

## Division 2 – Site Work

### Site Preparation

The Contractor will notify TTUS and call Texas Excavation Safety System (Dig TESS) 1-800-344-8377 or 811 at least 48 hours prior to start of work.

Geotechnical Surveys are to be directed by the project Design Professional. The Owners Representative shall witness all borings. Geotechnical services will be paid by the Owner.

Protect and maintain benchmarks and survey control points from disturbance during construction. If a benchmark or survey control point must be removed, establish a similar control using a Registered Professional Land Surveyor.

Remove obstructions, trees, shrubs, grass, and other vegetation for areas of new construction. Completely remove stumps, roots, obstructions, and debris in areas of new construction.

Except for topsoil to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

The TTUS shall retain an independent testing agency to conduct any contractually required tests. The TTUS shall pay for the original tests. Areas that do not meet contract document test requirements shall be tested again until specifications are met. The Contractor will be responsible for all cost related to re-testing and bringing the work up to contract standards.

Fill depressions caused during site preparation and demolition with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density specified by the Design Professional.

The Design Professional shall specify placement of fill and backfill for construction.

The Design Professional shall specify compaction requirements based on the geotechnical survey report.

### Site Demolition

Before beginning any demolition work, the Contractor shall carefully survey the existing conditions and examine the Drawings and Specifications to determine the extent of the work. The Contractor shall notify the appropriate utility owner and the Owner's Representative of his intent to remove any utility services. The Contractor shall take all necessary precautions to insure against damage to existing conditions to remain in place. Any damage to such work shall be repaired or replaced as approved by the Design Professional and Owners Representative at no additional cost. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing,  
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protection and supports, as required. The Contractor shall be responsible for ensuring the structural integrity of existing structures as required as a result of any cutting, removal or demolition work performed under any part of this contract. The extent of demolition work is to be shown on the Contract Drawings. Coordinate with the Project Manager to determine any salvaged items to be turned over to the TTUS and clearly indicate these in the project drawings and specifications.

Use saw cutting methods for removal of tunnel or vault walls, floors or roofs. Do not use impact hammers for tunnel or vault removal near tunnel sections to remain. Use saw cutting methods for removal of concrete curbs and paving.

During demolition operations and the removal of debris, ensure minimum interference with roadways, walks, and adjacent occupied or used facilities. Do not close or obstruct roadways, walks or other occupied or used facilities without permission from the Owner's Representative and Architect. Provide alternate routes around closed or obstructed traffic ways if required by the Architect, Owner, or governing regulations. Where pedestrian and driver safety are endangered, the Contractor shall provide sufficient safety precautions.

Existing utilities are to remain in service and protected against damage during demolition operations. If existing utilities are to be interrupted, notify the Architect and Owners Representative at least 72 hours in advance. All interruptions must be approved by TTUS.

### **Tree Protection**

Prevent unnecessary damage and mitigate the effects of construction to trees located within the construction zone. Prevent direct root damage, indirect root damage, and trunk and crown disturbances. Prevent soil compaction of critical root zone as defined as that area directly beneath the drip line of the tree canopy. Vehicles, equipment and materials shall not be parked or stored in the critical root zone of trees to remain. Provide tree preservation fencing around all existing trees to remain. All tree limb and root pruning shall be done at the discretion of the Grounds Maintenance Department or a certified arborist.

If existing trees are destroyed, killed or badly damaged as a result of construction operations, Contract sum will be reduced by the amount of assessed damages. Damages will be evaluated by Grounds Maintenance, using International Shade Tree Conference Standards and following formula: measurement of a cross section of tree trunk will be made at a point 2 feet above existing grade level to determine cross section area in square inches. Assessment for damage will be \$32.00 per square inch.

### **Excavation, Trenching, and Backfilling for Utilities**

The Contractor shall call Texas Excavation Safety System (Dig TESS) 1-800-344-8377 or 811 at least 48 hours prior to start of work. The Contractor is responsible for locating and protecting all utilities including the utility tunnels. Utilities shown on the Drawings are based on the available information.

The Contractor shall maintain utility service to the existing buildings throughout construction. Any utility interruption must be approved by and coordinated with the utility Owner and TTUS.

Tests shall be performed by an independent laboratory selected by the Owner. Only passing tests shall be paid for by the Owner. Test results shall be submitted to the Design Professional for review.

All trenches 12 inches or wider, as measured at the top, that are within roadways, or roadway right-of-ways, parking areas, and areas to be paved shall be tested for conformance to compaction requirements as specified. These trenches shall be backfilled and compacted to their full depth or to bottom of concrete T-cap. Tests shall be made every 100 feet along the pipeline, or a minimum of one test, and to 4 foot vertical intervals throughout the backfill. Tests taken in 4 foot intervals shall be staggered. Contractor shall maintain a record drawing profile of all depth trench testing. Compaction in other areas shall not be less than 90% of the Standard Proctor Test ASTM D 698. Tests in other areas shall be one test every 500 feet within the upper 4 feet of fill.

