Products List WW-27F will be measured by the linear foot. The estimated quantity on the bid form is only for restrained joint pipe having integral mechanically restrained joints.

Connecting a new water, wastewater, or reclaimed water service to an existing, comparable type of private service will be measured by each connection. Service pipe from the main to the service connection will be measured by the linear foot.

The Contractor shall be responsible for removing and treating ground water flowing into a trench up to a baseline flow rate of 350 gpm of sustained flow for each mainline open trench (no more than 300 linear feet open trench per work zone segment is allowed at one time). This baseline flow rate is not a prediction of ground water conditions to be expected on the Project. Rather, it establishes contract terms regarding the quantity of ground water for which the contractor is responsible without extra or separate compensation. The flow rate must exceed 350 gpm continuously for at least 4 consecutive hours to be considered sustained flow. It is expected that trench dewatering for this baseline rate may be accomplished with a single 3-inch trash-type pump per open trench; however, measured flow rate, not pump size, type or characteristics shall be used to determine if the baseline rate has been exceeded. Flow rate shall be determined by measurements made at the discharge point of the water treatment facilities. Surface storm water flowing into a trench shall be the Contractor's responsibility to remove and treat without compensation, regardless of inflow rate or volume.

Adjustment of elevations during construction resulting in changes in flow line elevations of plus or minus two feet or less will not be considered for credit or additional compensation and no measurement for payment will be made.

Stormwater pipe will be measured along the slope of the pipe. Where drainage pipe ties into inlets, headwalls, catch basins, manholes, junction boxes or other structures that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.

Excavation and backfill, when included as pipe installation will not be measured as such but shall be included in the unit price bid for constructing pipe and measured as pipe complete in place including excavation and backfill.

When pay items are provided for the other components of the system, measurement will be made as addressed hereunder.

Video inspection of newly installed box culverts and storm drain pipe will be measured per linear foot of pipe videoed.

Jumper hose will be measured per linear foot of hose installed, including all depths, excavation and backfill, complete, and in place.

Source: [Rule No. R161-17.05](#), 5-31-2017.

#### 510.5 - Payment

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the materials and type indicated, unless unstable material is encountered or trench excavation and backfill is bid as a separate item.

The concrete seal, foundation rock or coarse aggregate when used as directed in unstable material will be paid for at the unit price bid per cubic yard, which shall be full payment for all excavation and removal of unsuitable material and furnishing, placing and compacting the foundation rock, coarse aggregate or other approved material all complete in place.

Excavation and backfill, when included as a separate pay item, will be paid for by Pay Item No. 510-E or 510-F.

No separate payment will be made for dewatering a trench with ground water inflow of less than the baseline rate of 350 gpm of sustained flow as described above. Dewatering of those trenches shall be included in the contract unit price of the Pipe pay item. Payment for dewatering a trench with ground water inflow exceeding 350 gpm of sustained flow shall be agreed by change order. Dewatering of bore pits shall be included in the contract unit price for Bore Entry Pit or Exit Pit regardless of inflow rate or volume unless specified otherwise in the bid item for Bore Entry Pit or Exit Pit.

(1) Pipe

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot complete-in-place as designed and represented in the Drawings and other Contract documents. Restrained joint pipe meeting the requirements of Standard Products List WW-27F will be paid for separately at the unit price bid per linear foot. Unless otherwise provided herein, as separate pay item(s), the bid price per linear foot of pipe shall include the following:

- a. clearing
- b. constructing any necessary embankment
- c. excavation
- d. disposal of surplus or unusable excavated material
- e. furnishing, hauling and placing pipe
- f. field constructed joints, collars, temporary plugs, caps or bulkheads
- g. all necessary lugs, rods or braces
- h. pipe coatings and protection
- i. connections to existing systems or structures, concrete blocking and thrust blocks and restrained joints
- j. preparing, shaping, pumping for dewatering, and shoring of trenches
- k. bedding materials
- l. backfill materials
- m. hauling, placing and preparing bedding materials
- n. particle migration measures
- o. hauling, moving, placing and compacting backfill materials
- p. temporary and permanent pavement repairs and maintenance
- q. temporary removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction
- r. cleanup
- s. vertical stack on deep wastewater services
- t. all other incidentals necessary to complete the pipe installation as indicated.
- u. pipe joint restraint devices, where specified or allowed, meeting Standard Products List WW-27A or WW-27G.

No separate payment will be made for thrust restraint measures.

Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be paid for separately. These will be included in the unit price bid for the bid item Pipe.

(2) Concrete Cradles and Seals



When called for in the Bid, concrete cradles and seals will be paid for at the unit Contract price bid per linear foot for the size of pipe specified, complete in place.

(3) Concrete Retards

When called for in the Bid, Concrete retards will be paid under Item No. 593S, "Concrete Retards."

(4) Boring or Jacking.

When called for in the Bid, boring or jacking will be paid under Item 501S, "Jacking or Boring Pipe.

(5) Wet Connections to Potable or Reclaimed Water Mains

When called for in the bid, wet connections will be paid at the unit price bid per each, complete in place, according to the size of the main that is in service and shall be full compensation for all Work required to make the connection and place the pipe in service. (See subsection 510.3 'Construction Methods' part (24) (b) 'Wet Connections to Existing Water System').

(6) Fittings

Ductile iron fittings, furnished in accordance with these specifications, will be paid for at the unit price bid per ton, complete in place, according to the schedule of weights in Standard Products List WW-27C. Bolts, glands, and gaskets will not be paid for separately and shall be included in the contract unit price for fittings.

(7) Concrete Trench Cap and Encasement

Where the distance between the top of the concrete encasement and the top of the trench cap is less than 36 inches, the concrete cap and encasement shall be poured as one unit and paid for under this bid item at the Contract price bid per linear foot. When the distance above is greater than 36 inches or when the trench cap is placed separately, the trench cap shall be paid for as a separate item, per linear foot, complete in place.

(8) Cement-Stabilized Backfill

Cement-stabilized backfill will be paid for at the unit price bid per linear foot and shall be full payment to the Contractor for furnishing and installing the required material, mixed, placed and cured complete in place.

(9) Concrete Encasement

When called for in the Bid, Concrete Pipe Encasement will be paid under Item No. 505S, "Encasement and Encasement Pipe".

(10) Pressure Taps

Pressure taps will be paid for at the unit price bid, complete in place, according to the size tap made and the size main tapped and shall be full payment for furnishing all necessary materials, including tapping sleeve and valve, making the tap, testing and placing the connection in service.

(11) Excavation Safety Systems

When called for in Bid, Trench Safety Systems shall conform to Item No. 509S, "Excavation Safety Systems."

(12) Connecting a New Water, Wastewater, or Reclaimed Water Service to an existing, comparable type of private service will be paid for at the unit price bid, complete in place, according to the size of new service and size of existing private service, and shall be full

payment for furnishing and installing all necessary materials, such as cleanouts, pipe, couplings, and fittings, and including excavation and backfill.

(13) Video Inspection

Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe will be paid for at the unit price bid per linear foot and shall be full payment for all labor, equipment, and materials required for video inspection per this specification, including all submittals of CD/DVD as required.

(14) Jumper Hose

Jumper Hose will be paid at the unit bid price, complete and in place, including installation and removal of all materials necessary to provide a fully functional jumper hose. This item shall also include adequate protection for the jumper hose within vehicular traffic areas.

Source: [Rule No. R161-17.05](#), 5-31-2017.

Payment, when included as a Contract pay item, will be made under one of the following:

<b>Pay Item No. 510-AR_____Dia.:</b>	Pipe, _____ Dia. _____ Type (all depths), including Excavation and Backfill	Per Linear Foot.
<b>Pay Item No. 510-ARRJ_____Dia.:</b>	Factory Restrained Joint Pipe, _____ Dia., Class _____ Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
<b>Pay Item No. 510-BR_____×_____Dia.:</b>	Connecting New _____ Service to Existing Private Service ( _____ Dia. New Service to _____ Dia. Private Service)	Per Each.
<b>Pay Item No. 510-CR:</b>	Pipe Excavation, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-DR:</b>	Pipe Trench Backfill, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-ER:</b>	Concrete Seal or Cradle, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-FR:</b>	Concrete Trench Cap, _____ Ft. Width	Per Linear

		Foot.
<b>Pay Item No. 510-GR:</b>	Concrete Cap and Encasement, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-HR:</b>	Cement Stabilized Backfill, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510- IR: _____ x _____ Dia.:</b>	Pressure Taps, _____ Dia. x _____ Dia.	Per Each.
<b>Pay Item No. 510- JR: _____ x _____ Dia.:</b>	Wet Connections, _____ Dia. x _____ Dia.	Per Each.
<b>Pay Item No. 510-KR:</b>	Ductile Iron Fittings	Per Ton.
<b>Pay Item No. 510-ASD _____ Dia.:</b>	Pipe, _____ Dia. (all depths), including excavation and backfill	Per Linear Foot.
<b>Pay Item No. 510-CSD:</b>	Pipe Excavation, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-DSD:</b>	Pipe Trench Backfill, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-ESD:</b>	Concrete Seal or Cradle, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-FSD:</b>	Concrete Trench Cap, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-GSD:</b>	Concrete Cap and Encasement, _____ Dia. Pipe	Per Linear

		Foot.
<b>Pay Item No. 510-HSD:</b>	Cement Stabilized Backfill, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-AW _____ Dia.:</b>	Pipe, _____ Dia. _____ Type (all depths), including excavation and backfill	Per Linear Foot
<b>Pay Item No. 510-AWRJ _____ Dia.:</b>	Factory Restrained Joint Pipe, _____ Dia., Class Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
<b>Pay Item No. 510- BW _____ × _____ Dia.:</b>	Connecting New _____ Service to Existing Private Service ( _____ Dia. New Service to _____ Dia. Private Service)	Per Each.
<b>Pay Item No. 510-CW:</b>	Pipe Excavation, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-DW:</b>	Pipe Trench Backfill, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-EW:</b>	Concrete Seal or Cradle, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-FW:</b>	Concrete Trench Cap, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-GW:</b>	Concrete Cap and Encasement, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-HW:</b>	Cement Stabilized Backfill, _____ Dia.	Per Linear

	Pipe	Foot.
<b>Pay Item No. 510-IW:</b> _____ × _____ <b>Dia.:</b>	Pressure Taps, _____ Dia. × _____ Dia.	Per Each.
<b>Pay Item No. 510-JW:</b> _____ × _____ <b>Dia.:</b>	Wet Connections, _____ Dia. × _____ Dia.	Per Each.
<b>Pay Item No. 510-KW:</b>	Ductile Iron Fittings	Per Ton.
<b>Pay Item No. 510-AWW:</b> _____ <b>Dia.:</b>	Pipe, _____ Dia. _____ Type (all depths), including Excavation and Backfill	Per Linear Foot.
<b>Pay Item No. 510-AWWRJ</b> _____ <b>Dia.:</b>	Factory Restrained Joint Pipe, _____ Dia., Class ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
<b>Pay Item No. 510-BWW</b> _____ × _____ <b>Dia.:</b>	Connecting New _____ Service to Existing Private Service ( _____ Dia. New Service to _____ Dia. Private Service)	Per Each.
<b>Pay Item No. 510-CWW:</b>	Pipe Excavation, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-DWW:</b>	Pipe Trench Backfill, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-EWW:</b>	Concrete Seal or Cradle, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-FWW:</b>	Concrete Trench Cap, _____ Ft. Width	Per Linear Foot.
<b>Pay Item No. 510-GWW:</b>	Concrete Cap and Encasement, _____	Per Linear

	Dia. Pipe	Foot.
<b>Pay Item No. 510-HWW:</b>	Cement Stabilized Backfill, _____ Dia. Pipe	Per Linear Foot.
<b>Pay Item No. 510-KWW:</b>	Ductile Iron Fittings	Per Ton.
<b>Pay Item No. 510-VIDEO</b>	Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe	Per Linear Foot.
<b>Pay Item No. 510-JH</b>	2-inch Jumper Hose	Per Linear Foot.

An "R" after the pay item indicates the use for reclaimed water.

An "SD" after the pay item indicates the use for storm drain.

A "W" after the pay item indicates the use for water.

A "WW" after the pay item indicates the use for wastewater.

Source: [Rule No. R161-17.05](#), 5-31-2017.

**End**

Applicable References:

*Standard Specifications Manual:* Item Nos. Ref: 102S, 210S, 402S, 403, 501S, 505S, 506, 507S, 509S, 593S, 601S, 604S

*Standards Manual:* Standard Detail Nos. 510S-1, (520 - series).

*Design Criteria Manuals:* Utilities Criteria Manual, Section 5.

## ITEM NO. 511S - WATER VALVES 9-26-12

### 511S.1 - Description

This item shall govern the valves furnished and installed as indicated on the Drawings. Unless otherwise indicated on the Drawings, all valves 4 inches (102 mm) and larger shall be AWWA-type valves of suitable design and fully equipped for service buried in the earth, without need for further modification and shall be wrapped with 8-mil (0.2 mm) polyethylene film with all edges and laps securely taped to provide a continuous wrap. For reclaimed water piping, the polyethylene film shall be purple. Where not indicated, the Contractor may use valves with any type end-joint allowed for fittings of the pipe class being used. Unless otherwise indicated on the Drawings, all valve stems shall be adjusted to situate the operating nut not more than 24 inches (0.6 meters) below the proposed ground or paving surface of the finished project. Laydown valves shall not be used unless called out on the Drawings. Standard details shall not be used as an indicator of available options.

This specification is applicable for projects or work involving either inch-pounds or SI units. Within the text, inch-pound units are given preference followed by SI units shown within parentheses.

### 511S.2 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work is of the kind and quality that satisfies the specified functions and quality. The Austin Water Utility Standard Products Lists (SPL) are considered to form a part of these Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the Engineer/Architect (E/A) is still required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal. This will expedite the review process in which the E/A, and, if necessary, the Austin Water Utility Standard Products Committee, decide whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project.

The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A in conjunction with the Water and Wastewater Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

#### A. Samples, Inspection and Testing Requirements

All tests and inspections called for by the applicable standards shall be performed by the manufacturer. Upon request, results of these tests shall be made available to the purchaser.

#### B. Other Requirements

Each submittal shall be accompanied by:

1. Complete data covering:
  - a. the operator, including type and size, model number, etc.,
  - b. the name and address of the manufacturer's nearest service facility,
  - c. the number of turns to fully open or close the valve.
2. detailed instructions for calibrating the limit stops for open and closed positions, and
3. any other information, that may be necessary to operate and maintain the operator.

4. Complete dimensional data and installation instructions for the valve assembly as it is to be installed, including the operator.
5. Complete replacement parts lists and drawings, identifying every part for both the valve and operator.

### 511S.3 - Valves

#### A. Iron-Body Gate Valves

Resilient-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-509 and Standard Products List item WW-282.

Reduced-wall, resilient-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-515 and Standard Products List item WW-700.

Metal-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-500 and Standard Products List item WW-132.

1. **Stem Seals:** All valves shall have approved O-ring type stem seals. At least two O-rings shall be in contact with the valve stem where it penetrates the valve body.
2. **Operation:** All valves shall have non-rising stems with a 2-inch (50 mm) square operating nut, or with a spoke type handwheel when so ordered, turning clockwise to close.
3. **Gearing:** Gate valves in 24-inch (610 mm) and larger sizes shall be geared and, when necessary for proper bury depth and cover, shall be the horizontal bevel-gear type enclosed in a lubricated gear case.
4. **Bypass:** Unless otherwise indicated on the Drawings, 30-inch (762 mm) and larger metal-seated gate valves shall be equipped with a bypass of the non-rising stem type which meets the same AWWA standard required for the main valve.
5. **Valve Ends:** Valve ends shall be push-on, flanged or mechanical joint, as indicated or approved.  
Tapping valves shall have inlet flanges conforming to MSS SP-60, with boltholes drilled per ANSI B16.1 Class 125. Seat rings and body casting shall be over-sized as required to accommodate full size cutters; the outlet end shall be constructed and drilled to allow the drilling machine adapter to be attached directly to the valve.
6. **Gear Case:** All geared valves shall have enclosed gear cases of the extended type, attached to the valve bonnet in a manner that makes it possible to replace the stem seal without disassembly and without disturbing the gears, bearing or gear lubricant. Gear cases shall be designed and fabricated with an opening to atmosphere so that leakage past the stem seal does not enter the gear case.
7. **Valve Body:** Double disc gate valves in 30-inch (762 mm) and larger sizes installed in the horizontal position shall have bronze rollers, tracks, scrapers, etc. For reclaimed water valves, the body shall be manufactured in purple, factory painted purple, or field painted purple.

#### B. Butterfly Valves

Unless otherwise indicated, all valves shall conform to the current "AWWA" Standard C-504, "Rubber-Seated Butterfly Valves," Class 150B, except as modified or supplemented herein.

1. **Functional Requirements**
  - a. Valves shall be the short body design and shall have flanged connections on both ends unless otherwise called for.
  - b. Valves shall be of such design that the valve discs will not vibrate or flutter when operated in a throttled position. Valve discs shall be secured to the shafts by means of keys or pins so arranged that the valve discs can be readily removed without damage thereto. All keys



and pins used in securing valve discs to shafts shall be stainless steel or monel. Valve discs shall be stainless steel or ductile iron, ASTM A 536, Grade 65-45-12 (448-310-12); seating edge shall be stainless steel or other corrosion resistant material.

- c. Valve shafts shall be constructed of wrought stainless steel or monel. The ends of the shaft shall be permanently marked to indicate the position of the disc on the shaft.
- d. All buried valves shall have approved manufacturer's O-ring type or split V type "Chevron" shaft seals. When O-ring seals are used, there shall be at least two O-rings in contact with the valve shaft where it penetrates the valve body.

On 24-inch (635 mm) and larger valves, the seat shall be completely replaceable and/or adjustable with common hand tools without disassembling the valve from the pipeline.

Rubber seats located on the valve disc shall be mechanically secured with stainless steel retainer rings and fasteners.

- e. Unless otherwise indicated, valves shall be provided with manual operators with vertical stems and 2 inches (50 mm) square operating nut turning clockwise to close and equipped with a valve disc position indicator. All keys or pins shall be stainless steel or monel. Buried valves shall have the valve stems extended or adjusted to locate the top of the operating nut no more than 24 inches (0.6 meter) below finish grade.
- f. Unless otherwise indicated, motorized butterfly valves shall be equipped with 230/460 volt, 3-phase reversing motor operators, extended as required to locate the center line of the operator shaft approximately 4 feet to 4 feet, 6 inches (1.2 to 1.4 meters) above finish grade. Operators shall be equipped with cast iron or malleable iron manual override hand wheel with a valve position indicator, local push button controls, lighted status/position indicator, torque and travel limit switches and all switches, relays and controls (except external power and signal wiring) necessary for both local and remote operation.

## 2. Performance Requirements

- a. Unless otherwise indicated, valve operators shall be sized to seat, unseat, open and close the valve with 150 psi (1 megapascal) shutoff pressure differential across the disk and allow a flow velocity of 16 feet (4.9 meters) per second past the disc in either direction.
- b. Motorized valve motors shall be capable of producing at least 140 percent of the torque required to operate the valves under conditions of maximum non-shock shutoff pressure without exceeding a permissible temperature rise of 1310F over 1040F ambient (55 degrees Celsius over 40 degrees Celsius ambient); they shall have a duty rating of not less than 15 minutes and shall be capable of operating the valve through 4½ cycles against full unbalanced pressure without exceeding the permissible temperature rise. Motors shall be suitable for operating the valve under maximum differential pressure when voltage to motor terminals is 80 percent of nominal voltage. Motor bearings shall be permanently lubricated and sealed.

## C. Ball Valves

Ball valves shall be brass, bronze, stainless steel or PVC as indicated on the Drawings or Details or as approved by the Engineer or designated representative.

## D. Air-Vacuum Release Valves

- 1. Valves shall be combination air-release, air-vacuum units having small and large orifice units contained and operating within a single body or assembled unit.

The small orifice system shall automatically release small volumes of air while the pipe is operating under normal conditions. The large air-vacuum orifice system shall automatically exhaust large volumes of air while the pipe is being filled and shall permit immediate re-entry of air while being drained.

Valves shall be rated for at least 150 psi (1 megapascal) {maximum}normal service pressure.

## 2. Material Requirements

Valve exterior bodies and covers shall be cast iron or reinforced nylon.

Internal bushings, hinge pins, float guide and retaining screws, pins, etc., shall be stainless steel, bronze, nylon, or Buna-N rubber.

Orifice seats shall be Buna-N rubber.

Floats shall be stainless steel, nylon, or Buna-N rubber, rated at 1,000 psi (6.9 megapascals).

Unless otherwise indicated, these valves shall be as included in the Standard Products List (SPL WW-367 for water, WW-462 for wastewater force mains).

## E. Fire Hydrants

All fire hydrants shall be Dry Barrel, Traffic Model (break-away), Post Type having Compression Type Main Valves with 5 ¼" (133 mm) opening, closing with line pressure. Approved models are listed on SPL WW-3 of the Austin Water Utility Standard Products List.

### 1. Applicable Specifications

AWWA C-502 current: "AWWA Standard for Dry-Barrel Fire Hydrants."

NFPA 1963: "National (American) Standard Fire Hose Coupling Screw Thread" and City of Austin 4 inch (102 mm) Fire Hose Connection Standard (Available upon request from the Austin Water Utility's Standards Committee Chairperson at 972-0204).

ANSI A-21.11 current: "American National Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings."

### 2. Functional Requirements

Design Working Pressure shall be 200 psi (1.38 megapascals) and a test pressure of 400 psi (2.76 megapascals).

Inlet shall be side connection hub end for mechanical joint (ANSI A-21.11-current). Shoe shall be rigidly designed to prevent breakage.

Lower Barrel shall be rigid to assure above ground break at traffic feature. Bury length of hydrant shall be four (4) feet (1.2 meters) minimum, five (5) feet (1.5 meters) maximum (hydrant lead pipe may be elbowed up from main using restrained joints; flanged joints in lead pipes are not allowed). Flange type connections between hydrant shoe, barrel sections and bonnet shall have minimum of 6 corrosion resistant bolts.

Hydrant Main Valve shall be 5 ¼ inch (133 mm) I.D. Valve stem design shall meet requirements of AWWA C502, with Operating Nut turning clockwise to close. Operating Nut shall be pentagonal, 1½ inch (38 mm) point to flat at base, and 1 7/16 inches (36.5 mm) at top and 1 inch (25 mm) minimum height. Seat ring shall be bronze (bronze to bronze threading), and shall be removable with lightweight stem wrench. Valve mechanisms shall be flushed with each operation of valve; there shall be a minimum of two (2) drain ports.

Traffic Feature shall have replaceable breakaway ferrous metal stem coupling held to stem by readily removable type 302 or 304 stainless steel fastenings. Breakaway flange or frangible lugs shall be designed to assure aboveground break. Breakaway or frangible bolts will not be acceptable.

Outlet Nozzles shall be located approximately 18 inches (450 mm) above ground. Each hydrant shall have two (2) 2½ inch (63.5 mm) nozzles 180 degrees apart with National (American) Standard Fire Hose Coupling Screw Thread NFPA 1963 and one (1) 4 inch (102 mm) pumper nozzle with City of Austin standard thread-six (6) threads per inch (25 mm) "Higbee" cut, 4.8590 inch (123.4 mm) O.D., 4.6425 inch (117.9 mm) root diameter. Nozzles shall be threaded or cam-locked, O-ring sealed, and shall have type 302 or 304 stainless steel locking devices. Nozzle caps (without chains) and cap gaskets shall be furnished on the hydrant. The cap nut shall have the same configuration as the operating nut.

Hydrants shall be Dry-Top Construction, factory lubricated oil or grease with the lubricant plug readily accessible. The system shall be described for City approval.

A blue Type II-B-B reflectorized pavement marker, conforming to Standard Specification Item No. 863S, shall be placed 2 to 3 feet (0.6 to 0.9 meters) offset from the centerline of paved streets, on the side of and in line with, all newly installed fire hydrants.

Hydrant shall have double O-ring seals in a bronze stem sheath housing to assure separation of lubricant from water and shall have a weather cap or seal, or both, as approved by the Owner, to provide complete weather protection.

### 3. Material Requirements

All below ground bolts shall be corrosion resistant. The hydrant valve shall be Neoprene, 90 durometer minimum. The seat ring, drain ring, operating nut and nozzles shall be bronze, AWWA C-502 current, containing not over 16 percent zinc. Break-away stem coupling shall be of ferrous material; its retaining pins, bolts, nuts, etc. of type 302 or 304 stainless steel.

Coatings shall be durable and applied to clean surfaces. Exterior surfaces above ground shall receive a coating of the type and color specified in the applicable version of City of Austin SPL WW-3. The coating shall be applied according to coating manufacturer's specifications. Other exposed ferrous metal shall receive asphalt-based varnish, or approved equal, applied according to the coating manufacturer's specifications.

#### F. Pressure/Flow Control Valves

All control valves to regulate pressure, flow, etc., in City lines shall be models listed in the Austin Water Utility Standard Products List (SPL).

#### G. Drain Valves

Drain valve materials and installation shall conform to City of Austin Standard Detail No. 511S-9.

#### H. Valve Stem Extensions:

Valve stem extensions shall consist of a single piece of the required length with a socket on one end and a nut on the other.

### 511S.4 - Construction Methods

#### A. Setting Valves, Drains and Air Releases

Unless otherwise indicated, main line valves, drain valves and piping, air and vacuum release assemblies and other miscellaneous accessories shall be set and jointed in the manner described for cleaning, laying, and jointing pipe.

Unless otherwise indicated, valves shall be set at the locations shown on the Drawings and such that their location does not conflict with other appurtenances such as curb ramps. Valves shall be installed so that the tops of operating stems will be at the proper elevation required for the piping at the location indicated above. Valve boxes and valve stem casings shall be firmly supported and

maintained, centered and aligned plumb over the valve or operating stem, with the top of the box or casing installed flush with the finished ground or pavement in existing streets, and installed with the top of the box or casing approximately 6 inches (150 mm) below the standard street subgrade in streets which are excavated for paving construction or where such excavation is scheduled or elsewhere as directed by the Engineer or designated representative.

Drainage branches or air blowoffs shall not be connected to any sanitary sewer or submerged in any stream or be installed in any other manner that will permit back siphonage into the distribution system (see City of Austin "Standard Detail Drawings- Series 500/500S"). Every drain line and every air release line shall have a full sized independent gate valve flanged directly to the main. Flap-valves, shear gates, etc., will not be accepted.

#### B. Setting Fire Hydrants

Fire hydrants shall be located in a manner to provide accessibility and in such a manner that the possibility of damage from vehicles or conflict with pedestrian travel will be minimized. Unless otherwise directed, the setting of any hydrant shall conform to the following:

Hydrants between curb and sidewalk on public streets, shall be installed as shown on Standard 511S-17, with outermost point of large nozzle cap 6 inches to 18 inches (150 mm to 450 mm) behind back of curb. Where walk abuts curb, and in other public areas or in commercial areas, dimension from gutter face of curb to outermost part of any nozzle cap shall be not less than 3 feet (0.9 meters), nor more than 6 feet (1.8 meters), except that no part of a hydrant or its nozzle caps shall be within 6 inches (150 mm) of any sidewalk or pedestrian ramp. Any fire hydrant placed near a street corner shall be no less than 20 feet (6 meters) from the curb line point of tangency. Fire hydrants shall not be installed within nine feet (2.75 meters) vertically or horizontally of any sanitary sewer line regardless of construction.

All hydrants shall stand plumb; those near curbs shall have the 4-inch (102 mm) nozzle facing the curb and perpendicular to it. The hydrant bury mark shall be located at ground or other finish grade; nozzles of all new hydrants shall be approximately 18 inches (450 mm) above grade. Lower barrel length shall not exceed 5 feet (1.5 meters). Barrel extensions are not permitted unless approved by the Engineer or designated representative. Each hydrant shall be connected to the main by 6-inch (152 mm) ductile iron pipe; a 6-inch (152 mm) gate valve shall be installed in the line for individual shutoff of each new hydrant.

Below each hydrant, a drainage pit 2 feet (0.6 meter) in diameter and 2 feet (0.6 meter) deep shall be excavated and filled with compacted coarse gravel or broken stone mixed with coarse sand under and around the bowl of the hydrant, except where thrust blocking is located (City of Austin Specification Item 510 and Standard Detail 510-6 and to a level 6 inches (150 mm) above the hydrant drain opening.

The hydrant drainage pit shall not be connected to a sanitary sewer. The drain gravel shall be covered with filter fabric to prevent blockage of voids in the gravel by migration of backfill material. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with concrete thrust blocking (taking care not to obstruct the hydrant drain holes), or the hydrant shall be tied to the pipe with approved metal harness rods and clamps. The fire line shall be provided with joint restraint from the main line to the fire hydrant. Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

Fire hydrants on mains under construction shall be securely wrapped with a poly wrap bag or envelope taped into place. When the mains are accepted and placed in service the bag shall be removed.

#### C. Pressure Taps: Refer to Section 510.3 (24) of Standard Specification Item Number 510, "Pipe."

#### D. Plugging Dead Ends

Standard plugs shall be inserted into the bells of all dead ends of pipes, tees or crosses and spigot ends shall be capped. All end plugs or caps shall be secured to the pipe conforming to Section 510.3 (22) of Standard Specification Item Number 510, "Pipe."

E. Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other steel component shall be coal tar coated and shall be wrapped with standard minimum 8-mil (0.2 mm) low density polyethylene film or a minimum 4-mil (0.1 mm) cross laminated high-density polyethylene meeting ANSI/AWWA Specification C-105-current, with all edges and laps taped securely to provide a continuous and watertight wrap. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling. For reclaimed water piping, the polyethylene shall be purple.

F. Valve Box, Casing and Cover

Stems of all buried valves shall be protected by valve box assemblies. Valve box castings shall conform to ASTM A 48, Class 30B. Testing shall be verified by the manufacturer at the time of shipment. Each casting shall have cast upon it a distinct mark identifying the manufacturer and the country of origin. Valve boxes and covers for potable water shall be round. Valve boxes and covers for reclaimed water piping shall be square and shall have "Reclaimed Water" indicated on the lid.

G. Drain Valve Installations

Refer to City of Austin Standards 511S-9A.

H. Air Release Assemblies

Refer to City of Austin Standards 511S-1A, 511S-1B, 511S-2A, 511S-2B, 511S-3A and 511S-3B.

I. Pressure/Flow Control Valves

Assemblies shall be installed as indicated.

J. Connections to Existing System

Refer to Item No. 510, "Pipe" for connections to the existing system.

K. Shutoffs

Refer to Item No. 510, "Pipe" for shutoffs.

511S.5 - Measurement

All types of valves will be measured per each. Fire hydrants and drain valve assemblies will be measured per each. Fire Hydrant barrel extensions will be measured per vertical foot (meter: 1 meter equals 3.28 feet). Pressure/Flow control valve assemblies and both manual and automatic air release assemblies will be measured per each. Reflectorized pavement markers for identifying the location of newly installed fire hydrants shall be measured per each, as per Standard Specification Item No. 863S.7.

Bury depths exceeding 5.5 feet (1.68 meters) are defined as Additional Bury Depths. Additional bury depths will only be measured if indicated on the Drawings and identified in the Standard Contract Bid Form 00300U; otherwise, the unit bid price for each completed unit includes all depths.

511S.6 - Payment

Payment shall include full compensation, in accordance with the pay item established in the bid, for excavation, furnishing, hauling and placing valves, drain valve assemblies, fire hydrants and barrel extensions including anchorage and all incidental materials and work; preparing, shaping, dewatering,

bedding, placing and compacting backfill materials and for all other incidentals necessary to complete the installation, as indicated in the Drawings, complete in place.

Payment for iron fittings and for wet connections is covered in Section 510.6 of Standard Specification Item 510, "Pipe."

Payment for excavation safety systems is covered in Section 509S.10 of Standard Specification Item 509S, Excavation Safety Systems.

- A. Valves: Valves will be paid for at the unit bid price for the size and type valve installed, including valve stem casing and cover, excavation and backfill, setting, adjusting to grade, anchoring in place, and other appurtenances necessary for proper operation.
- B. Fire Hydrants: Fire Hydrants installation shall be paid for at the unit bid price, which includes all necessary labor and materials to set, adjust to grade and anchor the hydrant body, barrel extensions, concrete block, gravel drain and other appurtenances necessary for proper operation; but shall not include pipe and valve between the main line and fire hydrant base.
- C. Pressure or Flow Control Valve Assemblies: Pressure control and flow control valve assemblies will be paid for at the unit bid price, including box or vault, setting, adjusting to grade, anchoring in place, adjusting the control device to the required conditions, providing other appurtenances necessary for proper operation, and placing in operation.
- D. Drain Valve Assemblies: Drain valve installation shall be paid for at the unit bid price, which includes all necessary labor and materials to set, adjust to grade and anchor the bends, vertical piping, blind flange, joint restraint devices, concrete blocking, concrete pad the drain valve, setting, adjusting to grade, anchoring in place, and other appurtenances necessary for proper operation; but shall not include pipe and valve between the main line and drain valve buried bend.
- E. Manual Air Release Assemblies: Manual air release installations will be paid for at the unit bid price and shall include valves, fittings, pipe, tapping the main, box and cover, and other appurtenances necessary for proper operation.
- F. Automatic Combination Air/Vacuum Release Valve Assembly: Automatic air-vacuum release assemblies will be paid for at the unit bid price and will include the main line tap or outlet, all pipe, valves, fittings, box or vault and cover, and other appurtenances necessary for proper operation.
- G. Additional Bury Depth: Additional bury depth will be paid for at the unit bid price, which will include all work necessary to install units with bury depths exceeding 5.5 feet (1.68 meters).
- H. Fire Hydrant Barrel Extensions: Hydrant barrel extensions will be paid for at the unit bid price which will include necessary hardware and rod extensions.
- I. Reflectorized Pavement Markers: Pavement markers will be paid for at the unit bid price, which will include necessary surface preparation and adhesive, as per Standard Specification Item No. 863S.8.

Payment, when included as a contract pay item, will be made under one of the following:

<b>Pay Item No. 511S-A:</b>	Valves, _____ Type, _____ Diameter	Per Each.
<b>Pay Item No. 511S-B:</b>	Fire Hydrants (See Standard No. 511S-17)	Per Each.
<b>Pay Item No. 511S-C:</b>	Pressure or Flow Control Valve Assemblies	Per Each.

<b>Pay Item No. 511S-D:</b>	Drain Valve Assemblies (See Standard No. 511S-9A)	Per Each.
<b>Pay Item No. 511S-E:</b>	Manual Air Release Assemblies, ____Diameter	Per Each.
<b>Pay Item No. 511S-F:</b>	Automatic Combination Air/Vacuum Release Valve Assembly, _____ Diameter.	Per Each.
<b>Pay Item No. 511S-G:</b>	Additional Bury Depth	Per Vertical Foot.
<b>Pay Item No. 511S-H:</b>	Fire Hydrant Barrel Extensions	Per Vertical foot.

