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Procurement Department

ADDENDUM # 1

To: File 1805-909-23-4796
RFP for: Victoria Plaza Rehabilitation and Modernization

Please make the following change:

Remove the Bidders Certification page and replace with the attached Revision.

The following questions were received:

Question 1: The following specifications are missing per the table of contents:
310000 Site Earthwork
315000 Excavation Support and Protection
321123 Aggregate Base Courses
321216 Asphalt Paving
321313 Concrete Paving
331000 Water Utilities
Answer 1: Insert the attached specifications into the specifications section of the RFP.

Question 2: Would it be possible to schedule a second date to view the building with our subs?
Answer 2: The second date for viewing is Friday June 22, 2018 from 9:00 a.m to 12 Noon.

By: Charles R Bode
Charles Bode Asst. Director of Procurement

Date: June 20, 2018

Respondent's Certification

By signing below, Respondent certifies that the following statements are true and correct:

1. He/she has full authority to bind Respondents and that no member of Respondent's organization is disbarred, suspended or otherwise prohibited from contracting with any federal, state or local agency,

2. Items for which Proposals were provided herein will be delivered as specified in the Proposal,

3. In performing this contract, the contractor(s) shall comply with any and all applicable federal, state or local laws including but not limited to: Occupational Safety & Health, Equal Employment Opportunity, Immigration and Naturalization, The Americans with Disabilities Act, State Tax and Insurance Law, and the Fair Housing Act.,

4. Respondents agrees that this proposal shall remain open and valid for at least a period of 90 days from the date of the Proposal Opening and that this Proposal shall constitute an offer, which, if accepted by SAHA and subject to the terms and conditions of such acceptance, shall result in a contract between SAHA and the undersigned Respondents,

5. He/she has not given, offered to give, nor intends to give at any time hereafter any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to a public servant in connection with this Proposal,

6. Respondents, nor the firm, corporation, partnership, or institution represented by the Respondents, or anyone acting for such firm, corporation or institution has violated the antitrust laws of the State of Texas or the Federal Antitrust laws, nor communicated directly or indirectly the Proposal made to any competitor or any other person engaged in such line of business,

7. Respondents has not received compensation for participation in the preparation of the specifications for this RFP,

8. Non-Collusive Affidavit: The undersigned party submitting this Proposal hereby certifies that such Proposal is genuine and not collusive and that said Respondents has not colluded, conspired, connived or agreed, directly or indirectly, with any Respondents or person, to put in a sham Proposal or to refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the Proposal price of affiant or of any other Respondents, to fix overhead, profit or cost element of said Proposal price, or that of any other Respondents or to secure any advantage against SAHA or any person interested in the proposed contract; and that all statements in said Proposal are true.

9. Child Support**:** Pursuant to Section 231.006 (d) of the Texas Family Code, regarding child support, the bidder certifies that the individual or business entity named in this bid is not ineligible to receive the specified payment and acknowledges that this contract may be terminated and payment may be withheld if this certification is inaccurate.

10. Lobbying Prohibition**:** The Contractor agrees to comply with Section 1352 of Title 31, United States Code which prohibits the use of Federal appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

11. Non-Boycott of Israel: SAHA may not enter into a contract with a company for goods and services unless the contract contains a written verification from the company that; (i) it does not Boycott Israel; and (ii) will not Boycott Israel during the term of the contract. (Texas Government Code chapter 2270) by accepting these General Conditions and any associated contract, the CONTRACTOR certifies that it does not Boycott Israel, and agrees that during the term of this contract will not Boycott Israel as that term is defined in the Texas Government Code Section 808.001, as amended.

12. Tx. Gov. Code 2252.152: Prohibits a government entity from awarding a contract to a company identified as Iran, Sudan, or a Foreign Terrorist Organization as identified on a list maintained by the Texas Comptroller of Public Accounts. By signature hereon bidder certifies that it is not affiliated in any manner with the businesses on this list**.**

Addendum #1_____ Date_____

Addendum #2_____ Date_____

Addendum #_____ Date_____

Signature	**Date**
Printed Name	**Company**
E-mail address if available	
Phone	**Fax**

SECTION 015723 – TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 DEFINITIONS

A. A/E, Architect, Engineer of Record – The licensed design professional applying stamp and signature to the drawings regardless of their contractual relationship to the Owner.

B. BMP – Best Management Practices

C. Contractor – Firm responsible for providing prime construction services for the project under contract with the Owner. Refers to the General Contractor, Prime Contractor, Construction Manager at Risk or Design Build firm under various contract types.

D. CSN –Construction Site Notice

E. NOI &NOT – Notice of Intent and Notice of Termination for TPDES permits.

F. SWPPP – Storm Water Pollution Prevention Plan

G. TCEQ – Texas Commission on Environmental Quality

H. TPDES – Texas Pollutant Discharge Elimination System

I. Large Construction Activities – Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than five (5) acres

J. Small Construction Activities - Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than one (1) acre and less than five (5) acres of land.

1.2 RELATED DOCUMENTS AND APPLICABLE WORK

A. The TCEQ TPDES General Permit No. TXR150000, February 19, 2013 and the project SWPPP. This specification requires compliance with all provisions of the TCEQ with regards to the TPDES permit. The TCEQ requirements currently pertain to large construction activities of five (5) acres or more and small construction activities which disturb one (1) to less than five (5) acres

B. Information to Respondents, Agreement, Uniform General Conditions, Supplementary General Conditions and Special Conditions shall be carefully read for provisions pertaining to this work. In the event of conflict, the better quality or greater quantity shall prevail.

C. The work described in this section is applicable to any and all sections of the Contract Documents. Any and all work that would disturb the existing site conditions or present the potential for site run-off shall adhere fully to this specification section.

D. Unless specifically notified to the contrary by the Owner, in writing, all aspects of this specification shall apply to this project.

1.3 CONTRACTOR RESPONSIBILITIES

A. This project requires implementation of storm water “Best Management Practices” (BMP) for control devices and monitoring by the Contractor to comply with all provisions of the Storm Water Pollution Prevention Plan (SWPPP) developed for the project by the licensed civil engineer. The Contractor must fulfill all Texas Pollutant Discharge Elimination System (TPDES) regulatory requirements, including the filing of a NOI and NOT or signing and posting of the Construction Site Notice (CSN).

B. The Contractor shall provide signatures of a corporate Officer for the NOI, CSN and NOT and any other forms or applications as required by the TPDES General Permit TXR150000. The Contractor shall also provide delegated authorization to sign reports per 30 TAC 305.128. Individuals conducting site inspections shall be qualified to the satisfaction of the Owner. Documented qualifications shall be included in the SWPPP booklet.

C. When the Contractor receives the approved SWPPP from the Owner, the Contractor signs the NOI or CSN (see Sample form in Part 4 of this section) and forwards it to the Owner. A $100 application fee must accompany the NOI. The Owner signs his NOI and sends both NOI’s and application fees to TCEQ. The Contractor shall insert a copy of the signed NOI or CSN into the SWPPP booklet to be kept at the jobsite.

D. The SWPPP booklet kept at the jobsite shall also contain the following:

1. A letter delegating signature authority to the field personnel for both the Contractor and the Owner.

2. A copy of TPDES permit when received.

3. Posting Notice for large construction activities

E. The Contractor shall review SWPPP and verify existing conditions at the site before determining scope of implementation of site controls. Site survey and site plan drawings shall be used for additional reference. The Contractor shall notify the Owner, in advance, of this site review to allow for Owner participation.

F. The Contractor shall construct a Project SWPPP sign and place it at the main entrance to the project site. This sign shall include the NOI and TPDES permit; or the Construction Site Notice for small construction projects. The sign shall be constructed as detailed in the sample SWPPP sign drawing included in Part 4 of this Section.

G. Contractor shall contact Owners Representative for review of initial site controls in place prior to commencing site-disturbing activities, to ensure that any unusual circumstances or unforeseen site conditions with regard to erosion and sedimentation have been addressed.

H. The Contractor shall provide all material, labor, equipment and services required to implement, maintain and monitor all erosion and sedimentation controls in compliance with the Storm Water Pollution Prevention Plan (SWPPP). All controls implemented by the Contractor shall comply with the Texas Pollutant Discharge Elimination System (TPDES) regulations as issued by the Texas Commission on Environmental Quality

(TCEQ) on February 19, 2013. These controls shall remain in operation until project completion and reestablishment of the site or longer as directed by the Owners Representative. The work shall include, but not be limited to the following:

I. All earthwork as required to implement swales, dikes, basins and other excavations for temporary routing of utilities, to protect against erosion or sediment-laden ("polluted") storm water runoff.

J. All structural controls as shown or specified, including silt fences, sediment traps, stabilized construction entrance, subsurface drains, pipe slope drains, inlet/outlet protection, reinforced soil retention, gabions, rock berms, etc.

K. All non-structural controls as shown or specified, including temporary or permanent vegetation, mulching, geotextiles, sod stabilization, preservation of vegetative buffer strips, preservation/protection of existing trees and other mature vegetation.

L. All modifications and revisions to SWPPP necessary to meet changing site conditions, and to address new sources of storm water discharges, as the work progresses.

M. All maintenance and repair of structural and non-structural controls in place shall continue until final stabilization is achieved or as directed by the Owners Representative

N. Weekly site inspections, as required by the SWPPP, of pollutant sources, including hazardous sources, structural and non-structural controls, and all monitoring of SWPPP revisions and maintenance of inspection records.

O. Removal of all structural and non-structural controls as necessary upon completion, and only after final stabilization is achieved.

P. Filing of Notice of Termination (NOT) with the Owners Representative within 30 days of final stabilization being achieved, or of another Operator assuming control of the unstabilized portions of the site.

Q. Refer to the SWPPP for additional requirements to ensure compliance with TPDES regulations.

1.4 QUALITY ASSURANCE

A. In order to minimize the discharge of pollutants to storm water, the Contractor shall implement all permanent and temporary site controls according to Texas Pollutant Discharge Elimination System (TPDES) Guidelines, as set forth by the Texas Commission on Environmental Quality.

B. Implementation of site controls shall be performed by a qualified contractor experienced in the proper installation of such devices in accordance with manufacturers' specifications, and in keeping with recognized Best Management Practices (BMP's), and in keeping with TPDES regulations. Qualification of installing Contractor shall be reviewed with the Owner prior to entering into a contract with them for services.

C. The Contractor shall inspect all BMP's at regular intervals as specified in the Storm Water Pollution Prevention Plan for this project. Record all deficiencies of site controls,

and take immediate action to correct any deficiencies recorded. Keep records of inspections current and on file, available for review by EPA, TCEQ, MS4 operator and Owner.

1.5 SUBMITTALS

A. Submittals of products used in structural and non-structural controls shall be made through established procedures for review and approved by the Engineer of Record prior to installation on the site. The Contractor shall make available physical samples and product literature on any material used in structural or non-structural controls during the course of the project prior to its implementation in the field.

PART 2 - PRODUCTS

2.1 TEMPORARY EROSION CONTROL

A. In all cases, the development of plans and specifications will give first consideration to erosion controls, as it is much easier to maintain soil cover than to trap sediment. The goal of the planned erosion control will be to divert runoff away from unstable areas or to provide a stable surface that will resist the effects of rain and runoff. All projects should utilize one or more of the following practices unless engineer ascertains that there is no chance of runoff entering the project from areas adjoining the site. The preferred erosion controls to be used on the project include:

B. Interceptor swale - use as perimeter control, less than 5 acres only.

C. Diversion dike – use to route runoff away from project site, less than 10 acres only.

D. Pipe slope drain – transport runoff down steep, erodible slopes, less than 5 acres only.

E. Outlet stabilization – prevent erosion at outlet of channel or conduit.

F. Level spreader – outlet device for dikes and diversions.

G. Subsurface drain – use to prevent soils from becoming saturated and prevent seeps.

H. Tree protection – for erosion control and aesthetics.

I. Temporary vegetation – RECOMMENDED - use for temporary stabilization of disturbed areas; for slopes steeper than 3:1 use in conjunction with matting.

J. Blankets/matting – use in channels and on steep slopes.

K. Mulch – use to stabilize newly seeded areas.

L. Sod – use for immediate stabilization of channels, around inlets.

M. Dust Control – use in areas subject to air movement of dust.

2.2 TEMPORARY SEDIMENT CONTROL

A. Activities at most sites will result in soil disturbance. Erosion will occur in the disturbed areas and best management practices must be planned to contain and sediment transported by runoff. The preferred erosion controls to be used on the project include:

B. Construction exit – use at all designated access points

C. Silt fence (interior) – useful in areas of minor sheet flow, use 100 ft. or more of fence for each ¼ acre

D. Silt fence (exterior) – use along down slope borders of site, use 100 ft. or more of fence for each ¼ acre

E. Triangular filter dikes – use for areas within site requiring frequent access (movable)

F. Hay bale dike – use in areas of minor sheet flow, use 100 ft. or more for each ¼ acre – Note: replace every 3 months

G. Rock berm – use for drainage swales and ditches within and below site, less than 5 acres

H. High service rock berm – use around sensitive features and in high flow areas within and below site, less than 5 acres

I. Brush berm – use in small areas of sheet flow, less than 2 acres

J. Sand bag berm – use for construction in streambeds, contributing drainage area 5 – 10 acres

K. Buffer (vegetative) strips – use on floodplains, next to wetlands, along stream banks, and on steep slopes

L. Inlet protection – prevent sediment from entering storm inlet, less than 1 acre

M. Sediment trap – use where flows are concentrated in a swale of channel, 1 - 5 acres

N. Sediment basin – use for larger disturbed areas, 5 – 100 acres

PART 3 - EXECUTION

3.1 EROSION CONTROLS

A. INTERCEPTOR SWALE

1. Interceptor swales are used to shorten the length of exposed slope by intercepting runoff and can also serve as perimeter swales preventing off-site runoff from entering the disturbed area or prevent sediment-laden runoff from leaving the construction site or disturbed area. They may have a v-shape or be trapezoidal with a flat bottom and side slopes of 3:1 or flatter. The outflow from a swale should be directed to a stabilized outlet or sediment-trapping device. The swales should remain in place until the disturbed area is permanently stabilized. A schematic of an interceptor swale is shown below.

2. Materials

    a. Stone stabilization should be used when grades exceed 2% or velocities exceed 6 feet per second and should consist of a layer of crushed stone three inches thick, riprap or high velocity erosion control mats.

    b. Stabilization should extend across the bottom of the swale and up both sides of the channel to minimum height of three inches above the design water surface elevation based on a 2-year, 24-hour storm.

3. Installation

    a. An interceptor swale should be installed across exposed slopes during construction and should intercept no more than 5 acres of runoff.

    b. All earth removed and not needed in construction should be disposed of in an approved spoils site so that it will not interfere with the functioning of the swale or contribute to siltation in other areas of the site.

    c. Trees, brush, stumps, obstructions and other material should be removed and disposed of to avoid interference with proper functioning of the swale.

    d. Should have a maximum depth of 1.5 feet with side slopes of 3:1 or flatter. Swale should have positive drainage for its entire length to an outlet.

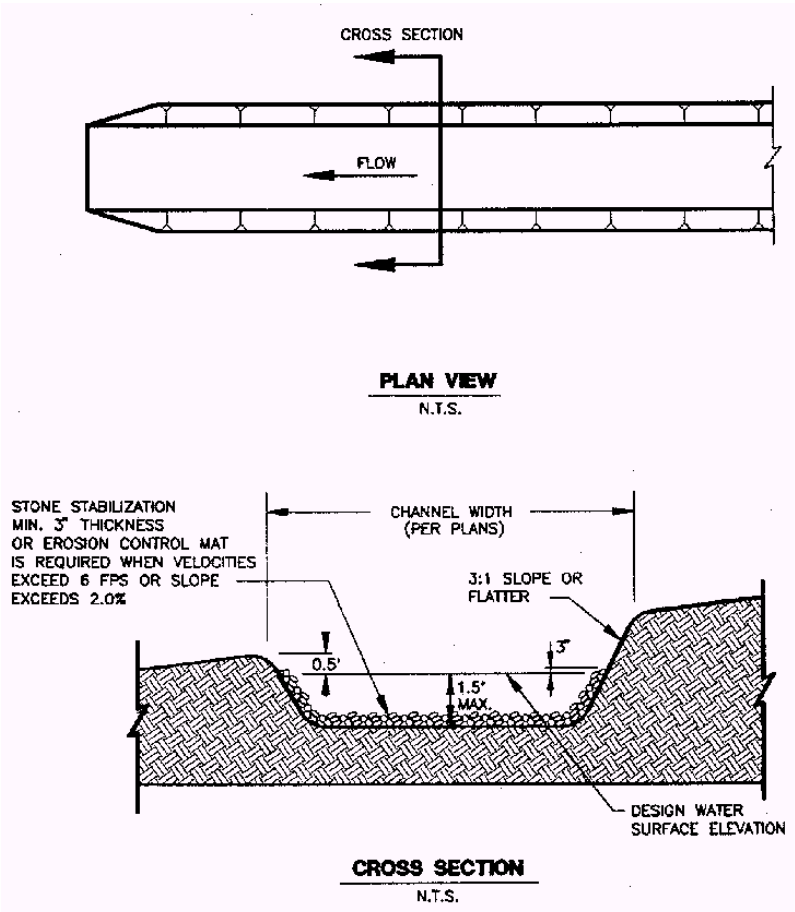
    e. When the slope exceeds 2 percent, or velocities exceed 6 feet per second (regardless of slope), stabilization is required. Stabilization should be crushed stone placed in a layer of at least 3 inches thick or may be high velocity erosion control matting. Check dams are also recommended to reduce velocities in the swales possibly reducing the amount of stabilization necessary.

    f. Minimum compaction for the swale should be 90% standard proctor density.