The Design Professional shall specify backfill requirements based on geotechnical surveys.

The Contractor shall perform all excavation to the depths shown on the Drawings or as specified. During excavation, materials suitable for backfilling shall be piled a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides and cave-ins. Excavated materials not suitable or required for fill or back-fill shall be removed from the site. All excavation shall be made by open cut. No tunneling shall be done unless shown on the Drawings.

All excavations are to be performed in strict accordance with OSHA Regulations. Before commencing any trench excavation that will exceed a depth of five feet, Contractor shall provide to Texas Tech a copy of any geotechnical investigations used for preparation of detailed Drawings and Specifications regarding the safety systems to be utilized. The Contractor shall submit a trenching plan that is approved and sealed by a professional engineer registered in the State of Texas and employed by the Contractor. Said engineer cannot be anyone who is employed on this Project by Texas Tech. Receipt of the plan is a prerequisite to the start of trenching. It is the Contractor's responsibility to comply with any additional requirements resulting from any pre-bid conference relating to coordination of geotechnical investigation subjects.

Minimum cover requirements to top of pipe or insulation for utilities:

- |                             |           |
|-----------------------------|-----------|
| a. Low pressure gas ounces  | 36 inches |
| b. High pressure gas pounds | 46 inches |
| c. Alarm systems            | 42 inches |
| d. Security systems         | 42 inches |
| e. Domestic water           | 36 inches |
| f. Irrigation mains         | 24 inches |
| g. Irrigation laterals      | 18 inches |

h. Communication	42 inches
i. Electrical primary voltage	42 inches including concrete cap
j. Electrical secondary voltage (less than 600 volts)	36 inches
k. Direct bury steam/condensate return	36 inches
l. Air	36 inches
m. Chilled water	36 inches
n. Reverse osmosis (R-O) water	36 inches
o. Fire Protection Main	36 Inches

For underground piping, specify bright colored continuously printed plastic ribbon tape. Ribbon shall be not less than six (6) inches wide by minimum four (4) mil thick, and shall be manufactured for direct burial service. Warning tape for utilities should be 12 to 16 inches below grade.

Provide a minimum of 12 gauge tracer wire for all below grade non-metallic piping systems. Metallic warning tape shall not be considered equivalent.

Refer to TTU Operating Policies and Procedure 61.11 "*Underground Trenching of Utilities*" for more specifics.

Grounds Maintenance shall be contacted prior to excavation any time pavement or concrete is to be removed.

### **Erosion, Sedimentation and Dust Control**

The Contractor shall establish, construct and maintain erosion and sediment control measures. Siltation control devices shall be installed in the locations shown in the Storm Water Pollution Prevention Plan (SWPPP) before construction begins. The erosion control structures shall be maintained until permanent ground cover is established. The Contractor with the advice and consultation of the Design Professional shall endeavor to stop all sediment and erosion to a level of effort acceptable to the Owner and Design Professional.

The Contractor shall exercise precautionary measures to minimize dust emissions which will include, but shall not be limited to, periodic sprinkling or wetting of the site. The Contractor has the option of using a dust palliative.

### **Storm Water Pollution Prevention Plan (SWPPP)**

The Texas Tech Storm Water Pollution Prevention Program requires preparation of a Storm Water Pollution Prevention Plan (SW3P) for any project that causes a disturbance of soil on any campus of the Texas Tech University System. The plan will incorporate measures in response to and ensure compliance with the terms of the Texas Pollution Discharge Elimination System (TPDES) General Permit for Storm Discharges from Construction Activities.

Texas Tech recognizes the construction Contractor as the Operator having day-to-day operational control of those activities at the project site which are necessary to ensure compliance with a SW3P. Texas Tech will provide the construction Contractor with a complete and comprehensive SW3P.

The Contractor shall implement, maintain, and keep current the SW3P. The Contractor shall comply with the Texas Commission for Environmental Quality (TCEQ) General Permit and submit to TCEQ 48 hours prior to commencement of soil disturbing work a TCEQ Notice of Intent (NOI) to obtain permit coverage. Display the NOI and the Construction Site Notice with appropriate information at the prime outside site entrance to the construction site and provide a copy of the NOI to the appropriate Municipal Separate Storm Sewer System (MS4) operator. Replace the NOI with the approved TCEQ permit when received. Prior to commencement of construction activities provide Texas Tech copies of the NOI and Construction Site Notice and provide a copy of the permit, when received.

The Contractor shall, at all times, keep a copy of the SW3P, the Construction Site Notice, the NOI, and/or the Permit at the job site. The Contractor shall update the SW3P as necessary to reflect current and changing site conditions and keep maintenance logs, inspection reports, and records related to compliance with the SW3P.