**END**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<u>Specification 511S, "Water Valves"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 510	Pipe
Section 510.3 (22)	Pipe Anchorage, Support and Protection
Section 510.3(24)	Water System Connections
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>

511S-1A	25 mm (1") - 76 mm (2") Vented Air Release Valve Installation (Type I)
511S-1B	25 mm (1") - 76 mm (2") Non-Vented Air Release Valve Installation (Type I)
511S-2A	Type II - 76 mm (3") or Larger Vented Air/Vacuum Valve Installation
511S-2B	Type II - 76 mm (3") or Larger Non-Vented Air/Vacuum Valve Installation
511S-3A	Type III - 76mm (3") or Larger Vented Air/Vacuum Valve Installation
511S-3B	Type III-76mm (3") or Larger Non-Vented Air/Vacuum Valve Installation
511S-9A	Drain Valve Assembly
511S-17	Standard Fire Hydrant Installation

Austin Water Utility Standard Products

<u>Designation</u>	<u>Description</u>
WW-132	Standard Products List for Metal-Seated Gate Valves, AWWA C-500
WW-282	Standard Products List for Resilient-Seated Gate Valves, AWWA C-509
WW-367	Standard Products List for Air Release Valves for Water
WW-462	Standard Products List for Air Release/Vacuum Relief Valves for Wastewater
WW-700	Standard Products List for Resilient-Seated Gate Valves, AWWA C

ANSI/AWWA Standards

<u>Designation</u>	<u>Description</u>
A-21.11	American National Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings



C-105	American National Standard for Polyethylene Encasement for Ductile-Iron Pipe
C-500	Metal-Seated Gate Valves for Water Supply Service
C-502	Dry-Barrel Fire Hydrants
C-504	Rubber-Seated Butterfly Valves
C509	Resilient Seated Gate Valves for Water and Sewerage Systems
C-515	Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service-515
<u>ASTM Standards</u>	
<u>Designation</u>	<u>Description</u>
ASTM A48/A48M	Specification for Gray Iron Castings
ASTM A 536	Specification for Ductile Iron Castings
<u>National Fire Protection Association (NFPA)</u>	
1963 National (American) Standard Fire Hose Coupling Screw Thread	

<b><u>RELATED CROSS REFERENCE MATERIALS</u></b>	
<u>Specification 511S, "Water Valves"</u>	
<u>City of Austin Standard Specification Items</u>	

<u>Designation</u>	<u>Description</u>
Item No. 501S	Jacking or Boring Pipe
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 509S	Trench Safety Systems

## ITEM NO. 620S - FILTER FABRIC 1-4-16

### 620S.1 - Description

This item shall govern the furnishing of materials and for placement of filter fabric as indicated on the Drawings or directed by the Engineer or designated representative. Filter Fabric shall have the capability for allowing the passage of ground water or stormwater through it without transporting the soil or medium placed around the filter fabric.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

### 620S.2 - Submittals

The submittal requirements of this specification item include:

- A. catalog cuts,
- B. samples of material selected,
- C. testing results,
- D. manufacturer's recommended installation procedures, and
- E. manufacturer certification of compliance with this specification.

### 620S.3 - Materials

#### A. General

The fabric shall be constructed exclusively of synthetic thermoplastic fibers and may be either woven or non-woven to form a mat of uniform quality. Fabric fibers may be either continuous or discontinuous and oriented in either a random or an aligned pattern throughout the fabric. The fabric shall be mildew resistant, rot proof and shall be satisfactory for use in a wet soil and aggregate environment. The fabric shall contain ultraviolet stabilizers and shall have non-raveling edges.

#### B. Physical Requirements

The fabric shall meet the requirements of Table 1, when sampled and tested in accordance with the methods indicated in the table below.

For applications such as water quality facility underdrain wrappings that require a high flow-through rate, or when specified by the engineer, the fabric shall be woven mono-filament and meet the requirements of Table 2.

All material shall be shipped with suitable wrapping to protect the fabric during shipping and storage at the job site.

Source: [Rule No. R161-15.14, 1-4-2016](#) .

### 620S.4 - Construction Methods

The submittal requirements shall be completed before any materials are ordered.

The "Filter Fabric" shall be installed in accordance with the manufacturer's recommendations, as indicated on the Drawings or as directed by the Engineer or designated representative. When lapping is required, it shall be in accordance with the manufacturer's recommendations. Backfilling around the Filter

Fabric shall be done in such a manner that the Filter Fabric material will not be damaged during the placement.

<b>TABLE 1: FILTER FABRIC REQUIREMENTS</b>		
<b>Original Physical Properties</b>	<b>Test Method</b>	<b>Requirements</b>
Fabric weight (mass), on an ambient temperature air-dried tension free sample, expressed in oz/ sq. yd (grams/square meter)	TxDoT Tex-616-J*	Slope Stabilization 4.0 (135) minimum
		Gabions and Revet Mattresses 6.0 (200) minimum
Water flow rate by falling head method, 7.9 inches (20 cm) to 3.9 inches (10 cm) on 2 inch (50 mm) ID cylinder with 1 inch (25 mm) diameter orifice, with flow rate expressed in gal/sq.ft/minute (liters/square meter/minute).	TxDoT Tex-616-J*	80 (3,260) minimum
Breaking load in either machine or cross-machine direction, expressed in pounds (newtons)	ASTM D-1682 grab method G**	100 (445) minimum
Equivalent opening size for US Standard (SI) sieves.	CW-02215	70 to 100 (212 to 150mm)
"Apparent elongation" at breaking load in either machine or cross-machine direction, expressed as percent	ASTM D-1682 grab method G**	100 maximum

\* TxDoT Tex-616-J, "Testing of Construction Fibers"

\*\* ASTM D 1682 grab method G, "Test Methods for Breaking Load and Elongation of Textile Fabrics" as modified by TxDoT Test Method Tex-616-J

\*\*\* CW-02215, US Army Corps of Engineers, Civil Works Construction Guide Specification "Plastic Filter Fabric".

<b>TABLE 2: HIGH FLOW FILTER FABRIC REQUIREMENTS</b>		
<b>Property</b>	<b>Test Method</b>	<b>Requirements</b>
Fabric Weight	>D 3776	3.0 ounces/square yard minimum
Ultraviolet (UV) Radiation Stability	D 4355	70% strength retained minimum, After 500 hours in xenon arc device
Mullen Burst Strength	D 3786	120 pound per square inch minimum
Water Flow Rate	D 4491	275 gallons/minute/square feet minimum

Source: [Rule No. R161-15.14, 1-4-2016](#) )

620S.5 - Measurement

Work and acceptable material for "Filter Fabric" and "High Flow Filter Fabric" will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards), complete in place.

Source: [Rule No. R161-15.14, 1-4-2016](#) )

620S.6 - Payment

The work performed and the materials furnished and measured as provided under "Measurement" will be paid at the unit bid price for "Filter Fabric". The unit bid price, when included in the contract as a pay item, shall include full compensation for all materials, excavation and backfilling and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item No. 620S-A:</b>	Filter Fabric	Per Square Yard.
<b>Pay Item No. 620S-B:</b>	High Flow Filter Fabric	Per Square Yard.

**End**

<u><b>SPECIFIC CROSS REFERENCE MATERIALS</b></u>
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Specification 620S, "Filter Fabric"

American Society for Testing and Materials (ASTM)

<u>Designation</u>	<u>Description</u>
D 1682	Test Methods for Breaking Load and Elongation of Textile Fabrics
D 3776	Standard Test Method for Mass Per Unit Area (Weight) of Fabric
D 4355	Test Method for Deterioration of Geotextiles by Exposure to Ultraviolet Light, Moisture, and Heat in a Xenon Arc Type Apparatus
D 3786	Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
D 4491	Standard Test Method for Water Permeability of Geotextiles by Permittivity

Texas Department of Transportation Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
Tex-616-J	Testing of Construction Fabrics

**RELATED CROSS REFERENCE MATERIALS**

Specification 620S, "Filter Fabric"

City of Austin Environmental Criteria Manual

<u>Designation</u>	<u>Description</u>
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Section 1.4.2.E	Rock Berm
Section 1.6.5.A.4	Sand Filtration Bed Details
Section 1.6.7.C	Biofiltration
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 639S-1	Rock Berm
Number 661-1	Sand Bed Filtration Configurations Using Geomembrane Liner
Number 661-2	Sand Bed Filtration Configurations Using Clay Liner/No Liner Required
Number 661-3	Biofiltration Bed Configurations Using Geomembrane/Clay Liner
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control

Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling



ITEM NO. 660S - BIOFILTRATION MEDIUM 1-4-16

660S.1 - Description

This item shall govern mixing and placing medium for a biofiltration basin intended to treat storm runoff. This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

(1) Submittals

The submittal requirements of this specification item include:

- A. A signed statement provided by the Contractor that:
  - 1. A laboratory analysis has been conducted by of the actual mixture being proposed, and has been verified as meeting the specifications below. The date of the laboratory analysis must be no more than six months prior to the date of installation of the biofiltration medium. A copy of the laboratory results must be provided.
  - 2. No "sandy loam" fill material (aka "red death") is included in the mixture.
  - 3. Report the source of organic matter.
- B. Laboratory reports of analyses results documenting that the mixture meets the following specifications:
  - 1. Particle size distribution performed per ASTM D-422:
    - Coarse fragments + sand content of 70 - 90% by weight
    - Clay content of 3 - 10% by weight
    - Silt + clay content  $\leq$  27% by weight
  - 2. Percent organic matter of 0.5 - 5% by weight per ASTM D2974 Method C
- C. Contractor's statement that the biofiltration medium has been tested by a laboratory using approved procedures (copy of lab results provided below) and meets the criteria as noted in Table 1 below:

**Table 1 - Biofiltration Medium Characteristics**

Parameter	Results*	Criteria	Criteria Met?*
Percent Sand + Coarse Fragments (ASTMD-422)		70 - 90%	
Percent Clay (< 0.002 mm)		3 - 10%	
Percent Silt + Clay (< 0.05 mm)		$\leq$ 27%	
Percent Organic Matter (ASTM D-2974)		0.5 - 5%	

Is any "Red Death" included in medium?		None allowed	
Is the mixture free of trash, stones, weeds, or other undesirable material?		None allowed	
Is the medium well-mixed and homogenous?		Must be homogenous	

\* Laboratory Must Fill In These Cells

**Table 2 - Biofiltration Medium Testing and Installation Dates**

Date of Laboratory Analysis (earliest)*	
Date of Medium Installation*	
Time between Dates (months)*	
Criteria for Time Between Dates (months)	6
Is Criteria Met?*	

\* Contractor Must Fill In These Cells

Source: [Rule No. R161-15.14, 1-4-2016](#) .

660S.2 - Materials

(1) Acceptable Materials

The following mixture (% by volume) should create an appropriate biofiltration medium, subject to specific characteristics of the topsoil, which may exhibit considerable variability:

- 70-80% concrete sand per ASTM C33 and/or screened decomposed granite sand
- 20-30% screened bulk topsoil (chocolate loam is also acceptable)
- The source materials must be free of stones, roots, or other similar objects larger than two inches. Additionally, it should be free of trash, other undesirable material, and should not contain weeds or weed seeds.
- The ingredients shall be well-mixed to create a homogenous medium.

(2) Unacceptable Materials

A commercially available fill material that should not be used is typically marketed as "sandy loam." This product is often referred to by landscapers as "red death", which refers to the color of the material, and is an infertile fill material that has poor drainage characteristics. All materials shall be free of Bermuda grass, Quackgrass, Johnson grass, or other noxious weeds, their roots or seeds.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.3 - Construction Methods

(1) Erosion Control

Prior to commencing this work, all required erosion control and environmental measures shall be in place as indicated on the approved site plan and/or modified.

(2) Scheduling, Delivery, Storage and Signage

The biofiltration medium must be delivered to, or mixed at, the site prior to the mid-construction conference. The medium must be certified as meeting the required specifications by the project Engineer, and approved by the City Inspector. The medium must be stored on-site separate from other materials, and covered to prevent erosion of the mixture by rainfall and runoff. The medium must have a prominent tag affixed that reads "BIOFILTRATION MEDIUM FOR WATER QUALITY POND."

(3) Placement

Complete construction and stabilize all areas draining to the biofiltration basin. Permanent controls will be cleaned out and filter medium will be installed after stabilization of the site. Install geotextile fabric per the Biofiltration Bed detail provided in Standard Detail 661-3. Biofiltration medium shall be placed in lifts of 12 to 18 inches without using heavy operating equipment or compaction. Lifts should be lightly watered to encourage soil settling. The final surface must be raked flat. The project Engineer must be notified 24 hours prior to installation of the biofiltration medium and approve and certify the installation.

(4) Shrinkage

Some shrinkage of the medium is to be expected after installation, in the range of 5-15%. As a general recommendation about 20 inches of medium should be installed to achieve a depth of 18 inches.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.4 - Measurement

Biofiltration medium will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction cross sections and plan grades. The plan quantities for biofiltration medium will be used as the measurement for payment of this item.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.5 - Payment

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

Payment will be made under the following:

<b>Pay Item No. 660S:</b>	Biofiltration Medium.	Per Cubic Yard.
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**END OF SECTION**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<u>Specification Biofiltration Medium</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.6.7.C	Biofiltration

<b><u>RELATED CROSS REFERENCE MATERIALS</u></b>	
<u>Specification Biofiltration Medium</u>	
City of Austin Environmental Criteria Manual	
Designation	Description
Section 1.6.5.A.4	Sand Filtration Basin Details
City of Austin Standards Details	
Designation	Description

Item No. 661-3	Biofiltration Bed Configurations Using Geomembrane/Clay Liner
City of Austin Standard Specifications	
Designation	Description
Item No. 620S	Filter Fabric

## **SPECIAL PROVISIONS**

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# Special Provision to Item 432

## Riprap

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Item 432, "Riprap" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 3. "Construction"** is supplemented by the following:

- 3.6. **Salvaged Rock Riprap.** Construct rock riprap using existing rock material placed on the slopes within the limits shown on the plans or otherwise required by the Engineer. Construct riprap as shown in Figure 4 on the *Stone Riprap Standard* and in accordance with applicable provision of this Item.

**Article 4. "Measurement."** The first paragraph is replaced by the following:

This Item will be measured by the cubic yard or square yard of material complete in place. Volume will be computed on the basis of the measured area in place and the thickness and toe wall width shown on the plans.

**Article 5. "Payment"** is replaced by the following:

The work performed and materials furnished in accordance with this Item and measured under "Measurement" will be paid for at the unit price bid for "Riprap" of the type, thickness, and void-filling technique (Dry, Grout, Mortar) specified or "Salvaged Rock Riprap" of the thickness, and void-filling technique (Dry, Grout, Mortar) specified as applicable.

Payment for excavation of toe wall trenches, for all necessary excavation below natural ground, or bottom of excavated channel, and for shaping of slopes for riprap will be included in the unit price bid of riprap or salvaged rock riprap.

When bedding is required for protection stone riprap, payment will be made at the unit price for "Bedding Material", of the thickness specified. This price is full compensation for furnishing, hauling, placing, and maintenance of the bedding material until placement of the riprap cover is completed and accepted, all excavation required for placement of bedding material, and for all labor, tools, equipment and incidentals necessary to complete the work. No payment will be made for excess thickness of bedding nor for material required to replace embankment material lost by rain wash, wind erosion, or otherwise, except for additional bedding material ordered in writing by the Engineer.

- 5.1 **Riprap.** This price is full compensation for furnishing, hauling, and placing riprap and for filter fabric, expansion joint material, concrete and reinforcing steel, grout and mortar, scales, test weights, equipment, labor, tools and incidentals.
- 5.2 **Salvaged Rock Riprap.** This price is full compensation for salvaging the existing riprap stone, stockpiling, hauling, and placing riprap and for filter fabric, grout and mortar, equipment, labor, tools and incidentals.

**SP551S**  
**Special Provision to COA Standard Specification Item No. 551S**  
**Pipe Underdrains**

For this project Item 551S, "Pipe Underdrains" of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this section of the City of Austin Technical Specifications are waived or changed.

**551S.1 Description**

Replace with the following:

This item shall consist of pipe underdrains embedded in filter material, filter fabric, and overflow/trash rack to be constructed at such places as indicated and in accordance with lines and grades established by Engineer. This item shall also consist of any pumping, bailing, drainage and Item No. 509, "Trench Safety Systems" for trench walls, when indicated.

**551S.2 Materials**

Replace (2) (a) Aggregate with the following:

Drainage Stone (i.e. filter material) for use creating the drainage layer and backfilling trenches under, around and over underdrains shall consist of hard, durable, clean, washed gravel or crushed stone conforming to ASTM D448, size No. 57, and shall be free from organic matter, clay balls or other deleterious matter.

Add the following at the end of this section:

(3) Trashrack

Trashrack for use in the rain garden overflow structures will be made of galvanized welded wire fabric with a maximum opening size of one (1) inch by one (1) inch and made from twelve (12) gauge wire. The wire joints should be joined using galvanized "J" clips. Trashrack filler stone shall be hard, durable, clean washed gravel ranging in size from 2-3 inches.

**510S.4 Measurement**

Replace with the following:

Work and accepted materials for "Pipe Underdrains" shall be measured by the linear foot of pipe measured along slope and shall include clearing, excavation, pipe, length of elbows, wyes, tees and other branches and backfill.

Work and accepted materials for "Rain Garden Drainage Stone" shall be measured by the square yard in place complete and shall include clearing, excavation, rock and geotextile filter fabric (2 layers).



Acceptable work and materials for the "Rain Garden Overflow Structure" will be measured per each in place and complete and shall include riser pipe and fittings, beehive grate, trashrack, filter fabric, and trashrack filler rock.

**510S.5 Payment**

Add the following after the second paragraph:

Work performed, and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid per square foot of "Rain Garden Drainage Stone" of type and size specified, which price shall be full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the work.

Work performed, and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Rain Garden Overflow Structure " of type and size specified, which price shall be full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the work.

Add the following pay items:

<b>Pay Item No. SP551-A:</b>	Rain Garden Drainage Stone	Per Square Yard.
<b>Pay Item No. SP551-B:</b>	Rain Garden Overflow Structure	Per Each.

**End**

**SECTION 591S-SP RIPRAP FOR SLOPE STABILIZATION**

The Special Provision to Item 591S serves to modify, add to, and/or delete from the City of Austin Standard Specifications. Any item, paragraph, article or work contained in the standard specification Item 591S, unless specifically modified, added to or deleted, shall remain unchanged.

Sections: 591 S.3 Materials

**591 S.3 Materials**

The gradation table under 591 S.3 Materials, subparagraph (A) Rock shall be replaced with the following gradation table:

Table 1: Aggregate Gradation Chart (TEX 401-A, % Retained per sieve)		
US 8 inch (SI 200 mm)	US 5 inch (SI 125 mm)	US 2 inch (SI 50 mm)
0	90-100	100

**END OF SECTION SP-591S**

## **SPECIAL SPECIFICATIONS**

**Special Specification Item No. SS02263  
Permanent Turf Reinforcement Matting**

**1.00 General**

1.01 Work Included

Furnish labor, materials, equipment and incidentals necessary to install permanent turf reinforcement matting (PTRM) including stripping excavation. Use the PTRM in erosion control applications for earthen embankment overtopping protection. The PTRM shall be North American Green SC250 or approved equal.

1.02 Quality Assurance

A. Design Criteria

1. The turf reinforcement mat shall be a machine-produced mat of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.
2. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the properties in the following table.
3. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between the bottom and middle ultra heavy-duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings and then covered by an ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle, dramatically corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

B. Packing and Identification Requirements

Provide the PTRM in rolls wrapped with protective covering to protect the material from mud, dirt, dust, and debris. The material shall be free of defects or flaws which significantly affect its physical properties. Label each roll in the shipment with a number or symbol to identify that production run.

C. Sampling and Compliance Requirements

The SC250 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.18 as a Type 5A, B, and C Permanent Turf Reinforcement Mat.*

A competent laboratory must be maintained by the producer of the PTRM at the point of manufacture to insure quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and

provide a manufacturer's certificate upon request to the Engineer prior to shipment. The certificate shall include:

1. Name of manufacturer
2. Chemical composition
3. Product description
4. Statement of compliance to specification requirements
5. Signature of legally authorized official attesting to the information required

### 1.03 Submittals

Submittals shall be in accordance with Section 01300, SUBMITTALS and shall include:

- A. Record Data
- B. Samples
- C. Manufacturer and/or its representative shall provide the City of Leander a written certification that the material was installed properly (meeting or exceeding manufacturer's recommendations) upon completion of installation.

## 2.00 Products (Not Used)

## 3.00 Execution

### 3.01 PTRM Installation

- A. Installation staple patterns shall be clearly marked on the turf reinforcement matting with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.
- B. Exposure of PTRM to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential. Install the PTRM fabric in accordance with the plans and Manufacturer's Recommendations. Construction vehicles will not be allowed to traffic directly on the fabric.
- C. Place and anchor PTRM on a smooth graded surface approved by the City/Engineer. The PTRM shall be placed so that placement of the overlying materials will not excessively stretch or tear the fabric. Anchoring of the terminal ends of the PTRM shall be accomplished through the use of key trenches or aprons at the crest and the toe of the slope. Successive PTRM sheets shall be overlapped so that the upstream sheet is placed over the downstream sheet and/or upslope over downslope. Overlaps when necessary shall be 12" minimum except when placed under water where the overlap shall be a minimum of 36". Use securing pins when necessary to insure proper anchoring of the fabric for intimate ground contact and to avoid bulges in the material.
- D. Securing pins shall be 3/16" steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 1-1/2". The pin length shall not be less than 19". U-shaped pins or special staples shall be

- an acceptable option, if approved by the Engineer and recommended by the Manufacturer.
- E. The backfill placement shall begin at the toe and proceed up the slope. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided.
  - F. The PTRM shall be installed in such a manner that the mat is in full contact with the soil and without bulges, wrinkles, or other anomalies that could result in future maintenance issues such as getting caught in a mower blade. If necessary to achieve good soil contact, the Contractor shall use additional anchors than the minimum recommended by the manufacturer.

#### 4.00 Measurement and Payment

PTRM shall be measured for payment by the square yard in place and will include the cost for all labor, materials, stripping excavation, backfill and appurtenances. Measurement will be the nearest square yard. No allowance will be made for material in laps and seams. No allowance will be made for having the manufacturer's representative onsite or for providing the written certification. Payment will be made at the contract unit price bid.

**Pay Item No. SS02263:** Permanent Turf Reinforcement Matting - Per Square Yard.

**END OF SECTION**

**02267 GEOMEMBRANE HDPE CONTAINMENT BARRIERS**

**1.00 GENERAL**

**1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install HDPE geomembrane. Use the HDPE geomembrane as a barrier to separate biofiltration medium and roadway base material.

**1.02 QUALITY ASSURANCE**

- A. Design Criteria: The geomembrane liner shall be a high-density polyethylene (HDPE) geomembrane liner. Each geomembrane roll shall be a minimum of 20 feet in width. The minimum average roll value (MARV) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the minimum average roll value (MARV) as stipulated herein.

<b>60 mil HDPE (Textured)</b>				
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>MARV</b>	<b>Frequency of Testing</b>
<b>Resin</b>				
Density	ASTM D1505	g/cc	≥0.932	Per 200,000 lbs. and each resin lot
Melt Flow Index	ASTM D1238	g/10 min	<1 (max)	Per 200,000 lbs. and each resin lot
<b>Manufacturer's Quality Control</b>				
Thickness	ASTM D5994	mils	54	Every roll
Density	ASTM D1505/D792	g/cc	0.94	Per 200,000 lbs.
Carbon Black Content	ASTM D4218	%	2-3	Per 20,000 lbs.
Carbon Black Dispersion	ASTM D5596	Rating	Nine in Categories 1 and 2. One in Category 3.	Per 45,000 lbs.
Tensile Strength at Break	ASTM D6693	lb./in. width	90	Per 20,000 lbs.
Tensile Strength at Yield	ASTM D6693	lb./in. width	126	Per 20,000 lbs.
Elongation at Break	GRI GM13	%	100	Per 20,000 lbs.
Elongation at Yield	ASTM D6693	%	12	Per 20,000 lbs.

Tear Resistance	ASTM D1004	lb.	40	Per 45,000 lbs.
<b>60 mil HDPE(Textured)</b>				
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>MARV</b>	<b>Frequency of Testing</b>
Puncture Resistance	ASTM D 4833	lb.	90	Per 45,000 lbs.
Asperity Height	ASTM D7466	mil.	18	Every second roll
Thermal Stability Oxidative Induction Time	ASTM D3895	min.	>100	Per 200,000 lbs.
Notched Constant Tensile Load	ASTM D5397	hr.	300	Per 200,000 lbs.
<b>Conformance Testing by Third Party Independent Laboratory</b>				
Thickness	ASTM D5994	mils	54	Every roll
Density	ASTM D1505/D792	g/cc	0.94	Per 200,000 lbs.
Carbon Black Content	ASTM D4218	%	2-3	Per 20,000 lbs.
Carbon Black Dispersion	ASTM D5596	Rating	Nine in Categories 1 and 2. One in Category 3.	Per 45,000 lbs.
<b>Conformance Testing by Third Party Independent Laboratory</b>				
Tensile Strength at Break	ASTM D6693	lb./in. width	90	Per 20,000 lbs.
Tensile Strength at Yield	ASTM D6693	lb./in. width	126	Per 20,000 lbs.
Elongation at Break	GRI GM13	%	100	Per 20,000 lbs.
Elongation at Yield	ASTM D6693	%	12	Per 45,000 lbs.
<b>Destructive Seam Field Testing</b>				
Shear	ASTM D6392 at 2 in/min	lb./in.	120 & exhibit FTB	Varies for field, lab and archive
Peel	ASTM D6392 at 2 in/min	lb./in.	78 & exhibit FTB	Varies for field, lab and archive
<b>Non-Destructive Seam Field Testing</b>				
Air Pressure	ASTM D5820	See Paragraph 3.01.C.6		All dual track fusion weld seams
Vacuum	ASTM D5820	See Paragraph 3.01.C.6		All non-air pressure



- B. Packing and Identification Requirements: Provide the geomembrane in rolls wrapped with protective covering to protect the geomembrane from mud, dirt, dust, and debris. The geomembrane shall be free of defects or flaws which significantly affect its physical properties. Label each roll of fabric in the shipment with a number or symbol to identify the thickness, length, and manufacturer's roll number.
- C. Sampling and Compliance Requirements:
1. A competent laboratory must be maintained by the producer of the geomembrane at the point of manufacture to ensure quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and provide a manufacturer's certificate to the Engineer prior to shipment. The certificate shall include:
    - a. Name of manufacturer.
    - b. Chemical composition.
    - c. Product description.
    - d. Roll numbers.
    - e. Date of Production.
    - f. Statement of compliance to specification requirements.
    - g. Signature of legally authorized official attesting to the information required.
  2. A third party independent laboratory must be retained by the Owner to ensure quality control prior to acceptance of the geomembrane. The laboratory must test for thickness (ASTM D5199-smooth, ASTM D1593-textured), melt flow index (ASTM D1238), specific gravity/density (ASTM D1505), carbon black content (ASTM D1603), carbon black dispersion (ASTM D3015) and tensile properties (ASTM D638). These tests must be performed at least once per 100,000 ft<sup>2</sup> and per each resin lot and must meet the MRVs listed in Paragraph 1.02, Quality Assurance, and Paragraph 2.01, Materials.
- D. Manufacturer's Experience: The manufacturer shall be listed by the National Sanitation Foundation (NSF) as having met Standard 54 for Flexible Membrane Liners. The manufacturer shall have previously demonstrated the ability to produce HDPE geomembrane rolls by having manufactured a minimum of 10,000,000 square feet of HDPE geomembrane. The manufacturer shall permit the Owner and/or Engineer to visit the manufacturing plant.
- E. Installation Experience:
1. The installation contractor shall be the manufacturer or an approved contractor trained and licensed to install the manufacturer's geomembrane.
  2. Installation shall be performed under the constant direction of a single field installation supervisor who shall remain on Site and be responsible, throughout the liner installation, for liner layout, seaming, patching, testing, repairs, and all other activities by the installer. This installation supervisor shall have installed or supervised the installation and seaming of a minimum of 2,000,000 square feet of HDPE geomembrane. Actual seaming shall be performed under the direction of a master seamer (who may also be the installation supervisor) who has seamed a minimum of 2,000,000 square feet of HDPE geomembrane, using the same type of seaming apparatus specified in the

Project. This installation supervisor and/or master seamer shall be present whenever seaming is performed.

### 1.03 SUBMITTALS

- A. Submittals shall be submitted prior to shipment, shall be in accordance with Section 01 33 00 "Submittal Procedures" and shall include:
  - 1. The manufacturer shall submit two sets of Certified Test Results verifying all liner materials meet requirements stipulated in this Section. All test data should be presented to verify testing.
  - 2. Submit Manufacturer's Certificate as stipulated in Paragraph 1.02.C.
  - 3. Submit letter from manufacturer regarding experience as stipulated in Paragraph 1.02.D.
  - 4. Manufacturer shall submit letter that states the material can withstand the environment that it will be exposed to.
  - 5. Submit two sets of Shop Drawings on the proposed installation layout identifying panel layout, installation details and seams.
  - 6. Submit letter from Installation Contractor regarding experience of Installation Supervisor as stipulated in Paragraph 1.02.E.
  - 7. The installation contractor shall include with the Shop Drawings a list of three similar installations which have been in satisfactory operation for at least 1 year. The list shall include the owner's name, location of the project, square feet of material installed, and completion date. The contractor shall also submit a list of three installations where the membrane supplier has supplied similar membrane material as specified herein. The list shall include the installation contractor, the owner, the location of the project, and the square feet of material installed. Shop Drawings not including this required information will not be accepted.

### 1.04 DELIVERY AND STORAGE

- A. Transportation: All HDPE liner material shall be shipped in rolls. Folded sections of panels are not acceptable and shall not be used in HDPE liner construction. Creased sections of panels (which are not a normal part of the manufacturing process for some HDPE manufacturers) are not acceptable and shall not be used in the geomembrane liner construction. The geomembrane rolls shall be packaged and shipped by appropriate means so that no damage is caused. Transportation shall be the responsibility of the installer.
- B. Delivery: Off-loading and storage of the geomembrane is the responsibility of the installer. The installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner. No off-loading shall be done unless the Engineer is present. Damage during off-loading shall be documented by the Engineer. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer. The Engineer will be the final authority on determination of damage.

C. On-Site Storage:

1. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage. A sacrificial cover must be used to protect the HDPE if stored on site more than 6 months. The rolls shall be stored in such a manner as to avoid shifting, abrasion, or other adverse movements that can damage the geomembrane liner material.
2. The rolls shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than three rolls high.

1.05 GUARANTEES

- A. The membrane manufacturer shall provide warranty coverage on the membrane for a period of five (5) years from date of installation. The supplier shall replace or repair any defective materials and workmanship including significant leakage, abnormal aging, deterioration of materials, and other defects of the membrane liner which fail within the warranty period. The Contractor shall furnish the Owner with a written warranty covering the requirements of this paragraph.
- B. The installer shall provide warranty coverage against defects in workmanship for a period of one (1) year from the date of geomembrane completion. The Installer shall replace or repair any defective workmanship including significant leakage and seams of the membrane liner that fail within the warranty period. The Contractor shall furnish the Owner with a written warranty covering the requirements of this paragraph.

2.00 PRODUCTS

2.01 MATERIALS

- A. The geomembrane shall be high-density, polyethylene (HDPE). The geomembrane shall be manufactured of virgin, first quality resin produced in the United States and shall be compounded and manufactured specifically for the intended purpose. The HDPE (compounded) resin shall have a minimum specific gravity of 0.932 as tested by ASTM D1505, shall have a maximum melt flow index of less than 1 g/10 min as tested by ASTM D1238 - Condition E, and shall have a Carbon Black Content between 2 percent and 3 percent as tested by ASTM D4218, shall have a Carbon Black Dispersion of A-2 as tested by ASTM D3015 and shall have the thickness determined in accordance with ASTM D5994 (textured). All resin lots are to be bracketed and tested.

3.00 EXECUTION

3.01 INSTALLATION

A. Earthwork:

1. General:
  - a. Earthwork shall be in accordance with Section 02200 Earthwork. For surfaces to be lined with a geomembrane, the uppermost lift of the earth fill or subgrade shall be compacted by a minimum of eight passes with a smooth drum roller. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects and

angular rock, or debris, or debris of any kind. These surfaces shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.

- b. The installer, on a daily basis, shall certify that the surface on which the geomembrane will be installed is acceptable. After the supporting soil surface has been accepted, it shall be the installer's responsibility to indicate to the Owner any change to its condition due to natural causes or occurrences that may require repair work.

B. Method of Placement: The installer shall be responsible for the following:

1. The geomembrane shall only be placed on prepared subgrade. The deployment (including equipment used in the handling of the geomembrane) shall not damage the subliner.
2. No vehicular traffic shall be allowed on the geomembrane. Only low-ground-pressure supporting equipment may be allowed to traverse across the geomembrane. If such supporting equipment is operating on the geomembrane it must be placed on a sacrificial surface or rub sheet in order to help protect the geomembrane liner.
3. Only those geomembrane liner sections that are to be placed and seamed in 1 day should be unrolled.
4. No equipment or tools shall damage the geomembrane by handling, trafficking, or other means.
5. No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane.
6. Wrinkles shall be identified as to proper location and compensation shall be identified on the Contractor's Record Drawings.
7. Adequate loading (e.g. sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).
8. Weather Conditions: Geomembrane deployment shall proceed between ambient temperatures of 40 F to 104 F. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g. fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.
9. Factory Seams: Factory seams shall not be allowed.

C. Field Seaming:

1. Seams shall be oriented parallel to the line of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized, and outside the corners.
2. Seam jointing of the sidewalls and bottom sections must be located in the bottom and at least 5 feet from the sidewall. No folds, large wrinkles, or fish-mouths shall be allowed in the seamed area. Where wrinkles or folds occur, the materials shall be cut and overlapped, and an extrusion weld applied. During wrinkle or fold repairs, adjacent geomembranes may not necessarily be required to meet the 3- to 4-inch minimum

overlap if approved by the Engineer. All complete seams shall be tightly bonded and sealed.

3. Seam Overlap:
  - a. Panels of geomembrane must have a finished overlap of a minimum of 4 inches for hot shoe fusion welding and 3 inches for extrusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam.
  - b. No solvent or adhesive may be used unless the product is approved by the Owner.
  - c. The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.
4. Seaming Equipment and Accessories: Equipment for field seaming is hot shoe fusion welders and extrusion welders in accordance with manufacturer's guidelines.
5. Trial Seams:
  - a. The Engineer should observe all test seam procedures and all seam testing. All seam testing of the geomembrane should follow these specifications.
  - b. Each day, prior to commencing field seaming, test seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate.
  - c. Each trial test seam shall be at least 3 feet long by 1 foot wide. Four (six when possible if using dual track fusion welding) adjoining 1-inch wide specimens will be die-cut from the test seam sample. Two specimens will be tested in the field for shear and two for peel (four when possible if testing both inner and outer welds for dual track fusion welding).
  - d. The failure criteria is the same as that for destructive seam testing as described in Paragraph 3.01.C.7, Destructive Seam Testing, of this Section. These test specimens must exhibit a Film Tear Bond "FTB" (ASTM D6392). If the seam does not delaminate, but fails in the adjacent sheet material on either side of the seam, it is an FTB or an acceptable failure mode. If one test seam fails, the trial seam will be repeated. If this trial seam also fails, then two more trial seams must be constructed and tested. This process must continue and no welding can begin for the machine or welder (if applicable) until all test seams are passing.
  - e. Additional trial seams shall be made for all of the following:
    1. At the beginning of each seaming period for each seaming apparatus used that day (The beginning of each seaming period is considered to be the morning, and immediately after a break).
    2. Each occurrence of significantly different environmental conditions (i.e., temperature, humidity, dust, etc.).
    3. Any time the machine is turned off for more than thirty minutes.
    4. When seaming different geomembranes (tie-ins and smooth to textured).
  - f. Both the welder and the machine must be tested for each new trial seam when extrusion welding. Only the machine needs to be tested for each new trial seam when fusion welding since the machine is not as operator dependent. Each

individual seaming shall make at least one test seam each day he/she actually performs seaming.