4. Inspection and Maintenance Guidelines

    a. Swales should be inspected weekly and after each rain event to locate and repair any damage to the channel or clear debris or other obstructions so as not to diminish flow capacity.

    b. Damage from storms or normal construction activities such as tire ruts or disturbance of swale stabilization should be repaired as soon as practical.



Schematic Diagram of an Interceptor Swale

B. DIVERSION DIKES

1. A temporary diversion dike is a barrier created by the placement of an earthen embankment to reroute the flow of runoff to an erosion control device or away from an open, easily erodible area. A diversion dike intercepts runoff from small upland areas and diverts it away from exposed slopes to a stabilized outlet, such as a rock berm, sandbag berm, or stone outlet structure. These controls can be used on the perimeter of the site to prevent runoff from entering the construction area. Dikes are generally used for the duration of construction to intercept and reroute runoff from disturbed areas to prevent excessive erosion until permanent drainage features are installed and/or slopes are stabilized. A schematic of a diversion dike is shown below.

2. Materials:

   a. Stone stabilization (required for velocities in excess of 6 fps) should consist of riprap placed in a layer at least 3 inches thick and should extend a minimum height of 3 inches above the design water surface up the existing slope and the upstream face of the dike.

b. Geotextile fabric should be a non-woven polypropylene fabric designed specifically for use as a soil filtration media with an approximate weight of 6 oz./yd2, a Mullen burst rating of 140 psi, and having an equivalent opening size (EOS) greater than a #50 sieve.

3. Installation

a. Diversion dikes should be installed prior to and maintained for the duration of construction and should intercept no more than 10 acres of runoff.

b. Dikes should have a minimum top width of 2 feet and a minimum height of compacted fill of 18 inches measured from the top of the existing ground at the upslope toe to top of the dike and having side slopes of 3:1 or flatter.

c. The soil for the dike should be placed in lifts of 8 inches or less and be compacted to 95 % standard proctor density.

d. The channel, which is formed by the dike, must have positive drainage for its entire length to an outlet.

e. When the slope exceeds 2 percent, or velocities exceed 6 feet per second (regardless of slope), stabilization is required. Situations in which velocities do not exceed 6 feet per second, vegetation may be used to control erosion.

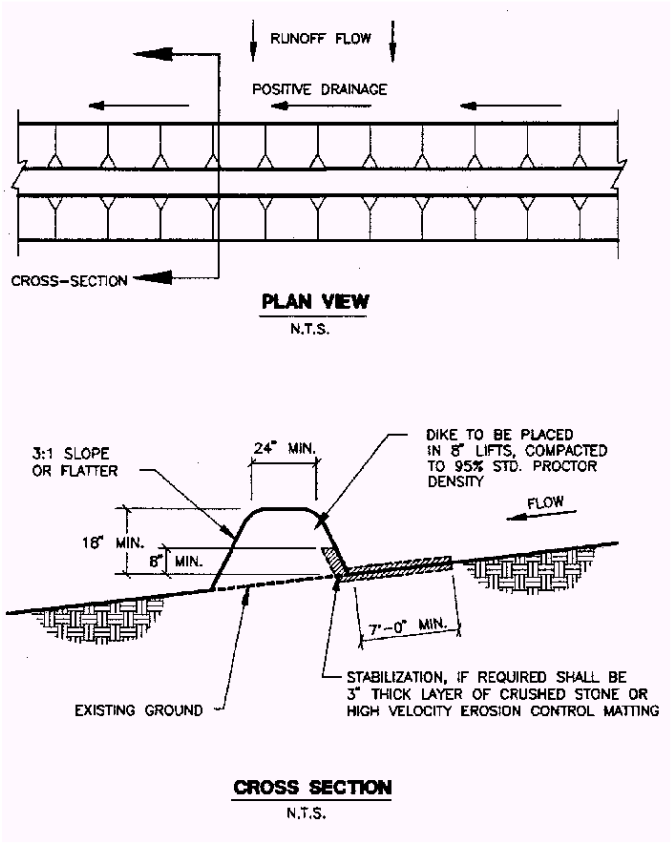
4. Inspection and Maintenance Guidelines

a. Swales should be inspected weekly and after each rain event to determine if silt is building up behind the dike or if erosion is occurring on the face of the dike. Locate and repair any damage to the channel or clear debris or other obstructions so as not to diminish flow capacity.

b. Silt should be removed in a timely manner.

c. If erosion is occurring on the face of the dike, the slopes of the face should either be stabilized through mulch or seeding or the slopes of the face should be reduced.

d. Damage from storms or normal construction activities such as tire ruts or disturbance of swale stabilization should be repaired as soon as practical.



Schematic of a Diversion Dike (NCTCOG, 1993b)

3.2 SEDEMENTATION CONTROLS

A. TEMPORARY CONSTRUCTION ENTRANCE/EXIT

1. The purpose of a temporary construction entrance is to provide a stable entrance/exit condition from the construction site and keep mud and sediment off public roads. A stabilized construction entrance is a stabilized pad of crushed stone located at any point traffic will be entering or leaving the construction site from a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or flowing of sediment onto public rights-of-way. This practice should be used at all points of construction ingress and egress. Excessive amounts of mud can also present a safety hazard to roadway users. To minimize the amount of sediment loss to nearby roads, access to the construction site should be limited to as few points as possible and vegetation around the perimeter should be protected were access is not necessary. A rock stabilized construction entrance should be used at all designated access points.

2. Materials:

    a. The aggregate should consist of 4 to 8 inch washed stone over a stable foundation as specified in the plan.

b. The aggregate should be placed with a minimum thickness of 8 inches.

c. The geotextile fabric should be designed specifically for use as a soil filtration media with an approximate weight of 6 oz./yd2, a mullen burst rating of 140 lb/in2, and an equivalent opening size greater than a number 50 sieve.

d. If a washing facility is required, a level area with a minimum of 4 inch washed stone or commercial rack should be included in the plans. Divert wastewater to a sediment trap or basin.

3. Installation

a. Avoid curves on public roads and steep slopes. Remove vegetation and other objectionable material from the foundation area. Grade crown foundation for positive drainage.

b. The minimum width of the entrance/exit should be 12 feet or the full width of exit roadway, whichever is greater.

c. The construction entrance should be at least 50 feet long.

d. If the slope toward the road exceeds 2%, construct a ridge, 6 to 8 inches high with 3:1 (H:V) side slopes, across the foundation approximately 15 feet from the entrance to divert runoff away from the public road.

e. Place geotextile fabric and grade foundation to improve stability, especially where wet conditions are anticipated.

f. Place stone to dimensions and grade shown on plans. Leave surface smooth and slope for drainage.

g. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin.

h. Install pipe under pad as needed to maintain proper public road drainage.

4. Common Trouble Points

a. Inadequate runoff control – sediment washes onto public road.

b. Stone to small or geotextile fabric absent, results in muddy condition as stone is pressed into soil.

c. Pad too short for heavy construction traffic – extend pad beyond the minimum 50 foot length as necessary.

d. Pad not flared sufficiently at road surface, results in mud being tracked on to road and possible damage to road edge.

e. Unstable foundation – use geotextile fabric under pad and/or improve foundation drainage.

5. Inspection and Maintenance Guidelines

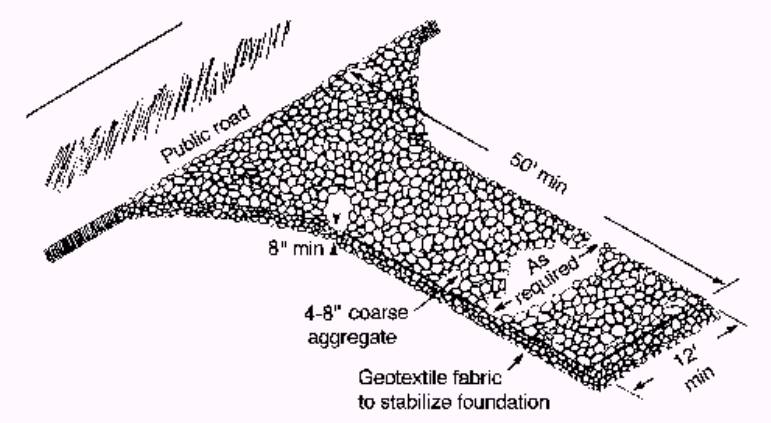
   a. The entrance should be maintained in a condition, which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment.

   b. All sediment spilled, dropped, washed or tracked on to public rights-of-way should be removed immediately by contractor.

   c. When necessary, wheels should be cleaned to remove sediment prior to entrance onto public right-of-way.

   d. When washing is required, it should be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin.

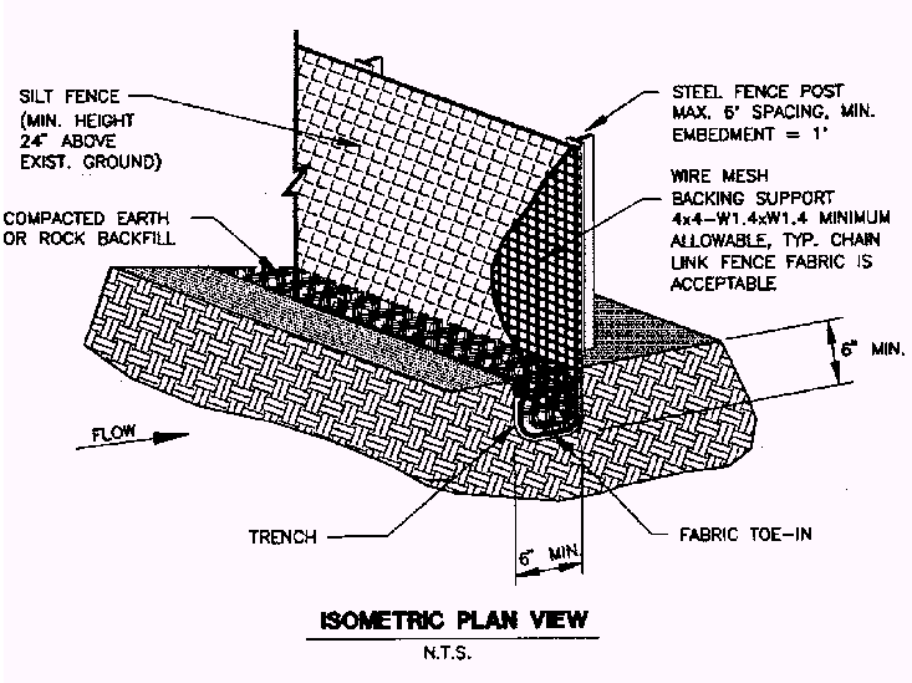
   e. All sediment should be prevented from entering any storm drain, ditch or water course by using approved methods.



Schematic of Temporary Construction Entrance (after NC, 1993)

B. SILT FENCE

1. A silt fence is a barrier consisting of geotextile fabric supported by metal posts to prevent soil and sediment loss from a site. When properly used, silt fences can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond, allowing heavier solids to settle out. If not properly installed, silt fences are not likely to be effective. A schematic illustration of a silt fence is shown below.



2. The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas of a limited extent. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence should remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way. If concentrated flow occurs after installation, corrective action must be taken such as placing a rock berm in the areas of concentrated flow. Silt fencing within the site may be temporarily moved during the day to allow construction activity provided it is replaced and properly anchored to the ground at the end of the day. Silt fences on the perimeter of the site or around drainage ways should not be moved at any time.

3. Materials

   a. Filter Fabric

      1) General: The filter fabric shall be of non-woven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36 inches wide.

      2) Physical Requirements: The fabric shall meet the following requirements when sampled and tested in accordance with the methods indicated:

Physical Properties	Method	Requirements
Fabric Weight (oz/sy)	ASTM D-3776	4.5 minimum
Water Flow Rate (gal/sq ft/min)	ASTM D-4491	40 maximum
Equivalent Opening Size	ASTM D4751	20 - 100
Grab Tensile (lbs)	ASTM D4632	100 minimum
Millen Burst Strength (psi)	ASTM D3786	300 minimum
Ultraviolet Resistance	ASTM D1682	70 minimum
Trapezoid Tear (lbs)	ASTM D4533	55 minimum
Elongation (%)	ASTM D4632	30 maximum

b. Fence Posts

1) Posts shall be painted or galvanized steel Tee of Y Posts with anchor plates, not less than 5 feet in length with a minimum weight of 1.3 pounds per foot with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A702.

c. Woven Wire shall be welded wire fabric 2x4-W1.0 x W 1.0.

4. Installation

a. Steel posts, which support the silt fence, should be installed on a slight angle toward the anticipated runoff source. Post must be embedded a minimum of 1 foot deep and spaced not more than 8 feet on center. Where water concentrates, the maximum spacing should be 6 feet.

b. Lay out fencing down-slope of disturbed area, following the contour as closely as possible. The fence should be sited so that the maximum drainage area is ¼ acre/100 feet of fence.

c. The toe of the silt fence should be trenched in with a spade or mechanical trencher, so that the down-slope face of the trench is flat and perpendicular to the line of flow. Where fence cannot be trenched in (e.g., pavement or rock outcrop), weight fabric flap with 3 inches of pea gravel on uphill side to prevent flow from seeping under fence.

d. The trench must be a minimum of 6 inches deep and 6 inches wide to allow for the silt fence fabric to be laid in the ground and backfilled with compacted material.

e. Silt fence should be securely fastened to each steel support post or to woven wire, which is in turn attached to the steel fence post. There should be a 3-foot overlap, securely fastened where ends of fabric meet.

f. Silt fence should be removed when the site is completely stabilized so as not to block or impede storm flow or drainage.

5. Common Trouble Points

a. Fence not installed along the contour causing water to concentrate and flow over the fence.

b. Fabric not seated securely to ground (runoff passing under fence)

c. Fence not installed perpendicular to flow line (runoff escaping around sides)

d. Fence treating too large an area, or excessive channel flow (runoff overtops or collapses fence)

6. Inspection and Maintenance Guidelines

a. Inspect all fencing weekly, and after any rainfall.

b. Remove sediment when buildup reaches 6 inches, or install a second line of fencing parallel to the old fence.

c. Replace any torn fabric or install a second line of fencing parallel to the torn section.

d. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points

C. TRIANGULAR SEDIMENT FILTER DIKES

1. The purpose of a triangular sediment filter dike is to intercept and detain water-borne sediment from unprotected areas of limited extent. The triangular sediment filter dike is used where there is no concentration of water in a channel or other drainage way above the barrier and the contributing drainage area is less than one acre. If the uphill slope above the dike exceeds 10%, the length of the slope above the dike should be less than 50 feet. If concentrated flow occurs after installation, corrective action should be taken such as placing rock berm in the areas of concentrated flow. This measure is effective on paved areas where installation of silt fence is not possible or where vehicle access must be maintained. The advantage of these controls is the ease with which they can be moved to allow vehicle traffic, then reinstalled to maintain sediment control.

2. Materials

a. Silt fence material should be polypropylene, polyethylene or polyamide woven or non-woven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz./yd., mullen burst strength exceeding 190 lb/in 2, ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.

b. The dike structure should be 6-gauge 6” x 6” wire mesh folded into triangular form being eighteen (18) inches on each side.