The Contractor shall conduct inspections as required by TCEQ General Permit and the SW3P, and maintain inspection records at the job site

The Contractor shall submit a Notice of Change (NOC) to TCEQ when required.

Upon completion of all soil disturbing activities at the site and establishing a uniform perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on the unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures, the Contractor shall notify Texas Tech that it intends to file with TCEQ a Notice of Termination (NOT) and provide to Texas Tech a copy of the proposed NOT. When approved by Texas Tech, the Contractor shall submit the NOT to TCEQ and provide a copy Texas Tech.

Provide copies or originals of all records including the SW3P, NOI, Permit, NOT, Construction Site Notice, inspection reports, maintenance logs and records to Texas Tech.

Refer to TTU Operating Policies and Procedure 60.07 "*Storm Water Compliance Program*" for more specifics.

## **Termite Treatments**

Effective preconstruction treatment for subterranean termite prevention requires the establishment of complete vertical and horizontal chemical barriers or approved physical barriers between wood in the structure and the termite colonies in the soil. Provide a continuous soil treatment zone under all new construction. Coordinate soil treatment application with excavating, grading, and concrete placement

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for footings, grade beams, and slabs. Treat soil under footings, grade beams, and slabs. The treatment must be applied prior to the vapor barrier being installed.

For Horizontal Chemical Barriers, applications shall be made using a low pressure spray after grading is completed and prior to the pouring of the slab or footing to provide thorough and continuous coverage of the area being treated.

For Vertical Chemical Barriers, establish vertical barriers in areas such as around the base of foundations, plumbing lines, backfilled soil against foundation walls and other areas, which may warrant more than just a horizontal barrier.

Provide and EPA-Registered termiticide.

Toxicant shall be applied per manufacturer's label. Provide Owner with a Soil Treatment Application Report. Do not apply when weather conditions favor drift from treated area.

Applicator of soil treatment shall be a State of Texas licensed pest control operator in the Termite Category for a minimum of five (5) years.

Toxicant shall not be injurious to plant life and shall be accepted by the Environmental Protection Agency and State authorities having jurisdiction, including TCEQ.

Warrant building and equipment to be free from infestation by subterranean termites for a period of five (5) years from Date of Substantial Completion. Should infestation occur, provide additional treatment as required, and repair or replace damaged building or equipment to its original condition and re-implement termite control at no cost to TTUS.

## **Utility Services**

All buried valves and fittings shall be thoroughly wrapped prior to installation with a polyethylene material meeting the requirements of ASTM D1248. The polyethylene material shall have a minimum thickness of 8 mils. The wrap shall be secured by 2-inch duct tape.

Concrete shall be used for thrust blocking the pipe and fittings and shall conform to the concrete standards as set forth in Division 3 Cast-In-Place Concrete. The blocking shall be poured against solid undisturbed ground or engineered fill. A minimum compressive strength of 3,000 psi will be acceptable.

The Contractor shall disinfect all potable pipe lines before being placed in service. The lines shall be disinfected by using a chlorinating agent in accordance with the requirements of AWWA C651 and the most current edition of the international Plumbing Code Section 610.1. The Contractor shall notify the Architect and Owner's Representative 72 hours in advance of disinfection so that the Architect and Owner's Representative may witness the disinfection activities. After disinfection has been completed

and the pipe is flushed, the Contractor shall perform a bacteriological test. Samples shall be taken after the pipeline disinfection treatment has been flushed. A minimum of two sets of samples taken 24 hours apart shall be tested and shall include one sample for every 1000 feet of water line plus sample sets at the end of each pipeline branch. If acceptable bacteriological test results are not received, the Contractor shall disinfect the pipe again and provide whatever measures necessary to achieve an acceptable result. Acceptable results shall be the bacteriological requirements for potable water as defined by the Texas Commission on Environmental Quality. Chlorine tablets are not acceptable for disinfecting procedures. Super chlorination (over 200 ppm) is not allowed unless approved by TTUS.

## **Asphalt Paving**

The asphalt paving should be specified, constructed, and tested to meet the following requirements:

1. Hot Mix Asphaltic Concrete Pavement – Texas Department of Transportation (TxDOT) Item 340, Type C or D, most current specification. Mixing and Placing practices by the Asphalt Institute in their publication, MS-22, “Principles of Construction of Hot-Mix Asphalt Pavements, current edition.
2. Hot Mix Asphaltic Concrete Base – TxDOT Item 340, most current specification,
3. Flexible Base Material – TxDOT Item 247, most current specification.

Design mix should be specified based on Performance Grade (PG) specification for asphalt binder grades used in hot mix asphalt (HMA) for the Lubbock area and approved by TTU Grounds Maintenance. All asphalt shall be a Performance Grade PG64-28 or better. For parking lots, a minimum of PG64-28 Type D asphalt will be specified. For roadways Specify Type C asphalt and the Performance Grade will be specified by the Design Professional with approval from the FP&C Design Team and TTU Grounds Maintenance.