6. Non-Destructive Seam Testing: The installer shall non-destructively test all field seams over their full length. All test equipment, including but not limited to the following shall be furnished by the installer:
  - a. Vacuum Box Testing (ASTM D5820):
    1. A suction value of approximately 3 to 5 inches of gauge vacuum must be applied to all extrusion welded seams tested in this manner.
    2. Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:
      - a. A vacuum box assembly consisting of rigid housing, transparent viewing window, soft rubber gasket attached to the bottom, port hole or valve assembly, and vacuum gauge.
      - b. A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
      - c. A rubber pressure/vacuum hose with fittings and connections.
      - d. A plastic bucket and wide paint brush.
      - e. A soapy solution.
      - f. The following procedures shall be followed by the installer:
        1. Excess sheet overlap shall be trimmed away.
        2. Clean the window, gasket surfaces and check for leaks.
        3. Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
        4. Wet a strip of geomembrane approximately 12 by 48 inches (length of box) with the soapy solution.
        5. Place the box over the wetted area and compress.
        6. Close the bleed valve and open the vacuum valve.
        7. Ensure that a leak tight seal is created.
        8. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
        9. If no bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch overlap and repeat the process. The Engineer must observe 100 percent of this testing.
        10. All areas where soap bubbles appear shall be marked and repaired and then retested.

- g. The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by the Engineer:
  - 1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.
  - 2. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Engineer for uniformity and completeness.
- b. Air Pressure Testing (ASTM D5820):
  - 1. The following procedures are applicable to those processes which produce a double seam with an enclosed space.
  - 2. Equipment for testing double fusion seams shall be comprised of the following:
    - a. An air pump equipped with pressure gauge capable of generating and sustaining a pressure of approximately 30 psi and mounted on a cushion to protect the geomembrane.
    - b. A manometer equipped with a sharp hollow needle, or other approved pressure feed device.
    - c. The following procedures shall be followed by the installer:
      - 1. Seal both ends of the seam to be tested.
      - 2. Insert needle or other approved pressure device into the tunnel created by the double wedge fusion weld.
      - 3. Energize the air pump to a pressure of approximately 30 psi, if possible. The air pump must then be shut off and the air pressure observed after 5 minutes.
      - 4. A loss of less than 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. A loss of more than 4 psi indicates the presence of a seam leak which must then be isolated and repaired by following appropriate repair procedures. The Engineer must observe and record all pressure gauge readings.
      - 5. Remove needle or other approved pressure feed device and seal.
- 7. Destructive Seam Testing: The installer shall provide the Engineer with a minimum of one destructive test sample per 500 feet of seam length from a location specified by the Engineer. The installer shall not be informed in advance of the sample location. At a minimum, a destructive test must be performed for each welding machine used for seaming or repairs.
  - a. Sample Procedure: In order to obtain test results prior to completion of liner installation, samples shall be cut by the installer as the seaming progresses. Sampling items and locations shall be determined by the Engineer. The Engineer must witness the obtainment of all field test samples and the installer shall mark all samples with their location roll and seam number. The installer shall also record in written form the date, time, location, roll seam number, ambient temperatures, and pass or fail description. A copy of the information must be attached to each sample

portion. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired. All patches shall be vacuum tested.

- b. Size and Disposition of Samples: The samples shall be 12 inches wide by 24 inches long with the seam centered lengthwise. If the installer desires a sample the size should be increased to 12 inches wide by 36 inches long.
- c. Field Laboratory Testing: At least two specimens shall be tested for peel strength (ASTM D4437). To be acceptable, all test specimens must pass the minimum specified value (and exhibit an FTB failure) as described in Paragraph 1.02.
- d. Independent Laboratory Testing: The Independent Laboratory Testing representative shall witness all field tests and see that proper identification and details accompany the test results. Details required include:
  1. Date and time.
  2. Ambient temperature.
  3. Identification of seaming unit, group or machine.
  4. Name of master seamer.
  5. Welding apparatus temperature and pressure.
  6. Pass or fail description.
- e. The Engineer shall properly mark, package and ship at least five specimens received from the installer to a laboratory for the determination of shear and peel strengths (ten when possible for both tracks of dual-track fusion welded seams). The test method and procedures to be used by the independent laboratory shall be the same used in field testing, where seam samples are 1 inch wide, and the grip separation rate is 2 ipm. All specimens tested in the peel mode must fail in FTB. At least four of five specimens from each peel and shear determination must meet the minimum specified value. The average value from all five specimens from each peel and shear determination must meet the minimum specified value.
- f. Procedures for Destructive Test Failure: The following procedures shall apply whenever a sample fails the field destructive test:
  1. The installer shall reconstruct the seam between the failed location and any passed test location.
  2. Additional samples shall be taken 10 feet on either side of the failed test for an additional field test. Should the sample pass the field test, duplicate samples shall be submitted for laboratory testing. If these laboratory samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.
  3. A maximum of two attempts will be made per 100 linear feet of seam before the section is determined failed and repair is to be affixed to the entire seam.
  4. Over the length of seam failure, the Contractor shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Engineer.



5. After reseaming or placement of the cap strip, additional destructive field test(s) shall be taken within the reseamed area. The reseamed sample shall be found acceptable if test results are approved by the Engineer. If test results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory by the Engineer.
  - g. In the event that a sample fails a laboratory destructive test, then the above procedures shall be followed, considering laboratory tests exclusively.
  - h. The Engineer will document all actions taken in conjunction with destructive test failures.
8. Defects and Repairs:
- a. All seams and non-seam areas of the geomembrane shall be inspected by the Engineer for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be brushed, blown, or washed by the installer if the amount of the dust or mud inhibits inspection. The Engineer shall decide if cleaning of the geomembrane is needed to facilitate inspection.
    1. Evaluation:
      - a. Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the Engineer. Each location that fails the non-destructive testing shall be marked by the Engineer, and repaired accordingly.
    2. Repair Procedures:
      - a. Defective seams shall be restarted/reseamed as described in these specifications.
      - b. All holes shall be patched.
      - c. Tears shall be repaired by patching. Where the seam is on a slope or an area of stress and has a sharp end, it must be rounded prior to patching.
      - d. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
      - e. Surfaces of HDPE which are to be patched shall be abraded and cleaned no more than 15 minutes prior to the repair. No more than 10 percent of the thickness shall be removed.
    3. Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled with an angle grinder prior to placement of the geomembrane. Patches shall be applied using approved methods only.
  - b. Restart/Reseaming for Extrusion Welding Procedures: The welding process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at

least 2 inches. Reseaming over an existing seam without regrinding shall not be permitted.

c. Verification of Repairs:

1. Each repair shall be non-destructively tested. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.
2. Daily documentation of all non-destructive and destructive testing shall be provided to the Engineer by the installer. The documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested.

D. Geomembrane Acceptance: The installer shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane liner shall be accepted by the Owner when all of the following conditions are met:

1. Installation is finished.
2. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.
3. Certification, including "as-built" drawing(s), is provided by the installer to the Owner's representative.

**END OF SECTION**

## **APPENDIX A**

### **A1.00 MEASUREMENT AND PAYMENT**

- A. Geomembrane shall be measured for payment by the square yard in place. Measurement will be to the nearest square yard. No allowance will be made for material in laps and seams. Payment will be made at the contract unit price bid for "Geomembrane - HDPE", which price and payment shall constitute full compensation for furnishing labor, material, equipment, and performing operations in connection with placing the geomembrane as shown on the Drawings. No measurement or payment will be made for damaged geomembrane due to the fault or negligence of the Contractor.

**END OF APPENDIX A**

## **SS-1000 BYPASS PUMPING**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. This item shall govern the management of all sanitary sewer flows under all flow conditions encountered during performance of the Work. The Contractor shall prevent sewage overflows and provide reliable sewer service at all times. The Contractor shall manage and maintain sewage flow in the construction area, where indicated on the plans, in order to prevent backup and/or overflow into upstream pipe segments and laterals, adjacent ditches, storm sewer, and waterways.
- B. Measurement and Payment shall be in accordance with the contract documents.

#### **1.02 MATERIALS**

- A. The Contractor shall provide and maintain adequate flow diversion systems, pumping equipment, force mains and/or other necessary appurtenances in order to maintain reliable sanitary sewer service in all sanitary sewer lines as required for construction. The Contractor shall have backup pump(s), force main(s), and/or other necessary appurtenances ready to deploy immediately. Intake and discharge points shall be approved by the Inspector.
- B. Remediation of any spillage, backups and/or overflows, etc. is the sole responsibility of the Contractor.
- C. The Contractor shall demonstrate that the diversion or pumping system is in good working order and is sufficiently sized to successfully handle all sanitary sewer flows by performing a test run for a period of 24 hours prior to beginning the Work.
- D. The Contractor shall be required to have all materials, equipment and labor necessary to complete the repair or replacement on the job site prior to isolating the sewer manhole or line segment and beginning flow diversion or pumping operations.

#### **1.03 SUBMITTALS**

- A. The Contractor shall submit a sanitary sewer Flow Management Plan. Plan shall define CONTRACTOR'S intended methods, techniques, equipment, down-hole tools, procedures and incidentals required to safely and effectively manage the sanitary sewer flows under all flow conditions. The plan shall also include a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), all excavation locations, interfering utilities, and flow bypass plan, an erosion and sedimentation control plan and contingency plans for possible problems. Work plan should be comprehensive, realistic and based on actual working conditions for the project.
- B. Where flow diversion and/or pumping will be performed by a Subcontractor, the Flow Management Plan shall identify that subcontractor including qualifications and similar experience.
- C. The Flow Management Plan will be reviewed for acceptance by Owner and Engineer.

D. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures".

**2.00 PRODUCTS [NOT USED]**

**3.00 EXECUTION**

A. Construction Methods

1. The Contractor shall provide flow management of sewage and wet weather flows around each Work area requiring flow management. The Contractor shall be responsible for all required bulkheads, flow plugs, pumping equipment, piping, etc. to accomplish the flow management.
2. All piping, joints and accessories shall be designed to withstand at least twice the maximum system pressure, or a minimum of 50 psi, whichever is greater. During flow diversion and/or pumping, no sewerage shall be leaked, dumped, or spilled in or onto, any area outside of the existing sanitary sewer system. When flow diversion and/or pumping operations are complete, all pumping shall be drained into the sanitary sewer prior to disassembly and all flow management components shall be removed from the site.
3. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Take all necessary steps to prevent flooding of any residence or business. Contractor shall be liable for any damages incurred as a result of this work
4. The Contractor shall provide an automatic controlled duplex pumping system with one (1) pump on stand-by.
5. Begin the flow diversion at the upstream manhole. Divert flow to the downstream manhole of the line section being worked. The bypass system must have sufficient capacity to handle peak flow during a rainstorm. The Contractor is responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing.
6. The Contractor shall provide continuous 24 hour monitoring of all by-pass pumping activities.
7. The contractor is responsible for any construction activities related to the pumping of existing sanitary sewer flow. The Contractor shall repair any damage resulting from wastewater flow backing up in the sanitary sewer system.

**END OF SECTION**

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# Special Specification 6120

## Dead End Roadway Barricade

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### 1. DESCRIPTION

Furnish and install dead end roadway barricades at the locations shown on the plans, in accordance with this specification, or as directed.

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### 2. CONSTRUCTION

Construct and install dead end roadway barricades as detailed on Traffic Operations Division Standard Sheet, "Delineator and Object Marker Placement Details" (D&OM), or as shown on the plans.

Construct and install signs and chevrons, when shown on the plans, in accordance with Traffic Operations Division Standard Sheet, "Delineator and Object Marker Placement Details" (D&OM), or as shown on the plans.

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### 3. MEASUREMENT

This Item will be measured by the foot of dead end roadway barricade assembly complete in place.

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### 4. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Dead End Roadway Barricade." This price is full compensation for furnishing materials including object markers; and for labor, tools, equipment, hauling and incidentals necessary to complete the work.

Signs, sign supports, and chevrons, when shown on the plans, will be paid for under Item 644, "Small Roadside Sign Assemblies."

## SPECIFICATION 6789

### GEOGRID REINFORCEMENT IN THE USE OF A MECHANICALLY STABILIZED AGGREGATE LAYER (MSAL)

#### 1.0 DESCRIPTION

This special specification covers the requirements for a Mechanically Stabilized Aggregate Layer (MSAL). This specification includes all materials requirements for geogrid, its handling and approval, and the construction process necessary to construct an acceptable MSAL. The properties and performance of the MSAL have been considered in and are integral to the structural design of the pavement structure; thus, no modification of the pavement shall be made other than those approved by the engineer per part 1.2 of this section and in accordance with the requirements for submission of alternates described herein.

A Mechanically Stabilized Aggregate Layer (MSAL) is a composite layer of a defined thickness comprised of unbound aggregate or crushed limestone base material (CLBM) combined with one or more layers of a geogrid reinforcement structure. The geogrid reinforcement structure shall be formed by a regular network of integrally connected, multi-directional tensile elements of appropriate orientation, size, and shape to allow interlocking with the unbound aggregate or base course materials. The combination of the two materials creates an improved or modified composite layer with significantly improved properties and performance capabilities.

#### 2.0 DESIGN & PERFORMANCE

**2.1 Design.** The design of the pavement shall be in accordance with the 1993 American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures and AASHTO R50-09, using the design input values contained in the project Geotechnical Report. The MSAL shall be incorporated into the pavement design by utilizing modified layer coefficient values. Modified layer coefficients values shall be calibrated and validated with the results of full scale laboratory, field and/or accelerated pavement testing where actual geogrids are testing in-soil and in representative conditions.

##### **2.1.1 Mechanically Stabilized Aggregate Layer, MSAL**

- a. The Mechanically Stabilized Aggregate Layer within the pavement structure shall have a minimum thickness of **6.0 inches**.
- b. Mechanically Stabilized Aggregate Layer **SN = 1.614**.

- 2.2 Performance.** In-air index testing of geogrid properties, or explanations of performance based on in-air index testing of geogrid properties are not sufficient to understand the complex mechanisms involved in soil/geogrid interaction and/or the performance of a MSAL. Therefore, acceptance of alternates based on material property comparisons or explanations of performance based on in-air testing of geogrid properties will not be allowed.
- 2.3 Alternate Design Submittals.** Any submittal for an alternative MSAL must be submitted 15 days prior to the bid date and reviewed for approval by the Geotechnical Engineer of record in advance of the bid date. The Engineer will respond within 10 days with a written justification to allow or disallow the requested alternate geogrid. The submittal must be accompanied with the following:
- 2.3.1** Full-scale laboratory and in-ground testing of pavement structures reinforced with the specific product being proposed. Validation testing conducted must have been performed at an Accelerated Pavement Testing (APT) Facility, in the United States, where the performance of the specific product was evaluated in a paved section in accordance with NCHRP Report 512. The design method utilized for incorporating the product being proposed must have undergone a full calibration and validation with the specific product. The method, performance testing (APT), and products used, must have been reviewed by a third party, recognized by AASHTO as a pavement engineering services firm. The third party must validate that the products being proposed, and the methodology used, are in full compliance with AASHTO R50-09. An assessment report, by the third party, shall accompany the submittal, and with a qualification summary of the third party reviewer.
  - 2.3.2** In-ground performance testing conducted in Texas and in compliance with ASTM D1195-93. A minimum of 10 documented tests performed at 1,000 cycles, and 2 documented tests performed at 10,000 cycles, must be completed on placed and compacted base courses in Texas, where Resilient modulus values and permanent deformation values have been measured using the specific geogrid product proposed for use. Testing performed should include a range of stresses from 2 to 50 psi. The location of each test, base aggregate classification and gradation, and subgrade conditions must be documented for each test location. The testing must be performed by a 3rd party who is not an employee of the contractor or geogrid manufacturer or supplier.
  - 2.3.3** A sample 4 x 7 inches or larger.
  - 2.3.4** Recommended installation instructions.
  - 2.3.5** Additional information as requested by the Engineer to fully evaluate the product.



### 3.0 MATERIALS

**3.1** An acceptable geogrid reinforcement component of the MSAL is Tensar TriAx TX8, or better, and shall be integrally formed and produced from a punched sheet of polypropylene which is then oriented in three substantially equilateral directions so that the resulting ribs shall have a high degree of molecular orientation, which continues at least in part through the mass of the integral node. The resulting geogrid structure shall have apertures that are triangular in shape, and shall have ribs with depth-to-width ratios greater than 1.0.

**3.2** The TriAx TX8 geogrid shall have the typical characteristics shown in the table below, and shall be certified in writing by the manufacturer to be TX8:

TriAx TX8

Properties	Longitudinal	Diagonal	Transverse	General
Rib pitch, mm (in)	33 (1.30)	33 (1.30)	-	
Mid-rib depth, mm (in)	-	1.6 (0.06)	1.2 (0.05)	
Mid-rib width, mm (in)	-	0.4 (0.02)	0.7 (0.03)	
Rib Shape				rectangular
Aperture shape				triangular

### 4.0 CONSTRUCTION METHODS

**4.1 Pre-Construction Conference.** Prior to the start of construction of the MSAL, the Contractor shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The Owner and the Engineer shall be notified at least 3 days in advance of the time of the meeting. A representative of the geogrid supplier shall be available on an "as needed" basis during construction.

**4.2 Examination, Storage and Protection.** The Contractor shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the contractor to be free of flaws or damage occurring during manufacturing, shipping, or handling. The Contractor shall prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming

in contact with and affixing to the geogrid materials. The geogrid shall be stored at temperatures above -20 degrees F (-29 degrees C). Rolled materials may be laid flat or stood on end. Geogrid materials shall not be left directly exposed to sunlight for a period longer than the period recommended by the manufacturer.

- 4.3 Preparation of Subgrade.** The subgrade shall be prepared in accordance with the project requirements and approved by the Engineer prior to further construction activities. The subgrade shall be firm and able to support, without displacement, the construction equipment and the compaction operations hereinafter specified. Soft or yielding subgrade shall be corrected and made stable before construction proceeds.
- 4.4 Installation.** The MSAL shall be constructed at the proper elevation and alignment as shown on the construction drawings. The geogrid shall be installed in accordance with these plans and specifications and any installation guidelines provided by the manufacturer or as directed by the Engineer. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required based on fill properties, fill placement procedures or weather conditions or as directed by the Engineer. Overlap adjacent rolls along their sides and ends 1-2 feet as directed by the Engineer or Manufacturer's Representative.
- 4.5 Granular Fill Placement over Geogrid.** Granular fill material shall be placed in lifts not exceeding 8 inches and not less than 4 inches and compacted as directed in the project requirements. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 5 mph). Sudden braking and sharp turning movements shall be avoided.
- 4.6 Inspection.** The Owner or Owner's representative may randomly inspect geogrid before, during and after (using test pits) installation. Any damaged or defective geogrid (i.e. frayed coating, separated junctions, separated layers, tears, etc.) before, during and after installation shall be replaced by the Contractor at no additional cost to the Owner. Proper replacement shall consist of replacing the affected area adding 3ft (1 m) of geogrid beyond the limits of the affected area.

## 5.0 METHOD OF MEASUREMENT

Tensor Triax TX8 Geogrid, or better, shall be paid for by the square yard. No allowance will be made for laps.

## **6.0 BASIS OF PAYMENT**

The accepted quantities measured as provided above, will be paid for at the contract unit price for:

GEOGRID REINFORCEMENT FOR A MECHANICALLY STABILIZED AGGREGATE LAYER  
(MSAL).....SQUARE YARD

which shall be full compensation for furnishing all materials, labor, equipment, storage, private lab testing, sampling, handling and tools, including all appurtenances and incidentals necessary to complete the installation of the approved geogrid. Test rolling and/or Proof rolling shall be considered incidental to the contract and will not be measured or paid for separately.

**END OF SECTION**



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August 26, 2014  
Arias Project No. 2013-756

Via Email: [Jessica.Rodriguez@freese.com](mailto:Jessica.Rodriguez@freese.com)

Ms. Jessica Rodriguez, P.E.  
Senior Project Manager  
Freese and Nichols, Inc.  
10431 Morado Circle  
Building 5, Suite 300  
Austin, Texas 78759

**RE: Geotechnical Design Memorandum  
Pavement Thickness Design**  
North Burleson Street Improvements  
W. Center Street to Market Place Ave  
Kyle, Texas

Dear Ms. Rodriguez:

Arias & Associates, Inc. (Arias) is pleased to submit this Geotechnical Design Memorandum (GDM) for the design of pavements for the above referenced project. Our services were performed as outlined in our proposal dated September 23, 2013, and formally authorized in Subconsultant Authorization Agreement executed May 13, 2014.

The purpose of this geotechnical engineering study was to establish engineering properties of subsurface soil and groundwater conditions present at the site. The geotechnical boring and laboratory findings are included in the Geotechnical Data Report (GDR) presented under separate cover. The scope of the study was to provide geotechnical engineering criteria for use in pavement thickness design and earthwork recommendations. Our findings and recommendations should be incorporated into the design and construction documents for the proposed development.

The following sections present a summary of the project information, and recommendations for design and construction of proposed pavements.

## **PROJECT INFORMATION**

The project will consist of roadway improvements to approximately 1.4 miles of N. Burleson Street, from W. Center Street to Market Place Avenue in Kyle, Texas. Currently, the majority of the project (approximately 1.3 miles) will be along existing Right of Way (ROW), and about 0.1 miles will include new ROW and new roadway construction. The existing ROW consists of 2-lane roadway with bar ditches. Proposed construction will include 3 lanes with a center turn lane, curb and gutter drainage improvements, and culvert crossing at an unnamed tributary of Plum Creek. Project location

information and subsurface conditions are included in the Geotechnical Data Report (GDR) presented under separate cover.

## PAVEMENT RECOMMENDATIONS

### Traffic Estimate

Traffic loading was estimated using Equivalent 18-kip Single Axle Loads (ESALs) over a 20-year design period. Using the City of Austin Transportation Criteria Manual (TCM) as a guide, we have estimated the following anticipated traffic distribution and average daily traffic for use in selecting a design ESALs for this pavement thickness design. If actual traffic loading information is different from that presented herein, we recommend that Arias be retained to revise our recommendations. The following equation and traffic factors were used to calculate the design ESALs:

$$ESALs = (ADT_i)(T)(T_f)(365)(L)(D)((1+G)^Y - 1)/G$$

**Table 1: Traffic Estimates and Traffic Factors**

<b>ESALs factors</b>	<b>Description</b>	<b>Primary Collector (90 ft ROW)</b>	<b>Primary Collector (90 ft ROW)</b>	<b>Primary Collector (120-ft ROW)</b>
ADT <sub>i</sub>	Initial Average Daily Traffic	6,000	6,000	8,000
T	Percent Trucks	5.9%	5.9%	8.9%
T <sub>f</sub>	Truck Equiv. Factor	0.62	0.62	0.62
L	Lane Distribution Factor	1.00	1.00	1.00
D	Directional Distribution Factor	0.5	0.5	0.5
G	Percent Growth	3%	3%	3%
Y	Design period	15	20	20
<b>ESAL<sub>s</sub></b>		<b>800,000</b>	<b>1,140,000</b>	<b>2,300,000</b>

Traffic counts were reviewed for average daily traffic in 2012 on TxDOT Statewide Planning Maps ([http://www.txdot.gov/apps/statewide\\_mapping/StatewidePlanningMap.html](http://www.txdot.gov/apps/statewide_mapping/StatewidePlanningMap.html)) for TxDOT roadways in the vicinity of the project site. An excerpt of that map is presented in the pavement thickness design calculations packet included in Appendix A. The nearby ADT in 2012 ranged from 6,500 to 11,800 along the IH-35 frontage road and FM 150. Therefore, an estimated ADT of 6,000 to 8,000 may be appropriate for the N. Burleson Road project and is suggested for design. Both a 15- and 20-year design ESAL are considered for the initial ADT option of 6,000, where the 15-year design life pavement section will require an overlay prior to the 20-year design life.

Subgrade conditions along the roadway alignment were variable in the borings and consisted mostly of fat clay with gravel and sand. Based on subsurface conditions encountered in the borings, and

the results of the CBR test, we have estimated a subgrade resilient modulus ( $M_R$ ) value of 3,500 psi for this analysis. Subgrade conditions were modeled using published empirical correlations<sup>1</sup> with measured plasticity indices, resulting CBR, and engineering judgment.

### Flexible Pavement Design

Using the 1993 AASHTO pavement thickness design procedure, a flexible pavement section consisting of hot mix asphaltic concrete (HMAC), over crushed limestone base material (CLBM) was developed for the estimated traffic loading conditions and anticipated subgrade condition. Recommended flexible pavement sections for the corresponding design life are provided in the following table. These sections are based on a reliability level of 85 percent, a terminal serviceability of 2.0, and that the pavement structure and subgrade are fully drained.

**Table 2: Recommended Flexible Pavement Sections**

Traffic ESAL	Design Life	Hot Mix Asphaltic Concrete (HMAC) Thickness, inches	Crushed Limestone Base Material (CLBM) Thickness, inches
800,000	15-year*	4.0	16
1,140,000	20-year	4.5	16
2,300,000	20-year	5.0	18
		5.5	16
* Requires 1.5-inch overlay (HMAC Type D), or 2.0-inch overlay (HMAC Type C) after 15 yrs			

Pavement sections shown above pass the TxDOT FPS21 mechanistic check for 20% fatigue cracking and 0.5 inch rutting criteria for the given design life. The mechanistic check involves structural computations of tensile strains at the bottom of the asphalt concrete layer that govern the number of load repetitions to failure in terms of fatigue, and vertical compressive strains at the top of the subgrade layer that govern the number of load repetitions to failure in terms of rutting. The TxDOT FPS21 mechanistic design check output, as well as support documentation and calculations for the recommended pavement sections above are included in Appendix A.

A 15-year pavement section is given above, requiring an HMAC overlay to support traffic growth and pavement longevity for a 20 year design life. According to the 2004 TxDOT Standard Specifications for the Construction of Highways, Streets and Bridges, a minimum overlying thickness of 1.5 inches is specified for HMAC Type D, and a minimum of 2.0 inches is specified for Type C. Pavement longevity and success of overlays (if planned) will be dependent on actual traffic loading and pavement maintenance prior to overlay.

<sup>1</sup> E.J. Yoder & M.W. Witczak "Principles of Pavement Design" John Wiley & Sons; 2<sup>nd</sup> Edition (1 Jan 1975)

### Alternative Pavement Sections

The project team has requested a full depth section of HMAC to facilitate rapid construction in areas that cannot be closed for extended periods of time such as areas subject to residential traffic. As requested, we have reviewed the use of a full-depth asphalt section that will allow the construction to proceed as a faster construction schedule to reduce the inconvenience to the local traffic. The following pavement sections were developed for the estimated traffic loading conditions and anticipated subgrade condition.

**Table 3: Alternative Pavement Sections – Full Depth Asphalt**

Traffic ESAL	Design Life	Hot Mix Asphaltic Concrete (HMAC) Type C or D Thickness, inches	Hot Mix Asphaltic Concrete (HMAC) Type A or B Thickness, inches
1,140,000	20-year	2	8
2,300,000	20-year	3	8
HMAC - Item 340, TxDOT Standard Specifications for the Construction of Highways, Streets, and Bridges, 2004.			

If reuse of existing pavement material is being contemplated as an alternative pavement section, additional information should be collected. This would include drilling of shallow borings through the existing pavement section to determine existing pavement thicknesses (volume) available for reuse, and or test pits to collect bulk samples for laboratory (strength) testing. Boring B-3 was drilled through the existing (side street) pavement and encountered approximately 1 inches of asphaltic concrete and 8 inches of base material. For preliminary planning purposes, it should be assumed that 75 to 80% of this volume would be available for reuse as fill material. Reused existing pavements are generally suitable for pavement subgrade and embankment fill placement, provided it has been processed to a maximum aggregate size of 3 inches or less.

It has been our experience that existing pavement materials tend to break down over time, and have resulting triaxial strengths about halfway between CLBM and the subgrade. If reuse of the existing pavement is considered a viable option for this project, Arias would be pleased to provide a proposal for additional data collection, testing, and engineering services to evaluate the site specific pavement conditions. It is noted that the borings drilled for this investigation were drilled in the easements (off the roadway) to lessen traffic burden and need for full lane closure (traffic control) during drilling.

## Pavement Construction

Recommendations for subgrade preparation are presented in the following Table 4. Recommendations for flexible pavement material construction are provided in Table 5.

**Table 4: Pavement Subgrade Recommendations**

<b>Recommendations for Pavement Subgrade</b>	
<b>Stripping Depth</b>	8 inches or as needed to remove roots, organics, and existing pavements
<b>Reuse Excavated Soils</b>	Material free of roots, debris and other deleterious material with a maximum particle size of 3 inches and PI<30 may be reused as subbase or embankment fill.
<b>Undercut Extent</b>	12 inches beyond the paving limits
<b>Exposed Subgrade Treatment</b>	Proof roll with equipment weighing at least 25 tons and remove and replace weak yielding material with select fill. Disk to 8-inch depth and recompact soils to $\geq 95\%$ maximum dry density at $\pm 2$ percentage points of optimum moisture content (TxDOT Tex-114-E if clayey and TxDOT Tex-113-E if gravelly); Proofroll the prepared subgrade in accordance with Item 216 of the current TxDOT Standard Specifications. Geotechnical engineer should observe proofrolling operation.
<b>General Fill Type</b>	Material free of roots, debris and other deleterious material with a maximum particle size of 3 inches and a PI less than 30.
<b>Maximum General Fill Loose Lift Thickness</b>	8 inches
<b>General Fill Placement Criteria</b>	Compact soils to $\geq 95\%$ maximum dry density at $\pm 2$ percentage points of optimum moisture content (TxDOT TEX-114-E if clayey and TxDOT TEX-113-E if gravelly)
<b>In-Place Density and Moisture Verification Frequency</b>	
<b>Test frequency (all materials)</b>	1 test per 10,000 square feet per lift (min. 3 tests per lift)



**Table 5: Flexible Pavement Section Materials**

<b>Flexible Asphalt Pavement</b>	
<b>Flexible Base Material Type</b>	TxDOT Item 247, Type A, Grades 1, 2 or 5
<b>Maximum Flexible Base Loose Lift Thickness</b>	8 inches
<b>Flexible Base Placement Criteria</b>	Compact to $\geq 100\%$ maximum dry density at -2 to +2 percentage points of optimum moisture content (TxDOT Tex-113-E)
<b>Hot Mix Asphaltic Concrete (HMAC) Type for Surface Course</b>	TxDOT Standard Specifications Item 340 Type C or D
<b>Hot Mix Asphaltic Concrete (HMAC) Type for Full-Depth Asphalt Course</b>	TxDOT Standard Specifications Item 340 Type A or B
<b>HMAC Placement Criteria</b>	91% to 95% Theoretical Lab Density (TEX 207 F)

Project specifications should dictate that the CLBM and HMAC thicknesses specified in the table above be a minimum at any location rather than an average.

**Drainage and Groundwater Control**

Groundwater was encountered in 7 of the 10 borings at depths of 3 to 8.5 feet deep at the time of drilling, and as shallow as 2 feet deep in boring B-6 stabilized after drilling. Depending on final grades proposed for the roadway, temporary and or permanent below-grade groundwater control and drainage may be required for satisfactory long term pavement performance. It is anticipated that the exceptionally shallow groundwater conditions at boring B-6 will require a trench drain or blanket drain to intercept groundwater and remove it from beneath the pavement structure. Placement of below grade drains, such as trench drains, blanket drains, and or transverse drains, will need to be determined based on location of stormwater catch basins and other discharge structures to facilitate removal of collected groundwater from the drains. Arias can provide supplemental recommendations for permanent drains once design has advanced.

Control of surface drainage and groundwater is important to the performance and life of pavements. Infiltration of water into the pavement subgrade and pavement structure will result in premature loss of serviceability. Adequate drainage provisions should be included in the pavement design. Additionally, the placement of curbs, islands and irrigation systems should be carefully planned in a manner that will not lead to ponding and saturation of pavement base materials that extend into island areas.

During the paving life, maintenance to seal surface cracks within the paving should be undertaken to achieve the desired paving life. Perimeter drainage should be controlled to reduce the influx of surface water from areas surrounding the paving. Water penetration into base or subgrade materials, sometimes due to irrigation or surface water infiltration leads to premature paving degradation. Curbs should be used in conjunction with paving to reduce potential for infiltration of moisture into the base course. Curbs should extend the full depth of the base course and should extend at least 3 inches below the base material. The base layer should be tied into the area inlets to drain water that may collect in the base.

## **ROADWAY AND CULVERT CONSTRUCTION**

### **Embankment Materials**

All material used for embankment construction should be non-dispersive, and should be free of organic material (trees, stumps and roots), debris, or other deleterious matter and should be processed before placement on the embankment so it is reasonably uniform in composition and moisture content. The fill should have a plasticity index less than 30 and a maximum particle size of 3 inches, and classify as a GC, SC, or CL material. Additionally, embankment material should be approved by the geotechnical engineer or his representative prior to stock piling and/or placement. The surficial topsoil containing organic materials should be stripped, stockpiled and used to promote vegetative slope protection for the outer slope faces of the embankment.

Proposed embankment materials should meet the requirements set forth in Texas Department of Transportation, 2004 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Item 132, Embankment.

### **Fill Placement and Compaction**

The embankments should be constructed in lifts such that all lifts are bonded together, the specific densities are met throughout each lift, the moisture content is uniform throughout the fill, and clods are broken down and bonded into the rest of the lift without nesting and voids. The embankment material should be compacted to at least 95 percent of the maximum dry density as determined by TxDOT Test Method TEX-114-E if clay soils, and 95 percent of the maximum dry density as determined by TxDOT Test Method TEX-113-E if granular (gravel) soils. Hold moisture contents to within  $\pm 2$  percent of optimum and compacted lift thicknesses to 6 inches. Borrow soils more than 3 percent dry of optimum should be prewetted in the borrow area, and should not be placed on the fill until their moisture contents have equilibrated.

### **Embankments and Cut Slopes**

Based on proposed grading and subgrade conditions, cut and fill slope configurations of 4H to 1V should be adequate with regard to slope stability, provided fill embankments are constructed as recommended herein, and slopes were less than 10 ft in height. If steeper slopes, taller slopes, or

mechanically stabilized earth structures are planned to achieve grade separation, Arias should be retained to provide slope stability analyses and recommendations.