3. Installation

   a. As shown in the schematic below, the frame should be constructed of 6” x 6”, 6 gauge welded wire mesh, 18 inches per side, and wrapped with geotextile fabric the same composition as that used for silt fences.

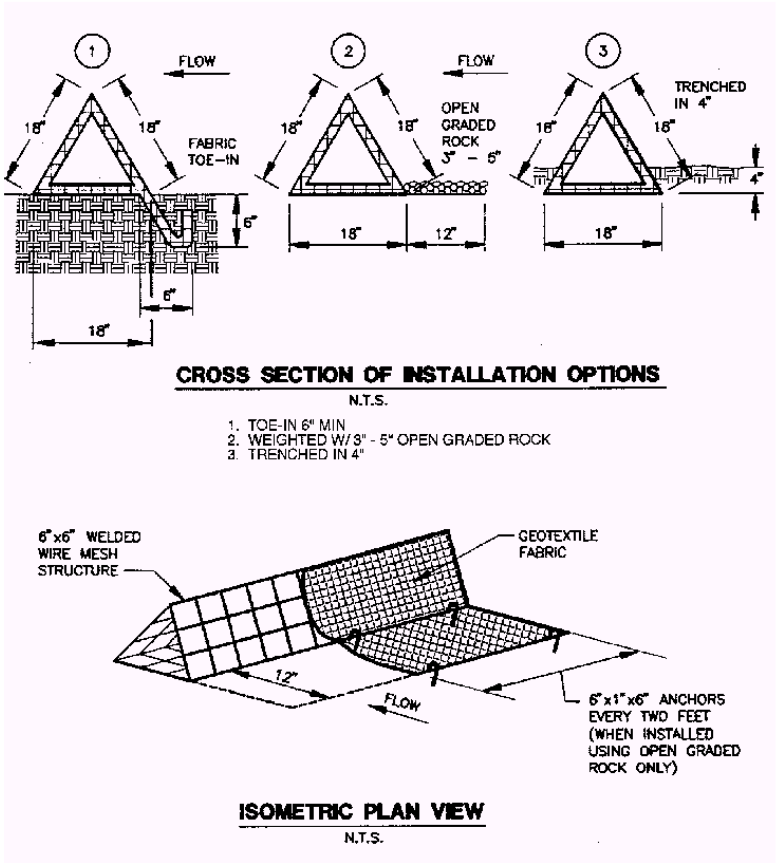
   b. Filter material should lap over ends six (6) inches to cover dike to dike junction; each junction should be secured by shoat rings.

   c. Position dike parallel to the contours, with the end of each section closely abutting the adjacent sections.

   d. There are several options for fastening the filter dike to the ground as shown in schematic below. The fabric skirt may be toed-in with 6 inches of compacted material, or 12 inches of the fabric skirt should extend uphill and be secured with a minimum of 3 inches of open graded rock, or with staples or nails. If these two options are not feasible the dike structure may be trenched in 4 inches.

   e. Triangular sediment filter dikes should be installed across exposed slopes during construction with ends of the dike tied into existing grades to prevent failure and should intercept no more than one acre of runoff.

   f. When moved to allow vehicular access, the dikes should be reinstalled as soon as possible, but always at the end of the workday.



Schematic of Triangular Sediment Filter Dike

D. HIGH SERVICE BERM

1. Materials

a. Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz./yd., mullen burst strength exceeding 190 lb/in 2, ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.

b. Fence posts should be made of hot rolled steel, at least 4 feet long with Tee or Y-bar cross section, surface painted or galvanized, minimum nominal weight 1.25 lb/ft2, and Brindell hardness exceeding 140. Rebar (either #5 or #6) may also be used to anchor the berm.

c. Woven wire backing to support the fabric should be galvanized 2” x 4” welded wire, 12 gauge minimum.

d. The berm structure should be secured with a woven wire sheathing having maximum opening of 1 inch and a minimum wire diameter of 20 gauge galvanized and should be secured with shoat rings.

e. Clean, open graded 3-to 5-inch diameter rock should be used, except in areas where high velocities or large volumes of flow are expected, where 5-to 8-inch diameter rocks may be used.

2. Installation

a. Lay out the woven wire sheathing perpendicular to the flow line. The sheathing should be 20 gauge woven wire mesh with 1-inch openings.

b. Install the silt fence along the center of the proposed berm placement, as with a normal silt fence described in Section 2.4.3.

c. Place the rock along the sheathing on both sides of the silt fence as shown in the diagram (Figure1.30), to a height not less than 24 inches. Clean, open graded 3-5" diameter rock should be used, except in areas where high velocities or large volumes of flow are expected, where 5-to 8-inch diameter rock may be used.

d. Wrap the wire sheathing around the rock and secure the tie wire so that the ends of the sheathing overlap at least 2 inches, and the berm retains its shape when walked upon.

e. The high service rock berm should be removed when the site is revegetated or otherwise stabilized or it may remain in place as a permanent BMP if drainage is adequate.

3. Common Trouble Points

a. Insufficient berm height or length (runoff quickly escapes over top or around sides of berm).

b. Berm not installed perpendicular to flow line (runoff escaping around one side).

c. Internal silt fence not anchored securely to ground (high flows displacing berm).

d. When installed in streambeds, they often result in diversion scour, so their use in this setting is not recommended.

4. Inspection and Maintenance Guidelines

a. Inspection should be made weekly and after each rainfall by the responsible party. For installations in streambeds, additional daily inspections should be made on rock berm.

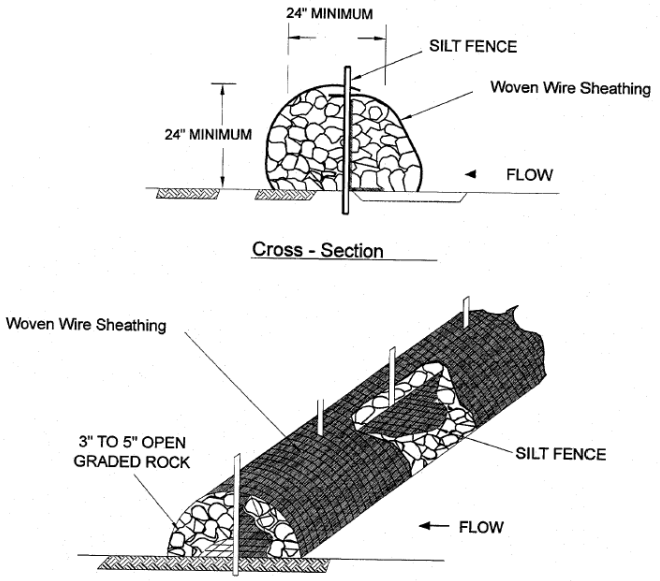
b. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt of in an approved manner.

c. Repair any loose wire sheathing.

d. The berm should be reshaped as needed during inspection.

e. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.

f. The rock berm should be left in place until all upstream areas are stabilized and accumulated silt removed.



Schematic of High Service Rock Berm (LCRS, 1998)

END OF SECTION 015723

SECTION 310000 – SITE EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment and incidentals as shown, specified and necessary to complete the work of site preparation, erosion control, surface drainage, ground water control, construction of compacted fills, excavations, trenching, installation and removal of sheeting and bracing, backfilling and final site grading.

B. This Section includes providing backfill materials for all trenches including select backfill, backfill, fill, granular embedment, and the satisfactory disposal of surplus and unacceptable materials.

C. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.

D. The Contractor shall perform all earthwork as specified in this Section. All trenching shall conform to the requirements of Section 315000 – Excavation Support and Protection.

1.2 RELATED SECTIONS

A. Section 312313 – Subgrade Preparation

B. Section 315000 – Excavation Support and Protection

1.3 REFERENCE STANDARDS

A. The contractor shall comply with applicable provisions and recommendations of the following:

1. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103, U.S.A. All references are to current active standard.

a. ASTM A36 – Standard Specification for Carbon Structural Steel.

b. ASTM A328 – Standard Specification for Steel Sheet Piling.

c. ASTM C33 – Standard Specification for Concrete Aggregates.

d. ASTM D421 – Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

e. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

f. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

g. ASTM D1140 – Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-µm) Sieve.

h. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil In-Place by the Sand-Cone Method.

i. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

j. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

k. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

l. ASTM D4943 – Standard Test Method for Shrinkage Factors of Soils by the Wax Method.

m. ASTM D6938 – Standard Test Method for In Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

2. OSHA: Occupational Safety & Health Administration, 200 Constitution Ave., NW, Washington DC 20210

   a. 29 CFR Part 1926 – Safety and Health Regulations for Construction.

3. TxDOT: Texas Department of Transportation, 125 E 11th St, Austin, Texas 78701

   a. Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, adopted by TxDOT June 1, 2004.

      1) Item 160 – Topsoil

      2) Item 164 – Seeding for Erosion Control

   b. Tex-104-E – Determining Liquid Limits of Soils.

   c. Tex-106-E – Calculating the Plasticity Index of Soils.

   d. Tex-110-E – Particle Size Analysis of Soils.

   e. Tex-116-E – Ball Mill Method for Determining Disintegration of Flexible Base Material.

   f. Tex-117-E – Triaxial Compression for Disturbed Soils and Base Materials.

4. Geotechnical Report.

1.4 SUBMITTALS

A. Test Reports

1. The testing laboratory shall submit copies of the following reports directly to the Engineer, with copy to the Contractor:

a. Field Density Tests.

b. Optimum Moisture – maximum density curve for each soil used as backfill.

B. Samples of all select backfill, backfill, fill, granular embedment, pit run sand, and drain gravel, shall be submitted by the Contractor to the Testing Laboratory. Samples of the proposed material shall be submitted to least fourteen (14) days in advance of its anticipated use. Each material sample shall be submitted to the Testing Laboratory in three (3) five-gallon containers.

1.5 QUALITY ASSURANCE

A. Testing Services

1. General:

a. Testing of materials, testing of moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of the Specifications shall be performed by a testing laboratory. See Division 1 of Specifications.

2. Testing Services Include:

a. Test the Contractor's proposed materials in the laboratory and/or field for compliance the Specifications.

b. Perform field moisture content and density tests to assure that the specified compaction of backfill material has been obtained.

c. Report all test results to the Engineer and the Contractor.

B. Earthwork – perform sampling and testing as specified in this Section and Section 014500 – Quality Control.

1. Perform one moisture-density (Proctor) test per soil type subgrade, backfill, fill and base materials.

2. Perform one Atterberg limits test per soil type subgrade, backfill, fill and base materials.

3. Perform one percent finer than #200 sieve test per soil type subgrade, backfill, fill and base materials.

4. In building areas refer to structural plans, notes, and specifications for requirements.

5. In pavement areas provide:

a. One moisture-density test per 5,000 square feet of surface area on the subgrade soil.

b. One moisture-density test per 5,000 square feet of surface area for each compacted six inch (6") thickness of fill.

6. Failures in tested areas shall be re-tested until passed at the expense of the Contractor.

C. Trench Backfill: Establish level of compaction effort by frequent testing of initial lifts. Provide not less than one (1) test per lift per 500 linear feet of trench.

1. Make random tests of subsequent lifts of backfill. Frequency of tests shall be adequate to guarantee proper compaction. In no case shall there be less than one (1) test per lift per 500 linear feet of trench.

2. Failures in tested areas shall be re-tested until passed at the expense of the Contractor.

1.6 SITE CONDITIONS

A. Refer to Division 1 Specifications for information pertaining to availability of subsurface investigations.

B. Contractor is referred to the Special Conditions and to other applicable sections of these Specifications in regard to protection of existing improvements and property shown to remain, as well as the proper barricading of all work areas.

C. Erosion Protection: Provide erosion control as shown on the plans and maintain for the duration of the project. Provide routine maintenance as required to maintain integrity of erosion and sedimentation protection measures and remove any accumulations of mud or debris which would jeopardize the integrity of control measures. Refer to plans for details.

D. Dust Control: The Contractor shall exercise care during site clearing operations to confine dust to the immediate work area and shall employ dust control measures to the satisfaction of the Owner to ensure adequate dust control throughout site clearing operations.

E. Street Conditions:

1. The Contractor shall be required to remove mud or debris from existing adjacent streets scheduled to remain in service throughout his contract period.

2. The Contractor shall be responsible and protect the Owner from damage during haul operations. Any damage shall be repaired at the Contractor's expense.

F. The use of explosives will not be permitted.

G. Burning is prohibited.

H. All traffic during construction shall confine their limits to an established “traffic route” submitted by the Contractor and reviewed by the Engineer.

1.7 COORDINATION

A. The Contractor shall expedite placement of compacted fill and embankments at the earliest practical time.

1.8 LEGALLY PERMITTED LANDFILL CERTIFICATION

A. The Contractor shall dispose of all materials in a legally permitted landfill, permitted to accept construction waste, as determined by the Texas Department of Health, Municipal Solid Waste Management Regulation.

B. The Contractor shall be required to provide written evidence of the permitted landfill prior to commencement of site clearing operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Materials

1. Materials for use as backfill shall be acceptable materials obtained from excavations on site; if material is obtained from off-site sources, their gradation shall not be more than 15% passing the No. 200 standard sieve as measured by ASTM D1140, and whose Plasticity Index (PI) is not in excess of 20 percent (20%) as determined by ASTM D4318. The material shall contain no vegetative matter.

2. All material to be used as backfill shall be tested and verified by the Testing Laboratory.

B. Fill Material

1. Materials for use as fill shall be acceptable materials obtained from excavations on site; if material is obtained from off-site sources, their gradation shall not be more than 35% passing the No. 200 standard sieve as measured by ASTM D1140, and whose Plasticity Index (PI) is not in excess of 20 percent (20%) as determined by ASTM D4318. The material shall contain no vegetative matter.

2. All material to be used as backfill shall be tested and verified by the Testing Laboratory.

C. Select Backfill

1. Obtain select fill from a source that meets the requirements of the Geotechnical Report. In general, select fill shall consist of non-expansive (inert) soils such as a low plasticity clayey soil, clayey gravel, crushed base material or caliche. Caliche used as select fill shall have a Plasticity Index (PI) between seven percent (7%) and twelve percent (12%).

2. Select fill for building areas shall meet the requirements of the Structural drawings and Section 033000.

3. The select fill materials shall be free of organic debris and shall not contain stones larger than three (3) inches in maximum dimension.

4. Select fill shall be defined as Grade 1, Grade 2, or Grade 3, adhering to the following physical requirements:

a. Clayey gravel materials shall be classified as crushed or uncrushed gravel.

b. Crushed base materials shall be produced from oversized quarried aggregate, sized by crushing and produced from a naturally occurring single source. Crushed gravel or uncrushed gravel shall not be submitted as crushed base material. No blending of sources and/or additive materials will be allowed.

c. Select fill shall meet the following physical requirements:

Property	Test	Grade 1	Grade 2	Grade 3
Master Gradation Sieve Size (% retained)				
2-1/2 in.	Tex-110-E	-	0	0
1-3/4 in.	Tex-110-E	0	0-10	0-10
7/8 in.	Tex-110-E	10-35	-	-
3/8 in.	Tex-110-E	30-50	-	-
No. 4	Tex-110-E	45-65	45-75	45-75
No. 40	Tex-110-E	70-85	60-85	50-85
Liquid Limit, % max.	Tex 104-E	35	40	40
Plasticity Index, max.	Tex-106-E	10	12	12
Wet Ball Mill, % max.	Tex-116-E	40	45	-
Wet Ball Mill, % max. increase passing the No. 40 sieve	Tex-116-E	20	20	-
Classification	Tex-117-E	1.0	1.1-2.3	-
Min. Compressive Strength, psi				
Lateral Pressure 0 psi	Tex-117-E	45	35	-
Lateral Pressure 15 psi	Tex-117-E	175	175	-

5. All material for select backfill must be tested and accepted by the Testing Laboratory.

6. No select backfill shall be placed without authorization.

D. Granular Embedment Material:

1. Granular embedment material shall be composed of sand meeting the requirements of ASTM C33, free of excess salt, alkali, vegetable matter and clay.

E. Trench Plugs:

1. Clay meeting the requirements of ASTM D2487 Classification of CL or CH and with at least 60 percent fines (passing No. 200 sieve) and a Plasticity Index of 15 or greater.

2. Flowable Fill

3. On-site silty sand soils processed with 20 pounds of bentonite clay per cubic yard.

F. Herbicide

1. Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7, U.S.C. Section 136) for requirements on Contractor's licensing, certification and record keeping.

G. Topsoil

1. Topsoil shall meet the requirements of TxDOT Item 160.

H. Tree Wound Paint

1. Bituminous based paint of standard manufacture specially formulated for tree wounds.

I. Tracer Wire for Nonmetallic Piping

1. Tracer wire shall be minimum 12 gauge (AWG) single strand, insulated copper wire with high molecular weight polyethylene (HMWPE) insulation, specifically manufactured for direct burial applications.

2. Provide tracer wire in sufficient length to be continuous over each separate run of non-metallic pipe.

3. All spliced or repaired wire connections in the tracer wire system shall be made using approved connectors.

J. Warning Tape

1. Detectable underground aluminum warning tape shall be minimum 3 inches wide, minimum 5 mils thick. Tape to be color coded according to American Public Works Association (APWA) Uniform Color Codes.

PART 3 - EXECUTION

3.1 PROTECTION

A. Roads and Walks

1. Keep roads and walks free of dirt and debris at all times.

B. Trees, Shrubs

1. Protection shall be in accordance with project plans.

C. Utility Lines

1. All existing utility locations shown on plans are approximate, based on information provided by utility service providers and field surveys. Utilities were not uncovered to

determine precise locations, except as noted on the plans. The contractor shall verify the location of underground utilities and drainage structures at least forty-eight (48) hours prior to construction, whether shown on the plans or not, and shall protect same during construction.

2. Protect existing utility lines that are not identified to be removed. Notify the ODR immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the ODR in ample time to minimize interruption of the service.

3.2 SITE PREPARATION

A. Do not begin operations until limits of clearing and grubbing have been identified and staked out by the Contractor and approved by the Owner's Designated Representative.

B. All areas of proposed construction shall be stripped of existing vegetation, concrete, asphalt and base, and six inches (6") of topsoil. Except as noted on the plans. Topsoil is to be stockpiled for reuse on the project, as noted below.

C. Clear and grub all existing trees and understory where indicated on the drawings.

1. A certified arborist shall perform all pruning. Contractor shall submit proof of qualifications and three (3) current references to Owner's Designated Representative for approval prior to commencing pruning.

2. Remove all dead trees and tree limbs or trees that have substantial structural or cosmetic damage.

3. Remove all climbing vines to a height of thirty feet (30') above the ground. Grub out vine roots.

4. Remove all broken limbs and vines on trees that could fall and pose a hazard to pedestrians.

5. Spray all Poison Ivy with two (2) applications of a contact herbicide labeled for such use. After a complete kill has been achieved, grub out all plants and roots. Do not burn any part of Poison Ivy plants.

6. Remove briars and other vines and brambles where these plants have grown up into trees.

7. Remove logs and stumps higher than four inches (4") above grade and other debris from this area. Backfill holes in accordance with this Section.

8. Trim tree limbs to allow five feet (5') clearance above ground.

9. Remove any trash or man-made debris from this area.

10. All material generated by pruning and clearing operations shall be disposed of legally off-site.

D. General Stripping of Existing Weeds and Grasses:

1. The area within the work limits shown shall be stripped of lawns and vegetation under the direction of the Owner's Designated Representative.

2. Method of removal shall remove a minimum amount of topsoil and shall be even so as to not generally change the overall grading.

3. Remove and dispose of all products of stripping from the site. Do not allow material to accumulate at locations in or about the work areas.

E. Stripping and Removal of Existing Sod:

1. All areas designated shall be stripped of existing sod to a depth of two and one-half inches (2 ½"), or as deep as necessary to remove the majority of roots.

2. Sod shall be stripped by acceptable means and materials, Products of stripping operations shall be removed from the project area and be legally disposed of.

F. Stripping and Stockpiling of Existing Topsoil:

1. Strip from all disturbed areas all suitable topsoil. Strip to a depth of four inches (4") or as necessary to remove all topsoil. Do not strip topsoil when conditions are muddy and avoid admixture with subsoil.

2. Strip no topsoil where grades require only slight change.

3. Stockpile the topsoil in areas designated on the Drawings or as agreed upon with the Owner. Stockpiled topsoil shall be free from trash and other related material and shall be protected during the duration of the Contract.

4. Stripped and stockpiled topsoil not used for landscape fill or for planting operations shall be removed from the site and be legally disposed of.

G. Any depressions created by site preparation operations shall be filled as directed below.

3.3 DEWATERING

A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe is installed therein, and backfill operations have been completed.

1. The different working areas on the site shall be kept free of surface water at all times. The Contractor shall install drainage ditches and dikes and shall perform all pumping and other necessary work to divert or remove rainfall and all other accumulations of surface water from the excavations and fill areas. The diversion and removal of surface

water shall be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.

2. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the water downstream of the point of discharge shall not be directly discharged. Such waters shall be diverted through a settling basin or filter before being discharged.

3. The Contractor will be held responsible for the condition of any pipe, conduit or channel which he may use for drainage purposes and all such pipes, conduits or channels shall be left clean and free of sediment.

B. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose, piping, wellpoints, deep wells, etc., necessary to depress and maintain the ground water level below the base of the excavations during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained two feet (2') below the lowest subgrade excavation made until structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water. The system must be operated on a 24-hour basis and standby pumping facilities and personnel shall be provided to maintain the continued effectiveness of the system. If, in the opinion of the Engineer, the water levels are not being lowered or maintained as required by these Specifications, the Contractor shall install additional or alternate dewatering devices as necessary, at no additional cost to the Owner.

1. Elements of the system shall be located so as to allow a continuous dewatering operation without interfering with the construction of the permanent work. Where portions of the dewatering system are located in the area of permanent construction, the Contractor shall submit details of the methods he proposes to construct the permanent work in this location for the review of the Engineer. Control of groundwater shall continue until the permanent construction provides sufficient dead load to withstand the hydrostatic uplift of the normal groundwater, until concrete has attained sufficient strength to withstand earth and hydrostatic loads, until all waterproofing work below normal groundwater level has been completed, and until pipelines are properly jointed.

2. Dispose of all water removed from the excavation in such a manner so as not to endanger any portion of the work under construction or completed. Convey water from the excavations in a closed conduit. Do not use trench excavations as temporary drainage ditches. Before discontinuing dewatering operations, or permanently permitting the rise of the groundwater level, computations shall be made to show that any pipeline or structure affected by the water level rise is protected by backfill or other means to sustain uplift. Use a safety factor of 1.25 when making these computations.

3. Dewatering operations shall not be discontinued without the prior authorizations of the Engineer.

3.4 GRADING

A. The site shall be prepared and shaped in conformity with the lines and grades as shown on the plans and the recommendations contained in the Geotechnical Report.

3.5 EXCAVATION

A. General

1. The Contractor shall excavate and backfill, in advance of the construction, test pits to determine conditions or location of the existing utilities. The Contractor shall perform all work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits.

2. The Contractor shall be responsible for the definite location of each facility constructed by others involved within the area of his excavation for work under this contract. Care shall be exercised during such location work to avoid damaging and/or disrupting the affected facility. The Contractor shall be responsible for repairing, at his expense, damage to any structure, piping, or utility caused by his work.

3. Excavation of every description and of whatever substance encountered within the limits of disturbance of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required by the work.

   a. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

   b. Exposed soil after excavations have been made shall be protected against detrimental damage and change in condition from physical disturbance and rain. Wherever possible, concrete footings shall be done the same day the excavation is made. If this is not done, the footing excavations shall be properly protected.

4. All excavated materials that meet the requirements for backfill shall be stockpiled within the site, but not less the twenty-five feet (25') from the surface borders of any excavation, for use as backfill, or for providing final site grades. All excavated materials which are not considered suitable for fill, and any surplus or excavated material which is not required for fill shall be disposed of off the site by the Contractor. Upon completion of the fill, all on-site waste and disposal areas shall be cleaned and the debris removed from the site.

5. Materials deposited off the site shall be transported and placed in accordance with all applicable rules and regulations of all authorities having jurisdiction thereof. No surplus or unacceptable excavated materials of any kind shall be deposited in any stream or water course on dumped on public property.

B. Excavations for Structures

1. Excavations for construction of structures shall be carefully made t the depths indicated or required. Bottoms for footings and slabs shall be level, clean, dry and clear of loose material and the lower sections true to size.

2. Subgrade preparation for structures shall meet the requirements of the Structural Drawings and Notes.

3. Footings and slab excavations shall be verified by the Testing Laboratory, and reviewed by the Engineer, before concrete is placed thereon.

4. In excavations for structures where, in the opinion of the Testing Laboratory, the ground, not affected by high water level, is spongy or otherwise unsuitable for the contemplated foundation, the Contractor will be required to remove such unsuitable earth and replace it with suitable material in accordance with the requirements of the Structural Drawings and Notes.

5. Excavations for structures which have been carried below the depths indicated shall be refilled to the proper grade with select backfill material properly compacted in accordance with the Structural Drawings and Notes.

6. All structure excavations shall be hand-trimmed to permit the placing of full widths and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.

7. Excavation shall be extended a minimum of two feet (2') on each side of structures, footings, etc., unless otherwise shown or specified.

C. Excavations for Pavements

1. Pavement excavation shall consist of excavations for all site pedestrian and vehicular pavements, in conformity with the typical sections shown on the Drawings, and to the lines and grades established by the Engineer and shown on the Drawings, by the removal of existing material or addition of acceptable material.

2. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with acceptable material.

3. All holes, ruts, and depressions shall be filled with select fill material.

4. Subgrade preparation shall comply with the requirement of Section 311213 – Subgrade Preparation.

D. Trench Excavations

1. Reference Section 315000 – Excavation Support and Protection.

2. Trenches shall be excavated to a width that will provide adequate working space and clearances for proper pipe installation, jointing and embedment.

3. Where pipe elevations are not shown on the Drawings, trenches shall be excavated to a depth sufficient to provide a minimum cover of three feet (3') over the top of the pipe, unless otherwise shown or specified.

4. Where necessary to reduce earth load on pipe trench banks to prevent sliding or caving, banks may be cut back on slopes that shall not extend lower than twelve inched (12”) above the top of the pipe.

5. Except where otherwise required, pipe trenches shall be excavated six inches (6”) below or 1/8 of the outside diameter of the pipe, whichever is greater, the underside of the pipe to provide for the installation of granular embedment material.

6. Over depth excavations shall be backfilled with select backfill material compacted to 95 percent (95%) of maximum density, as determined by ASTM D698 at a moisture content between optimum and optimum +4%.

7. Whenever subgrade material that is incapable of properly supporting the pipe is encountered, the subgrade material shall be removed to the depth required and the trench backfilled to the proper grade with select backfill material compacted to 95 percent (95%) of maximum density, as determined by ASTM D698 at a moisture content between optimum and optimum +4%.

8. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling should be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

9. Where existing piping constructed by others cross the new pipeline trench, the existing piping or ductbank shall be adequately supported and protected from damage due to construction. All methods of supporting and maintaining these facilities shall be subject to review by the Engineer and/or the Testing Laboratory.

3.6 UNAUTHORIZED EXCAVATION

A. All excavation outside the lines and grades shown, and which is not in conformance with the plans and specifications as determined by the Testing Laboratory, together with the removal and disposal of the associated material shall be at the Contractor’s expense.

B. The unauthorized excavation shall be fill with select backfill and compacted as specified by the Testing Laboratory by the Contractor at his expense.

3.7 PLACEMENT OF FILL AND BACKFILL

A. General

1. All select backfill, backfill and fill required for structures and trenches and required to provide the finished grades shown and as described herein shall be furnished, placed and compacted by the Contractor.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

a. Observation by the Engineer of construction below finish grade.

b. Observation, testing and recording of locations of underground piping and ductwork.

c. Removal of concrete formwork.

d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

e. Removal of trash and debris.

f. Backfill against foundation walls only after review by the Engineer. Do not damage waterproofing when placing backfill.

3. Fill containing organic materials or other unacceptable material shall be removed and replaced with acceptable fill material.

B. Placement of Select Backfill, Backfill, and Fill Materials

1. Material shall be placed to the grades shown on the Drawings. The lift thickness and compaction moisture content range given herein are approximate. These values will be finally determined from the laboratory test results on the fill materials.

2. All material shall be placed in horizontal loose lifts not exceeding nine inches (9") in thickness and shall be mixed and spread in a manner assuring uniform lift thickness after placing. Each lift shall be compacted by not less than two complete coverages of the specified compactor. Select backfill shall be placed to the underside of all concrete slabs. The fill material shall extend a minimum of two feet (2') outside the face of each structure and be twelve inches (12") below finished grade. The maximum slope of select backfill to the subgrade shall be one vertical to one and one-half horizontal.

3. Backfill around and outside of structures and over select backfill shall be deposited in layers not to exceed nine inches (9") in uncompacted thickness and mechanically compacted, using platform type tampers. Compaction of structural backfill, by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of select backfill and/or backfill by inundation with water will not be permitted. All materials shall be deposited as specified herein and as shown on the Drawings.

4. All material shall be placed at a moisture content that falls in the range of laboratory optimum moisture content and laboratory optimum +4%. It shall be compacted to a density of 95 percent (95%) of the maximum laboratory dry density for that material as determined by ASTM D698. The Contractor shall provide equipment capable of adding measured amounts of water to the material to bring it to a condition within the range of the required moisture content. The Contractor shall provide equipment capable of discing, aerating, and mixing the soil to insure reasonable uniformity of moisture content throughout the material and to reduce the moisture content of the material by air drying if necessary. If the subgrade material must be moisture conditioned before compaction, the material shall be sufficiently mixed or worked on the subgrade to insure a uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of the specified limit shall be dried by aeration or stockpiled for drying

5. No material shall be placed when free water is standing on the surface of the area where the material is to be placed. No compaction of material will be permitted with free water on any portion of the material to be compacted. No material shall be placed or

compacted in a frozen condition or on top of frozen material. Any material containing organic materials or other unacceptable material previously described shall be removed and replaced with acceptable material prior to compaction.

6. Each lift of compacted material shall be compacted by the designated number of coverages of all portions of the surface of each lift by a smooth-drum vibratory roller for granular material having a static weight not less than 5,500 pounds, a sheeps-foot roller for cohesive material exerting a pressure of 250 psi on the surface of the feet, or equivalent equipment, prior to commencement of the work. One coverage is defined as the condition obtained when all portions of the surface of the backfill material have been subjected to the direct contact of the compactor. The compactor shall be operated at a forward speed not exceeding 40 feet per minute.

7. Compaction shall be performed with equipment suitable for the type of material being placed. The contractor shall select equipment that is capable of providing the minimum density required by these Specifications. The gross weight of compacting equipment shall not exceed 7,000 pounds within a distance of ten feet (10') from the wall of any existing structure or completed structure under this contract. Equipment shall be provided that is capable of compacting in restricted areas next to structures and around piping. The effectiveness of the equipment selected by the Contractor shall be tested at the commencement of compacted material work by construction of a small section of material within the area where material is to be placed. If tests on this section of backfill show that the specified compaction is not obtained, the Contractor shall increase the amount of coverages, decrease the lift thicknesses or obtain a different type of compactor.

8. Particular care shall be taken to compact structure backfill that will be beneath pipes, roads, or other surface construction or structures. In addition, wherever a trench passes through structure backfill, the structure backfill shall be placed and compacted to an elevation twelve inches (12") above the top of the pipe before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

9. The compaction requirements specified are predicated on the use of normal materials and compaction equipment. In order to establish criteria for the placement of a controlled fill so that it will have compressibility and strength characteristics compatible with the proposed structural loadings, a series of laboratory compaction and/or compressive strength tests will be performed on the samples of materials submitted by the Contractor. From the results of the laboratory tests, the final values of the required percent compaction, the allowable compaction moisture content range, and the maximum permissible lift thickness will be established for the fill material and construction equipment proposed.

10. The requirements of this Section apply for the placement and compaction of all fill materials.

C. Backfill in Pipe trenches

1. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.

2. All pipe larger than six inches (6") in diameter shall be placed on granular embedment material. Pipe six inches (6") in diameter and smaller shall be placed in bedding zone of granular embedment material unless the trench bottom has been graded to provide uniform and continuous support of the installed pipe.

3. Backfill is divided into three (3) separate zones: (a) bedding, the material in trench bottom in direct contact with the bottom of the pipe; (b) initial backfill, the backfill zone extending from the surface of the bedding to a point one foot (1') above the top of the pipe; and (c) secondary backfill, the backfill zone extending from the initial backfill surface to the top of the trench. Placement of materials for each of the zones shall be as described herein.

    a. Bedding

        1) When unacceptable materials such as water, silt, muck, trash or debris, or rock boulder or coarse gravel (particle size greater than 1 ¾ inch) exist at the bearing level or for pipes with a nominal inner diameter greater than six inches (6"), a bedding of granular embedment material shall be used.