Topsoil should be placed and a vegetative cover established in the cut slope face to prevent erosion of the exposed face. Grading should be established with necessary interceptor swales and diversion dikes to prevent erosion of the slope crest, face, and toe.

Maintenance of stable construction slopes for the safety of workers is the responsibility of the contractor. All temporary excavations made by the contractor should be in accordance with current OSHA regulations on trench safety. The slope ratio discussed herein is intended to be the steepest permissible for the long-term performance of the earthen-structures. The contractor is required to evaluate the suitability of all slopes for construction safety purposes and to construct flatter slopes where required.

### **Slope Protection**

All permanent slope faces should be protected from erosion by placement of at least 6 inches of topsoil with vegetative cover, turf reinforcement mattresses, concrete rip rap, etc. Embankment slopes protected by vegetation should be periodically inspected and repaired if necessary. Some minor, shallow sloughing and gulying should be expected and planned for in the owner's maintenance budget.

### **Stripping and Surface Preparation**

The ground surface within the embankment footprint will require preparation prior to the start of construction. All trees, stumps, roots, brush and surficial soils should be grubbed and removed from the embankment areas.

### **Culverts**

A culvert structure is planned at the unnamed tributary of Plum Creek (near boring B-4). We recommend the following for foundation and below grade wall design and construction of the culvert:

1. Within the culvert foundation footprint, and for a distance 3 ft outside the footprint (where practical), remove all loose fat clay soils, organics, any deleterious material, and surficial soils to a depth of at least 6 inches.
2. Scarify at least 6 inches of the cut soil subgrade and recompact to a minimum of 95% of the maximum dry density as determined using the Texas Department of Transportation (TxDOT) Test Method TEX-114-E. Hold water contents within  $\pm 2\%$  of optimum.
3. The geotechnical engineer or his representative should observe the prepared foundation subgrade prior to reinforcing steel placement. At that time, the engineer may recommend

removal of unsuitable (soft or wet) subgrade soils and/or installation of a stabilization layer. This stabilization layer may consist of gravel and cobble-sized crushed stone wrapped in a geotextile to improve the foundation subgrade, control groundwater during construction, and/or to achieve specified compaction of culvert wall backfill. Contract documents should include a bid item for placement of a stabilization layer.

4. For poured in place concrete foundations for the concrete box culvert, we recommend that the foundations extend at least 2 ft below final grade, be at least 36 inches wide, and sized using an allowable net bearing pressure of 2,500 psf. These recommendations do not include provisions for scour effects, and foundation will need to be deepened or turned down for potential scour, to be determined by others.
5. The backfill material behind the culvert walls should consist of "select fill" material meeting the plasticity and gradation requirements of Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges, Item 247, Type A or B, Grade 3 or better. The proposed backfill zone should extend for a lateral distance behind the wall equivalent to at least the height of the wall. General embankment material may be used beyond this zone for roadway construction.
6. Compact select fill to at least 95% of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Hold water contents within  $\pm 2\%$  of the optimum water content, and maintain compacted lift thicknesses to six inches or less.
7. Provided the culvert is backfilled as recommended in Items 5 and 6 above, use an equivalent fluid unit weight of 95 pcf, assuming undrained conditions.
8. Use a coefficient of horizontal earth pressure of 0.5 for uniform vertical surcharge loads adjacent to the culvert. A uniform surcharge pressure of 240 psf should be used for culvert backfill subjected to traffic loading, per the Federal Highway Administration and TxDOT standards.

## **LIMITATIONS**

This report was prepared as an instrument of service for this project exclusively for the use of Freese & Nichols, Inc. and its design team. If the development plans change relative to layout, size or anticipated loads or if different subsurface conditions are encountered, we should be informed and retained to ascertain the impact of these changes on our recommendations. We cannot be responsible for the potential impact of these changes if we are not informed.

### **Geotechnical Design Review**

Arias should be given the opportunity to review the design and construction documents. The purpose of this review is to check to see if our recommendations are properly interpreted into the project plans and specifications. Please note that design review was not included in the authorized scope and additional fees may apply.

### **Subsurface Variations**

Soil and groundwater conditions may vary between the sample boring locations. Transition boundaries or contacts, noted on the boring logs to separate soil/rock types, are approximate. Actual contacts may be gradual and vary at different locations. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions or highly variable subsurface conditions are encountered during construction, we should be contacted to evaluate the significance of the changed conditions relative to our recommendations.

### **Quality Assurance Testing**

The long-term success of the project will be affected by the quality of materials used for construction and the adherence of the construction to the project plans and specifications. As Geotechnical Engineer of Record (GER), we should be engaged by the Owner to provide Quality Assurance (QA) testing. Our services will be to evaluate the degree to which constructors are achieving the specified conditions they're contractually obligated to achieve, and observe that the encountered materials during earthwork for foundation and pavement installation are consistent with those encountered during this study. In the event that Arias is not retained to provide QA testing, we should be immediately contacted if differing subsurface conditions are encountered during construction. Differing materials may require modification to the recommendations that we provided herein. A message to the Owner with regard to the project QA is provided in the ASFE publication included in Appendix B.

Arias has an established in-house laboratory that meets the standards of the American Standard Testing Materials (ASTM) specifications of ASTM E-329 defining requirements for Inspection and Testing Agencies for soil, concrete, steel and bituminous materials as used in construction. We maintain soils, concrete, asphalt, and aggregate testing equipment to provide the testing needs required by the project specifications. All of our equipment is calibrated by an independent testing agency in accordance with the National Bureau of Standards. In addition, Arias is accredited by the

American Association of State Highway & Transportation Officials (AASHTO), the United States Army Corps of Engineers (USACE) and the Texas Department of Transportation (TxDOT), and also maintains AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL) proficiency sampling, assessments and inspections.

Furthermore, Arias employs a technical staff certified through the following agencies: the National Institute for Certification in Engineering Technologies (NICET), the American Concrete Institute (ACI), the American Welding Society (AWS), the Precast/Prestressed Concrete Institute (PCI), the Mine & Safety Health Administration (MSHA), the Texas Asphalt Pavement Association (TXAPA) and the Texas Board of Professional Engineers (TBPE). Our services are conducted under the guidance and direction of a Professional Engineer (P.E.) licensed to work in the State of Texas, as required by law.

### **Standard of Care**

Subject to the limitations inherent in the agreed scope of services as to the degree of care and amount of time and expenses to be incurred, and subject to any other limitations contained in the agreement for this work, Arias has performed its services consistent with that level of care and skill ordinarily exercised by other professional engineers practicing in the same locale and under similar circumstances at the time the services were performed.

Information about this geotechnical report is provided in the ASFE publication included in Appendix B.

**CLOSING**

The following attachments complete this report:

Appendix A  
Appendix B

Pavement Thickness Design Calculations  
Project Quality Assurance  
ASF E Information – Geotechnical Report

We sincerely appreciate the opportunity to provide these geotechnical engineering services and look forward to our continued association throughout construction. Please do not hesitate to call with any questions or comments concerning this report, or if we may be of further service.

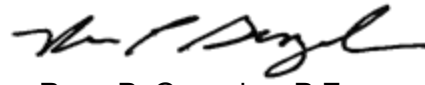
Sincerely,

**ARIAS & ASSOCIATES, INC.**

TBPE Registration No. F-32



Rebecca A. Russo, P.E.  
Senior Geotechnical Engineer



Rene P. Gonzales, P.E.  
Project Manager

## **APPENDIX A**





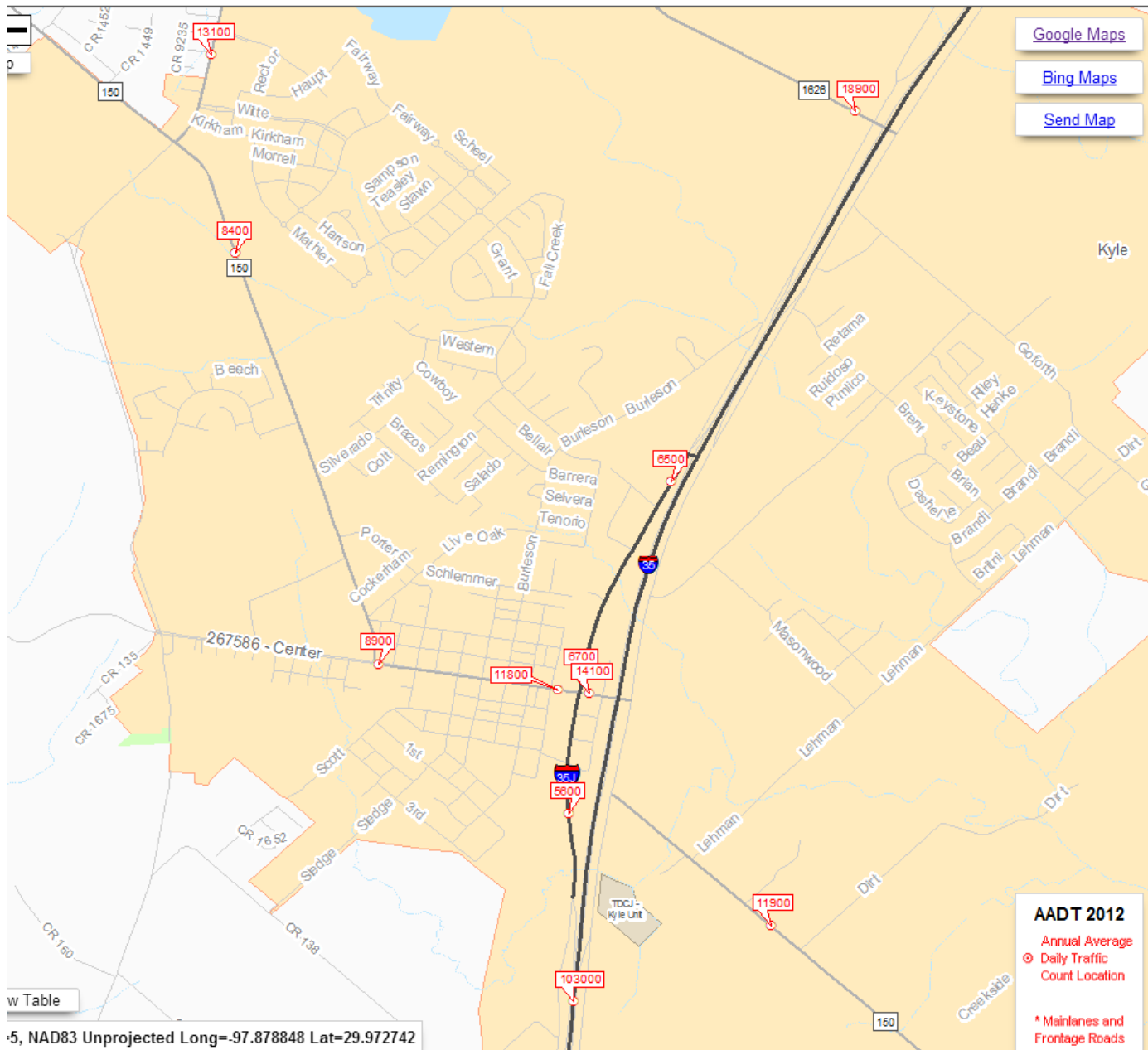
### CALCULATION COVER SHEET

PROJECT N. Burleson Rd	PROJECT NO. 2013-756				
CALCULATION TITLE Flexible Pavement Thickness Calculations					
ORIGINATED BY R. Russo	DATE 8/22/14	CHECKED BY	DATE		
SUBJECT Determining flexible pavement thickness for ACP over CLBM					
STATEMENT OF PROBLEM Used City of Austin TCM for traffic loading: ROW = 90 ft, ADT = 6,000, ESALs 1,020,000 ROW = 120 ft, ADT = 8,000, ESALs 2,010,000 Subgrade conditions: CBR = 2.4, Mr = 3500 psi					
SOURCES OF DATA City of Austin Transportation Criteria Manual TxDOT Statewide Planning (range 6500 to 11800 ADT in vicinity) ROW plans provided by F&N					
SOURCES OF FORMULAS & REFERENCES AASHTO 1993 Pavement Design Guidelines Yoder and Witczak - Pavement Design FPS21 - TxDOT pavement program					
INTENDED USE <input type="checkbox"/> PRELIMINARY CALC. <input type="checkbox"/> SUPERCEDES CALC. NO. _____ <input checked="" type="checkbox"/> FINAL CALC. <input type="checkbox"/> OTHER _____					
REV. NO.	DESCRIPTION	BY	DATE	CHECK	DATE
	<i>M. Russo</i>		<i>8/22/14</i>		

**Table 3-11 Summary of Minimum Paving Thickness**  
 (modified 07/31/02 to include Truck %, Terminal Serviceability, Truck Factor, and Lane Distribution Factor)

Street Classification	Austin Transportation Study (ATS) Designation	ROW Width (Ft.)	Paving Width E-E (Ft.)	Median Width F-F (Ft.)	Initial ADT (VPD)	Percent Growth (%)	Total Equivalent 18 Kip Single Axle Load Applications (20 Year Flexible Design)	Minimum Percent Truck (%)	Minimum Thickness of HMA Surface Course (In.)	Minimum Thickness of Flexible Base Course (In.)	Terminal Serviceability Index (TSI)	Truck Factor (TF) (average City truck)	Lane Distribution Factor (LDF)
<b>Local (Residential)</b>											<b>Light Sections</b>		
SF-1 to SF-2		50	27		500	3.0%	20,000	2.0%	1½"	8"	1.0	0.40	100%
SF-3 to SF-6		56	33		500	3.0%	20,000	2.0%	1½"	8"	1.0	0.40	100%
<b>Collectors</b>											<b>Medium Sections</b>		
Residential		60	37		1,000	3.5%	80,000	3.4%	2"	10"	1.5	0.48	100%
Neighborhood		64	41		2,000	4.0%	290,000	5.5%	2"	10"	1.5	0.53	100%
<b>Primary Collectors</b>											<b>Heavy Sections</b>		
Commercial	COL	70	45		5,000	4.0%	1,240,000	8.6%	3½"	12"	2.0	0.58	90%
Industrial	COL	90	57		2,000	4.0%	930,000	16.1%	3"	12"	2.0	0.58	90%
Prim, Undiv, 4	COL	70	45		3,500	4.0%	650,000	6.4%	2½"	12"	2.0	0.53	90%
Prim, Undiv, 5	COL	90	57		3,500	4.0%	850,000	8.9%	3"	12"	2.0	0.58	90%
Prim, Div, 4-LN	COL	90	2 @21	16	6,000	4.0%	1,020,000	5.9%	3½"	12"	2.0	0.62	90%
Prim, Div, 6-LN	COL	120	2 @33	23	8,000	4.0%	2,010,000	9.8%	3½"	12"	2.0	0.62	80%
<b>Minor Arterials</b>													
Minor, Undiv.	MNR4	70	48		6,000	4.0%	1,020,000	5.5%	4"	12"	2.5	0.62	90%
Minor, Undiv, 5	MNR5	90	60		8,000	4.0%	2,680,000	11.5%	4"	12"	2.5	0.62	90%
Minor, Div, 4-LN	MAD4	90	2 @24	16	9,000	4.0%	3,020,000	10.9%	4"	12"	2.5	0.62	90%
<b>Major Arterials</b>													
Major, Undiv, 4*	MAU4	70	48		18,000	4.0%	4,000,000	7.2%	5"	12"	2.5	0.84	90%
Major, Div, 6-LN	MAD6	120	2 @36	23	18,000	4.0%	5,200,000	7.8%	5"	12"	2.5	0.84	80%
Major, Div, 8-LN	MAD8	150	2 @48	23	25,000	4.0%	6,300,000	8.3%	5"	12"	2.5	0.84	70%

Note: These values are minimums and are not to be used without verification by a computerized pavement design for specific site subgrade and local traffic conditions. \*Major Arterial, Undivided, 4-Lane has been added for consistency with Austin Transportation Study (ATS) documents for proposed roadway configuration MAU4.





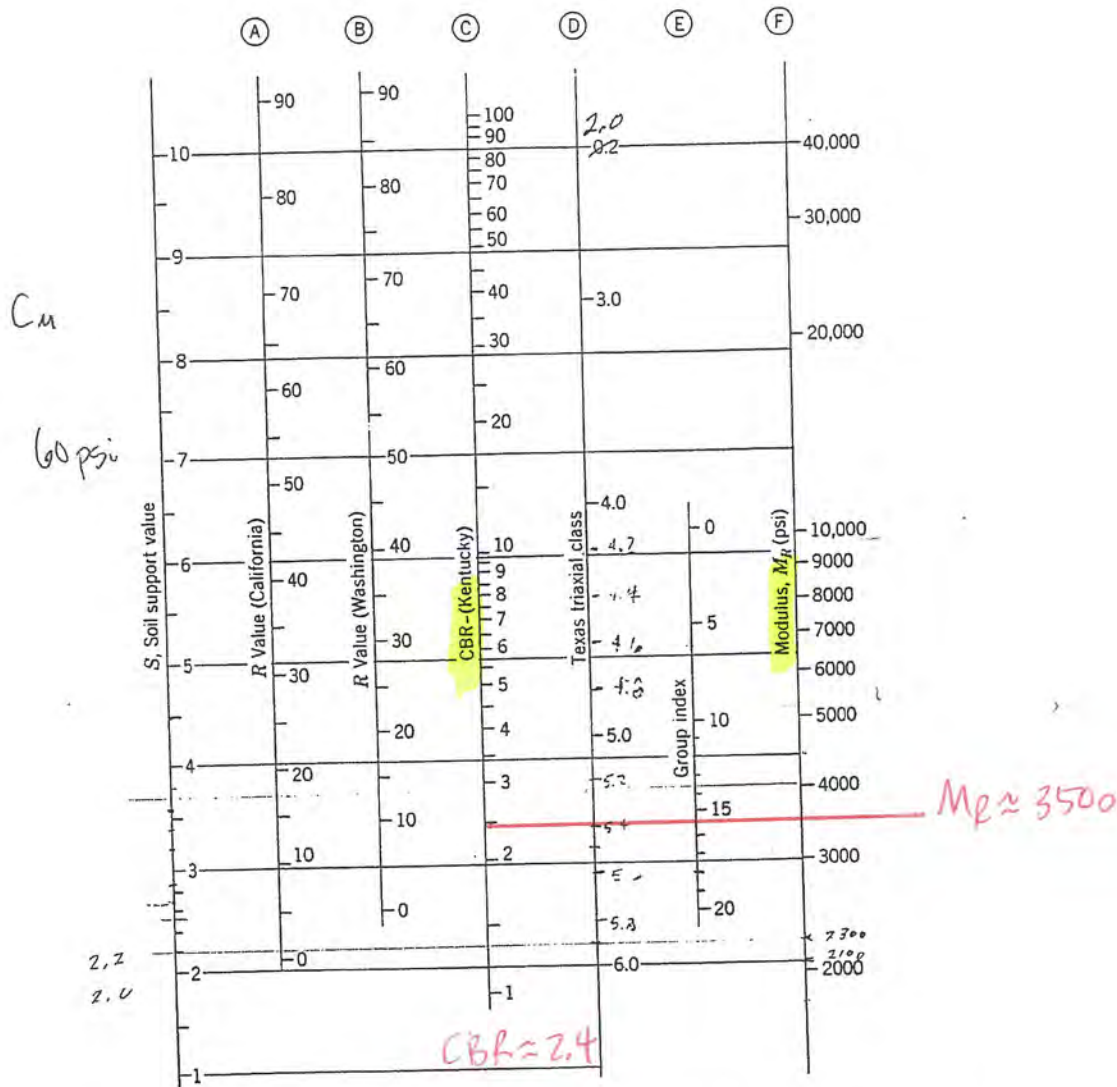


Figure 15.5. Continued.

for the conditions of the problem. As an aid to checking to see if all trial alternatives satisfy the minimum SN condition, consider the conventional pavement design alternatives. For the subgrade ( $S = 4.0$ ) the required SN = 3.78. However, for the subbase material, an appropriate  $S = 6$  from Figure 15.5a and for the crushed stone base  $S = 8.5$ . The respective SN values for these two layers obtained from Figure 15.1 are 2.82 and 1.95. Thus, for these conditions any pavement structure proposed must have at least a SN greater than 3.78 above the subgrade, a SN  $\geq 2.82$  above the subbase, and a SN  $\geq 1.95$  above the base course. Referring to Table 15.3, it can be seen that these conditions are satisfied for all conventional pavement trials except Trial 1. In this case, the actual SN above the subbase is 2.62 ( $2.10 + 0.52$ ) which is less than the minimum of 2.82.

of High-  
Soil Param.

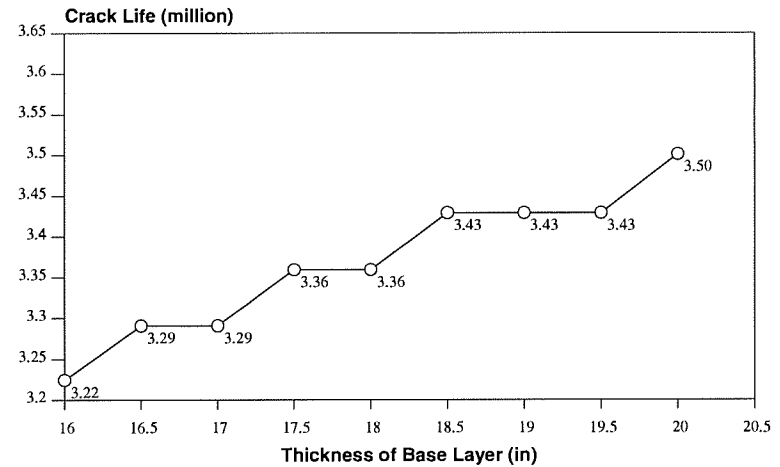
Year	ADT	Percent Trucks	Truck Factor	Lane Distribution Factor	Directional Distribution Factor	ESALs	Cummulative ESALs
2013	6000	0.059	0.62	1	0.5	40,055	40,055
2014	6180	0.059	0.62	1	0.5	41,257	81,312
2015	6365	0.059	0.62	1	0.5	42,494	123,806
2016	6556	0.059	0.62	1	0.5	43,769	167,576
2017	6753	0.059	0.62	1	0.5	45,082	212,658
2018	6956	0.059	0.62	1	0.5	46,435	259,093
2019	7164	0.059	0.62	1	0.5	47,828	306,921
2020	7379	0.059	0.62	1	0.5	49,263	356,183
2021	7601	0.059	0.62	1	0.5	50,741	406,924
2022	7829	0.059	0.62	1	0.5	52,263	459,187
2023	8063	0.059	0.62	1	0.5	53,831	513,018
2024	8305	0.059	0.62	1	0.5	55,446	568,463
2025	8555	0.059	0.62	1	0.5	57,109	625,572
2026	8811	0.059	0.62	1	0.5	58,822	684,394
2027	9076	0.059	0.62	1	0.5	60,587	744,981
2028	9348	0.059	0.62	1	0.5	62,405	807,386
2029	9628	0.059	0.62	1	0.5	64,277	871,663
2030	9917	0.059	0.62	1	0.5	66,205	937,868
2031	10215	0.059	0.62	1	0.5	68,191	1,006,059
2032	10521	0.059	0.62	1	0.5	70,237	1,076,296
2033	10837	0.059	0.62	1	0.5	72,344	<b>1,148,640</b>
						Cumulative 20 year ESALs	1,148,640

Growth 3.0 %

Year	ADT	Percent Trucks	Truck Factor	Lane Distribution Factor	Directional Distribution Factor	ESALs	Cummulative ESALs
2014	8000	0.089	0.62	1	0.5	80,563	80,563
2015	8240	0.089	0.62	1	0.5	82,980	163,542
2016	8487	0.089	0.62	1	0.5	85,469	249,012
2017	8742	0.089	0.62	1	0.5	88,033	337,045
2018	9004	0.089	0.62	1	0.5	90,674	427,719
2019	9274	0.089	0.62	1	0.5	93,394	521,113
2020	9552	0.089	0.62	1	0.5	96,196	617,309
2021	9839	0.089	0.62	1	0.5	99,082	716,391
2022	10134	0.089	0.62	1	0.5	102,055	818,446
2023	10438	0.089	0.62	1	0.5	105,116	923,562
2024	10751	0.089	0.62	1	0.5	108,270	1,031,832
2025	11074	0.089	0.62	1	0.5	111,518	1,143,350
2026	11406	0.089	0.62	1	0.5	114,863	1,258,213
2027	11748	0.089	0.62	1	0.5	118,309	1,376,522
2028	12101	0.089	0.62	1	0.5	121,858	1,498,381
2029	12464	0.089	0.62	1	0.5	125,514	1,623,895
2030	12838	0.089	0.62	1	0.5	129,280	1,753,174
2031	13223	0.089	0.62	1	0.5	133,158	1,886,332
2032	13619	0.089	0.62	1	0.5	137,153	2,023,485
2033	14028	0.089	0.62	1	0.5	141,267	2,164,753
2034	14449	0.089	0.62	1	0.5	145,505	<b>2,310,258</b>
						Cumulative 20 year ESALs	2,310,258

**Growth**      3.0      %

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	5.00	500.00	0.35	ASPH CONC PVMT
Base	18.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	10.50	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_t)^{f_3}$$

$$f_1 = 7.96E-02$$

$$f_2 = 3.291$$

**Rutting Model:**

$$f_3 = .854$$

$$N_d = f_4 (\epsilon_v)^{f_5}$$

$$f_4 = 1.37E-09$$

$$f_5 = 4.477$$

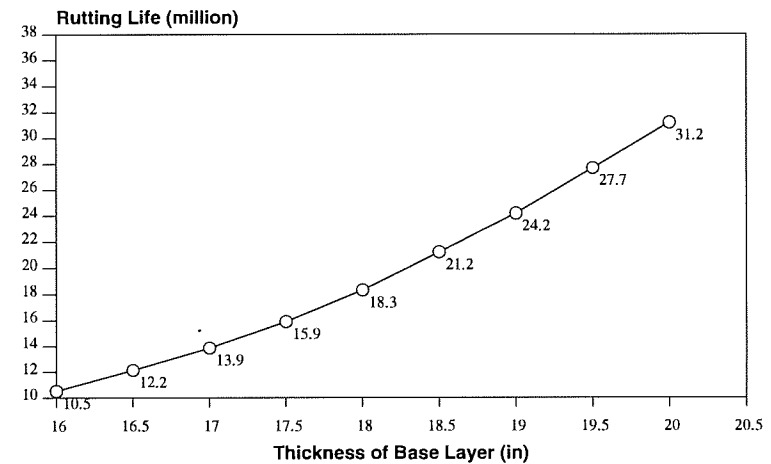
TFO(Traffic to 1st Overlay): 2.30 (million)

Crack Life: 3.36 (million)  $\epsilon_t = 160.00 (\mu\epsilon)$

Rut Life: 18.33 (million)  $\epsilon_v = -250.00 (\mu\epsilon)$

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.30millions.

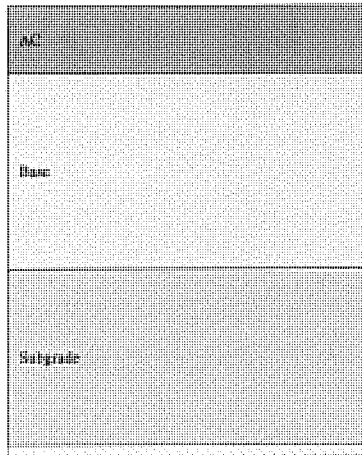
Also the start ADT:8000.0 and ending ADT:17000.0



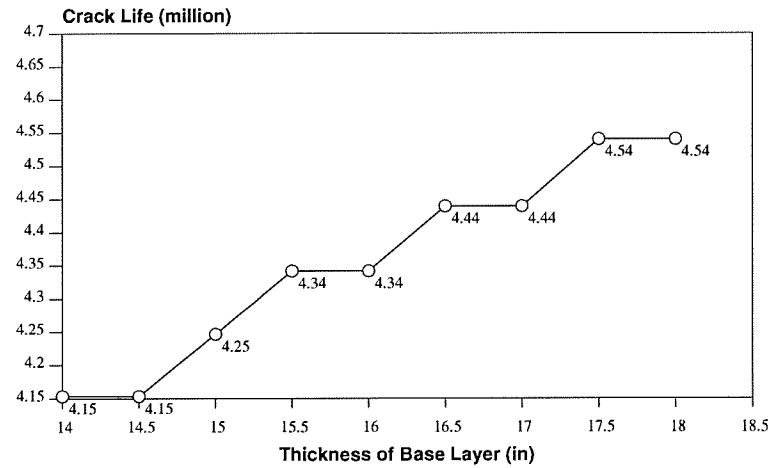
**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type: Asphalt concrete + Flexible Base over Subgrade			



Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
5.50	500.00	0.35	ASPH CONC PVMT
16.00	50.00	0.35	FLEXIBLE BASE
200.00	10.50	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_t)^{f_3}$$

$f_1 = 7.96E-02$

$f_2 = 3.291$

**Rutting Model:**

$f_3 = .854$

$$N_d = f_4 (\epsilon_v)^{f_5}$$

$f_4 = 1.37E-09$

$f_5 = 4.477$

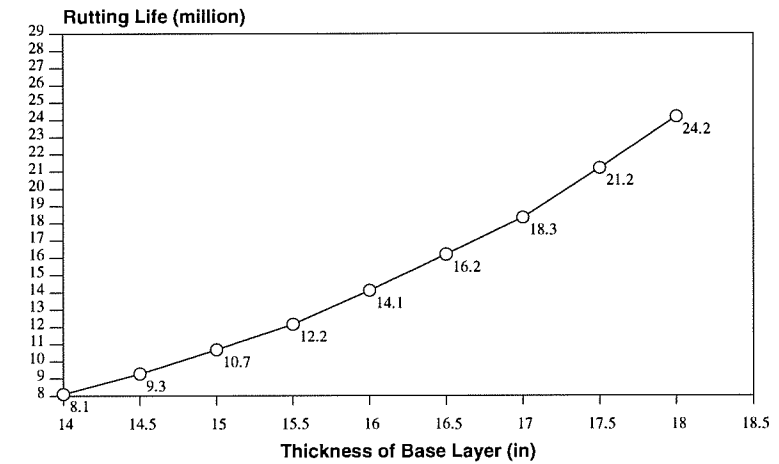
TFO(Traffic to 1st Overlay): 2.30 (million)

Crack Life: 4.34 (million)  $\epsilon_\tau = 148.00 (\mu\epsilon)$

Rut Life: 14.12 (million)  $\epsilon_v = -265.00 (\mu\epsilon)$

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.30millions.

Also the start ADT:8000.0 and ending ADT:17000.0



**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type:Asphalt concrete + Flexible Base over Subgrade			



W18	2,300,000
ZR	-1.037
So	0.45
PSli	4.2
PSlf	2.0
MR*	3,500
dPSI	2.2

Reliability	ZR
75%	-0.674
80%	-0.841
85%	-1.037
90%	-1.282
95%	-1.645
99%	-2.327

SN	4.654
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6.3617 Left side of AASHTO equation\*\*

6.3617 Right side of AASHTO equation

0.00 Left-Right balance of AASHTO equation

Material	Thickness	Coeff	Structural Capacity
AC	5.0	0.44	2.20
Base	18	0.14	2.52
Subbase 1	0	0.11	0.00
Subbase 2	0	0	0
Subbase 3	0	0	0

SN	4.72
SN req'd	4.65

**Design OK**

\*Design Subgrade CBR=2.4 (Correlation from Witczak & Yoder)

\*\*Solves 1993 AASHTO equation (see report text)

W18	2,300,000
ZR	-1.037
So	0.45
PSIi	4.2
PSIf	2.0
MR*	3,500
dPSI	2.2

Reliability	ZR
75%	-0.674
80%	-0.841
85%	-1.037
90%	-1.282
95%	-1.645
99%	-2.327

SN	4.654
----	-------

6.3617 Left side of AASHTO equation\*\*

6.3617 Right side of AASHTO equation

0.00 Left-Right balance of AASHTO equation

Material	Thickness	Coeff	Structural Capacity
AC	5.5	0.44	2.42
Base	16	0.14	2.24
Subbase 1	0	0.11	0.00
Subbase 2	0	0	0
Subbase 3	0	0	0

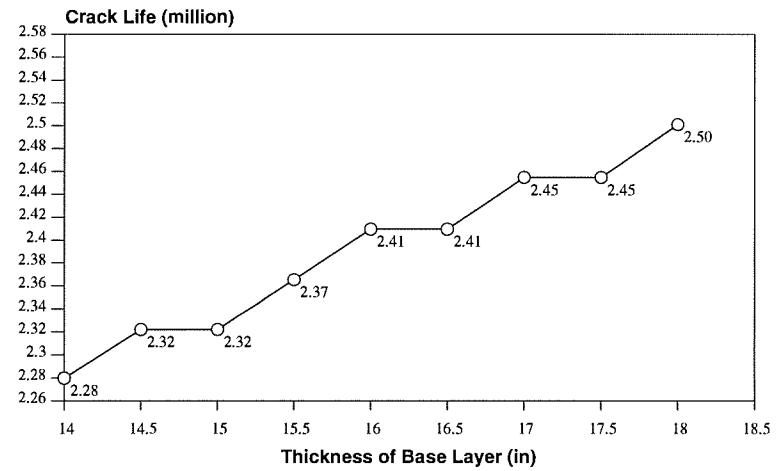
SN	4.66
SN req'd	4.65

**Design OK**

\*Design Subgrade CBR=2.4 (Correlation from Witczak & Yoder)

\*\*Solves 1993 AASHTO equation (see report text)

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	4.50	500.00	0.35	ASPH CONC PVMT
Base	16.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	10.50	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_t)^{f_3} \quad f_1 = 7.96E-02$$

$$f_2 = 3.291$$

**Rutting Model:**

$$f_3 = .854$$

$$N_d = f_4 (\epsilon_v)^{f_5} \quad f_4 = 1.37E-09$$

$$f_5 = 4.477$$

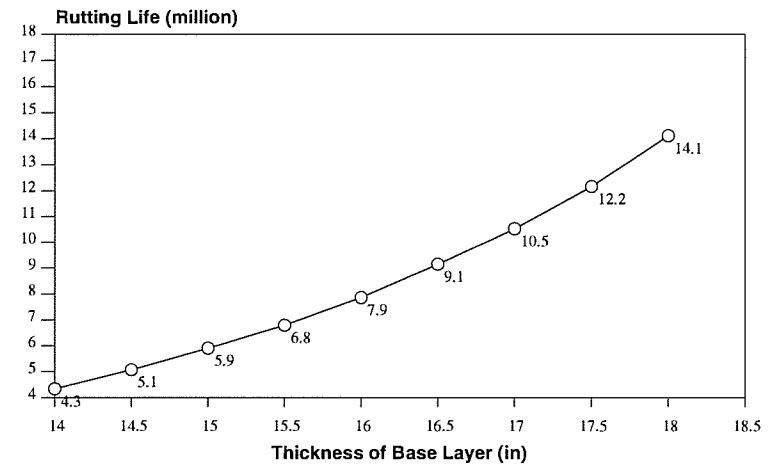
TFO(Traffic to 1st Overlay): 1.10 (million)

Crack Life: 2.41 (million)       $\epsilon_t = 177.00 (\mu\epsilon)$

Rut Life: 7.87 (million)       $\epsilon_v = -302.00 (\mu\epsilon)$

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:1.10millions.