        2) Unstable materials shall be removed at the direction of the Engineer and replaced to a minimum depth of four inches (4") or one-eighth (1/8) of the outside diameter of the pipe, whichever is greater, with granular embedment material. This material shall extend up to the sides of the pipe sufficient to embed the lower quadrant of the pipe. If stability is not accomplished by using the above procedure, the Engineer may require additional granular embedment.

        3) Granular embedment shall be spread and graded to provide a uniform and continuous bedding zone beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface to withdraw pipe slings or other lifting tackle. After each pipe has been graded, aligned, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations. Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

        4) Each layer of embedment material shall be compacted by at least two complete coverages of all portions of the surface of each lift using adequate compaction equipment. One coverage is defined as the conditions reached when all portions of the lift fill have been subjected to the direct contact of the compacting surface of the compactor.

        5) The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

    b. Initial Backfill

1) Select Initial Backfill: Where pipe is to be laid in a rock cut or where rock in boulder ledge or coarse gravel (particle size larger than 1¾ inch) formations exist in the initial backfill zone, or where trench walls or conditions are unstable or where the pipe to be laid is flexible pipe, select initial backfill material shall conform to the requirements of Granular Embedment. For conduits less than twenty-four inches (24") in diameter select initial backfill material shall be placed in two (2) lifts. The first lift shall be spread uniformly and simultaneously on each side and under the shoulders of the pipe to the mid-point or spring line of the pipe. The first lift of select initial backfill shall be inspected and approved prior to placement of the second lift. The second lift of select initial backfill material shall extend from the spring line of the pipe to a depth sufficient to produce a compacted depth of material a minimum of one foot (1') above the top of the pipe. The second lift shall be evenly spread in a similar manner as the first lift. For conduits twenty-four (24") in diameter and larger, select initial backfill material shall be evenly and simultaneously spread alongside, under the shoulders or haunches of the pipe and over the pipe in twelve-inch (12") lifts to a point sufficient to produce a compacted depth of material a minimum of one foot (1') above the top of the pipe.

2) Optional Select Initial Backfill: Where the pipe to be laid is Flexible Pipe or where unstable materials exist at the pipe bearing level or the initial backfill zone, in lieu of the material specified above, an optional select backfill may be used by the Contractor where rock, in ledge, boulder, or coarse gravel (particle size larger than 1 ¾" inch) formations are not present in the bedding or initial backfill zone of the trench and where water is not present at the pipe bearing level. Optional Select Initial Backfill shall be clean, well graded gravels, crushed screenings or sand with 100% passing a ½" sieve, 95% to 100% passing a ¼" sieve. The plasticity index shall not be more than 12 when tested in accordance with the ASTM D4318. Optional select initial backfill shall be placed around the pipe and to the defined limit for initial backfill above. Sand and other materials as may be required by the Engineer shall be thoroughly compacted. Minimum thickness of completed optional select initial backfill shall be one foot (1') above the top of the pipe.

3) Natural Initial Backfill: Where the pipe to be laid is rigid pipe and where stable materials and laying conditions exist at the pipe bearing level and initial backfill zone and existing excavated materials are acceptable to the Engineer, such excavated natural materials may be utilized as initial backfill material.

c. Secondary Backfill

1) Secondary backfill shall generally consist of materials removed from the trench and shall be free of trash brush and other debris. No rock or stones having any dimension larger than one half of the trench width, or eight inches (8"), unless otherwise approved, at the largest dimension, whichever is less, shall be used in the secondary backfilling zone. In special cases where excessive width and/or depth of the trench permit, and only with approval of the Engineer, larger rocks up to twelve inches (12") in diameter may be incorporated into the backfill provided that the surrounding

compactable soil may be properly and adequately compacted. Material for backfill shall be placed in uniform layers not more than nine inches (9") in depth (loose measurement) and shall be compacted to the density specified herein.

2) The initial lift of secondary backfill shall be a maximum of nine inches (9"") in loose thickness. Consideration should be given to keeping the initial lift of secondary backfill as close as possible to the maximum nine inches (9") thickness to reduce the possibility of damage resulting from the compaction operations. This initial lift of secondary backfill material shall be compacted to a minimum of 95 percent of the laboratory determined maximum dry density (ASTM D698) using suitable compaction equipment. The backfill material shall be wetted or dried in such a manner as to provide uniform moisture content near the optimum moisture content identified by laboratory testing. Moisture contents in excess of 5 percent above or below the optimum laboratory moisture content are considered unacceptable and will require adjustment as necessary.

3) Moisture density tests will be performed by a geotechnical engineer at periodic intervals on the top of the initial lift of backfill to determine the degree of compaction. If these test results indicate marginal compaction has been obtained near the surface of this lift, the Contractor will be given the option of applying more compactive effort or excavating a portion of the upper fill materials to allow access for moisture-density testing near the bottom of the lift. Any materials determined to be undercompacted will require additional work by the Contractor to meet the above compaction requirements.

4) After the initial lift of secondary backfill has been properly compacted as evidenced by moisture-density tests, subsequent lifts of secondary backfill material shall be placed and compacted in accordance with the above Specification. All subsequent lifts of secondary backfill shall be placed in loose lifts not to exceed twelve inches (12") in thickness and compacted in accordance with the above Specifications. Succeeding lifts of supplemental backfill may be placed only after completion of adequate moisture-density tests on backfill material already in place.

5) Due to the rather large vertical displacement of backfill material, experienced by using thick lifts, it is anticipated that, in some areas, the final lift of backfill material could be approximately one foot (1') thick. Compaction of this last lift of backfill material may be accomplished in the manner described above, or by a combination of use of vibratory plate compaction equipment and conventional pneumatic or sheeps-foot rollers

4. Clay Plugs

a. A clay plug shall be installed on all utility trenches before they enter the building or go under a foundation.

b. The plug must be installed a distance of one (1) foot from the foundation.

D. Compaction Density Requirements

1. The degree of compaction required for all types of fills shall be listed below. Material shall be moistened or aerated as necessary to provide the moisture content specified below:

Uncompacted Material/Location	Standard	Maximum Required Density	Loose Lift Thickness
- Select Backfill	ASTM D698	95%	12 inches
- Backfill/Around Structures	ASTM D698	95%	12 inches
- All Other Backfill	ASTM D 698	95%	12 inches
- Fill/Roadway Embankment	ASTM D698	95%	12 inches
- Roadway Subgrade	ASTM D698	95%	
- Fill/Pipe Trenches	ASTM D 698	95%	12 inches
- Granular Embedment/ Pipe Trenches	ASTM D 698	95%	12 inches

2. The Testing Laboratory shall perform tests necessary to provide data for selection of fill material and control of placement water content.

3. The Testing Laboratory will perform field density tests at the completion of each lift to ensure that the specified density is being obtained. Number of tests shall be determined by the Testing Laboratory.

4. If the tests indicate unsatisfactory compaction, the Contractor shall provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction work shall be performed by the Contractor at no additional cost to the Owner until the specified compaction is obtained. The work shall include complete removal of unacceptable (as determined by the Testing Laboratory) fill areas and replacement and re-compaction until acceptable fill is provided.

E. Pit Run Sand Placement: Pit run sand shall be placed and compacted to the limits shown on the Drawings.

F. Drainage Gravel: Drain gravel shall be compacted in maximum twelve inch (12”) lifts with a minimum of two passes of a hand operated vibratory plate compactor weighing between 150 and 500 pounds.

G. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, the excavation shall be backfilled to the required subgrade with select backfill material and thoroughly compacted to 95 percent (95%) of ASTM D698, at a moisture content between optimum and optimum +4%, in layers not thicker than twelve inches (12"). Sides of the excavations shall be sloped in accordance to the maximum inclinations specified for each structure location.

3.8 FINAL GRADING AND EMBANKMENTS

A. To the extent available, backfill material from excavations shall be placed in accordance with this Section to final grades with a maximum compacted depth of six inches (6”).

B. After other outside work has been finished, and backfilling and embankments completed and settled, all areas on the site of the work which are to be graded shall be brought to a subgrade suitable with the indicated elevations, slopes, and grades with suitable excess excavation material. Final grades shall be within 0.1 foot of the finished grades shown on the Drawings.

C. Final stabilization of non-paved areas shall comply with the requirements of TxDOT Item 164.

3.9 DISPOSITION OF SURPLUS MATERIAL

A. All surplus materials shall be removed from the Owner’s property and be disposed of in a legal manner.

3.10 PROTECTION OF UTILITIES AND PROPERTY

A. The Contractor is referred to other portions of this Section, the Special Conditions and other Sections and/or Divisions within these Specifications for requirements concerning the protection of utilities, property and existing trees.

B. Locate and identify all above and below grade utilities in advance of any excavation operations and/or activities. Stake and flag locations. Maintain and protect existing utilities thus identified. Notify A/E or Owner's Representative if concealed conditions affect work.

END OF SECTION 310000

SECTION 312313 - SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Terms and Conditions of the Contract, including Supplementary and Special Conditions of the Contract, and the Drawings apply to this Section.

1.2 SUMMARY

A. Section includes furnishing all labor, materials, and equipment necessary for completing all subgrade preparation operations for pavement, drainage facilities and other improvements shown on the drawings associated with this project.

1.3 RELATED SECTIONS

A. Section 310000 – Site Earthwork

1.4 DEFINITIONS

A. Prepared Ground Surface – Ground surface after completion of site clearing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

B. Subgrade – Layer of existing soil after completion of clearing, grubbing, scalping to topsoil prior to placement of fill, structural fill, roadway structure or base for floor slab.

C. Proof Rolling – Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement, and locate areas of instability

1.5 REFERENCE STANDARDS

A. The contractor shall comply with applicable provisions and recommendations of the following:

1. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103, U.S.A. All references are to current active standard.

    a. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

    b. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2. Geotechnical Report.

1.6 SUBMITTALS

A. Provide certifications and laboratory analysis results for all fill materials proposed for use on the project, indicating conformity to the specifications and source of materials.

B. Perform, document and report the following quality control tests at the designated frequency in accordance with Section 014500.

1. Submit two (2) copies of test reports of the moisture-density and compaction results for review.

2. Comply with Submittal requirements outlined in Sections 013300 and 014500.

1.7 SITE CONDITIONS

A. Environmental Requirements: Prepare subgrade when unfrozen and free of ice and snow.

1.8 SEQUENCING AND SCHEDULING

A. Complete applicable work as specified in Section 310000 – Site Earthwork prior to subgrade preparation.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Proof Rolling Equipment

1. The proof rolling equipment shall consist of not less than four pneumatic tired wheels, running on axles carrying not more than two wheels, and mounted in a rigid frame and provided with loading platform or body suitable for ballast loading. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces.

2. The proof roller under working conditions shall have a rolling width of from 8 feet to 10 feet, and shall be so designed that, by ballast loading, the gross load may be varied uniformly from 25 tons to 50 tons. The tires shall be capable of operating under the various loads with variable air pressure up to 150 pounds per square inch. Tires shall be practically full of liquid. (Tires shall be considered as being practically full when liquid will flow from the valve stem of a fully inflated tire with the stem in the uppermost position). The operating load and tire pressure shall be within the range of the manufacturer's chart. The Contractor shall furnish the A/E charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished.

3. The proof roller shall be towed by a suitable crawler type tractor or rubber tired tractor of adequate tractive capacity, or may be of the self-propelled type. A proof roller unit shall consist of either a self-propelled roller or combination of roller and towing tractor

4. There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of 50 tons.

5. Rubber tired tractive equipment shall be used on base courses and asphalt pavements. Other type tractive equipment may be used on embankment subgrade. The heavy pneumatic tire roller unit shall be capable of turning 180 degrees in the crown width or operating in forward and reverse modes.

6. In lieu of the rolling equipment specified, the Contractor may, upon written permission from the A/E, operate other compacting equipment that will produce equivalent results in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired results within the same period of time as would be expected of the specified equipment, as determined by the A/E, its use shall be discontinued.

PART 3 - EXECUTION

3.1 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as hauls roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

E. The Contractor shall be responsible for providing accurate lines and grades of subgrade per drawings.

3.2 APPROVAL OF SUBGRADE

A. Proof-Rolling: Proof-roll subgrade below the building pad and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Completely proof-roll subgrade in one direction, each succeeding trip of the proof roller shall be offset by not greater than one tire width. Repeat proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

C. Remove soft spots down to firm soil, minimum 12 inches deep, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by A/E representative, fill with select structural fill in maximum 8 inches deep lifts, and compact as specified.

3.3 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, disking, harrowing, or other methods, to hasten drying process.

3.4 QUALITY CONTROL TESTING

A. Provide certifications and laboratory analysis results for all fill materials proposed for use on the project, indicating conformity to the specifications and source of materials.

B. Engage a testing laboratory for control testing during subgrade preparation operations to perform, document and report the following quality control tests at the designated frequency in accordance with Section 014500.

1. Perform laboratory density tests in accordance with ASTM D698.

2. Field density tests may also be performed by the nuclear method in accordance with ASTM D6938, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D698. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work.

3. Perform at least one field in-place density test for each 5,000 square feet.

END OF SECTION 312313

SECTION 315000 – EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Terms and Conditions of the Contract, including Supplementary and Special Conditions of the Contract, and the Drawings apply to this Section.

1.2 SUMMARY

A. Section includes furnishing and installing all equipment, materials, and labor for a trench safety system meeting appropriate requirements established in Occupational Safety and Health Administration (OSHA) Safety and Health Regulations, Part 1926, Subpart P - Excavations, Trenching, and Shoring.

1.3 RELATED WORK

A. Related work of other Sections includes:

1. Section 310000 – Site Earthwork
2. Section 312313 – Subgrade Preparation
3. Section 331000 – Water Utilities
4. Division 22 Sections – Piping and appurtenances
5. Division 26 Sections – Electric

1.4 REFERENCES

A. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103, U.S.A. All references shall be to current active standard.

1. ASTM A36 – Standard Specification for Carbon Structural Steel.
2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
3. ASTM A328 – Standard Specification for Steel Sheet Piling.
4. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
5. ASTM A588 – Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.

B. American Welding Society (AWS). D1.1 - Structural Welding Code.

C. United States Department of Labor Occupational Safety and Health Administration (OSHA). Part 1926, Subpart P, Code of Federal Regulations.

1.5 SUBMITTALS

A. Submit drawings showing the design and details of proposed sheeting, shoring and bracing, and the proposed sequence of excavation and backfill to the Owner's Representative for review.

1. The drawings shall be sealed by a registered professional engineer licensed in the State of Texas.

2. Refer to the geotechnical study included with the bid documents for soil

3. Classification, trench construction, trench shields, and trench shoring considerations.

4. Do not begin construction of the sheeting, shoring, and bracing until the design and drawings have been reviewed.

5. Review of the drawings by the Owner's Representative is for acceptance only insofar as it affects compliance with OSHA Regulations, and such acceptance will not relieve the Contractor of the responsibility from the adequacy of the design, or for compliance with OSHA regulations.

PART 2 - PRODUCTS

2.1 TIMBER

A. Trench sheeting materials shall be a minimum of 2" in thickness, solid and sound, free from weakening defects such as loose knots and splits. Shoring timber sizes shall not be less that that called for in OSHA regulations.

2.2 STEEL SHEET PILING

A. Steel sheet piling shall conform to the following specifications: ASTM A328,

B. ASTM A572, Grade 50.

C. Steel for stringers and cross braces shall conform to ASTM A588.

2.3 TRENCH BOXES

A. Portable trench boxes shall be constructed of steel conforming to ASTM A36. Connecting bolts shall conform to ASTM A307. Welds shall conform to requirements of AWS Specification Dl.1.

PART 3 - EXECUTION

3.1 GENERAL

A. Trench safety system shall be constructed, installed and maintained in accordance with the OSHA regulations and to the design prepared by the Contractor's registered Professional Engineer to prevent death or injury to personnel or damage to structures in or near these trench excavations. Materials excavated from trench to be stored no closer to the edge of the trench that on-half the depth of the trench.

3.2 INSTALLATION

A. Installation of trench safety system shall meet OSHA regulations and the Contractor's registered Professional Engineer's requirements.

3.3 SUPERVISION

A. Contractor shall provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment and materials pertaining to the safety systems in this item are sufficient to meet requirements of OSHA regulations.

3.4 MAINTENANCE OF SAFETY SYSTEM

A. The safety system shall be maintained in the condition required by the OSHA regulations or as specified by the Contractor's registered Professional Engineer.

B. The Contractor shall take all necessary precautions to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel shall be immediately removed from the trench or excavation area and the safety system repaired. The Contractor shall take all necessary precautions to ensure no loads, except those included in the safety system design, are imposed upon the excavation.

3.5 INSPECTION

A. Contractor shall make daily inspection of trench safety system to ensure that the system meets OSHA requirements. Daily inspection to be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench shall cease until necessary precautions have been taken to safeguard personnel entering trench. Contractor to maintain permanent record of daily inspections.

3.6 REMOVAL

A. Bed and backfill pipe to a point at least one foot above top of pipe prior to removal of any portion of trench safety system. Bedding and backfill to be in accordance to other applicable specification items. Backfilling and removal of trench supports shall progress together from bottom of trench upward. Remove no braces or trench supports until all personnel have evacuated the trench. Backfill trench to within 5 feet of natural ground prior to removal of entire trench safety system.

END OF SECTION 315000

SECTION 321123 – AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing flexible base for curbs and gutters, roadways, and parking areas as shown and detailed on the Drawings.

1.2 RELATED WORK

A. Related Work of Other Sections:

1. Section 310000 – Site Earthwork
2. Section 312313 – Subgrade Preparation
3. Section 321216 – Asphalt Paving

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pennsylvania 19103. All references shall be to current active standard.

1. ASTM C117 – Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
2. ASTM D75 – Standard Practice for Sampling Aggregates.
3. ASTM D422 – Standard Test Method for Particle Size Analysis of Soils.
4. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
5. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
6. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
8. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Texas Department of Transportation (TxDOT), 125 East 11^{th} Street, Austin, Texas 78701.

1. Tex-116-E – Ball Mill Method for Determining the Disintegration of Flexible Base Material

2. Tex-117-E – Triaxial Compression for Disturbed Soils and Base Materials

3. Tex-140-E – Measuring Thickness of Pavement Layer

1.4 SUBMITTALS

A. Test Reports: Submit two (2) copies of test reports of the physical properties of base material for review and approval by the Owner's Representative.

B. Laboratory analysis of each base course material proposed demonstrating compliance with the requirements listed below in 2.1A. Utilize the following ASTM and TxDOT standard laboratory test procedures:
1. Moisture Content (ASTM D2216)
2. Liquid Limit (ASTM D4318)
3. Plasticity Index (ASTM D4318)
4. Sieve Analysis (ASTM D422)
5. Moisture-Density Determination (ASTM D1557)
6. Roadway Density (ASTM D6938)
7. Wet Ball Mill (Tex-116-E)
8. Compressive Strength (Tex-117-E)

1.5 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

B. Take samples for laboratory testing in conformance with ASTM D75.

C. One optimum moisture-maximum density curve from proposed material.

PART 2 - PRODUCTS

2.1 BASE COURSE

A. Base course material shall be crushed stone produced from oversize quarried aggregate, sized by crushing and produced from a naturally occurring single source. Crushed gravel or uncrushed gravel shall not be acceptable A material. No blending of sources and/or additive materials will be allowed in material. The material shall meet the following criteria:

Property	Test Method	Grade 1	Grade 2
Master Gradation Sieve Size (% Retained)	ASTM D422		
2-1/2”		-	0

1-3/4”		0	0-10
7/8”		10-35	-
3/8”		30-50	-
No. 4		45-65	45-75
No. 40		70-85	60-85
Liquid Limit (% Max.)	ASTM D4318	35	40
Plasticity Index (Max.)	ASTM D4318	10	12
Wet Ball Mill (% Max.)	Tex-116-E	40	45
Wet Ball Mill (% Max. Increase Passing No. 40 Sieve)	Tex-116-E	20	20
Minimum Compressive Strength (psi)			
Lateral Pressure 0 psi	Tex-117-E	45	35
Lateral Pressure 15 psi	Tex-117-E	175	175

1. The Engineer may accept material if no more than one (1) of the five (5) most recent gradation tests has an individual sieve outside the specified limits of the gradation.

2. The Engineer may accept material if no more than one (1) of the five (5) most recent plasticity index tests is outside the specified limit. No single test may exceed the allowable limit by more than 2 points.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall provide and set all construction stakes as required by a Registered Professional Land Surveyor for the work required. All stakes shall be checked for conformity with the drawings and existing conditions. After approval of lines and grades the Contractor shall protect and maintain the approved stakes until they have served their purpose. Blue tops shall be set by the Contractor for subgrade on centerline, quarter points, and curb lines at intervals not exceeding 50 feet or 25 feet within curves.

B. The subgrade shall have been compacted to a minimum of 95 percent density, to the typical sections, lines and grades shown on the drawings. The Contractor shall verify that the subgrade has been prepared and compacted in accordance with Section 312313 by proof rolling. Any deviation shall be corrected and proof rolled prior to placement of aggregate, and must be approved by the Owner's Representative. As soon as possible after the acceptance of the condition of the subgrade, the base course shall be installed.

3.2 PLACEMENT

A. Placing: Flexible base shall be placed in eight inch (8") courses maximum and in accordance with the following:

1. First Course:

a. It shall be the responsibility of the Contractor to deliver the required amount of base material to each 100-foot station. Base material shall be spread uniformly and shaped the same day as delivered. In the event inclement weather or other unforeseen circumstances render this impractical, the material shall be shaped as soon as practical.

b. Prior to compacting the flexible base, the flexible base material shall be bladed and shaped to conform to the typical sections as shown on the plans. All areas of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material, as directed by the Engineer and at the Contractor's expense.

c. The Contractor shall sprinkle for dust control as directed by the Engineer.

2. Succeeding or Finish Courses:

a. Construction methods shall be the same as required for the first course. Throughout this entire operation, the shape of each course shall be maintained by blading. Upon completion, the surface shall be smooth and in conformity with the typical section as shown on the plans and the established lines and grades. Prior to placing the surfacing on the completed base, the base shall be cured to the extent directed by the Engineer.

3. Compaction Method:

a. The flexible base shall be compacted to a minimum of 98% of the maximum dry density as determined by the modified Proctor test (ASTM D1557) and the moisture content shall be within plus or minus 1.5% of the optimum moisture content.

b. When the material fails to meet the density requirements, or it loses the required stability, density or finish before the next course is placed or the project is completed, it shall be reworked and retested in accordance with Section 3.2.A.4, below

4. Reworking a Section:

a. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete; it shall be reworked, recompacted and refinished at the sole expense of the Contractor.

5. Tolerances shall conform to the following:

a. Density Tolerances. The Engineer may accept the work pro- viding not more than one (1) out of the most recent five (5) consecutive density tests

performed is below the specified density, and providing that the failing test is no more than three (3.0) pounds per cubic foot below the specified density.

b. Grade Tolerances. In areas on which surfacing is to be placed, any deviation in excess of 1/4 inch in cross section or 1/4 inch in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

c. Thickness Measurement. When the measurement is by the square yard, the flexible base will be measured for depth in units of 4000 square yards, or fraction thereof. The measurements will be at location(s) determined by the Engineer and performed in accordance with Test Method Tex-140-E. In any unit where flexible base is deficient by more than 1/2 inch in thickness, the deficiency shall be corrected by scarifying, adding material as required, reshaping, recompacting and refinishing at the Contractor's expense.

B. Spreading

1. Flexible base material deposited upon the prepared subgrade shall be spread, shaped and rolled the same day if possible. If not possible to do this within the first twenty-four hours (24), delay shall be held to a minimum. The base shall be wetted, bladed and rolled to achieve at least 98% compaction as determined by ASTM D1557. If the material fails to meet the density specified, it shall be re-worked as necessary to meet the density required.

C. Deviation

1. Any deviation in the finish surface in excess of 1/4" in cross-section or removing material, reshaping and recompacting by sprinkling or rolling. Any re-working of the base course required to conform to these specifications shall be at the cost of the Contractor.

3.3 QUALITY CONTROL TESTING

A. Inspect and test each lift of base course. Do not place base for subsequent lifts until test results for the previously placed lift verify compliance with compaction requirements.

B. Perform field density tests in accordance with ASTM D6938.

C. Perform at least one field in-place density test for every 500 square feet, in no case shall be less than three (3) tests for any base course placement.

D. Moisture-Density Relationship: One test of a representative sample of each day’s delivery.

END OF SECTION 321123

SECTION 321216 – ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Terms and Conditions of the Contract, including Supplementary and Special Conditions of the Contract, and the Drawings apply to this Section.

1.2 SUMMARY

A. Section includes furnishing and installing asphalt concrete paving including prime coat, tack coats, and related work as shown and detailed on the Drawings.

1.3 RELATED WORK

A. Related work of other Sections includes:

1. Section 310000 – Site Earthwork
2. Section 312313 – Subgrade Preparation
3. Section 321123 – Aggregate Base Courses

1.4 REFERENCES

A. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103, U.S.A. All references shall be to current active standard.

1. ASTM D946 – Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
2. ASTM D977 – Standard Specification for Emulsified Asphalt
3. ASTM D2027 – Standard Specification for Cutback Asphalt (Medium-Curing Type)
4. ASTM D2397 – Standard Specification for Cationic Emulsified Asphalt

B. TxDOT: Texas Department of Transportation Standard Specifications for Construction of Highways, Streets and Bridges, TxDOT 2004 edition

1. TxDOT Item 340 – Dense-Graded Hot-Mix Asphalt

1.5 SUBMITTALS

A. Contractor shall certify the mixing plant will conform to the requirements of TxDOT Item 340.

B. Mix design reports for Type D mixture in accordance with TxDOT Method Tex-204-F.

1.6 DELIVERY, STORAGE AND HANDLING

A. Asphaltic Concrete Material shall be hauled in tight trucks previously cleaned of all dirt and foreign material with the load completely covered by canvas.

PART 2 - PRODUCTS

2.1 PRIME COAT

A. Provide grade MC-30 in accordance with ASTM D2027.

2.2 TACK COAT

A. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 HOT MIX ASPHALTIC CONCRETE SURFACE COURSE

A. The asphaltic concrete surface course shall be plant mixed, hot laid TxDOT Item 340 Type D (Fine Graded Surface Course) meeting the master specifications requirements in listed below. The mix is to be designed for a stability of 40 (minimum) when tested in accordance with TxDOT Test Method Tex-208-F. The asphalt cement content by percent of total mixture weight shall fall within a tolerance of -0.2 to +0.4 percent asphalt cement from the specific mix. The grade of asphalt cement shall be PG 70-10, ASTM D946. In addition, the mix shall be designed so that 75 to 85 percent of the voids in the mineral aggregate (VMA) are filled with asphalt cement. The coarse aggregate shall be crushed limestone, not gravel. Aggregates known to be prone to stripping should not be used in the hot mix. The mix shall have at least 70 percent strength retention when tested in accordance with Tex-531-C.

Master Gradation Bands (% Passing by Weight or Volume)	
Sieve Size	% Passing
3/4”	-
1/2”	98.0 – 100.0
3/8”	85.0 – 100.0
#4	50.0 – 70.0
#8	35.0 – 46.0
#30	15.0 – 29.0
#50	7.0 – 20.0
#200	2.0 – 7.0

2.4 HOT MIX ASPHALTIC CONCRETE BASE COURSE

A. The asphaltic concrete base course shall be plant mixed, hot laid TxDOT Item 340 Type A (Coarse Base) or Type B (Fine Base) meeting the master specifications requirements in

listed below. The mix is to be designed for a stability of 40 (minimum) when tested in accordance with TxDOT Test Method Tex-208-F. The asphalt cement content by percent of total mixture weight shall fall within a tolerance of -0.2 to +0.4 percent asphalt cement from the specific mix. The grade of asphalt cement shall be PG 64-22, ASTM D946. In addition, the mix shall be designed so to have a minimum 12.0 (Type A) or 13.0 (Type B) percent voids in mineral aggregate (VMA). Aggregates known to be prone to stripping should not be used in the hot mix. The mix shall have at least 70 percent strength retention when tested in accordance with Tex-531-C.

Type A Master Gradation Bands (% Passing by Weight or Volume)	
Sieve Size	% Passing
1 1/2”	98.0 – 100.00
1”	78.0 – 94.0
3/4”	64.0 – 85.0
1/2”	50.0 – 70.0
3/8”	-
#4	30.0 – 50.0
#8	22.0 – 36.0
#30	8.0 – 23.0
#50	3.0 – 19.0
#200	2.0 – 7.0
Type B Master Gradation Bands (% Passing by Weight or Volume)	
Sieve Size	% Passing
1 1/2”	-
1”	98.0 – 100.0
3/4”	84.0 – 98.0
1/2”	-
3/8”	60.0 – 80.0
#4	40.0 – 60.0
#8	29.0 – 43.0
#30	13.0 – 28.0
#50	6.0 – 20.0

#200	2.0 – 7.0

2.5 EQUIPMENT

A. All equipment shall comply with the requirements below:

1. Asphalt Paver: Furnish a paver that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements. Ensure paver does not support the weight of any portion of hauling equipment other than the connection. Provide loading equipment that does not transmit vibration or other motions to the paver that adversely affect the finished pavement quality. Equip the paver with an automatic, dual, longitudinal-grade control system and an automatic, transverse-grade control system

2. Tractor Unit: Supply tractor unit that can push or propel vehicles, dumping directly into the finishing machine to obtain the desired lines and grades to eliminate any hand finishing. Equip the unit with a hitch sufficient to maintain contact between the hauling equipment's rear wheels and the finishing machine's pusher rollers while mixture is unloaded.

3. Screed: Provide a heated compacting screed that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements. Screed extensions must provide the same compacting action and heating as the main unit unless otherwise approved

4. Grade Reference: Provide a grade reference with enough support that the maximum deflection does not exceed 1/16 in. between supports. Ensure that the longitudinal controls can operate from any longitudinal grade reference including a string line, ski, mobile string line, or matching shoes. Furnish paver skis or mobile string line at least 40 ft. long unless otherwise approved

5. Material Transfer Devices: Ensure the devices provide a continuous, uniform mixture flow to the asphalt paver,

6. Remixing: When required, provide equipment that includes a pug mill, variable pitch augers, or variable diameter augers operating under a storage unit with a minimum capacity of 8 tons.

7. Motor Grader: When allowed, provide a self-propelled grader with a blade length of at least 12 ft. and a wheelbase of at least 16 ft.

8. Handheld Infrared Thermometer: Provide a handheld infrared thermometer meeting the requirements of Tex-244-F.

9. Straightedges and Templates: Furnish 10 ft. straightedges and other templates as required or approved.

10. Coring Equipment: When coring is required, provide equipment suitable to obtain a pavement specimen meeting the dimensions for testing.

11. Rollers:

a. Pneumatic Tire Rollers – Pneumatic tire rollers consist of rubber wheels on axels mounted in a frame with either a loading platform or body suitable for ballast loading. Arrange the rear tires to cover the gaps between adjacent tires of the forward group. Furnish rollers capable of forward and backward motion, Compact asphalt pavements and surface treatments with a roller equipped with smooth-tread tires. Compact without damaging the surface. When necessary, moisten the wheels with water or an approved asphalt release agent. Select and maintain the operating load and tire pressure within the range of the manufacturer's charts or tabulations to attain maximum compaction. Furnish the manufacturer's charts or tabulations showing the contact areas and contact pressures for the full range of loadings for the particular tires furnished. Maintain individual tire inflation pressures within 5 psi of each other. Provide uniform compression under all tires.

PART 3 - EXECUTION

3.1 INSPECTION

A. Proof-roll prepared subbase and base course surfaces to check for unstable areas and areas requiring additional compaction or which have become wet beyond acceptable limits. Do not begin paving work until deficient areas have been corrected and are ready to receive paving.

3.2 PRIME COAT

A. Conditions

1. Prime coat shall not be applied when the air temperature is below 60 degrees F and falling, but it may be applied when the temperature is above 50 degrees F and is rising; the air temperature being taken in the shade and away from artificial heat.

B. Preparation

1. Clean the surface by sweeping with a vacuum sweeper or other approved methods as directed by the Engineer

C. Application

1. Apply with an approved sprayer. Prime coat shall be applied at a rate not to exceed 0.20 gallons per square yard over compacted base material, smoothly and evenly, and shall be cured for 24 hours minimum. During the application of prime coat care shall be taken to prevent splattering of adjacent pavement, curbs, gutters or structures.