Also the start ADT:6000.0 and ending ADT:14000.0



**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type:Asphalt concrete + Flexible Base over Subgrade			

W18	1,140,000
ZR	-1.037
So	0.45
PSli	4.2
PSlf	2.0
MR*	3,500
dPSI	2.2

Reliability	ZR
75%	-0.674
80%	-0.841
85%	-1.037
90%	-1.282
95%	-1.645
99%	-2.327

SN	4.221
----	-------

6.0569 Left side of AASHTO equation\*\*  
 6.0569 Right side of AASHTO equation

0.00 Left-Right balance of AASHTO equation

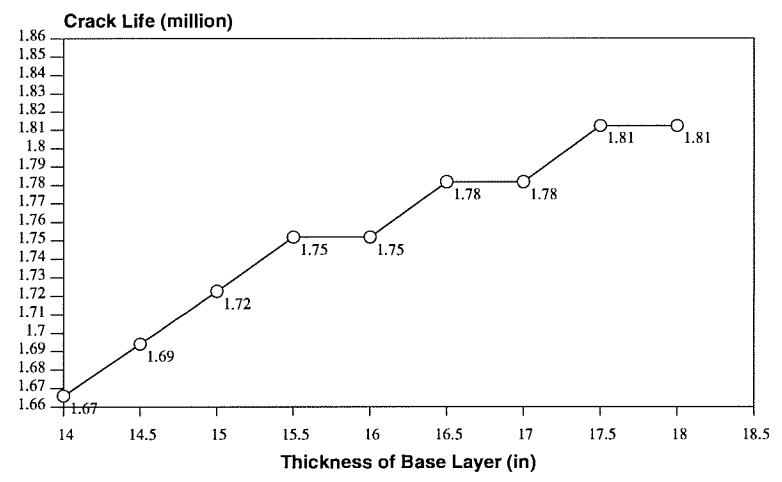
Material	Thickness	Coeff	Structural Capacity
AC	4.5	0.44	1.98
Base	16	0.14	2.24
Subbase 1	0	0.11	0.00
Subbase 2	0	0	0
Subbase 3	0	0	0

SN	4.22
SN req'd	4.22

**Design OK**

\*Design Subgrade CBR=2.4 (Correlation from Witczak & Yoder)  
 \*\*Solves 1993 AASHTO equation (see report text)

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	4.00	500.00	0.35	ASPH CONC PVMT
Base	16.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	10.50	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_t)^{f_3}$$

$f_1 = 7.96E-02$   
 $f_2 = 3.291$

**Rutting Model:**

$$N_d = f_4 (\epsilon_v)^{f_5}$$

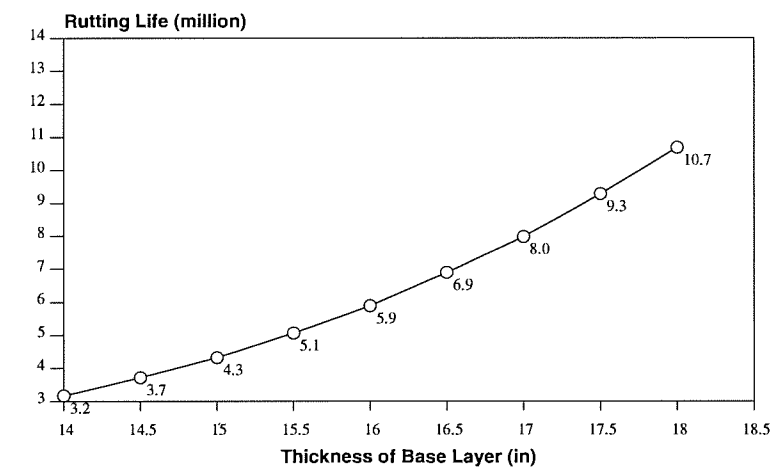
$f_3 = .854$   
 $f_4 = 1.37E-09$   
 $f_5 = 4.477$

TFO(Traffic to 1st Overlay): 0.80 (million)

Crack Life: 1.75 (million)  $\epsilon_\tau = 195.00 (\mu\epsilon)$

Rut Life: 5.90 (million)  $\epsilon_v = -322.00 (\mu\epsilon)$

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips.:80millions.  
 Also the start ADT:6000.0 and ending ADT:9400.0



**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type:Asphalt concrete + Flexible Base over Subgrade			

W18	800,000
ZR	-1.037
So	0.45
PSli	4.2
PSlf	2.0
MR*	3,500
dPSI	2.2

Reliability	ZR
75%	-0.674
80%	-0.841
85%	-1.037
90%	-1.282
95%	-1.645
99%	-2.327

SN	4.014
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5.9031 Left side of AASHTO equation\*\*

5.9031 Right side of AASHTO equation

0.00 Left-Right balance of AASHTO equation

Material	Thickness	Coeff	Structural Capacity
AC	4.0	0.44	1.76
Base	16	0.14	2.24
Subbase 1	0	0.11	0.00
Subbase 2	0	0	0
Subbase 3	0	0	0

SN	4.01
SN req'd	4.01

**Design OK**

\*Design Subgrade CBR=2.4 (Correlation from Witczak & Yoder)

\*\*Solves 1993 AASHTO equation (see report text)

W18	500,000
ZR	-1.037
So	0.45
PSli	4.2
PSlf	2.0
MR*	3,500
dPSI	2.2

Reliability	ZR
75%	-0.674
80%	-0.841
85%	-1.037
90%	-1.282
95%	-1.645
99%	-2.327

SN	3.750
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5.6990 Left side of AASHTO equation\*\*

5.6990 Right side of AASHTO equation

0.00 Left-Right balance of AASHTO equation

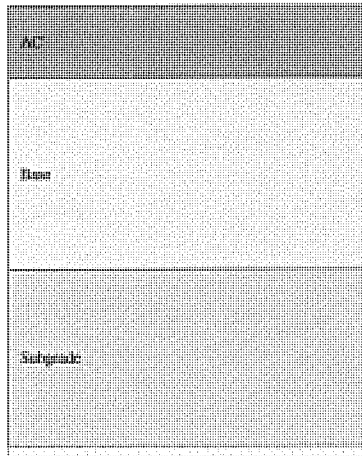
Material	Thickness	Coeff	Structural Capacity
AC	3.5	0.44	1.54
Base	16	0.14	2.24
Subbase 1	0	0.11	0.00
Subbase 2	0	0	0
Subbase 3	0	0	0

SN	3.78
SN req'd	3.75

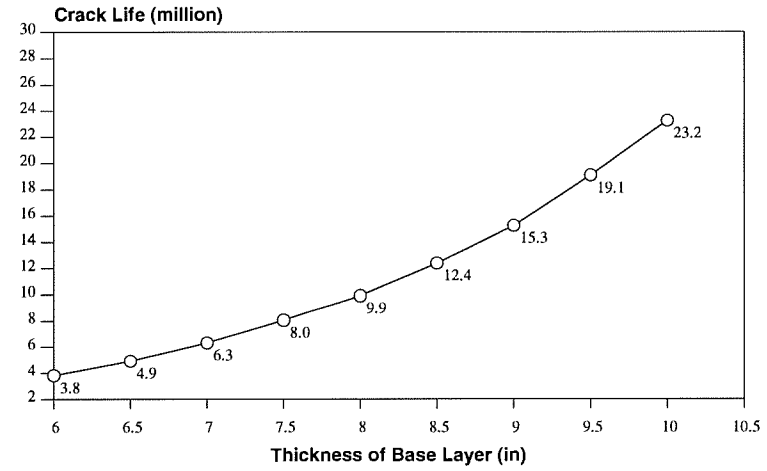
**Design OK**

\*Design Subgrade CBR=2.4 (Correlation from Witczak & Yoder)

\*\*Solves 1993 AASHTO equation (see report text)



Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
3.00	500.00	0.35	ASPH CONC PVMT
8.00	400.00	0.35	ASPH STAB BASE
200.00	8.00	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_1)^{f_3}$$

$f_1 = 7.96E-02$   
 $f_2 = 3.291$

**Rutting Model:**

$$N_d = f_4 (\epsilon_v)^{f_5}$$

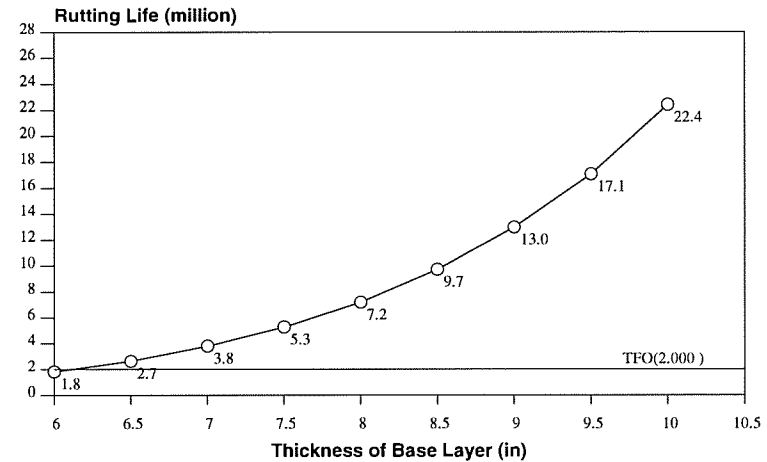
$f_4 = 1.37E-09$   
 $f_5 = 4.477$

TFO(Traffic to 1st Overlay): 2.00 (million)

Crack Life: 9.92 (million)     $\epsilon_\tau = 122.00$  (  $\mu\epsilon$  )

Rut Life: 7.20 (million)     $\epsilon_v = -308.00$  (  $\mu\epsilon$  )

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.00millions.  
 Also the start ADT:8000.0 and ending ADT:17000.0



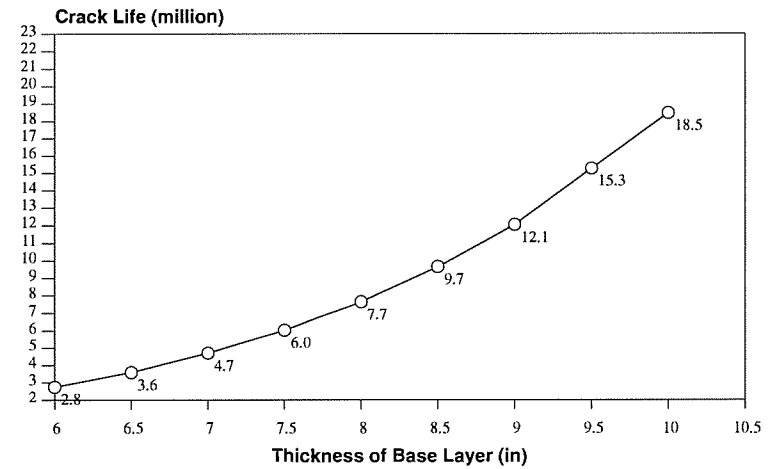
**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type:Asphalt concrete + Asphalt Stabilized Base over Subgrade			



	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	2.00	500.00	0.35	ASPH CONC PVMT
Base	8.00	400.00	0.35	ASPH STAB BASE
Subgrade	200.00	10.50	0.40	SUBGRADE(200)



**Fatigue Crack Model:**

$$N_f = f_1 (\epsilon_t)^{f_2} (E_t)^{f_3}$$

$f_1 = 7.96E-02$

$f_2 = 3.291$

**Rutting Model:**

$f_3 = .854$

$$N_d = f_4 (\epsilon_v)^{f_5}$$

$f_4 = 1.37E-09$

$f_5 = 4.477$

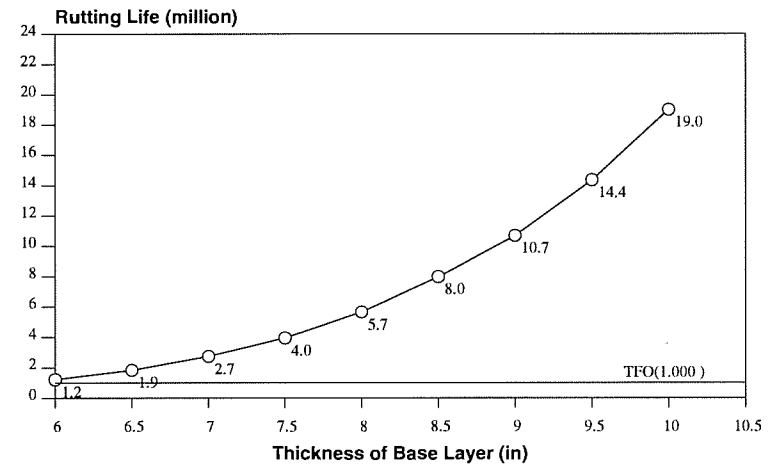
TFO(Traffic to 1st Overlay): 1.00 (million)

Crack Life: 7.65 (million)  $\epsilon_t = 132.00 (\mu\epsilon)$

Rut Life: 5.66 (million)  $\epsilon_v = -325.00 (\mu\epsilon)$

Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:1.00millions.

Also the start ADT:6000.0 and ending ADT:14000.0



**Mechanistic Check Conclusion:**

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	Burleson	Problem	001
C-S-J	1234 - 1 - 123	Date	8/26/2014
District	Austin	County	HAYS
Design Type:Asphalt concrete + Asphalt Stabilized Base over Subgrade			

### 340.4 to 340.4

before shipping to ensure that it does not exceed 350°F. The Department will not pay for or allow placement of any mixture produced at more than 350°F. Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant.

- E. Hauling Operations.** Before use, clean all truck beds to ensure mixture is not contaminated. When a release agent is necessary to coat truck beds, use a release agent on the approved list maintained by the Construction Division.
- F. Placement Operations.** Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot mix by at least 6 in. Place mixture so longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly. Place mixture within the compacted lift thickness shown in Table 8, unless otherwise shown on the plans or allowed.

**Table 8**  
**Compacted Lift Thickness and Required Core Height**

Mixture Type	Compacted Lift Thickness	
	Minimum (in.)	Maximum (in.)
A	3.00	6.00
B	2.50	5.00
C	2.00	4.00
D	1.50	3.00
F	1.25	2.50

- 1. Weather Conditions.** Place mixture when the roadway surface temperature is 60°F or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Unless otherwise shown on the plans, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.
- 2. Tack Coat.** Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at the rate directed by the Engineer. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply

## **APPENDIX B**

# A Message to Owners

Construction materials engineering and testing (CoMET) consultants perform quality-assurance (QA) services to evaluate the degree to which constructors are achieving the specified conditions they're contractually obligated to achieve. Done right, QA can save you time and money; prevent unanticipated-conditions claims, change orders, and disputes; and reduce short-term and long-term risks, especially by detecting molehills before they grow into mountains.

**Done right, QA can save you time and money; prevent claims and disputes; and reduce risks. Many owners don't do QA right because they follow bad advice.**

Many owners don't do QA right because they follow bad advice; e.g., "CoMET consultants are all the same. They all have accredited facilities and certified personnel. Go with the low bidder." But there's no such thing as a standard QA scope of service, meaning that – to bid low – each interested firms *must* propose the cheapest QA service it can live with, jeopardizing service quality and aggravating risk for the entire project team. Besides, the advice is based on misinformation.

Fact: ***Most CoMET firms are not accredited,*** and the quality of those that are varies significantly. Accreditation – which is important – nonetheless means that a facility met an accrediting body's minimum criteria. Some firms practice at a much higher level; others just barely scrape by. And what an accrediting body typically evaluates – management, staff, facilities, and equipment – can change substantially before the next review, two, three, or more years from now.

**Most CoMET firms are not accredited. It's dangerous to assume CoMET personnel are certified.**

Fact: ***It's dangerous to assume CoMET personnel are certified.*** Many have no credentials at all; some are certified by organizations of questionable merit, while others have a valid certification, but *not* for the services they're assigned.

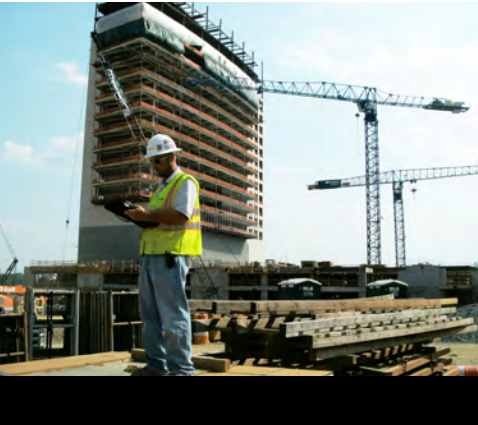
Some CoMET firms – the "low-cost providers" – *want* you to believe that price is the only difference between QA providers. It's not, of course. Firms that sell low price typically lack the facilities, equipment, personnel, and insurance quality-oriented firms invest in to achieve the reliability concerned owners need to achieve quality in quality assurance.

**ASFE** THE GEOPROFESSIONAL  
BUSINESS ASSOCIATION

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Internet: [www.asfe.org](http://www.asfe.org)



Firms that sell **low price typically lack the facilities, equipment, personnel,** and insurance quality-oriented firms invest in to achieve the reliability concerned owners need to achieve quality in quality assurance.



To derive maximum value from your investment in QA, require the CoMET firm's project manager to serve actively on the project team from beginning to end, a level of service that's relatively inexpensive and can pay huge dividends. During the project's planning and design stages, experienced CoMET professionals can help the design team develop uniform technical specifications and establish appropriate observation, testing, and instrumentation procedures and protocols. They can also analyze plans and specs much as constructors do, looking for the little errors, omissions, conflicts, and ambiguities that often become the basis for big extras and big claims. They can provide guidance about operations that need closer review than others, because of their criticality or potential for error or abuse. They can also relate their experience with the various constructors that have expressed interest in your project.

To derive maximum value, **require the project manager to serve actively** on the project team from beginning to end.

CoMET consultants' construction-phase QA services focus on two distinct issues: those that relate to geotechnical engineering and those that relate to the other elements of construction.

The geotechnical issues are critically important because they are essential to the "observational method" geotechnical engineers use to significantly reduce the amount of sampling they'd otherwise require. They apply the observational method by developing a sampling plan for a project, and then assigning field representatives to ensure

samples are properly obtained, packaged, and transported. The engineers review the samples and, typically, have them tested in their own laboratories. They use the information they derive to characterize the site's subsurface and develop *preliminary* recommendations for the structure's foundations and for the specifications of various "geo" elements, like excavations, site grading, foundation-bearing grades, and roadway and parking-lot preparation and surfacing.

**Geotechnical engineers cannot finalize their recommendations until they or their field representatives are on site to observe what's excavated to verify that the subsurface conditions the engineers predicted are those that actually exist.**

When unanticipated conditions are observed, recommendations and/or specifications should be modified.

Responding to client requests, many geotechnical-engineering firms have expanded their field-services mix, so they're able to perform overall construction QA, encompassing – in addition to geotechnical issues – reinforced concrete, structural steel, welds, fireproofing, and so on. Unfortunately, that's caused some confusion. Believing that all CoMET consultants are alike, some owners take bids for the overall CoMET package, including the geotechnical field observation. *Entrusting geotechnical field observation to someone other than the geotechnical engineer of record (GER) creates a significant risk.*

Geotechnical engineers cannot finalize their recommendations until they are on site to verify that the subsurface conditions they predicted are those that actually exist. **Entrusting geotechnical field observation to someone other than the geotechnical engineer of record (GER) creates a significant risk.**

GERs have developed a variety of protocols to optimize the quality of their field-observation procedures. Quality-focused GERs meet with their field representatives before they leave for a project site, to brief them on what to look for and where, when, and how to look. (*No one can duplicate this briefing*, because no one else knows as much about a project’s geotechnical issues.) And once they arrive at a project site, the field representatives know to maintain timely, effective communication with the GER, because that’s what the GER has trained them to do. By contrast, it’s extremely rare for a different firm’s field personnel to contact the GER, even when they’re concerned or confused about what they observe, because they regard the GER’s firm as “the competition.”

Divorcing the GER from geotechnical field operations is almost always penny-wise and pound-foolish. Still, because owners are given bad advice, it’s commonly done, helping to explain why *“geo” issues are the number-one source of construction-industry claims and disputes.*

**Divorcing the GER from geotechnical field operations is almost always penny-wise and pound-foolish, helping to explain why “geo” issues are the number-one source of construction-industry claims and disputes.**

To derive the biggest bang for the QA buck, identify three or even four quality-focused CoMET consultants. (If you don’t know any,

use the “Find a Geoprofessional” service available free at [www.asfe.org](http://www.asfe.org).) Ask about the firms’ ongoing and recent projects and the clients and client representatives involved; *insist upon receiving verification of all claimed accreditations, certifications, licenses, and insurance coverages.*

**Insist upon receiving verification of all claimed accreditations, certifications, licenses, and insurance coverages.**

Once you identify the two or three most qualified firms, meet with their representatives, preferably at their own facility, so you can inspect their laboratory, speak with management and technical staff, and form an opinion about the firm’s capabilities and attitude.

Insist that each firm’s designated project manager participate in the meeting. You will benefit when that individual is a seasoned QA professional familiar with construction’s rough-and-tumble. Ask about others the firm will assign, too. There’s no substitute for experienced personnel who are familiar with the codes and standards involved and know how to:

- read and interpret plans and specifications;
- perform the necessary observation, inspection, and testing;
- document their observations and findings;
- interact with constructors’ personnel; and
- respond to the unexpected.

*Important:* Many of the services CoMET QA field representatives perform – like observing operations and outcomes – require the good judgment afforded by extensive training and experience, especially in situations where standard operating procedures do not apply. You need to know who will be exercising that judgment: a 15-year “veteran” or a rookie?

Many of the services **CoMET QA field representatives perform** require good judgment.

Also consider the tools CoMET personnel use. Some firms are passionate about proper calibration; others, less so. Passion is a good thing! Ask to see the firm's calibration records. If the firm doesn't have any, or if they are not current, be cautious. *You cannot trust test results derived using equipment that may be out of calibration.* Also ask a firm's representatives about their reporting practices, including report distribution, how they handle notifications of nonconformance, and how they resolve complaints.

**Scope flexibility is needed to deal promptly with the unanticipated.**

For financing purposes, some owners require the constructor to pay for CoMET services. **Consider an alternative approach** so you don't convert the constructor into the CoMET consultant's client. If it's essential for you to fund QA via the constructor, have the CoMET fee included as an allowance in the bid documents. This arrangement ensures that you remain the CoMET consultant's client, and it prevents the CoMET fee from becoming part of the constructor's bid-price competition. (Note that the International Building Code (IBC) *requires the owner to pay* for Special Inspection (SI) services commonly performed by the CoMET consultant as a service separate from QA, to help ensure the SI services' integrity. Because failure to comply could result in denial of an occupancy or use permit, having a contractual agreement that conforms to the IBC mandate is essential.)

If it's essential for you to fund QA via the constructor, **have the CoMET fee included as an allowance in the bid documents.** Note, too, that the International Building Code (IBC) **requires the owner to pay for Special Inspection (SI) services.**

CoMET consultants can usually quote their fees as unit fees, unit fees with estimated total (invoiced on a unit-fee basis), or lump-sum (invoiced on a percent-completion basis referenced to a schedule of values). No matter which method is used, estimated quantities need to be realistic. Some CoMET firms lower their total-fee estimates by using quantities they know are too low and then request change orders long before QA is complete.

Once you and the CoMET consultant settle on the scope of service and fee, enter into a written contract. Established CoMET firms have their own contracts; most owners sign them. Some owners prefer to use different contracts, but that can be a mistake when the contract was prepared for construction services. *Professional services are different.* Wholly avoidable problems occur when a contract includes provisions that don't apply to the services involved and fail to include those that do.

**Some owners create wholly avoidable problems by using a contract prepared for construction services.**





## PROJECT QUALITY ASSURANCE



This final note: CoMET consultants perform QA for owners, not constructors. While constructors are commonly allowed to review QA reports as a *courtesy*, you need to make it clear that constructors do *not* have a legal right to rely on those reports; i.e., if constructors want to forgo their own observation and testing and rely on results derived from a scope created to meet *only* the needs of the owner, they

*must do so at their own risk.* In all too many cases where owners have not made that clear, some constructors have alleged that they did have a legal right to rely on QA reports and, as a result, the CoMET consultant – not they – are responsible for their failure to deliver what they contractually promised to provide. The outcome can be delays and disputes that entangle you and all other principal project participants. Avoid that. Rely on a CoMET firm that possesses the resources and attitude needed to manage this and other risks as an element of a quality-focused service. Involve the firm early. Keep it engaged. And listen to what the CoMET consultant says. A good CoMET consultant can provide great value.

For more information, speak with your ASFE-Member CoMET consultant or contact ASFE directly.



**ASFE** THE GEOPROFESSIONAL  
BUSINESS ASSOCIATION

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# Important Information about Your Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*While you cannot eliminate all such risks, you can manage them. The following information is provided to help.*

## **Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

## **Read the Full Report**

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## **A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors**

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## **Subsurface Conditions Can Change**

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.*

## **Most Geotechnical Findings Are Professional Opinions**

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## **A Report's Recommendations Are *Not* Final**

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual



subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

### **A Geotechnical Engineering Report Is Subject to Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

### **Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance**

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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July 31, 2015

Arias Project No. 2013-756

Via Email: [Jessica.Rodriguez@freese.com](mailto:Jessica.Rodriguez@freese.com)

Ms. Jessica Rodriguez, P.E.  
Senior Project Manager  
Freese and Nichols, Inc.  
10431 Morado Circle  
Building 5, Suite 300  
Austin, Texas 78759

**RE: Geotechnical Design Memorandum – Global Stability Analysis  
Retaining Wall - STA 10+00 – STA 14+14.85**  
North Burleson Street Improvements  
Kyle, Texas

Dear Ms. Rodriguez:

As requested and authorized, Arias & Associates, Inc. (Arias) has performed a slope stability analysis for the above referenced retaining wall. The retaining wall is located along the southbound lane of N. Burleson Street from Tenorio Street to Saint Anthony's Drive. According to the provided plan and profile sheet (attached), the top of wall will have an elevation of about 714 to 715 feet, and grade at the toe of the wall will have an elevation of about 707 to 708 feet. For this analysis, we assumed the wall is 8 ft in height above grade, 2 feet below grade, horizontal backfill, and 240 psf traffic surcharge.

Nearby boring data, B-4, was utilized to develop subsurface stratigraphy for the wall analysis (see Geotechnical Data Report, GDR, dated August 26, 2014). The ground surface elevation at boring B-4 is reported to be El. 713 feet. Accordingly, the proposed wall foundation at approximate El. 705 ft will be founded in about 2 to 3 feet of tan clayey sand (completely weathered limestone), underlain by limestone at approximate elevation 703 feet. For the global stability analysis, approximately 2 feet of gray sandy fat clay (alluvium) was modeled from elevation 705 to 707 feet. The groundwater was modeled as being at elevation 705 feet.

The proposed MSE wall will serve as a side wall along a drainage channel. Accordingly, we recommend that free-draining, open-graded backfill be used in the reinforced zone, consisting of TxDOT Standard Specifications, Item 423, Type D. If Type C is preferred, then longer reinforcing strap ratio will be required to satisfy stability requirements for minimum factors of safety, as presented herein.



## Global Stability

Soil parameters estimated from nearby boring data of B-4 and used for this global stability analysis are summarized in the following table.

Soil Properties Used in Global Stability Analysis			CH (EI 705-707)	CL (EI. 703-705)
Foundation Soil	Unit Weight, $\gamma$	pcf	120 pcf	120 pcf
	Cohesion, $c$	psf	200 psf	100 psf
	Friction Angle, $\phi$	deg.	22°	26°
Retained Soil (Existing / Embankment)	Unit Weight, $\gamma$	pcf	125 pcf	
	Cohesion, $c$	psf	50 psf	
	Friction Angle, $\phi$	deg.	27°	
Select Backfill (Reinforced Zone)	Unit Weight, $\gamma$	pcf	125 pcf	
	Cohesion, $c$	psf	1000 psf	
	Friction Angle, $\phi$	deg.	34°	

The computer program SLIDE 6.0, by RocScience, was used to analyze rotational stability using soil parameters presented above. Two conditions were considered: steady state (drained) and rapid draw down with a 3-ft drawdown condition. The results are summarized below. Summary computer output are presented in Appendix A.

Max Wall Height	Backfill Slope	Factor of Safety: Drained $\gamma_{(reinf)} = 125 \text{ pcf} /$ $\gamma_{(reinf)} = 105 \text{ pcf}$	Factor of Safety: 3-ft RDD $\gamma_{(reinf)} = 125 \text{ pcf} /$ $\gamma_{(reinf)} = 105 \text{ pcf}$
8 ft	Horizontal	2.3 / 2.3 (minimum 1.5)	1.9 / 1.9 (minimum 1.3)

The resulting global stability calculations result in factors of safety that meet or exceed minimum requirements per TxDOT Geotechnical Manual.

## External Stability Analyses

External stability analyses were performed to determine the minimum reinforcing length ratio to satisfy required factors of safety for MSE wall construction. External stability calculations (sliding, overturning, eccentricity, and bearing capacity) were carried out using methods described in FHWA NHI-00-043 and the TxDOT Geotechnical Manual. The computer program, MSEW (3.0) by ADAMA Engineering, Inc. was used to analyze factors of safety based on soil parameters prescribed by TxDOT and presented herein. Based on provided plan and profile sheet (attached), the MSE wall analysis was based on the following assumptions:

- Horizontal backfill for a wall height of 8 ft, with 240 psf surcharge.
- 2-ft footing (leveling pad) embedment depth.
- Groundwater at El. 705 at the top of the leveling pad for the steady state condition, and at the ground surface (El. 707 ft) and 3 feet above this elevation in the retained zone for the rapid draw down (RDD) analysis;
- The wall face is assumed vertical, the reinforcement length is assumed to be uniform over the full wall height.

Minimum factors of safety selected for this analysis are based on recommendations from the TxDOT Geotechnical Manual and FHWA NHI-00-043.

- For base sliding, the minimum factor of safety is 1.5;
- For overturning and bearing capacity, the minimum factor of safety is 2.0; and
- The base pressure resultant is in the middle third beneath the retained zone.

Soil parameters used for this analysis are summarized in the table below. It is assumed that the retained soil will consist of existing and compacted soils generated from onsite sources, placed and compacted as specified in the project documents for embankment fill. Unit weight and omission of cohesion are prescribed by TxDOT for various failure modes (TxDOT design sheet rwstde01.dgn).

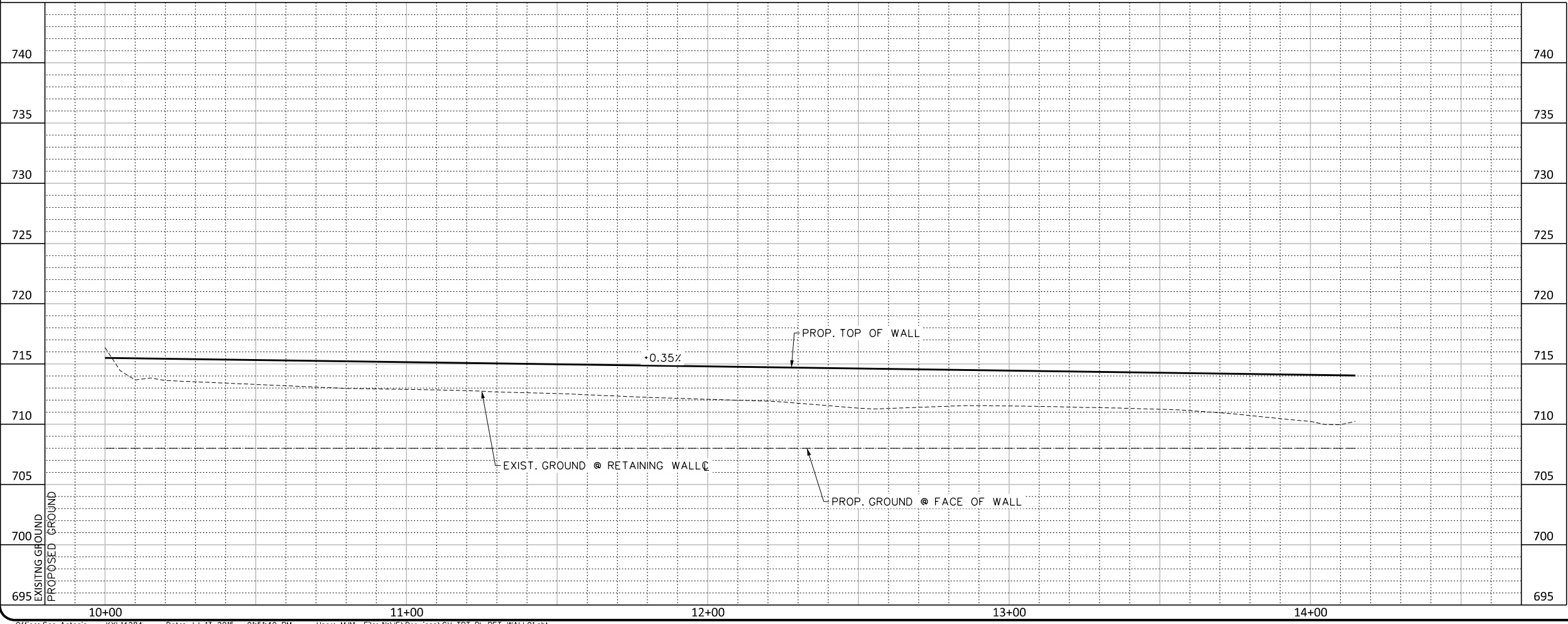
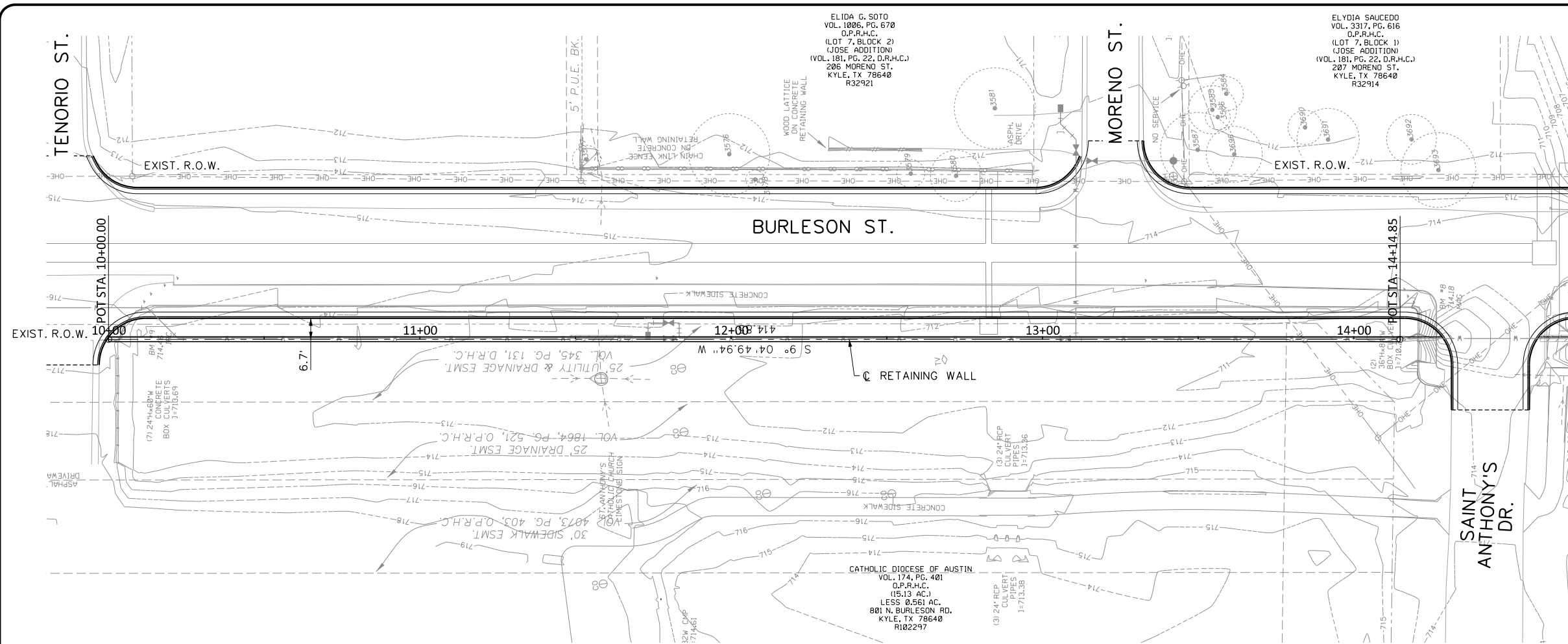
Soil Properties Used in Analysis			TxDOT/FHWA
<b>Foundation Soil</b>	Unit Weight, $\gamma$	pcf	125
	Friction Angle, $\phi$	deg.	27°
	Cohesion, $c$	psf	0
<b>Retained Soil (Existing Alluvium/Fill)</b>	Unit Weight, $\gamma$	pcf	125
	Friction Angle, $\phi$	deg.	28°
<b>Select Backfill (Reinforced Zone)</b>	Unit Weight, $\gamma$ (Sliding, Overturning, Eccentricity)	pcf	105
	Unit Weight, $\gamma$ (Bearing Capacity, Global Stability)	pcf	105 <sup>(1)</sup> pcf - Type D 125 pcf – Type C
	Friction Angle, $\phi$	deg.	34°

(1) Type D (Item 423) is recommended in reinforced zone due to potential drainage condition.