3.3 TACK COAT

A. Preparation

1. Clean the surface by sweeping with a vacuum sweeper or other approved methods as directed by the Engineer.

B. Application

1. Apply with an approved sprayer. Tack coat shall be applied at a rate not to exceed 0.10 gallons per square yard over the surface, smoothly and evenly. All contact surfaces of curbs and surfaces and all joints shall be painted with a thin uniform coat of the tack coat material. During the application of prime coat care shall be taken to prevent splattering of adjacent pavement, curbs, gutters or structures.

3.4 SURFACE COURSE

A. Conditions

1. The asphaltic mixture, when placed with a spreading and finishing machine, or the tack coat shall be placed when the air temperature is at least 50 degrees F.

2. The asphaltic mixture, when placed with a motor grader, shall not be placed when the air temperature is below 55 degrees F and is falling, but may be placed when the air temperature is above 45 degrees F and is rising.

3. The air temperature shall be taken in the shade and away from artificial heat.

4. If, after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture falls below 200 degrees F, it will be rejected.

B. The surface course shall be the thickness as shown on the drawings and spread in one lift. Spread the lift in such a manner that when compacted, the finished course will be smooth, of uniform density, and to section, line and grade as shown on the drawings. All surface course placement shall meet the requirements of TxDOT Item 300.

3.5 ROLLING

A. A Troxler nuclear density gauge shall be used to determine rolling pattern.

B. Begin rolling while pavement is still hot and as soon as it will bear the roller without undue displacement or hair cracking. To prevent adhesion of surface mixture to the roller, keep wheels properly moistened with water. Excessive use of water will not be permitted. Complete compaction before mix temperature cools to 185 degrees F.

C. Compress the surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing a minimum of 12 tons. Obtain subsequent compression by starting at the side and rolling longitudinally toward the center of the pavement, overlapping on successive trips by at least on-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until not further compression can be obtained and all rolling marks are eliminated.

D. Use a tandem roller for the final rolling. Double coverage with an approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

E. All rolling compaction shall be completed before the mixture temperature drops below 175 degrees F.

3.6 HAND TAMPING

A. Along walls, curbs, headers and similar structures, and in all locations not accessible to rollers, compact the mixture thoroughly with a vibrating plate compactor

3.7 DENSITY

A. Compact the surface course to the density between 91 and 95 percent of the maximum theoretical density as measured by TEX-227-F. If, during the construction, the results of density tests show that either the compacted base course, binder course or surface course has a density less than specified, an additional rolling with a 3-wheel or pneumatic roller will be required. Such a rolling shall be done before the mix cools if it is to be successful.

3.8 SURFACE TESTS

A. The Contractor shall conduct surface testing. The completed surface, when tested with a 10 foot straightedge laid parallel to the center line of the pavement, shall show no deviation in excess of 3/16 inch per foot from the nearest point of contact. The maximum ordinate measured from the face of the straightedge shall not exceed 1/4 inch at any point. Furnish approved templates for checking subgrade in finished sections. The strength and rigidity of templates shall be such that if a support is transferred to center, no deflection is excess of 1/8 inch will be observed.

3.9 CONSTRUCTION JOINTS

A. Place courses as nearly continuously as possible. Pass the roller over unprotected ends of the freshly laid mixture only when the mixture has become chilled. When work is resumed, cut back the laid material to produce a slightly beveled edge for the full thickness of the course. Remove old material which has been cut away and lay the new mix against the fresh cut.

3.10 DEFECTIVE PAVEMENT

A. Recompact pavement sections not meeting specified densities or replace them with new asphaltic concrete material. Replace with new material section of surface course pavement not meeting surface test requirements or having an unacceptable surface texture. Patch asphalt pavement sections in accordance with procedures established by the Asphalt Institute. Replace asphalt pavement sections which did not meet the specifications.

3.11 DEFICIENT SURFACE THICKNESS

A. Any area of asphalt surface found deficient in thickness by more than 0.25 inches, and if low and causing ponding, shall be removed and replaced, at the Contractor's expense, with asphalt surface of the thickness shown on the drawings. Care should be taken not to damage or remove the pavement below the asphalt surface. Should damage to the pavement below the asphalt surface occur, it shall also be removed and replaced at the Contractor's expense

B. No additional payment over the contract price will be made for any asphalt surface of a thickness exceeding that required by the drawings.

3.12 QUALITY CONTROL TESTING

A. Perform document and report the following quality control tests:

1. Bulk specific gravity tests of the in-place, compacted bituminous mixtures in accordance with TxDOT Test Method Tex-207-F, Part I.

2. For Type D mixture take three (3) cores for each 500 tons placed.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Curbs and gutters

2. Walks

B. Related Sections:

1. Section 014300 – Quality Assurance

2. Section 014500 – Quality Control

3. Section 033000 – Cast-In-Place Concrete

4. Section 310000 – Site Earthwork

5. Section 312313 – Subgrade Preparation

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 REFERENCES

A. Geotechnical Report

B. AASHTO: American Association of State Highway and Transportation Official, 444 N Capitol St. NW, Suite 249, Washington, DC 20001. All references are to current active publication.

1. AASHTO M182 – Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.

C. ACI: American Concrete Institute, 38800 Country Club Drive, Farmington Hills, Michigan 48331, USA. All references shall be to current active publication.

1. ACI 117 – Specification for Tolerances for Concrete Construction and Materials.

2. ACI 301 – Specifications for Structural Concrete.

3. ACI 306 – Guide to Cold Weather Concreting.

4. ACI 315 – Manual of Standard Practices for Detailing Reinforced Concrete Structures.

5. ACI 325 – Guide for Design of Jointed Concrete Pavements for Streets and Local Roads

6. ACI 330 – Guide for Design and Construction of Concrete Parking Lots.

D. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103, USA. All references shall be to current active standard.

1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

2. ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

3. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

4. ASTM C33 – Standard Specification for Concrete Aggregates.

5. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

6. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

7. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 – Standard Specification for Portland Cement.

9. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.

10. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

11. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

12. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

13. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

14. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

15. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Natural Pozzolan for Use in Concrete.

16. ASTM C873 – Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds.

17. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

18. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete.

19. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.

20. ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

21. ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.

22. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

23. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Reinforcement: Submit shop drawing for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of reinforcement. Include special reinforcement required at openings through concrete construction and locations of construction joints not indicated on the Drawings.

E. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.

3. Fiber reinforcement.

4. Admixtures.

5. Curing compounds.

6. Applied finish materials.

7. Bonding agent or epoxy adhesive.

8. Joint fillers.

F. Material Test Reports: For each of the following:

1. Aggregates.

G. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

1) Concrete mixture design.

2) Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

1) Contractor's superintendent.

2) Independent testing agency responsible for concrete design mixtures.

3) Concrete paving subcontractor.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities

1.8 DELIVERY, STORAGE AND HANDLING

A. All requirements for storage of materials, conveying, depositing, temperature for placing and protecting as specified under Section 033000 shall apply to the concrete work performed under this section.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

2. Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60, except Grade 40 permitted for No 3 and No 2 sizes.

B. Joint Dowel Bars: ASTM A615, Grade 60, unless otherwise noted. Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A775; with ASTM A615, Grade 60, plain-steel bars

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150, gray portland cement Type I/II. Supplement with the following:

2. Fly Ash: ASTM C618, Class F

3. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

B. Normal Weight Aggregates: ASTM C33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar paving application and service conditions using similar aggregates and cementitious materials. -

1. Maximum Coarse-Aggregate Size:

2. Paving: 1-1/2 inches nominal.

3. Curb and Sidewalk: 1 inch nominal.

4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement

C. Water: Potable and complying with ASTM C94.

D. Air-Entraining Admixture: ASTM C260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material:

1. Water-Reducing Admixture: ASTM C494, Type A.

2. Retarding Admixture: ASTM C494, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.

6. Plasticizing and Retarding Admixture: ASTM C1017, Type II

F. Color Pigment: ASTM C979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

2. ChemMasters.

3. Davis Colors.

4. Dayton Superior Corporation.

5. Elementis Pigments.

6. Hoover Color Corporation.

7. Lambert Corporation.

8. LANXESS Corporation.

9. QC Construction Products.

10. Scofield, L.M. Company.

11. Solomon Colors, Inc.

12. Stampcrete International, Ltd.

13. SureCrete Design Products.

14. Color: As selected by Architect from manufacturer's full range.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Axim Italcementi Group, Inc.; Caltexol CIMFILM.

2) BASF Construction Chemicals, LLC; Confilm.

3) ChemMasters; Spray-Film.

4) Conspec by Dayton Superior; Aquafilm.

5) Dayton Superior Corporation; Sure Film (J-74).

6) Edoco by Dayton Superior; BurkeFilm.

7) Euclid Chemical Company (The), an RPM company; Eucobar.

8) Kaufman Products, Inc.; VaporAid.

9) Lambert Corporation; LAMBCO Skin.

10) L&M Construction Chemicals, Inc.; E-CON.

11) Meadows, W. R., Inc.; EVAPRE.

12) Metalcrete Industries; Waterhold.

13) Nox-Crete Products Group; MONOFILM.

14) Sika Corporation, Inc.; SikaFilm.

15) SpecChem, LLC; Spec Film.

16) Symons by Dayton Superior; Finishing Aid.

17) TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.

18) Unitex; PRO-FILM.

2. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309. Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.

2) Burke by Edoco; Aqua Resin Cure.

3) ChemMasters; Safe-Cure Clear.

4) Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.

5) Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).

6) Euclid Chemical Company (The); Kurez DR VOX.

7) Kaufman Products, Inc.; Thinfilm 420.

8) Lambert Corporation; Aqua Kure-Clear.

9) L&M Construction Chemicals, Inc.; L&M Cure R.

10) Meadows, W. R., Inc.; 1100 Clear.

11) Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.

12) Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.

13) Tamms Industries, Inc.; Horncure WB 30.

14) Unitex; Hydro Cure 309.

15) US Mix Products Company; US Spec Maxcure Resin Clear.

2. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Anti-Hydro International, Inc.; A-H Curing Compound #2 WP WB.

2) ChemMasters; Safe-Cure 2000.

3) Conspec by Dayton Superior; [D.O.T. Resin Cure White] [DSSCC White Resin Cure].

4) Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).

5) Edoco by Dayton Superior; Resin Emulsion Cure V.O.C. (Type II).

6) Euclid Chemical Company (The), an RPM company; Kurez VOX White Pigmented.

7) Kaufman Products, Inc.; Thinfilm 450.

8) Lambert Corporation; AQUA KURE - WHITE.

9) L&M Construction Chemicals, Inc.; L&M CURE R-2.

10) Meadows, W. R., Inc.; 1100-WHITE SERIES.

11) SpecChem, LLC; PaveCure Rez White.

12) Symons by Dayton Superior; Resi-Chem White.

13) Vexcon Chemicals Inc.; Certi-Vex Enviocure White 100.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D1751 asphalt saturated cellulosic fiber in preformed sheets.

B. Slip Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) ChemMasters; Exposee.

2) Conspec by Dayton Superior; Delay S.

3) Dayton Superior Corporation; Sure Etch (J-73).

4) Edoco by Dayton Superior; True Etch Surface Retarder.

5) Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.

6) Kaufman Products, Inc.; Expose.

7) Meadows, W. R., Inc.; TOP-STOP.

8) Metalcrete Industries; Surftard.

9) Nox-Crete Products Group; CRETE-NOX TA.

10) Scofield, L. M. Company; LITHOTEX Top Surface Retarder.

11) Sika Corporation, Inc.; Rugasol-S.

12) SpecChem, LLC; Spec Etch.

13) TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.

14) Unitex; TOP-ETCH Surface Retarder.

15) Vexcon Chemicals Inc.; Certi-Vex Envioset.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

G. Joint Sealants: Acceptable sealants are:

1. SL2 Sealant, by Sonneborn

2. Sikaflex-1A, by Sika Corporation

3. Eucolastic 11, by Euclid Chemical Company

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days):

1) Concrete Pavement: 4,000 psi.

2) Concrete Sidewalk: 3,000 psi.

3) Concrete Curb and Gutter: 3,500 psi.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.

3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.

2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete as required for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Ground Granulated Blast-Furnace Slag: 50 percent.

3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATIN

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312313 – Subgrade Preparation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare subgrade as per Section 312313 – Subgrade Preparation.

B. Remove loose material from compacted subbase surface immediately before placing concrete/

C. Notify A/E a minimum of 24 hours prior to commencement of concreting operations.

D. Moisten base as required to minimize absorption of water from fresh concrete. Do not permit puddles of water to accumulate.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

2. Align joints in pavement, curb and sidewalks.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at maximum intervals of 50 feet unless otherwise indicated for curbs and sidewalks.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface. Joints are to be soft saw cut with an early entry saw, same day as pour. If not shown provide at approximately 4' intervals for walks and 10' intervals for paving unless otherwise indicated. Construct joints 1/4 of paving thickness unless otherwise indicated. Verify with A/E.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase, surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature,

provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Division 32 Section "Unit Paving".

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

1) Water.

2) Continuous water-fog spray.

3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.

2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch.

3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.

4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

5. Lateral Alignment and Spacing of Dowels: 1 inch.

6. Vertical Alignment of Dowels: 1/4 inch.

7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.

8. Joint Spacing: 3 inches.

9. Contraction Joint Depth: Plus 1/4 inch, no minus.

10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

2. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.

8. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 331000 – WATER UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing water mains, fittings and appurtenances from a point 5 feet outside building lines to the point of connection to an existing system. Refer to Division 22 Sections for continuation of water systems.

1.2 RELATED WORK

A. Related Work of Other Sections:

1. Section 033000 – Cast-In-Place Concrete
2. Section 310000 – Site Earthwork
3. Section 312313 – Subgrade Preparation
4. Section 315000 – Excavation Support and Protection

1.3 DEFINITIONS

A. Private Fire Service Main – That pipe and it appurtenances on private property that is between a source of water and the base of the system riser or between a source of water and the base elbow of private fire hydrants.

B. Public Water Main – A water supply pipe for public utilization controlled by public authority.

C. Water Supply System – All piping and components that convey potable water from the public water main to the points of usage.

1.4 REFERENCES

A. American National Standards Institute (ANSI) 1899 L Street, NW, 11th Floor, Washington, DC 20036

1. ANSI/NSF 61 – Drinking Water System Components - Health Effects

B. American Water Works Association (AWWA), 6666 West Quincy Avenue, Denver, Colorado 80235. All references are to currently active publication.

1. AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings for Water

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

4. AWWA C115/A21.15 – Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

5. AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water

6. AWWA C153/A21.53 – Ductile-Iron Compact Fittings for Water Service

7. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service

8. AWWA C502 – Standard for Dry-Barrel Fire Hydrants

9. AWWA C508 – Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS

10. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

11. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances

12. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

13. AWWA C800 – Underground Service Line Valves and Fittings

14. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

15. AWWA C901 – Polyethylene Pressure Pipe & Tubing, ½”-3” (13mm-76mm) For Water Service

16. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1,600 mm) for Water Distribution and Transmission

17. AWWA M23 – Manual: PVC Pipe - Design and Installation

C. American Society of Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pennsylvania 19103. All references shall be to current active standard.

1. ASTM A48 – Standard Specification for Gray Iron Castings.

2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

3. ASTM A536 – Standard Specification for Ductile Iron Castings.

4. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.

5. ASTM A746 – Standard Specification for Ductile Iron Gravity Sewer Pipe.
6. ASTM B88 – Standard Specification for Seamless Copper Water Tube
7. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
8. ASTM C150 – Standard Specification for Portland Cement.
9. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
10. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
11. ASTM D746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
12. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
13. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
14. ASTM D1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
15. ASTM D1599 – Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
16. ASTM D1784 – Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
17. ASTM D1785 – Standard Specification for Polyvinyl Chloride (PVC), Plastic Pipe, Schedules 40, 80, and 120
18. ASTM D2241 – Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
19. ASTM D2464 – Standard Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
20. ASTM D2467 – Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
21. ASTM D2564 – Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems

22. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

23. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

24. ASTM D3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

25. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

26. ASTM F402 – Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

27. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

28. ASTM F1290 – Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

29. ASTM F1473 – Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins

30. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe

31. ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

D. International Code Council

1. International Plumbing Code (IPC)

E. International Standards Organization (ISO)

1. ISO 13477 – Thermoplastics pipes for the conveyance of fluids -- Determination of resistance to rapid crack propagation (RCP) -- Small-scale steady-state test (S4 test)

2. ISO 9001 –Quality management systems -- Requirements

F. National Fire Protection Association (NFPA)

1. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances

2. NFPA 704 – Standard System for the Identification of the Hazards of Materials for Emergency Response

3. NFPA 1963 – Standard for Fire Hose Connections.

G. Texas State Department of Health Rules and Regulations for Public Water Systems, Adopted 1988

1. Para 337.204 – Water Sources.

2. Para 337.206 – Water Distribution.

H. Plastic Pipe Institute (PPI), 105 Decker Court, Suite 825 Irving TX, 75062

1. PPI TR-4 – PPI Listing of Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

I. Texas Commission on Environmental Quality (TCEQ)

J. Underwriters Laboratories (UL)

1. UL 194 – Standard for Gasketed Joints for Ductile-Iron Pipe and Fittings for Fire Protection Service

2. UL 246 – Hydrants for Fire-Protection Service

3. UL 262 – Gate Valves for Fire-Protection Service

4. UL 312 – Check Valves for Fire-Protection Service

5. UL 789 – Standard for Indicator Posts for Fire-Protection Service

K. Uni-Bell PVC Pipe Association (UBPPA)

1. UBPPA UNI-B-3 – Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

2. UBPPA UNI-B-8 – Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 Inch)

1.5 SUBMITTALS

A. Shop Drawings

1. Product Submittals

a. Pipe Materials, fittings, joints, valves and couplings.

b. Fire Hydrants.

c. Indicator posts.

d. Valve boxes.