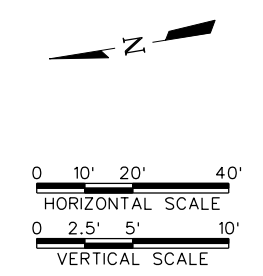
The reinforcement length analyzed for the wall height was initially set at 0.8H (8 feet strap length minimum), and incrementally increased until minimum factors of safety were achieved for various failure modes (strap lengths were rounded up to the nearest foot). The results are summarized in the following table. MSEW computer output are included in Appendix B. These minimum ratios are based on soil parameters summarized in above.



MicroStation V8 User: MJM, Office: San Antonio  
 KYL14284, N:\V\Drawings\CV-TRT-PL-RET WALL01.sht  
 Plot Scale: 40,000.00 (1" = 400'-0")  
 Date: Jul 13, 2015 - 05:54:40 PM  
 Project: Freese and Nichols, Inc.



NOTE:  
 1. ALL MEASUREMENTS TAKEN FROM BACK OF CURB (BOC) UNLESS OTHERWISE NOTED ON PLANS.



NOT FOR CONSTRUCTION  
 THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PERMIT REVIEW UNDER THE TEXAS PUBLIC INFORMATION ACT. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

**FREES & NICHOLS**  
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 Phone: (512) 617-3100  
 Fax: (512) 617-3101  
 Web: www.freeseandnichols.com

CITY OF KYLE, TEXAS  
**N. BURLESON ST. IMPROVEMENTS**  
 CIVIL  
**RETAINING WALL PLAN AND PROFILE**  
**STA. 10+00 TO STA. 14+14.85**

NO.	ISSUES	BY	DATE	FN	JOB NO.	DATE	DESIGNER	TRPE	DRAWN	REVISION	CHECKED	TRPMS	FILE NAME
					KYL14284	05/29/15							CV-TRT-PL-RET WALL01.sht
SHEET	72												
TOTAL	160												

# Boring Log No. B-4



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/2/14

Location: See Boring Location Plan

Coordinates: N29°59'40.05" W97°52'34.45"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	RECR	RQD
[FILL] FAT CLAY (CH) with sand, stiff, dark brown, moist with organics, scattered coarse sand and gravel.	0	T					2.0						
	1	T	31	22	73	51	2.25		82				
SANDY FAT CLAY (CH), stiff, gray to light gray, moist with ferrous staining	5	T					1.5						
	6	T	11	13	26	13	4.0		41				
[CWLS] CLAYEY SAND with Gravel (SC), medium dense to very dense, tan, with limestone fragments	10	SS						50/5"					
	11	SS											
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.	15	RC	8							147 (UW)	133	93	82

Borehole terminated at 15 feet

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01, GDT, LIBRARY, RAR, G.L.B)

**Groundwater Data:**

First encountered during drilling: 8.5-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

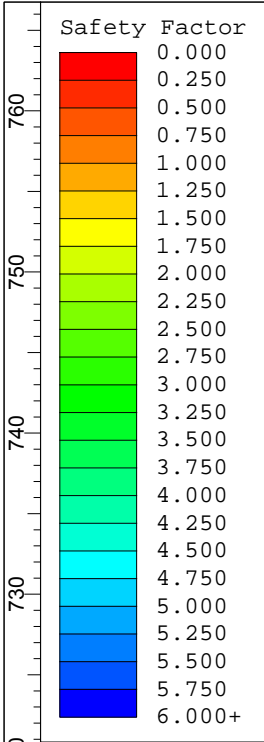
Single flight auger: 0 - 10 ft  
 Rock core: 10 - 15 ft

**Nomenclature Used on Boring Log**

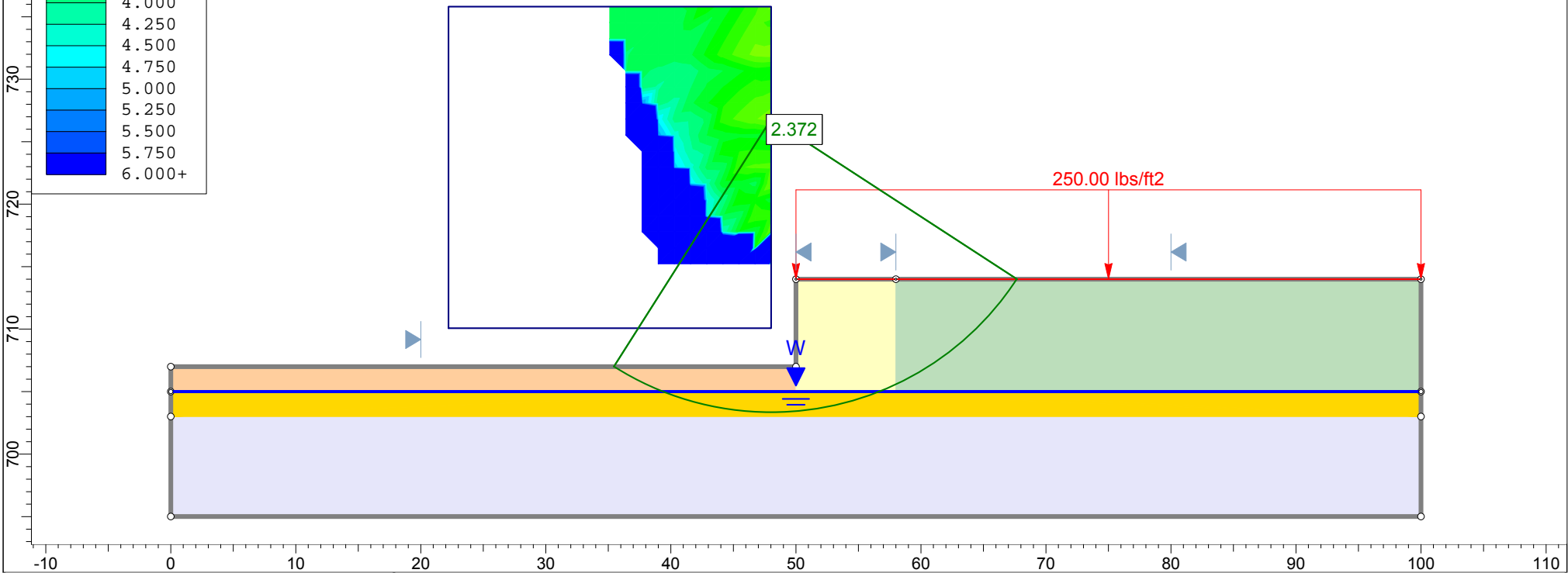
- Thin-walled tube (T)
- Split Spoon (SS)
- ▽ Water encountered during drilling
- ▬ Rock Core (RC)
- WC = Water Content (%)
- PL = Plastic Limit
- LL = Liquid Limit
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- N = SPT Blow Count
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Compressive Strength (tsf)
- RQD = Rock Quality Designation
- REC = % Recovery
- UW = Unit Weight (pcf)



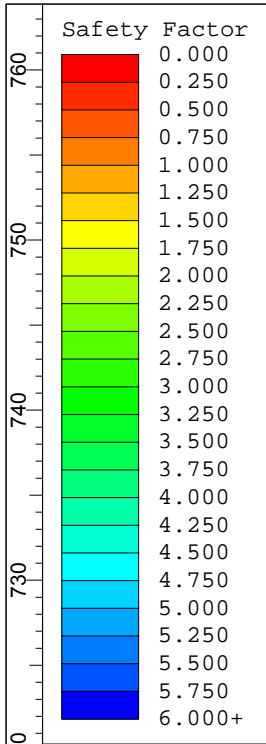
## **APPENDIX A**



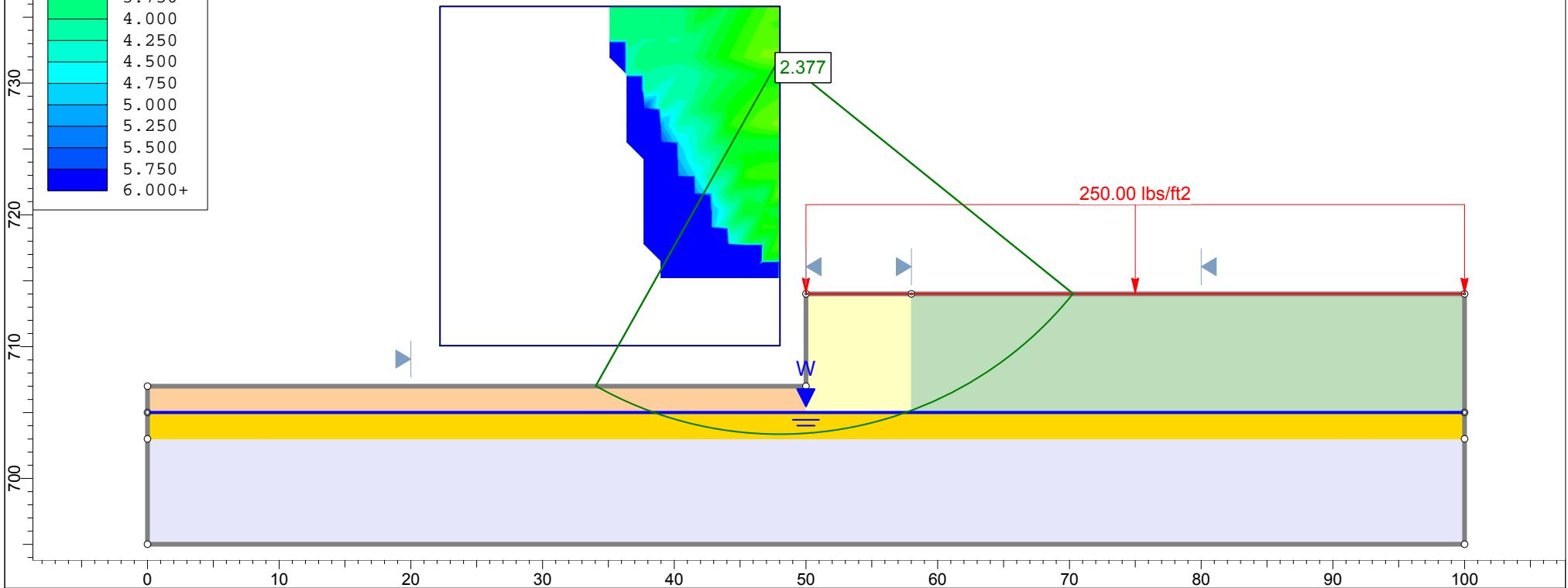
Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Reinforced zone		125	Mohr-Coulomb	1000	34	Water Surface	Custom	1
Retained Zone		120	Mohr-Coulomb	50	27	Water Surface	Custom	1
Clay CH		120	Mohr-Coulomb	200	22	Water Surface	Custom	1
Clay CL		120	Mohr-Coulomb	100	26	Water Surface	Custom	1
limestone		140	Mohr-Coulomb	5000	40	Water Surface	Custom	1



	Project			N. Burleson Road Retaining Wall		
	Analysis Description			Global Stability		
	Drawn By	R. Russo	Scale	1:143	Company	Arias
	Date	7/30/2015, 9:36:32 PM			File Name	Slide1.slim

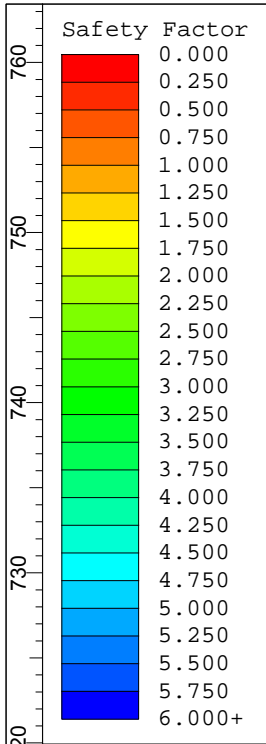


Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Reinforced zone		105	Mohr-Coulomb	1000	34	Water Surface	Custom	1
Retained Zone		120	Mohr-Coulomb	50	27	Water Surface	Custom	1
Clay CH		120	Mohr-Coulomb	200	22	Water Surface	Custom	1
Clay CL		120	Mohr-Coulomb	100	26	Water Surface	Custom	1
limestone		140	Mohr-Coulomb	5000	40	Water Surface	Custom	1

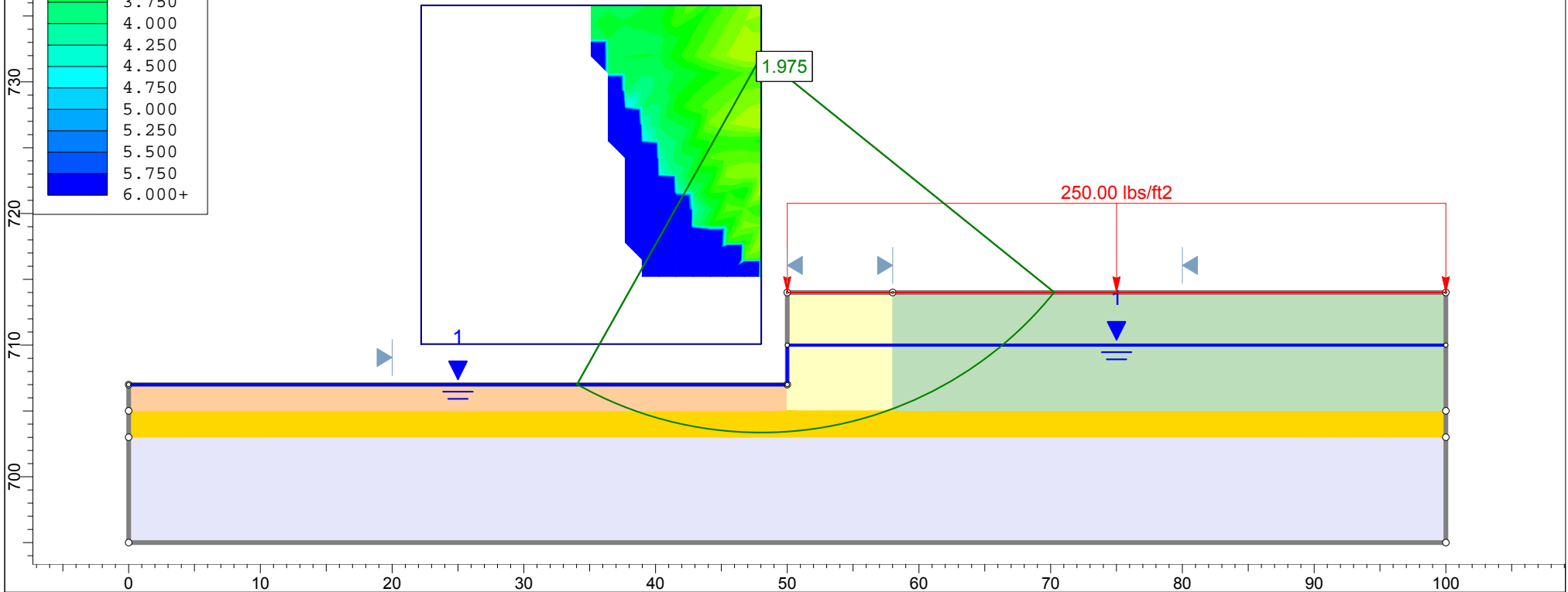


SLIDEINTERPRET 6.035

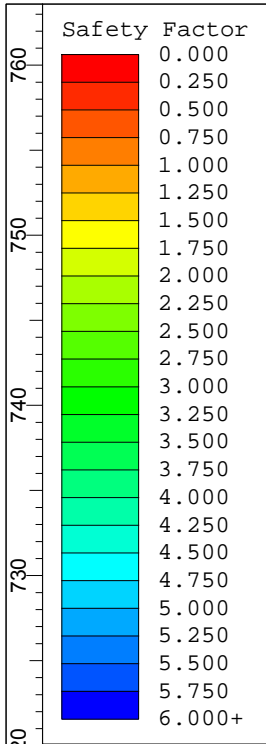
Project		N. Burleson Road Retaining Wall	
Analysis Description		Global Stability	
Drawn By	R. Russo	Scale	1:135
Date	7/30/2015, 9:36:32 PM	Company	Arias
		File Name	Slide1.slim



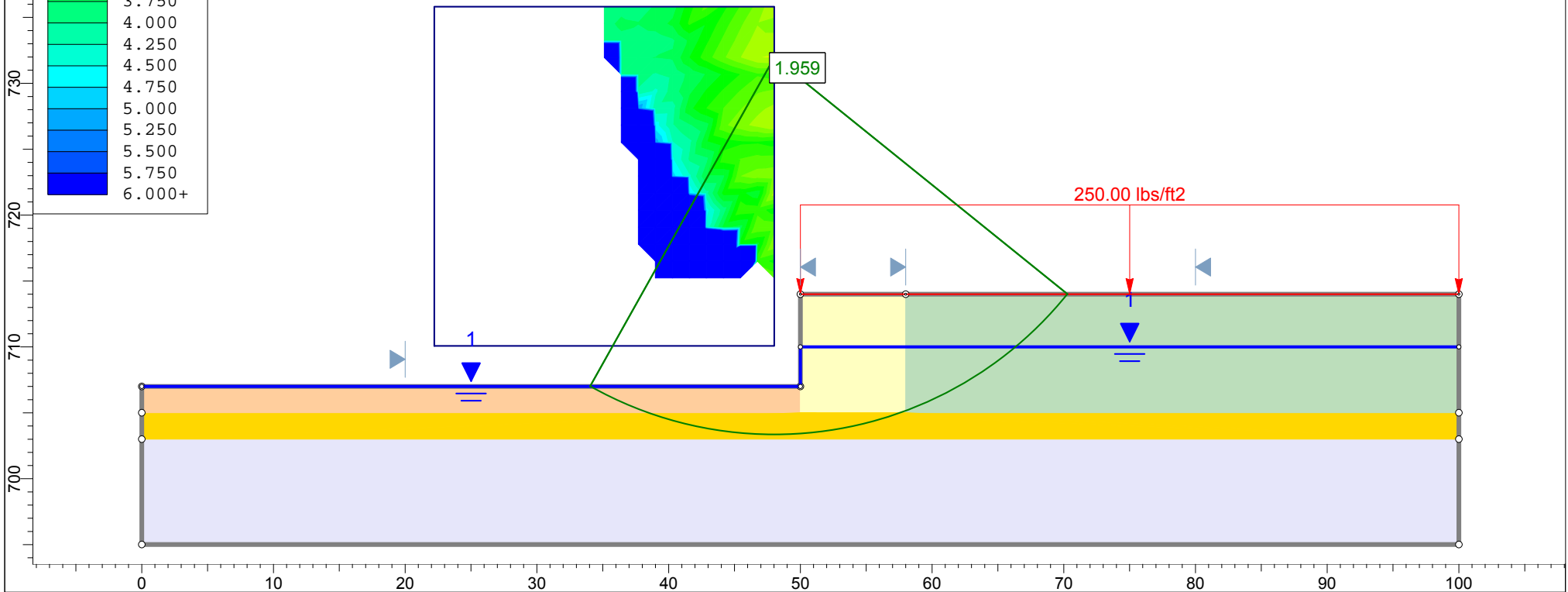
Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Reinforced zone		125	Mohr-Coulomb	1000	34	Piezometric Line 1		
Retained Zone		120	Mohr-Coulomb	50	27	Piezometric Line 1		
Clay CH		120	Mohr-Coulomb	200	22	Piezometric Line 1		
Clay CL		120	Mohr-Coulomb	100	26	Piezometric Line 1		
limestone		140	Mohr-Coulomb	5000	40	Piezometric Line 1		



	Project			N. Burluson Road Retaining Wall		
	Analysis Description			Global Stability		
	Drawn By	R. Russo	Scale	1:135	Company	Arias
	Date	7/30/2015, 9:36:32 PM			File Name	Slide1.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Reinforced zone		105	Mohr-Coulomb	1000	34	Piezometric Line 1		
Retained Zone		120	Mohr-Coulomb	50	27	Piezometric Line 1		
Clay CH		120	Mohr-Coulomb	200	22	Piezometric Line 1		
Clay CL		120	Mohr-Coulomb	100	26	Piezometric Line 1		
limestone		140	Mohr-Coulomb	5000	40	Piezometric Line 1		



SLIDEINTERPRET 6.035

Project		N. Burleson Road Retaining Wall	
Analysis Description		Global Stability	
Drawn By	R. Russo	Scale	1:135
Date	7/30/2015, 9:36:32 PM	Company	Arias
		File Name	Slide1.slim

## **APPENDIX B**











































# **Geotechnical Data Report**

**North Burleson Street Improvements  
W. Center Street to Market Place Ave  
Kyle, Texas**

**Arias Project No. 2013-756**



**Prepared For:  
Freese and Nichols, Inc.**

**August 2014**



13581 Pond Springs Road, Suite 210, Austin, Texas 78729 • Phone: (512) 428-5550 • Fax: (512) 428-5525

August 26, 2014  
Arias Project No. 2013-756

Via Email: [Jessica.Rodriguez@freese.com](mailto:Jessica.Rodriguez@freese.com)

Ms. Jessica Rodriguez, P.E.  
Senior Project Manager  
Freese and Nichols, Inc.  
10431 Morado Circle  
Building 5, Suite 300  
Austin, Texas 78759

**RE: Geotechnical Data Report**  
North Burleson Street Improvements  
W. Center Street to Market Place Ave  
Kyle, Texas

Dear Ms. Rodriguez:


Arias & Associates, Inc. (Arias) is pleased to submit this Geotechnical Data Report (GDR) of findings for the above referenced project. Our services were performed as outlined in our proposal dated September 23, 2013, and formally authorized in Subconsultant Authorization Agreement executed May 13, 2014.

The GDR is a compilation of geotechnical boring and laboratory testing data obtained to date for this project, and a description of geologic and stratigraphic conditions encountered at the site. The scope of the study was to provide geotechnical engineering criteria for use in pavement thickness design and earthwork recommendations. Geotechnical recommendations for pavements and earthwork are provided under separate cover in a Geotechnical Design Memorandum.

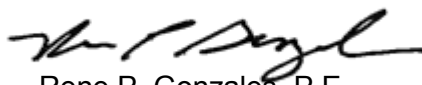
Arias sincerely appreciates the opportunity to be part of the design team and look forward to our continued association throughout final design and construction phases. Please do not hesitate to contact us regarding this report, or if we may be of further service.

Sincerely,

**ARIAS & ASSOCIATES, INC.**  
TBPE Registration No. F-32

  
Rebecca A. Russo, P.E.  
Senior Geotechnical Engineer



  
Rene P. Gonzales, P.E.  
Project Manager

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## PROJECT INFORMATION

The project will consist of roadway improvements to approximately 1.4 miles of N. Burleson Street, from W. Center Street to Market Place Avenue in Kyle, Texas. Currently, the majority of the project (approximately 1.3 miles) will be along existing Right of Way (ROW), and about 0.1 miles will include new ROW and new roadway construction. The existing ROW consists of 2-lane roadway with bar ditches. Proposed construction will include 3 lanes with a center turn lane, curb and gutter drainage improvements, and culvert crossing at an unnamed tributary of Plum Creek. A *Vicinity Map* showing the project site location is presented on Figure 1 of Appendix A. A summary of the project information is given in the table below.

**Table 1: Project Summary**

<b>Project</b>	North Burleson Street Improvements
<b>Project Location</b>	N. Burleson St. from W. Center to Market Place Ave
<b>Proposed Development</b>	<u>1.4 Miles of Roadway Improvements:</u> 1.3 Miles of existing Right of Way 0.1 Miles of new Right of Way
<b>Proposed Construction</b>	Roadway Widening to 3-lane with curb-and-gutter Culvert crossing at unnamed tributary

## FIELD EXPLORATION

A total of 10 borings were drilled at the approximate locations shown on the *Boring Location Plan* presented on Figure 2 in Appendix A. The borings were drilled to depths of 7.3 to 20 feet below existing grade. A summary of the boring drilling information is presented in the following table.

**Table 2: Boring Summary Table**

<b>Boring Designation</b>	<b>Drill Depth, ft</b>	<b>Drill Date</b>	<b>Groundwater Depth ATD, ft</b>	<b>Notes</b>
B-1	9	6/2/2014	6	
B-2	10.5	6/2/2014	5.5	
B-3	10	5/29/2014		
B-4	15	6/2/2014	8.5	
B-5	9.5	6/2/2014	6.5	
B-6	7.3	5/29/2014	5 (2 ft after drilling)	Boring terminated at 7.3 feet due to possible utility trench

Boring Designation	Drill Depth, ft	Drill Date	Groundwater Depth ATD, ft	Notes
B-7	20	6/2/2014		
B-8	10	6/5/2014		
B-9	10	5/29/2014	3	
B-10	9	6/2/2014	4	

**Notes:**

- 1) ATD – At the Time of Drilling.
- 2) Drill Depth is depths below ground surface at the time of the geotechnical study.

The borings were generally sampled using the split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586) at approximately 2 foot intervals and material was obtained from the cuttings as the borings were advanced (ASTM D 1452). Select samples were also obtained using seamless push tubes for cohesive strata (ASTM D 1587). Rock core sampling (ASTM D 2113) of the limestone stratum was performed in 6 of the 10 borings to obtain rock quality designation (ASTM D 6032) and to obtain limestone samples for laboratory testing. The boring depths were measured from below the existing ground surface at the time of drilling. A truck-mounted drill rig using air and rotary drilling methods together with the sampling tool noted was used to obtain the subsurface soil/rock samples. After completion of drilling, the boreholes were backfilled using the auger cuttings and bentonite mixture.

Detailed descriptions of subsurface conditions encountered in the borings are presented on the Logs of Borings included in Appendix B. Keys to terms and symbols used on the boring logs are included in Appendix B, following the logs of borings. Sample type and interval are included on the individual soil boring logs at the respective sample depth. An Arias' representative visually logged each recovered sample and selected representative samples for laboratory testing.

SPT N-values for those intervals where the sampler was advanced for a 12-inch penetration after the initial 6-inch seating are shown on the individual boring logs. Descriptions of field testing procedures are included in Appendix B, following the boring logs and keys to terms and symbols. GPS coordinates (horizontal datum NAD 83) obtained using a hand-held GPS device are shown on the boring logs, and should be considered approximate. Drilling and groundwater notes are also shown on the boring logs.

Soil classifications and borehole logging were conducted during the exploration by one of our field engineering technicians working under the supervision of our Geotechnical Engineer. Final soil classifications, as seen on the boring logs included in Appendix B, were determined in the laboratory based on laboratory and field test results and applicable ASTM procedures.

## LABORATORY TESTING

The laboratory testing was performed on representative samples to determine soil water content, Atterberg Limits (ASTM D4318), grain size analyses (ASTM D422) and unconfined compression strength tests on rock core samples (ASTM D7012). In addition to classification and strength testing, one CBR (California Bearing Ratio) test was conducted on a bulk sample obtained from auger cuttings in boring B-6. The results of the CBR test and Proctor compaction test (ASTM D698), as well as plasticity and gradation curves are included in Appendix C. A description of laboratory procedures is included in Appendix C, following the data.

The soil laboratory testing for this project was done in accordance applicable ASTM procedures with the specifications and definitions for these tests listed in the Appendix C. Remaining soil samples recovered from this exploration will be routinely discarded following submittal of this report.

## SUBSURFACE CONDITIONS

Area geology, generalized stratigraphy and groundwater conditions are discussed in the following sections. The subsurface and groundwater conditions are based on conditions encountered at the boring locations to the depths explored. A *Geologic Map* is presented on Figure 4 in Appendix A.

### Area Geology

According to published geologic mapping<sup>1</sup>, the site is underlain by surficial clay remnants and limestone of the Austin Group of Limestones. The Austin limestone is usually described as chalk, and is comprised of chalky limestone, clayey limestone, limestone, and marl (a hard calcareous clay). Unweathered Austin is gray to light gray in color, and becomes tan with weathering. Surficial weathered remnants typically consist of tan and brown fat and lean clay.

Referring to the Geologic Map, it can be seen the project site is situated near a fault between the Austin Group of Limestone and the Pecan Gap Formation of the Taylor Group just east of IH-35. Surficial outcropping of Del Rio / Georgetown undivided is mapped to the west. In faulted regions, it is not uncommon for smaller secondary faulting with surficial expressions of nearby formations to be encountered along the project alignment, with the possible presence of highly plastic potentially expansive clay (Taylor, Del Rio), or relatively hard limestone (Buda). Further, the presence of faulting oftentimes promotes the passage of groundwater from upgradient sources.

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<sup>1</sup> Barnes, V.E. (1974), "Geologic Atlas of Texas, Austin and Seguin Sheets," Second Printing 1995, Bureau of Economic Geology, The University of Texas at Austin, map and explanatory bulletin.

## Site Stratigraphic and Engineering Properties

Subsurface conditions can be best understood by a thorough review of the *Boring Logs* included in Appendix B and the *Generalized Subsurface Profile* which precedes the boring logs. In general, the borings encountered surficial fill material (in 8 of the 10 borings) underlain by fat and lean clay, transitioning to weathered limestone and limestone of the Austin Group. The generalized stratigraphic conditions and engineering properties are summarized in the table below.

**Table 3: Generalized Stratigraphic Conditions**

Stratum	Depth (ft)	Material Type	Index Test		N
I	0 - 7.5 Avg 4.2	FILL – Dark brown FAT CLAY (CH) to CLAYEY GRAVEL (GC) with sand	PI= 23 to 51 Avg 39	N200= 25 to 82 Avg 50	PP=1.5 to 4.5 Avg 2.2 tsf N=6, 7, 4, 8
Ila	1 - 7.5 to 3 to 10	CWLS – Tan LEAN CLAY (CL) to CLAYEY SAND (SC)	PI= 8 to 20 Avg 16	N200= 25 to 53 Avg 36	N=6 to 50/3” (average 50+)
Ilb	4 to 4.5	ALLUVIUM – Light gray sandy FAT CLAY (CH)	PI=32	N200=79	PP=4.0
III	3 - 10 to BTD Avg 5.5	Tan LIMESTONE (Austin Group)	REC= 78 to 100 Avg 93	RQD= 23 to 100 Avg 58	N=50/2” to 50/3” UC= 111 to 595 Avg UC=225, 165*

\* Excluded high value of 595 tsf from average.

**Where:** Depth - Depth from existing ground surface at the time of geotechnical study, feet  
 PI - Plasticity Index, %  
 N200 - Percent passing U.S. Standard No. 200 sieve, %  
 PP - Pocket Penetrometer, tsf  
 N - Standard Penetration Test (SPT) blow count value, blows per foot (bpf)  
 Avg - Average Value  
 BTD - Boring Termination Depth  
 CWLS - Completely Weathered Limestone

## Groundwater

Groundwater was encountered in 7 of the 10 borings at depths of 3 to 8.5 feet below grade at the time of drilling. Boring B-6 had groundwater at 2-ft depth after drilling. Due to the proximity of the site to nearby creeks and mapped geologic faulting, it is anticipated that groundwater will be present during construction along portions of the alignment. For construction planning purposes, the presence of shallow groundwater should be made known to the contractor, particularly in the vicinity of borings B-4 and B-10 near site creeks, and B-6 which may be due to groundwater traveling in utility backfill or sourced from nearby faulting, or both. Permanent

drainage beneath pavements may be necessary depending on final roadway grades, and will be addressed under separate cover in the Geotechnical Design Memorandum.

Groundwater levels will often change significantly over time and should be verified immediately prior to construction. Water levels in open boreholes may require several hours to several days to stabilize depending on the permeability of the soils. Groundwater levels at this site may differ during construction because fluctuations in groundwater levels can result from seasonal conditions, rainfall, drought, or temperature effects. Pockets or seams of gravels, sands, silts or open fractures and joints can store and transmit “perched” groundwater flow or seepage.