2. Test Reports

a. Backfill density tests.

b. Bacteriological tests.

c. Hydrostatic tests.

B. Submit Record Documents (As Builts) locating actual horizontal and vertical location of installed piping, service connections, valves, and appurtenances.

C. Provide Owner with three (3) valve keys each for operating gate valves, both cast iron and brass.

1.6 DELIVERY STORAGE AND HANDLING

A. Delivery and Storage

1. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

B. Handling

1. Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Owner. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

2. Miscellaneous Plastic Pipe and Fittings

a. Handle Polyvinyl Chloride (PVC) pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

b. Storage facilities shall be classified and marked in accordance with NFPA 704.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials which come in contact with water, including but not limited to pipes, coatings, valves, water meters, fittings, gaskets, adhesives, and lubricants, shall be evaluated, tested and certified for conformance with ANSI/NSF 61.

2.2 PIPING

A. All pipes 4 inch to 12 inch shall meet the requirements of AWWA C900, Class 200, unless otherwise noted. Pipe shall be gasket bell end. Gasket shall be in conformance with ASTM F477. Integral bell shall be at least as strong as the pipe in conformance with ASTM D3139.

B. Ductile Iron Pipe

1. All ductile iron pipe shall be centrifugally cast with mechanical joints meeting the requirements of AWWA C151.A21.51.29

2. All pipe shall have an interior cement mortar lining applied in accordance with AWWA C104/A21.4. No asphaltic coating will be required on the interior cement mortar lining.

3. Exterior coating shall consist of a nominal 1 mil thick asphaltic material allied to the outside of the pipe as described in Section 51.8 of AWWA C151.

4. All rubber joint gaskets utilized on ductile iron pipe shall be in conformance with AWWA C111/A21.11.

2.3 FITTINGS

A. Fittings for AWWA C900 pipe shall comply with the requirements of AWWA C110 and AWWA C153, with a minimum pressure rating of 250 psi.

B. Fittings for ductile iron pipe shall meet the requirements of AWWA C111/A21.11.

2.4 JOINT RESTRAINT

A. Joint restraint system utilized for PVC C900 pipe shall meet the requirements of ASTM F1674.

B. Joint restraint system utilized for ductile pipe shall meet the requirements of UL 194.

2.5 VALVES

A. Valves shall be resilient-seated type meeting the requirements of AWWA C509. Valves for fire protection lines shall also be UL 262 compliant.

B. Valves shall be designated for installation in either a horizontal or vertical position as required.

C. The sealing mechanism shall consist of a replaceable rubber disc seat ring, internally reinforced with a concentric steel ring, molded separately from the disc. Said seat ring shall be secured to the disc with self-locking stainless steel screws and shall be so shaped as to prevent improper installation. Resilient material for seal shall be natural rubber.

D. All mechanical joint valves shall be supplied with glands, bolts, and gaskets. Bolts for mechanical joints shall be high strength low alloy steel meeting the requirements of AWWA C111.

E. Valve ends shall have either a flanged mechanical joint, hub-end, push-on joint (“Ring-Tite”), or any combination thereof.

F. All valves shall open clockwise SAWS REQUIREMENT.

G. Valves shall have a minimum 10 YEAR LIMITED WARRANTY from the manufacturer on materials and workmanship.

H. Resilient wedge valves shall be MUELLER SUPER SEAL Model 2360, or approved equal.

I. Automatic Air Release Valves shall be APCO Series 140C, or approved equal

J. Post indicator valves shall be UL listed in accordance with NFPA 24 and FM approved.

K. Double check valve assemblies shall be approved by the Foundation for Cross-Section Control and Hydraulic Research at the University of Southern California.

2.6 VALVE BOXES

A. Each valve box assembly shall be of cast-iron and shall consist of a base, top section and lid.

B. Valve boxes shall be of a single size with a nominal diameter of 6 inches.

C. The valve box lid shall be designed so that it will remain firmly seated in place when subjected to vehicular traffic.

D. The valve box assembly shall be of sufficient toughness and strength to withstand impact loads and shock resulting from vehicular traffic.

E. The valve box assembly shall be coated with a bituminous coating of either coal tar or asphaltic basic applied to all inside and outside surfaces.

F. The word “WATER” shall be cast on the lid.

2.7 DEBRIS CAPS

A. Provide SW Services (22223 N 16th Street, Phoenix, Arizona 85024, 1-800-462-2773) plastic debris caps, or approved equal, with blue handles in all new exterior water valve boxes.

2.8 FREESTANDING FIRE HYDRANTS

A. Fire hydrants shall comply with the requirements of AWWA Standard C502. The bronze used for valve seats, drain outlet, stems and all other hydrant components shall not contain more than 15 percent zinc or more than 2 percent aluminum.

B. Shut-off valves shall be of the compression type.

C. Main valve shall be circular with a minimum opening of 5 inches in diameter.

D. Inlet connection shall be an elbow with AWWA Standard bell designed for 6 inch mechanical joint, hub end, or “Ring-Tite” assembly as specified.

E. Bury length shall be as specified.

F. Hydrants shall have 2 hose nozzles and one pumper nozzle.

G. Nominal inside diameter shall be 2-1/2 inches for the hose nozzles and 4 inches for the pumper nozzle.

H. Hose nozzle and pumper nozzle threads shall be in conformance with NFPA 1963.

I. Nozzle gaskets are required and shall be of rubber composition.

J. Hydrants shall be open right (clockwise).

K. Stuffing box shall be O-ring seal type and bronze.

L. A lubrication chamber shall be provided, sealed top and bottom with O-rings, and filled with a noon-toxic lubricant which shall remain fluid through a temperature range of -60 degrees F to +150 degrees F. The design shall be such that the thrust collar and the threaded operating parts are automatically lubricated each time the hydrant is cycled. There shall be no less than two (2) O-rings separating the oil reservoir from the waterway and that portion of the stem contacting the O-rings shall be sleeved with bronze. An anti-friction device shall be in place above the collar to further minimize operating torque.

M. Hydrants shall be painted with a suitable primer and finished with a color determined by the Owner from the top of the hydrant to a point 24 inches below the centerline of the pumper nozzle.

N. Hydrants shall have at least one untapped drain opening. When the main valve is in the fully opened position, leakage through the drain opening shall be cause for rejection.

O. All gaskets shall be of rubber or Neoprene composition.

P. All fire hydrants having mechanical joint inlets shall be supplied with glands, bolts, and gaskets. Bolts shall be high strength low allow steel meeting the requirements of AWWA C111.

Q. Hydrants shall have non-rising stems.

R. Barrel shall have an inside diameter of not less than 7 inches. The wall thickness shall be in accordance with AWWA C502.

S. Hydrants shall be equipped with a breakable coupling on the barrel section and the stem. These couplings shall be at least two (2) inches above the finished grade line. The breakable coupling shall be so designed that in case of a traffic collision, the barrel safety flange and stem safety flange will break before any other part of the hydrant. The coupling shall be designed to allow the hydrant to rotate 360 degrees.

T. Valve stems shall have a diameter of 1-1/4” for hydrants up to and including 5’-0” bury. Hydrants with a bury of greater than 5’-0” shall have a stem diameter of not less than 1-3/8”.

U. Hydrants shall have a minimum 10 YEAR LIMITED WARRANTY from the manufacturer on materials and workmanship. Manufacturer repair and replacement parts must be used to maintain valid warranty.

V. Hydrants shall be MUELLER SUPER CENTURION 200, or approved equal.

W. Failure to comply with any of the above requirements is sufficient cause for rejection of proposed hydrant.

X. The Owner reserves the right to accept only those materials which are in FULL compliance with these specifications and are deemed most advantageous to its interests.

2.9 TAPPING SLEEVES

A. Tapping sleeves shall be JCM Industries 432 SS Tapping Sleeve, PowerSeal 3490AS or 3490MJSS, Ford Meter Box Company FTSS, or Dresser Style 610.

2.10 TRACER WIRE FOR NONMETALLIC PIPING

A. Tracer wire shall be minimum 12 gauge (AWG) single strand, insulated copper wire with high molecular weight polyethylene (HMWPE) insulation, specifically manufactured for direct burial applications.

B. Provide tracer wire in sufficient length to be continuous over each separate run of non-metallic pipe.

C. All spliced or repaired wire connections in the tracer wire system shall be made using approved connectors.

D. Tracer wire to have blue insulation.

2.11 WARNING TAPE

A. Detectable underground aluminum warning tape shall be minimum 3 inches wide, minimum 5 mils thick. Tape to be color coded according to American Public Works Association (APWA) Uniform Color Codes.

2.12 CONCRETE FOR THRUST BLOCKS

A. Concrete shall meet the requirements of ASTM C94, having a minimum 28 day compressive strength of 2,500 psi.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 feet above the top of pipe and has been properly compacted.

3.2 PREPARATION

A. Stake locations of fittings, fire hydrants and valves prior to installation for review by Engineer.

B. Prior to installation, remove foreign matter from within the valves and fire hydrants. Inspect the valves and fire hydrants in open and closed position to verify that parts are in satisfactory working condition.

3.3 PIPE INSTALLATION

A. Preparation:

1. Do not lay pipe in water, or when trench or weather is unsuitable to work. Keep water out of trench until jointing is complete and initial backfill is placed on top of pipe. When

work is not in progress, close ends of pipes and fittings securely so that no trench water, earth or other substance will enter pipes or fittings.

2. Remove fins and burrs from pipe and fittings.

3. Clean inside of pipe, fitting, valves, accessories, and maintain in a clean condition.

4. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves or any other water line material into trenched.

5. Before installation, inspect pipe for defects and tap with a light hammer to detect cracks. Replace sections of pipe found to be defective, damaged or unsound before or after laying.

B. Pipe Laying and Jointing

1. Water line shall be installed with 4 feet of cover.

2. Locate joints no closer than 9 feet from sanitary sewer cross-overs.

3. Piping bedding and backfill shall be as shown on the Drawings.

4. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.

5. Blocking or wedging between bells and spigots will not be permitted.

6. Lay bell and spigot pipe with the bell end pointing in the direction of laying.

7. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bell, joints, and couplings. Take up and relay pipe when grade or joint is disturbed after laying.

8. Install mechanical joints in accordance with manufacturer’s recommendations.

9. Do not exceed pipe manufacturer’s recommendations for deflections from straight line or grade as required by vertical curves, horizontal curves, or offsets. If alignment requires deflections in excess of these limitations, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within limits set or approved.

10. Anchor tees, bends and plugged, valved or capped ends of water lines with concrete thrust blocks as necessary and as shown on the Drawings. Place blocks so that the joints will be accessible for inspections and repair.

11. Where pipe ends are left for future connections, install valves, plugs or caps and thrust blocking as shown on the drawings.

C. Installation of Tracer Wire

1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe at minimum 10 foot intervals in such a manner that it will not be displaced during construction operations. Extend ends of tracer wire into valve boxes and anchor in place.

D. Installation of Detectable Warning Tape

1. Install detectable warning tape 12 inches below finished grade.

E. Connections to Existing Water Lines

1. Make connections to existing water line after approval is obtained from Owner and with a minimum interruption of service on the existing line.

2. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.

3. Underground piping is to be completely flushed before the connection is made to the downstream piping.

F. Installation of Ductile Iron Pipe

1. Install ductile iron pipe per the above requirements and AWWA C600.

G. Installation of PVC Pipe

1. Install pipe and fittings in accordance with the above requirements and UNI-B-3.

3.4 INSTALLATION OF VALVES AND HYDRANTS

A. Installation of Valves

1. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve and fitting installation and with the recommendations of the Appendix (“Installation, Operation, and Maintenance of Gate Valves”) to AWWA C500.

2. Set valves plumb and as detailed on the Drawings.

3. Center valve boxes on valves.

B. Installation of Fire Hydrants

1. Install hydrants in accordance with AWWA C600.

3.5 STERILIZATION

A. Sterilize each unit of completed distribution system with chlorine before acceptance for domestic operation. Use not less than 50 mg/liter chlorine to water. Flush lines thoroughly before introducing chlorinating materials. Introduce chlorinating material to the water lines in and distribution systems in an approved manner.

B. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 0.2 mg/liter chlorine to water.

3.6 FIELD QUALITY CONTROL TEXTING

A. Public Water Main Hydrostatic Test:

1. All testing to comply with TCEQ regulations.

2. Prior to completion of backfill, and while joints and fittings are still exposed, test new water lines hydrostatically. Conduct hydrostatic tests in presence of Owner’s Designated Representative. Provide pumps, gages, meters and other equipment necessary for performance of tests.

3. Test water lines at 200 psi.

4. Before applying pressure test, expel air from pipe by slowly filling each valved section of pipe with water and providing taps if necessary to expel trapped air.

5. Test water lines in lengths between valves or plugs of no more than 1,500 feet, unless otherwise directed by the Engineer.

6. Examine pipe, fittings and joints during testing.

7. Allowable leakage shall not exceed 11.65 gallons per inch of diameter per mile of pipe per 24 hours.

8. No joint leakage is allowed.

9. Minimum duration of testing for each section shall be 4 hours for new mains in excess of 1,000 linear feet and 1 hour for new mains less than 1,000 linear feet after the main has been brought up to test pressure.

10. Replace defective material with sound material and repeat test until satisfactorily completed and approved.

11. Repair observed or visible leaks at exposed joints, regardless of total leakage.

B. Water Supply System Hydrostatic Test

1. The tests shall be performed in compliance with IPC Sections 107 and 312.

2. Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested and proved tight under a water pressure not less than the working pressure of the system; or for piping systems other than plastic, by an air test of not less than 50psi. This pressure shall be held for not less than 15 minutes.

3. The water utilized for tests shall be obtained from a potable source of supply.

C. Private Fire Service Main Hydrostatic Test

1. All testing shall be in accordance with the requirements of NFPA 24.

2. Prior to completion of backfill, and while joints and fittings are still exposed, test new water lines hydrostatically. Conduct hydrostatic tests in presence of Owner's Designated Representative. Provide pumps, gages, meters and other equipment necessary for performance of tests.

3. All piping and attached appurtenances subject to system working pressure shall be hydrostatically tested at gauge pressure of 200 psi or 50 psi in excess of system working pressure, whichever is greater, and shall maintain that pressure at gauge pressure of +/-5 psi for 2 hours.

4. Acceptable test results shall be determined by indication of either a pressure loss less than gauge pressure of 5 psi or no visible leakage.

5. Where additional water is added to the system to maintain test pressure, the amount of water shall be measured and shall not exceed 0.057 gph/100 ft of pipe for 6" nominal pipe diameter and 0.076 gph/100 ft of pipe for 8" nominal pipe diameter

D. Bacteriological Tests:

1. After sterilizing and flushing mains, obtain services of an approved laboratory to gather representative samples and conduct bacteriological tests.

2. Tests shall meet requirements of Texas Department of Health and Texas Commission On Environmental Quality.

3. Make necessary correction, repeat sterilization and flushing procedures, and retest affected lines if test results are not acceptable.

4. Repeat this procedure until satisfactory test results are obtained.

5. No main shall be placed in service or accepted until water samples are approved by applicable regulatory agency.

3.7 CLEANUP

A. Upon completion of the installation of water lines and appurtenances, all debris and surplus materials resulting from the work shall be removed.

END OF SECTION 331000