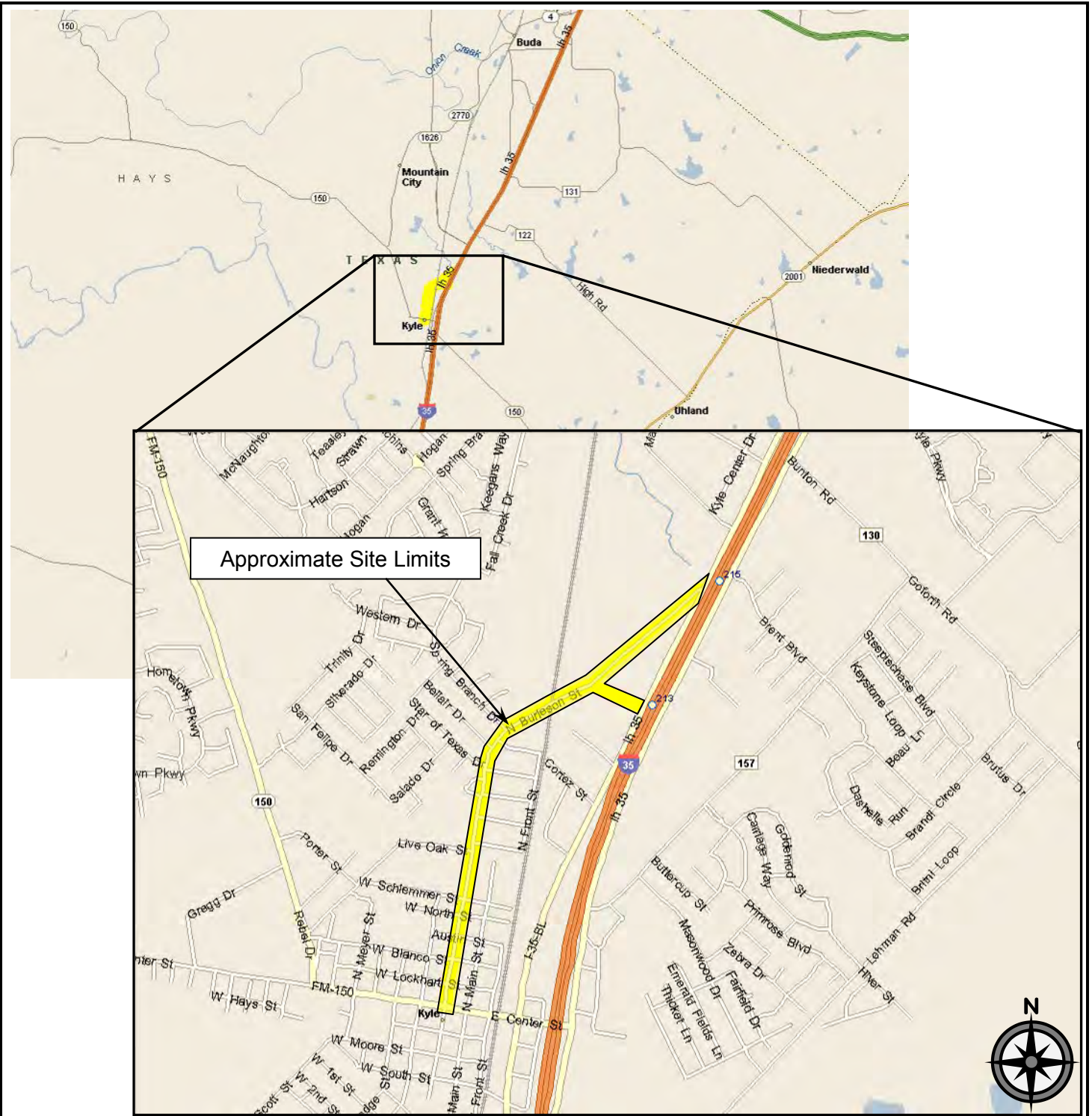
## **LIMITATIONS**

It should be noted that the subsurface conditions consider those conditions discovered at the specific boring locations. *Significant variations in soil and groundwater conditions between and beyond the borings often exist and can occur at this site.* Transition boundaries or contacts, noted on the boring logs to separate soil types, are approximate. Actual contacts may be gradual and vary at different locations. If conditions encountered during construction indicate more variation than established as a result of this study, we should be contacted to evaluate the significance of the changed conditions relative to our descriptions.

This report was prepared for this project exclusively for the use of Freese and Nichols, Inc. and the design team. If different subsurface conditions are encountered, we should be informed and retained to ascertain the impact of these changes on the date included in this report. We cannot be responsible for the potential impact of these changes if we are not informed. This report has been prepared in accordance with generally accepted geotechnical engineering practice with a degree of care and skill ordinarily exercised by reputable geotechnical engineers and geologists practicing in this area.



## **APPENDIX A: FIGURES**



**ARIAS**  
GEOPROFESSIONALS

13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
Phone: (512) 428-5550 • Fax: (512) 428-5525

**VICINITY MAP**

North Burselson Street  
from West Center Street to Market Place Avenue  
Kyle, Texas

Date: June 18, 2014	Job No.: 2013-756
Drawn By: TAS	Checked By: RAR
Approved By: RPG	Scale: N.T.S.

**Figure 1**





13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
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**OVERALL BORING LOCATION PLAN**

North Burlison Street  
 from West Center Street to Market Place Avenue  
 Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

**Figure 2**  
1 of 1





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 Phone: (512) 428-5550 • Fax: (512) 428-5525

**BORING LOCATION PLAN**

North Burleson Street  
 from West Center Street to Market Place Avenue  
 Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 23, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

**Figure 2a**  
1 of 4





**BORING LOCATION PLAN**

North Burleson Street  
from West Center Street to Market Place Avenue  
Kyle, Texas

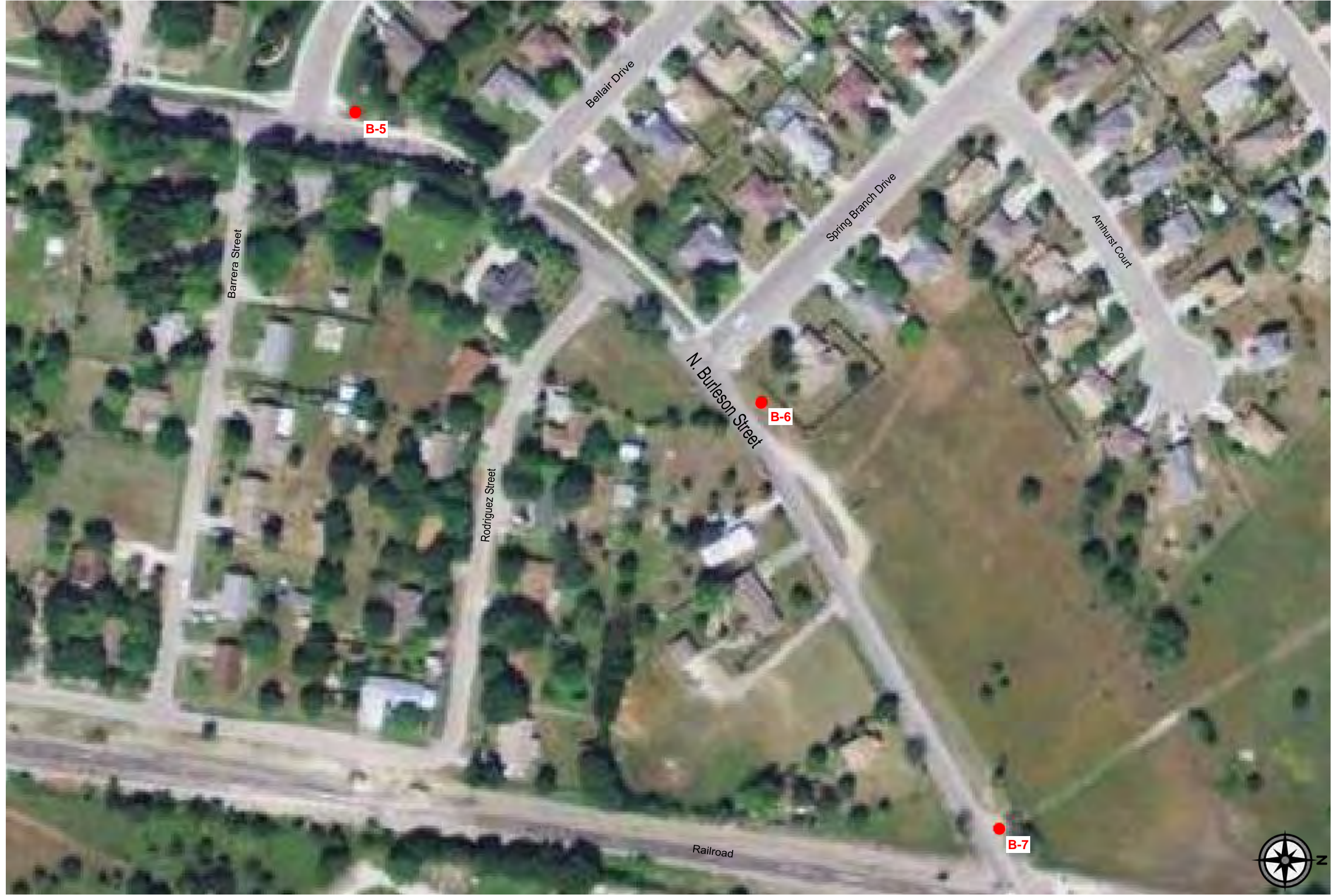
Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

**Figure 2b**  
2 of 4



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13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
 Phone: (512) 428-5550 • Fax: (512) 428-5525

**BORING LOCATION PLAN**

North Burleson Street  
 from West Center Street to Market Place Avenue  
 Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

**Figure 2c**  
3 of 4





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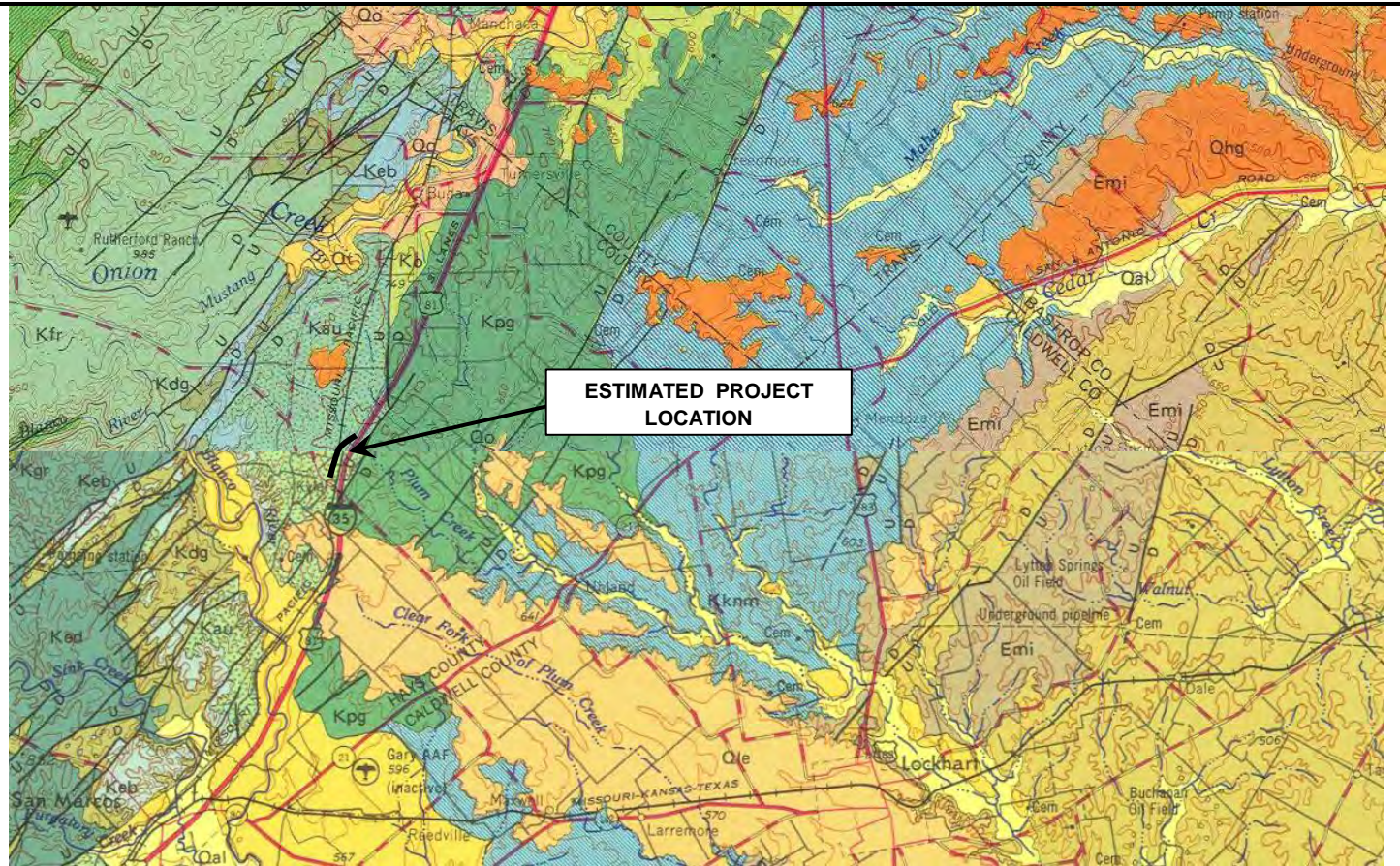
**BORING LOCATION PLAN**

North Burleson Street  
 from West Center Street to Market Place Avenue  
 Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

**Figure 2d**  
4 of 4






**PORTION OF GEOLOGIC ATLAS OF TEXAS  
(Austin and Seguin Sheet)**

**LEGEND**



<u>Symbol</u>	<u>Name</u>	<u>Age</u>
Qal	Alluvium	Quaternary Period / Recent
Qt/Qo/Qhg	Fluviatile Terrace Deposits	Quaternary Period / Pleistocene
Emi	Midway Group	Quaternary Period / Eocene
Kknm	Navarro Formation	Upper Cretaceous Period
Kpg	Pecan Gap Chalk	Upper Cretaceous Period
Kau	Austin Chalk	Upper Cretaceous Period
Keb	Eagle Ford and Buda Limestone	Upper Cretaceous Period
Kdg	Del Rio Clay and Georgetown	Lower Cretaceous Period
Kfr	Fredericksburg Group	Lower Cretaceous Period
Kgr(u)	Glen Rose Formation (Upper)	Lower Cretaceous Period

 Fault Segment with Indication of Relative Movement



13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
Phone: (512) 428-5550 • Fax: (512) 428-5525

**GEOLOGIC MAP**

North Burleson Street  
from West Center Street to Market Place Avenue  
Kyle, Texas

Date: August 21, 2014	Job No.: 2013-756
Drawn By: PPL	Checked By: RAR
Approved By: RPG	Scale: N.T.S.

**Figure 3**





Photo 1 – Boring B-1 near W. Center Street, facing north.



Photo 2 – Boring B-2, facing south.

DISCLAIMER: This drawing is for illustration only and should not be used for design or construction purposes. All locations are approximate.



13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
 Phone: (512) 428-5550 • Fax: (512) 428-5525

## SITE PHOTOS

North Burleson Street Improvements  
 W. Center to Market Place Ave  
 Kyle, Texas

Date: August 23, 2014	Job No.: 2013-756
Drawn By: RAR	Checked By: RAR
Approved By: JSL	Scale: N.T.S.

**Figure 4**





Photo 3 – Boring B-7, facing northeast, note sanitary sewer manhole (utility). Person in photo is utility locator.



Photo 4 – Drilling of B-9, facing north.



13581 Pond Springs Road, Suite 210, Austin, Texas 78729  
Phone: (512) 428-5550 • Fax: (512) 428-5525

## SITE PHOTOS

North Burleson Street Improvements  
W. Center to Market Place Ave  
Kyle, Texas

Date: August 23, 2014

Job No.: 2013-756

Drawn By: RAR

Checked By: RAR

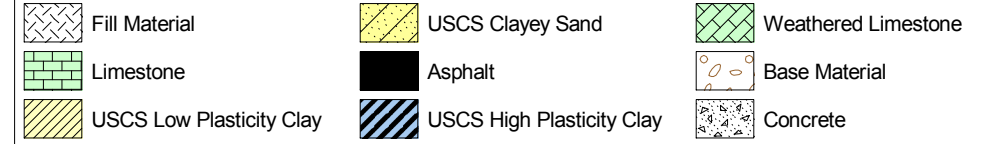
Approved By: RPG

Scale: N.T.S.

**Figure 4**

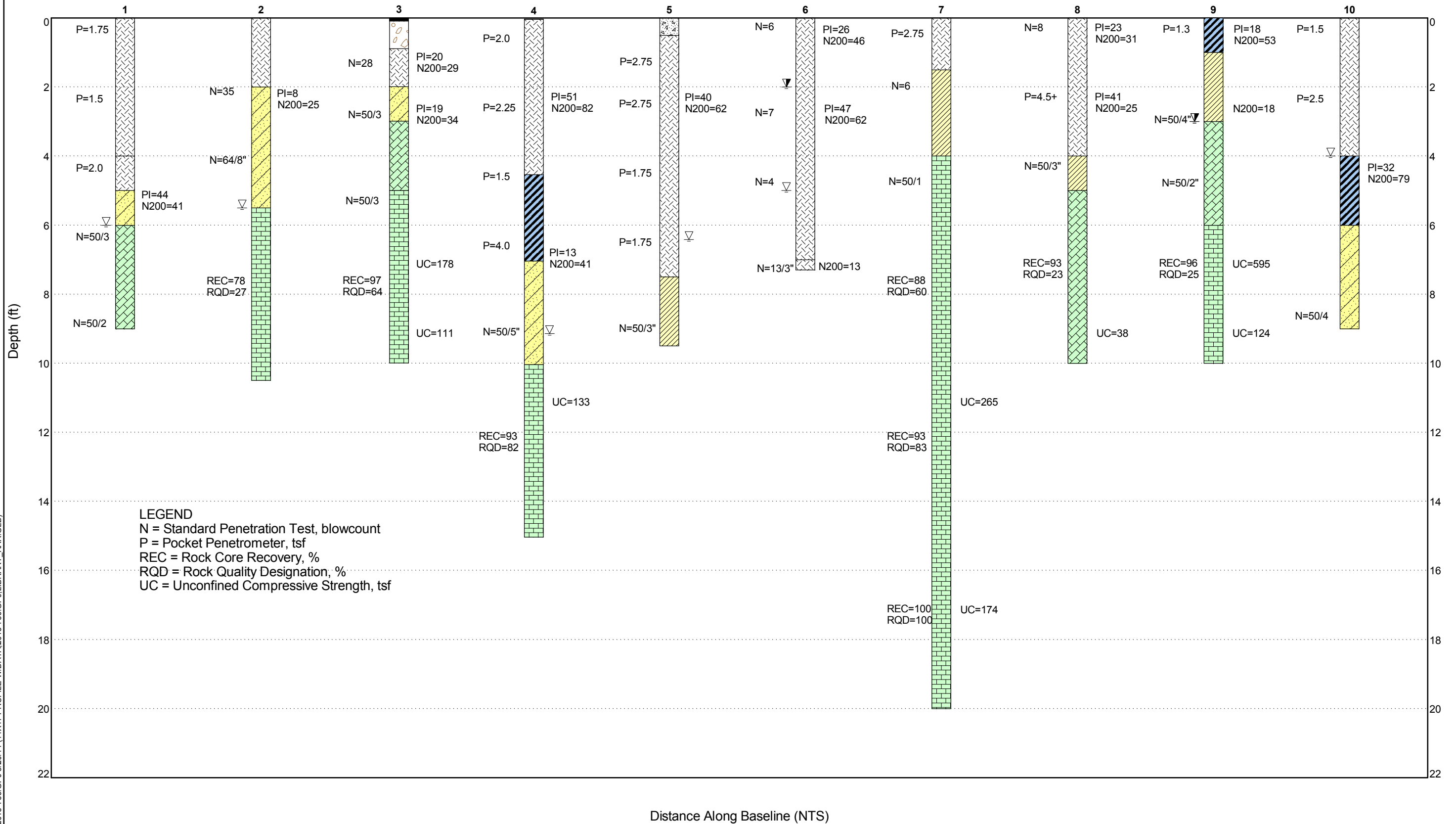
## **APPENDIX B: SOIL BORING LOGS AND KEY TO TERMS**

# SUBSURFACE DIAGRAM



CLIENT Freese & Nichols, Inc.  
 PROJECT NUMBER 2013-756

PROJECT NAME North Burleson Street  
 PROJECT LOCATION See Boring Location Plan



# Boring Log No. B-1



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/2/14

Coordinates: N29°59'20.87" W97°52'38.35"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
[FILL] FAT CLAY (CH) with sand and gravel, stiff, dark brown with reddish tan, moist with limestone fragments	.....	T					1.75		
	.....	T					1.5		
[FILL] CLAYEY GRAVEL with Sand (GC), dark gray with tan, moist with limestone fragment and coarse sand	5	T	17	21	65	44	2.0		41
[CWLS] CLAYEY SAND (SC), very dense, tan and light gray, moist	.....	SS						50/3"	
[AUSTIN] Weathered CHALK, tan and light gray	.....	SS						50/2"	

Borehole terminated at 9 feet

**Groundwater Data:**

First encountered during drilling: 6-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
Logged By: R. Russo  
Driller: Austin Geo-Logic  
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9 ft

**Nomenclature Used on Boring Log**

■ Thin-walled tube (T)

■ Split Spoon (SS)

∇ Water encountered during drilling

WC = Water Content (%)

N = SPT Blow Count

PL = Plastic Limit

-200 = % Passing #200 Sieve

LL = Liquid Limit

PI = Plasticity Index

PP = Pocket Penetrometer (tsf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01\_GDT, LIBRARY\_RAR.GLB)

# Boring Log No. B-2



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/2/14

Location: See Boring Location Plan

Coordinates: N29°59'26.94" W97°52'36.66"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200	RECR	QD
[FILL] SILTY SAND (SM), brown, dry with gravel.	0 - 1.5	T								
[CWLS] CLAYEY SAND (SC), dense to very dense, tan, with limestone fragments.	1.5 - 5.5	SS	16	21	29	8	35	25		
	5.5 - 10.5	SS					64/8"			
[AUSTIN] LIMESTONE, tan and light gray, moderately hard with clay partings, weathered layers and discontinuities.	10.5 - 10.5	RC							78	27

Borehole terminated at 10.5 feet

**Groundwater Data:**

First encountered during drilling: 5.5-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
Logged By: R. Russo  
Driller: Austin Geo-Logic  
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5.5 ft  
Rock core: 5.5 - 10.5 ft

**Nomenclature Used on Boring Log**

Thin-walled tube (T)

Split Spoon (SS)

Water encountered during drilling

Rock Core (RC)

WC = Water Content (%)

-200 = % Passing #200 Sieve

PL = Plastic Limit

QD = Rock Quality Designation

LL = Liquid Limit

REC = % Recovery

PI = Plasticity Index

N = SPT Blow Count

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01\_GDT, LIBRARY\_RAR.GLB)



# Boring Log No. B-3



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 5/29/14

Coordinates: N29°59'34.28" W97°52'34.73"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200	DD	Uc	RECR	QD
1" Asphalt over 8" BASE	0	GB										
[FILL] CLAYEY GRAVEL with Sand (GC), medium dense, dark brown and tan	1	SS	7	17	37	20	28	29				
[CWLS] CLAYEY SAND with Gravel (SC), very dense, light tan and gray	2	SS	11	18	37	19	50/3"	34				
Weathered LIMESTONE, light tan and gray	3	SS	6				50/3"					
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.  <i>-light gray from 7 to 8 ft</i>	5	RC							147 (UW)	178	97	64
	10								143 (UW)	111		

Borehole terminated at 10 feet

**Groundwater Data:**

During drilling: Not encountered

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: W. Persyn  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft  
 Rock core: 5 - 10 ft

**Nomenclature Used on Boring Log**

Grab Sample (GB)

Split Spoon (SS)

Rock Core (RC)

WC = Water Content (%)  
 PL = Plastic Limit  
 LL = Liquid Limit  
 PI = Plasticity Index  
 N = SPT Blow Count

-200 = % Passing #200 Sieve  
 DD = Dry Density (pcf)  
 Uc = Compressive Strength (tsf)  
 RQD = Rock Quality Designation  
 REC = % Recovery

UW = Unit Weight (pcf)

# Boring Log No. B-4



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/2/14

Location: See Boring Location Plan

Coordinates: N29°59'40.05" W97°52'34.45"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	RECR	QD
[FILL] FAT CLAY (CH) with sand, stiff, dark brown, moist with organics, scattered coarse sand and gravel.	0	T					2.0						
	1	T	31	22	73	51	2.25		82				
SANDY FAT CLAY (CH), stiff, gray to light gray, moist with ferrous staining	5	T					1.5						
	6	T	11	13	26	13	4.0		41				
[CWLS] CLAYEY SAND with Gravel (SC), medium dense to very dense, tan, with limestone fragments	10	SS						50/5"					
	11		8							147 (UW)	133		
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.	15	RC										93	82

Borehole terminated at 15 feet

**Groundwater Data:**

First encountered during drilling: 8.5-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Single flight auger: 0 - 10 ft  
 Rock core: 10 - 15 ft

**Nomenclature Used on Boring Log**

- Thin-walled tube (T)
- Split Spoon (SS)
- Rock Core (RC)
- Water encountered during drilling
- WC = Water Content (%)
- PL = Plastic Limit
- LL = Liquid Limit
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- N = SPT Blow Count
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Compressive Strength (tsf)
- RQD = Rock Quality Designation
- REC = % Recovery
- UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01, GDT, LIBRARY, RAR, G.L.B.)



# Boring Log No. B-5



Project: **North Burleson Street**  
**From W. Center to Market Place Avenue**  
**Kyle, Texas**

Sampling Date: 6/2/14

Location: See Boring Location Plan

Coordinates: N29°59'53.1" W97°52'31.79"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
4" Conc. sidewalk									
[FILL] FAT CLAY (CH) with sand and gravel, stiff to very stiff, dark brown with tan and gray, with sand and gravel layers.		T					2.75		
		T	30	18	59	41	2.75		62
- increased gravel from 4.5 to 5 feet	5	T					1.75		
		T					1.75		
- abundant gravel at 7 to 8 feet									
[CWLS] SANDY LEAN CLAY (CL), stiff, tan, wet		SS							50/3"

Borehole terminated at 9.5 feet

**Groundwater Data:**

First encountered during drilling: 6.5-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9.5 ft

**Nomenclature Used on Boring Log**

■ Thin-walled tube (T)

■ Split Spoon (SS)

∇ Water encountered during drilling

WC = Water Content (%)

N = SPT Blow Count

PL = Plastic Limit

-200 = % Passing #200 Sieve

LL = Liquid Limit

PI = Plasticity Index

PP = Pocket Penetrometer (tsf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01\_GDT, LIBRARY\_RAR.GLB)

# Boring Log No. B-6



Project: **North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 5/29/14

Coordinates: N29°59'57.77" W97°52'27.99"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
[FILL] GRAVELLY FAT CLAY (CH), firm, brown and tan, wet intermixed with clayey sand and gravel		SS	16 24	22	48	26	6	45
		SS	26	19	66	47	7	62
	5	SS					4	
		GB	38					
[FILL] CONCRETE, tan, possible flowable fill		SS	22				13/3"	13

Borehole terminated at 7.3 feet

**Groundwater Data:**

First encountered during drilling: 5-ft depth  
After 30 minutes: 2-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
Logged By: W. Persyn  
Driller: Austin Geo-Logic  
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 7.3 ft

**Nomenclature Used on Boring Log**

Split Spoon (SS)

Grab Sample (GB)

Water encountered during drilling

Delayed water reading

WC = Water Content (%)

-200 = % Passing #200 Sieve

PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

N = SPT Blow Count

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01\_GDT, LIBRARY\_RAR.GLB)

# Boring Log No. B-7



Project: **North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/2/14

Coordinates: N30°0'0.49" W97°52'22.31"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PP	N	DD	Uc	RECR	QD
[FILL] CLAYEY SAND (SC), brown to reddish tan, moist with gravel.	0 - 1	T		2.75					
SANDY LEAN CLAY (CL), firm, tan to reddish tan, wet with limestone fragments.	1 - 2	SS			6				
[AUSTIN] CHALK, tan to light gray, moderately hard with clay partings, weathered layers and discontinuities.	2 - 5	SS			50/1"				
	5 - 7	RC	7					88	60
	7 - 10	RC	6			146 (UW)	265	93	83
	10 - 15	RC	7			150 (UW)	174	100	100
	15 - 20								

Borehole terminated at 20 feet

**Groundwater Data:**

During drilling: Not encountered

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft  
 Rock core: 5 - 20 ft

**Nomenclature Used on Boring Log**

- Thin-walled tube (T)
- Split Spoon (SS)
- Rock Core (RC)
- WC = Water Content (%)
- PP = Pocket Penetrometer (tsf)
- N = SPT Blow Count
- DD = Dry Density (pcf)
- Uc = Compressive Strength (tsf)
- RQD = Rock Quality Designation
- REC = % Recovery
- UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01, GDT, LIBRARY, RAR, GLB)

# Boring Log No. B-8



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 6/5/14

Coordinates: N30°0'3.42" W97°52'15.2"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	RECR	RQD
[FILL] CLAYEY GRAVEL (GC), loose to medium dense, dark brown and tan, with sand and subrounded gravel	0	SS	14	25	48	23		8	30				
	1	T					4.5+		24				
[CWLS] SANDY LEAN CLAY (CL), hard, tan	5	SS						50/3"					
[AUSTIN] Weathered LIMESTONE, tan to gray, soft to moderately hard, with marl layers, and alternating tan and gray layers.	10	RC	13							139 (UW)	38	93	23

Borehole terminated at 10 feet

**Groundwater Data:**

During drilling: Not encountered

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Hand Auger: 0 - 1 ft

**Nomenclature Used on Boring Log**

Split Spoon (SS)

Thin-walled tube (T)

Rock Core (RC)

WC = Water Content (%)

N = SPT Blow Count

REC = % Recovery

PL = Plastic Limit

-200 = % Passing #200 Sieve

UW = Unit Weight (pcf)

LL = Liquid Limit

DD = Dry Density (pcf)

PI = Plasticity Index

Uc = Compressive Strength (tsf)

PP = Pocket Penetrometer (tsf)

RQD = Rock Quality Designation

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01, GDT, LIBRARY, RAR, GLB)

# Boring Log No. B-9



**Project: North Burleson Street  
From W. Center to Market Place Avenue  
Kyle, Texas**

Sampling Date: 5/29/14

Coordinates: N30°0'0.05" W97°52'9.27"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	RECR	QD
FAT CLAY (CH), stiff, dark brown	0												
SANDY LEAN CLAY (CL), hard, tan	3	T	27	21	40	19	1.3		53				
Weathered LIMESTONE, light tan and light gray, with clay seams and layers	5	SS	11					50/4"	18				
	6	SS	16					50/2"					
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.	10	RC								153 (UW)	595		
	10									145 (UW)	124	96	25

Borehole terminated at 10 feet

**Groundwater Data:**

First encountered during drilling: 3-ft depth  
After 30 minutes: 3-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
Logged By: W. Persyn  
Driller: Austin Geo-Logic  
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft  
Rock core: 5 - 10 ft

**Nomenclature Used on Boring Log**

Thin-walled tube (T)

Split Spoon (SS)

Rock Core (RC)

Water encountered during drilling

Delayed water reading

WC = Water Content (%)

N = SPT Blow Count

REC = % Recovery

PL = Plastic Limit

-200 = % Passing #200 Sieve

UW = Unit Weight (pcf)

LL = Liquid Limit

DD = Dry Density (pcf)

PI = Plasticity Index

Uc = Compressive Strength (tsf)

PP = Pocket Penetrometer (tsf)

RQD = Rock Quality Designation

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01\_GDT, LIBRARY\_RAR.GLB)

# Boring Log No. B-10



Project: **North Burleson Street**  
**From W. Center to Market Place Avenue**  
**Kyle, Texas**

Sampling Date: 6/2/14

Coordinates: N30°0'11.48" W97°52'4.08"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
[FILL] FAT CLAY (CH), stiff, dark brown, moist with coarse sand and small angular gravel.		T					1.5		
		T					2.5		
FAT CLAY (CH) with sand, stiff, light gray to tan, moist with coarse sand and small angular gravel.	5	T	18	17	50	33			79
CLAYEY SAND (SC), tan to light gray, wet		T							
		SS							50/4"

Borehole terminated at 9 feet

**Groundwater Data:**

First encountered during drilling: 4-ft depth

**Field Drilling Data:**

Coordinates: Hand-held GPS Unit  
 Logged By: R. Russo  
 Driller: Austin Geo-Logic  
 Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9 ft

**Nomenclature Used on Boring Log**

■ Thin-walled tube (T)

■ Split Spoon (SS)

∇ Water encountered during drilling

WC = Water Content (%)

N = SPT Blow Count

PL = Plastic Limit

-200 = % Passing #200 Sieve

LL = Liquid Limit

PI = Plasticity Index

PP = Pocket Penetrometer (tsf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02, ARIASSA12-01, GDT, LIBRARY, RAR, GLB)

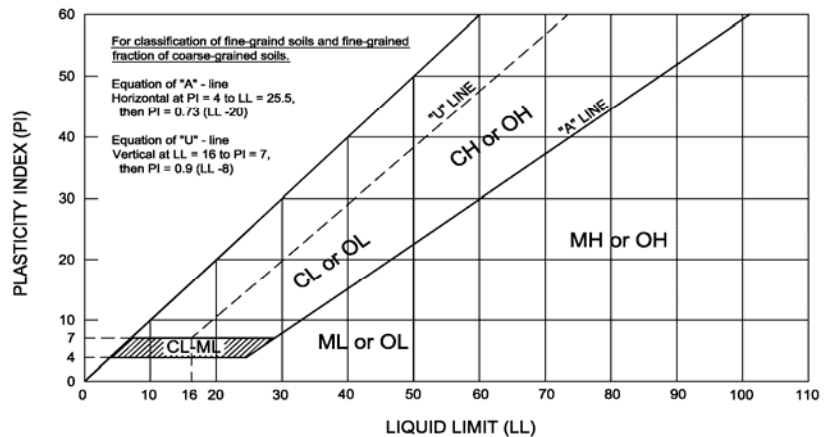
## KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS	DESCRIPTIONS				
<b>COARSE-GRAINED SOILS</b>	More than half of material LARGER than No. 200 Sieve size	<b>GRAVELS</b>	Clean Gravels (little or no Fines)	<b>GW</b>	Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines			
			Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines	<b>GP</b>	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines			
			Silty Gravels, Gravel-Sand-Silt Mixtures	<b>GM</b>	Silty Gravels, Gravel-Sand-Silt Mixtures			
			Clayey Gravels, Gravel-Sand-Clay Mixtures	<b>GC</b>	Clayey Gravels, Gravel-Sand-Clay Mixtures			
		<b>SANDS</b>	More than half of Coarse fraction is SMALLER than No. 4 Sieve size	Clean Sands (little or no Fines)	<b>SW</b>	Well-Graded Sands, Gravelly Sands, Little or no Fines		
				Poorly-Graded Sands, Gravelly Sands, Little or no Fines	<b>SP</b>	Poorly-Graded Sands, Gravelly Sands, Little or no Fines		
			Sands with Fines (Appreciable amount of Fines)	Silty Sands, Sand-Silt Mixtures	<b>SM</b>	Silty Sands, Sand-Silt Mixtures		
				Clayey Sands, Sand-Clay Mixtures	<b>SC</b>	Clayey Sands, Sand-Clay Mixtures		
				<b>SILTS &amp; CLAYS</b>	Liquid Limit less than 50	Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity	<b>ML</b>	Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
						Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	<b>CL</b>	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
<b>SILTS &amp; CLAYS</b>	Liquid Limit greater than 50	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts	<b>MH</b>	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts				
		Inorganic Clays of High Plasticity, Fat Clays	<b>CH</b>	Inorganic Clays of High Plasticity, Fat Clays				
<b>FORMATIONAL MATERIALS</b>	<b>SANDSTONE</b>		Massive Sandstones, Sandstones with Gravel Clasts	Massive Sandstones, Sandstones with Gravel Clasts				
	<b>MARLSTONE</b>		Indurated Argillaceous Limestones	Indurated Argillaceous Limestones				
	<b>LIMESTONE</b>		Massive or Weakly Bedded Limestones	Massive or Weakly Bedded Limestones				
	<b>CLAYSTONE</b>		Mudstone or Massive Claystones	Mudstone or Massive Claystones				
	<b>CHALK</b>		Massive or Poorly Bedded Chalk Deposits	Massive or Poorly Bedded Chalk Deposits				
	<b>MARINE CLAYS</b>		Cretaceous Clay Deposits	Cretaceous Clay Deposits				
<b>GROUNDWATER</b>			Indicates Final Observed Groundwater Level	Indicates Final Observed Groundwater Level				
			Indicates Initial Observed Groundwater Location	Indicates Initial Observed Groundwater Location				

Density of Granular Soils	
Number of Blows per ft., N	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
Over 50	Very Dense

Consistency and Strength of Cohesive Soils		
Number of Blows per ft., N	Consistency	Unconfined Compressive Strength, $q_u$ (tsf)
Below 2	Very Soft	Less than 0.25
2 - 4	Soft	0.25 - 0.5
4 - 8	Medium (Firm)	0.5 - 1.0
8 - 15	Stiff	1.0 - 2.0
15 - 30	Very Stiff	2.0 - 4.0
Over 30	Hard	Over 4.0

**PLASTICITY CHART (ASTM D 2487-11)**



# KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

**TABLE 1 Soil Classification Chart (ASTM D 2487-11)**

Criteria of Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>			Soil Classification				
			Group Symbol	Group Name <sup>B</sup>			
<b>COARSE-GRAINED SOILS</b>	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines <sup>C</sup> )	Cu ≥ 4 and 1 ≤ Cc ≤ 3 <sup>D</sup>	GW	Well-Graded Gravel <sup>E</sup>		
		Gravels with Fines (More than 12% fines <sup>C</sup> )	Cu < 4 and/or [Cc < or Cc > 3] <sup>D</sup>	GP	Poorly-Graded Gravel <sup>E</sup>		
	More than 50% retained on No. 200 sieve	Sands (50% or more of coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines <sup>H</sup> )	Fines classify as ML or MH	GM	Silty Gravel <sup>E,F,G</sup>	
			Sands with Fines (More than 12% fines <sup>H</sup> )	Fines classify as CL or CH	GC	Clayey Gravel <sup>E,F,G</sup>	
		<b>FINE-GRAINED SOILS</b>	Silt and Clays	inorganic	PI > 7 and plots on or above "A" line <sup>I</sup>	CL	Lean Clay <sup>K,L,M</sup>
			Liquid limit less than 50	organic	PI < 4 or plots below "A" line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>
50% or more passes the No. 200 sieve	Silt and Clays	inorganic	Liquid limit - oven dried <sup>L</sup> / <sub>Liquid &amp; #10</sub> < 0.75	OL	Organic Clay <sup>K,L,M,N</sup>		
		organic	PI plots on or above "A" line	CH	Organic Silt <sup>K,L,M,O</sup>		
Liquid limit 50 or more	Silt and Clays	inorganic	PI plots on or above "A" line	MH	Elastic Silt <sup>K,L,M</sup>		
		organic	Liquid limit - oven dried <sup>L</sup> / <sub>Liquid &amp; #10</sub> < 0.75	OH	Organic Clay <sup>K,L,M,P</sup>		
<b>HIGHLY ORGANIC SOILS</b>		Primarily organic matter, dark in color, and organic odor		PT	Peat		

<sup>A</sup> Based on the material passing the 3-inch (75mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobble sor boulders, or both" to group name

<sup>C</sup> Gravels with 5% to 12% fines require dual symbols:

GW-GM well-graded gravel with silt

GW-GC well-graded gravel with clay

GP-GM poorly-graded gravel with silt

GP-GC poorly-graded gravel with clay

<sup>D</sup>  $Cu = D_{60}/D_{10}$        $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

<sup>E</sup> If soil contains ≥ 15% sand, add "with sand" to group name

<sup>F</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM

<sup>G</sup> If fines are organic, add "with organic fines" to group name

<sup>H</sup> Sand with 5% to 12% fines require dual symbols:

SW-SM well-graded sand with silt

SW-SC well-graded sand with clay

SP-SM poorly-graded sand with silt

SP-SC poorly-graded sand with clay

<sup>I</sup> If soil contains ≥ 15% gravel, add "with gravel" to group name

<sup>J</sup> If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay

<sup>K</sup> If soil contains 15% to < 30% plus No. 200, add "with sand" or "with gravel," whichever is predominant

<sup>L</sup> If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name

<sup>M</sup> If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name

<sup>N</sup> PI ≥ 4 and plots on or above "A" line

<sup>O</sup> PI < 4 or plots below "A" line

<sup>P</sup> PI plots on or above "A" line

<sup>Q</sup> PI plots below "A" line

## TERMINOLOGY

<b>Boulders</b>	Over 12-inches (300mm)	<b>Parting</b>	Inclusion < 1/8-inch thick extending through samples
<b>Cobbles</b>	12-inches to 3-inches (300mm to 75mm)	<b>Seam</b>	Inclusion 1/8-inch to 3-inches thick extending through sample
<b>Gravel</b>	3-inches to No. 4 sieve (75mm to 4.75mm)	<b>Layer</b>	Inclusion > 3-inches thick extending through sample
<b>Sand</b>	No. 4 sieve to No. 200 sieve (4.75mm to 0.075mm)		
<b>Silt or Clay</b>	Passing No. 200 sieve (0.075mm)		
<b>Calcareous</b>	Containing appreciable quantities of calcium carbonate, generally nodular		

<b>Stratified</b>	Alternating layers of varying material or color with layers at least 6mm thick
<b>Laminated</b>	Alternating layers of varying material or color with the layers less than 6mm thick
<b>Fissured</b>	Breaks along definite planes of fracture with little resistance to fracturing
<b>Slack-sided</b>	Fracture planes appear polished or glossy sometimes striated
<b>Blocky</b>	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
<b>Lensed</b>	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
<b>Homogeneous</b>	Same color and appearance throughout



## KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

### Hardness Classification of Intact Rock

Class	Hardness	Field Test	Approximate Range of Uniaxial Compression Strength kg/cm <sup>2</sup> (tons/ft <sup>2</sup> )
I	Extremely hard	Many blows with geologic hammer required to break intact specimen.	> 2,000
II	Very hard	Hand held specimen breaks with hammer end of pick under more than one blow.	2,000 – 1,000
III	Hard	Cannot be scraped or peeled with knife, hand held specimen can be broken with single moderate blow with pick.	1,000 – 500
IV	Soft	Can just be scraped or peeled with knife. Indentations 1mm to 3mm show in specimen with moderate blow with pick.	500 – 250
V	Very soft	Material crumbles under moderate blow with sharp end of pick and can be peeled with a knife, but is too hard to hand-trim for triaxial test specimen.	250 – 10

### Rock Weathering Classifications

Grade	Symbol	Diagnostic Features
Fresh	F	No visible sign of Decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock, but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct, but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil, but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

### Rock Discontinuity Spacing

Description for Structural Features: Bedding, Foliation, or Flow Banding	Spacing	Description for Joints, Faults or Other Fractures
Very thickly (bedded, foliated, or banded)	More than 6 feet	Very widely (fractured or jointed)
Thickly	2 – 6 feet	Widely
Medium	8 – 24 inches	Medium
Thinly	2½ – 8 inches	Closely
Very thinly	¾ – 2½ inches	Very closely
Description for Micro-Structural Features: Lamination, Foliation, or Cleavage	Spacing	Descriptions for Joints, Faults, or Other Fractures
Intensely (laminated, foliated, or cleaved)	¼ – ¾ inch	Extremely close
Very intensely	Less than ¼ inch	

### Engineering Classification for in Situ Rock Quality

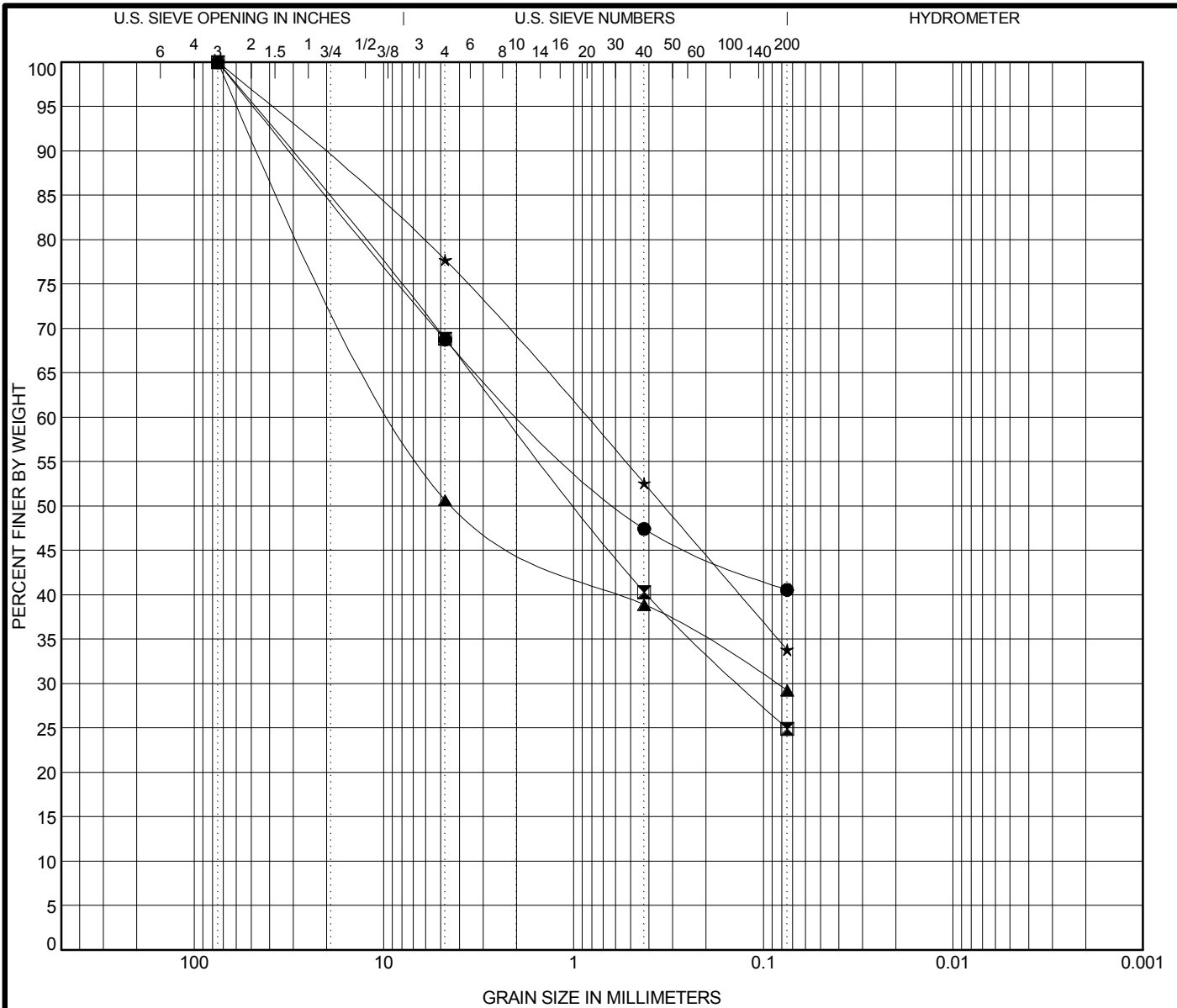
RQD %	Velocity Index	Rock Mass Quality
90 – 100	0.80 – 1.00	Excellent
75 – 90	0.60 – 0.80	Good
50 – 75	0.40 – 0.60	Fair
25 – 50	0.20 – 0.40	Poor
0 – 25	0 – 0.20	Very Poor

## **FIELD EXPLORATORY PROCEDURES**

The field exploration program included drilling at selected locations within the site and intermittently sampling the encountered materials. The boreholes were drilled using either single flight auger (ASTM D 1452) or hollow-stem auger (ASTM D 6151). Samples of encountered materials were obtained using a split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586), or by taking material from the auger as it was advanced (ASTM D 1452). The sample depth interval and type of sampler used is included on the soil boring log. Arias' field representative visually logged each recovered sample and placed a portion of the recovered sampled into a plastic bag for transport to our laboratory.

SPT N values and blow counts for those intervals where the sampler could not be advanced for the required 18-inch penetration are shown on the soil boring log. If the test was terminated during the 6-inch seating interval or after 10 hammer blows were applied used and no advancement of the sampler was noted, the log denotes this condition as blow count during seating penetration. Penetrometer readings recorded for thin-walled tube samples that remained intact also are shown on the soil boring log.

## **APPENDIX C: LABORATORY TESTING**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring	Elev	Depth	Classification					LL	PL	PI	Cc	Cu
● 1		4.0	CLAYEY GRAVEL with SAND (GC)					65	21	44		
☒ 2		2.0	CLAYEY SAND with GRAVEL (SC)					29	21	8		
▲ 3		1.0	CLAYEY GRAVEL with SAND (GC)					37	17	20		
★ 3		2.5	CLAYEY SAND with GRAVEL (SC)					37	18	19		

Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 1	4.0	75	1.763			31.2	28.2	40.6	
☒ 2	2.0	75	2.245	0.133		31.1	43.9	24.9	
▲ 3	1.0	75	8.007	0.086		49.3	21.4	29.3	
★ 3	2.5	75	0.866			22.3	43.9	33.8	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

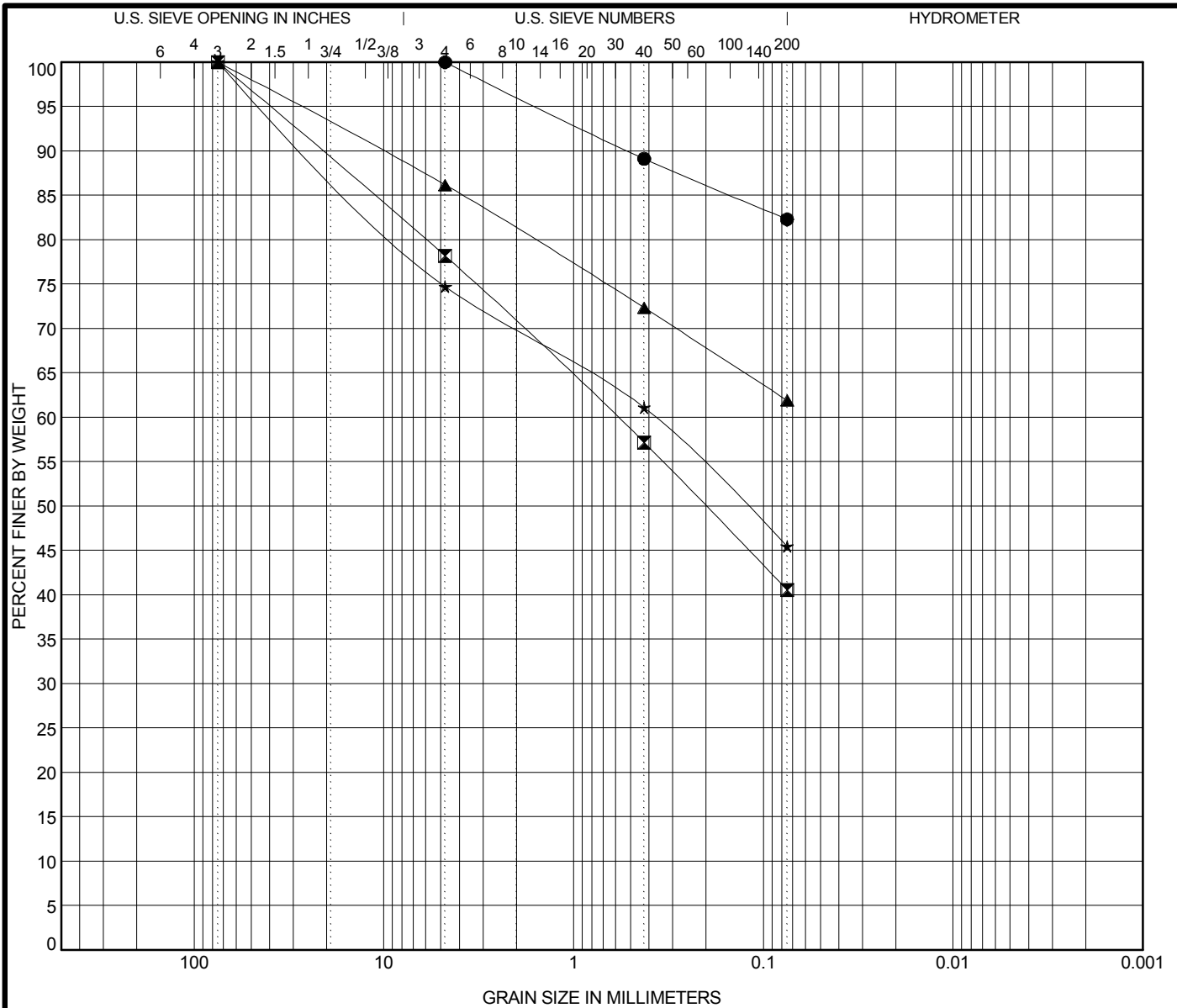


Arias & Associates, Inc.  
 13581 Pond Springs Rd, S210  
 Austin, TX 78729  
 Phone: 512.428.5550  
 Fax: 512.428.5525

### GRAIN SIZE DISTRIBUTION

Project: North Burleson Street  
 Location: See Boring Location Plan  
 Job No.: 2013-756

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US LAB.GDT.LIBRARY RAR.GLB)



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring	Elev	Depth	Classification					LL	PL	PI	Cc	Cu
●	4	2.0	FAT CLAY with SAND (CH)					73	22	51		
☒	4	6.0	CLAYEY SAND with GRAVEL (SC)					26	13	13		
▲	5	2.0	SANDY FAT CLAY (CH)					59	18	41		
★	6	0.0	CLAYEY SAND with GRAVEL (SC)					48	22	26		

Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4	2.0	4.75			0.0	17.7	82.3	
☒	4	6.0	75	0.588		21.8	37.6	40.5	
▲	5	2.0	75			13.8	24.3	61.9	
★	6	0.0	75	0.376		25.3	29.2	45.5	

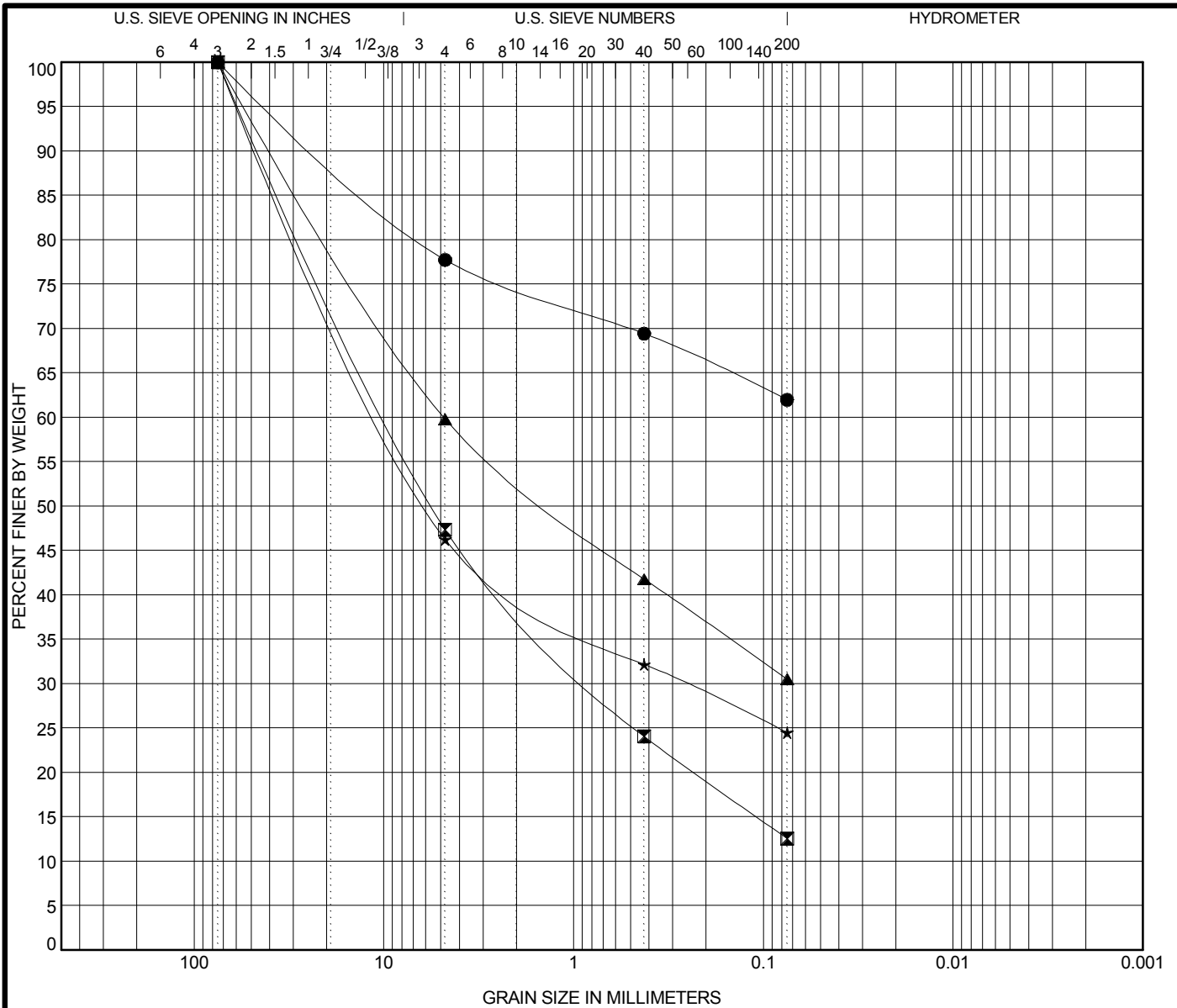
Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.



Arias & Associates, Inc.  
 13581 Pond Springs Rd, S210  
 Austin, TX 78729  
 Phone: 512.428.5550  
 Fax: 512.428.5525

GRAIN SIZE DISTRIBUTION	
Project:	North Burleson Street
Location:	See Boring Location Plan
Job No.:	2013-756

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US LAB.GDT.LIBRARY PAR.GLB)



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	6	2.5	<b>GRAVELLY FAT CLAY with SAND (CH)</b>	66	19	47		
⊠	6	7.0						
▲	8	0.0	<b>CLAYEY GRAVEL with SAND (GC)</b>	48	25	23		
★	8	2.0	<b>CLAYEY GRAVEL with SAND (GC)</b>	67	26	41		

Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	6	75				22.3	15.7	62.0	
⊠	6	75	9.214	0.788		52.6	34.8	12.6	
▲	8	75	4.813			40.2	29.3	30.5	
★	8	75	9.621	0.261		53.7	21.8	24.5	

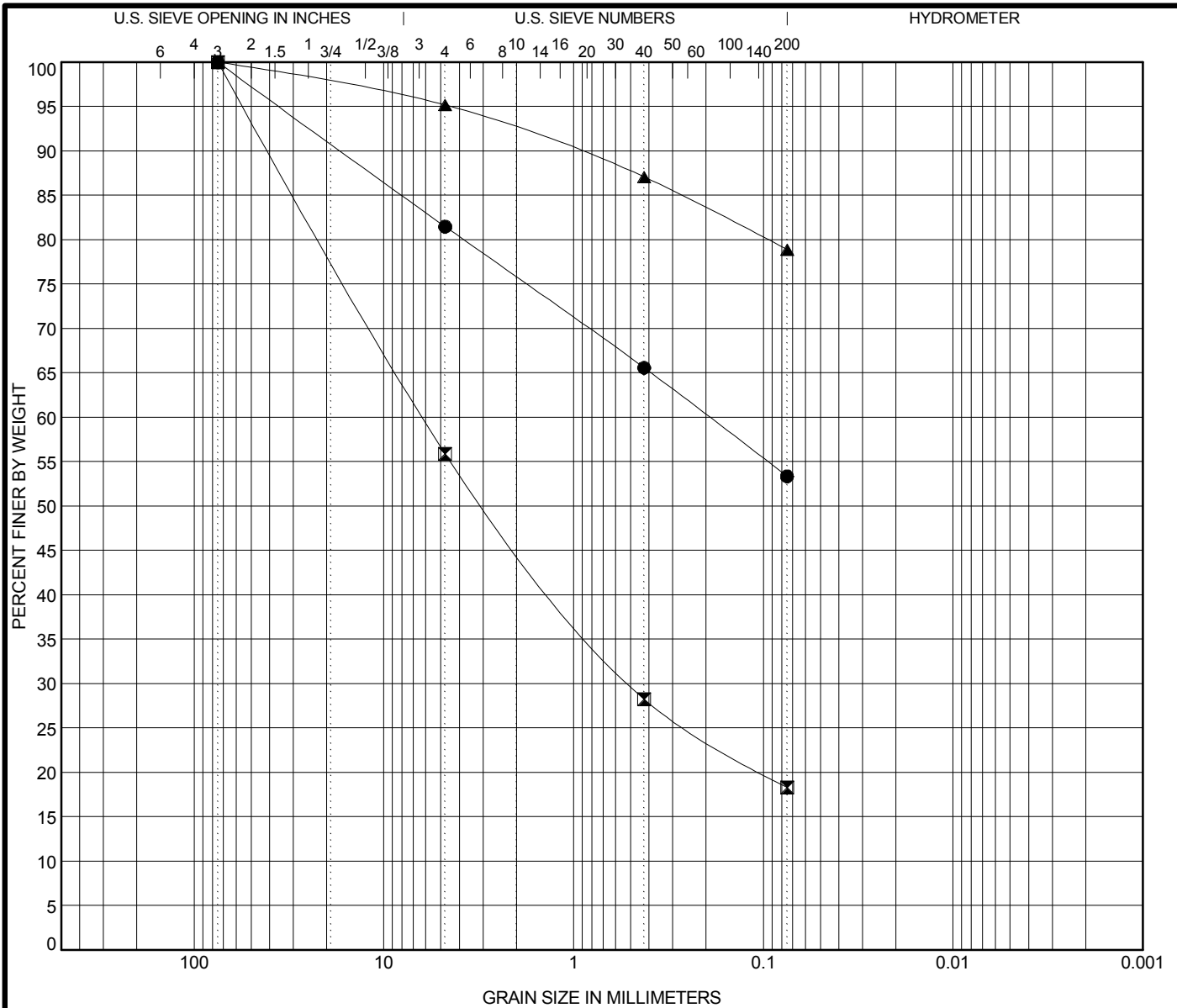
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Project:	North Burleson Street
Location:	See Boring Location Plan
Job No.:	2013-756

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US LAB.GDT.LIBRARY PAR.GLB)




COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

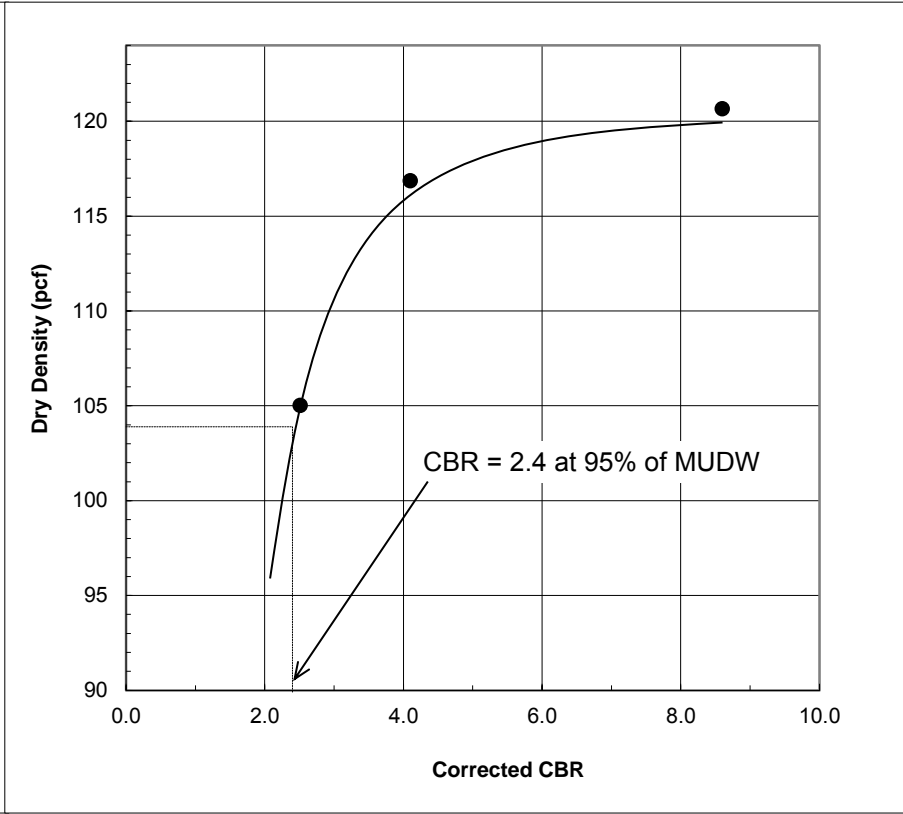
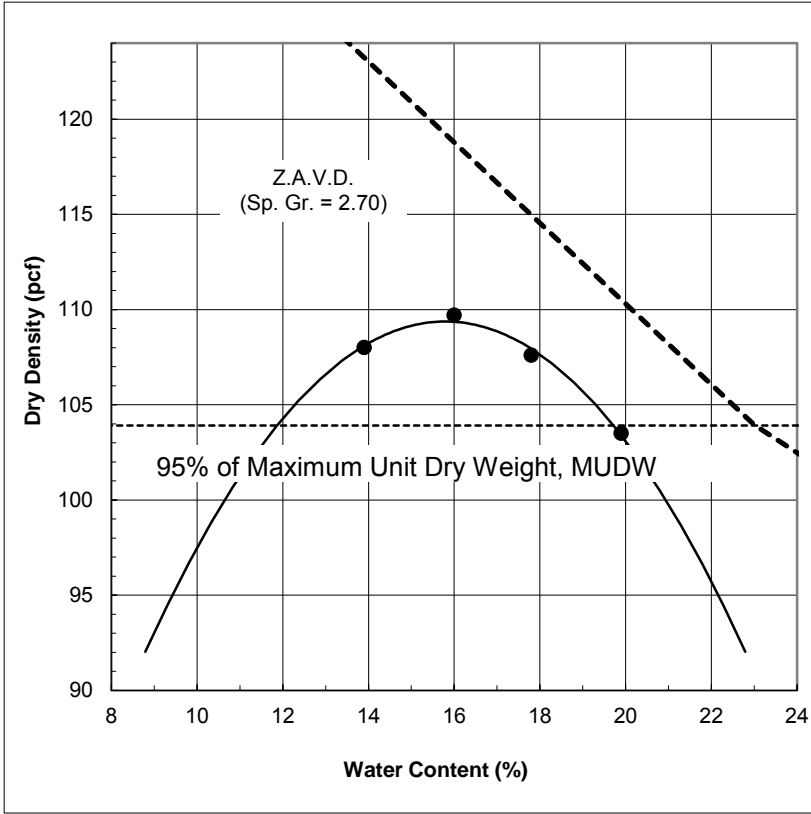
Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	9	0.0	<b>SANDY LEAN CLAY with GRAVEL (CL)</b>	<b>40</b>	<b>21</b>	<b>19</b>		
☒	9	2.5						
▲	10	4.0	<b>FAT CLAY with SAND (CH)</b>	<b>50</b>	<b>17</b>	<b>33</b>		

Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	9	75	0.193			18.5	28.1	53.3	
☒	9	75	6.14	0.496		44.1	37.6	18.3	
▲	10	75				4.8	16.3	78.9	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

 <p>Arias &amp; Associates, Inc. 13581 Pond Springs Rd, S210 Austin, TX 78729 Phone: 512.428.5550 Fax: 512.428.5525</p>	<b>GRAIN SIZE DISTRIBUTION</b>	
	Project: North Burleson Street	
	Location: See Boring Location Plan	
Job No.: 2013-756		

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US LAB.GDT.LIBRARY RAR.GLB)



**Sample:** 1  
**Test Method:** ASTM D698, Method C  
**Material:** Dark Brown Clayey Sand with Gravel (SC)

**Optimum Water Content:** 15.8 %  
**Maximum Unit Dry Weight:** 109.4 pcf  
**Liquid Limit:** 33  
**Plasticity Index:** 16  
**% Passing #200 Sieve:** 33

**% SWELL**  
**72 blows:** 1.4  
**56 blows:** 1.7  
**25 blows:** 1.7

**MOISTURE-DENSITY AND CBR TEST RESULTS**  
**N. BURLERSON ROAD IMPROVEMENTS**  
**KYLE, TEXAS**



## LABORATORY TESTING PROCEDURES

Arias performed soil mechanics laboratory tests on selected samples to aid in soil classification and to determine engineering properties. Tests commonly used in geotechnical exploration, the method used to perform the test, and the column designation on the boring log where data are reported are summarized as follows:

Test Name	Test Method	Log Designation
Water (moisture) content of soil and rock by mass	ASTM D 2216	WC
Liquid limit, plastic limit, and plasticity index of soils	ASTM D 4318	PL, LL, PI
Amount of material in soils finer than the No. 200 sieve	ASTM D 1140	-200

The laboratory results are reported on the soil boring logs.

One Proctor compaction test (ASTM D698) was performed on a bulk sample obtained from boring B-6 for the purpose of running a CBR. The test is performed by placing loose soil into a standardized compaction mold in lifts and using a hammer of specified size and energy to compact the soil. The sample is weighed and dried, and the dry density is then calculated. This process is repeated for a range of soil moisture contents to develop a density versus moisture content relationship. From this relationship, the theoretical maximum dry density can be determined which occurs at a specific moisture content referred to as the optimum moisture content.

Once the moisture density relationship is determined, a sample is remolded to a density near 95% of the maximum theoretical dry density, and near optimum moisture. The CBR test (ASTM D1883) is conducted by driving a 3-square inch piston into the remolded sample at a specified rate, and recording the load required to drive the piston into the remolded sample. This “punching shear” test provides data that is a semi-empirical index of the strength and deflection characteristics of a soil correlated with pavement performance to establish design curves for pavement thickness.

## **APPENDIX D: ASFE INFORMATION**

# Important Information about Your Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*While you cannot eliminate all such risks, you can manage them. The following information is provided to help.*

## **Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

## **Read the Full Report**

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## **A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors**

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## **Subsurface Conditions Can Change**

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## **Most Geotechnical Findings Are Professional Opinions**

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## **A Report's Recommendations Are *Not* Final**

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual



subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

### **A Geotechnical Engineering Report Is Subject to Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

### **Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance**

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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