If seal coating is specified, for parking lot seal coating, a minimum of TxDOT Tier 2 (medium traffic) will be specified, and for roadways seal coating, TxDot Tier 1 (heavy traffic) will be specified.

The thickness of the pavement section elements shall be recommended by the geotechnical consultant based on soil conditions and anticipated traffic loadings. The thickness of HMA surface shall be a minimum of (2) inches.

Specify to furnish and provide all the submittals, labor, materials and equipment necessary to deliver, place and compact Hot-Mix Asphalt Concrete (HMAC) pavement including prime coat and tack coats as shown and detailed on the Drawings.

Materials, parameters and methods shall be in basic conformance with the TxDot “Standard Specifications for Construction of Highways, Streets and Bridges,” latest edition and applicable ASTM standards.

Submit the Job-Mix Formula and mix design reports and laboratory test results for Base Course and Surface Course mixtures.

Submit the Aggregate gradation test reports for coarse and fine aggregates used for Base Course and Surface Course mixtures.

Submit the TxDot Mixing Plant certification documentation.

Coarse aggregate material to be sound, angular crushed stone complying with ASTM D692.

Fine aggregate material shall comply with ASTM D1073.

HMAC materials shall be hauled in trucks previously cleaned of all dirt and foreign material with the load completely covered.

HMAC materials shall be delivered so that HMAC can be placed and rolled during daylight hours.

Verify that the subgrade is dry and in suitable condition to support paving and imposed loads. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course. Ensure that prepared subgrade is ready to receive paving.

The Owner may engage a qualified independent testing agency to perform field inspections and tests, and to prepare test reports. When such testing indicates that Contractor's work does not comply with the specified requirements, additional testing shall be performed by the Owner's testing agency at no additional cost to the Owner to determine compliance of corrected Work with the specified requirements. Owner's material testing lab sampling at asphalt mixing plants outside of Lubbock County will be paid for by the Contractor.

### **Concrete Paving**

All concrete products shall be designed, formed, transported, placed, tested, and finished in strict accordance with the American Society for Testing and Materials (ASTM) and the American Concrete Institute's (ACI) requirements.

Batch design mix will be specified by the Design Professional. Manufacturer's batching mixture and reinforcement certificate (when applicable) must be approved by the Design Professional and Owner's Representative prior to installation.

Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities. Delivery tickets shall be furnished with each  
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load of concrete delivered to the project. Ticket shall show class and strength of concrete, number of pounds of cement, size of coarse aggregate, batching time, slump ordered and amount of admixture. Indicate amounts of mix water to be withheld for later addition at project site.

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

Provide fiber mesh concrete sidewalks to the following criteria:

1. Compressive Strength: 4000 psi.
2. Slump: 3 to 5 inches.
3. Air Entrained: 5.0 percent maximum. ( $\pm 1\%$ )

Provide concrete paving with steel reinforcement for roadways to the following criteria:

1. Compressive Strength: Per Design Professional
2. Slump: Per Design Professional.
3. Air Entrained: Per Design Professional
4. Steel Reinforcement per Design Professional's specification.

Provide concrete finishing to the following criteria:

1. Concrete Paving: Heavy broom finish.
2. Sidewalk Paving: Light broom, radius to 3/8 inch radius, and trowel joint edges.
3. Direction of Texturing: Transverse to direction of traffic.
4. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions. Provide additional curing methods in harsh weather as directed by the Architect.

Pedestrian walkways will be provided on the campus in a variety of scales depending upon their location and use requirements. Major pedestrian walkways shall be between fourteen feet and twenty feet in width. Minor pedestrian walkways will be between eight feet and twelve feet in width.

Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173,

- volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  6. Compression Test Specimens: ASTM C 31; cast, mold and cure one set of four standard 6"X12" test cylinder specimens or five 4"X8" test cylinder specimens for each composite sample.
  7. Compressive-Strength Tests: ASTM C 39; for 6"X12" cylinders test one cured specimens at 7 days for information only and two at 28 days to average compressive strength. Hold one sample for re-testing if required. For 4"X 8" cylinders test one cured specimens at 7 days for information only and three at 28 days to average compressive strength. Hold one sample for re-testing if required.
    - a. A compressive-strength test shall be the average of the strengths of at least two 6"X12" cylinders or at least three 4"X8" cylinders made from the same sample of concreted and tested at 28 days.
  8. Testing specimens are to be taken after all admixtures and/or field added water has been added and incorporated into concrete.

Defer joint filling until concrete has cured and per sealant manufacturers recommendations.

## **Pavement Markings**

Paint shall be yellow, except fire lane marking shall be red, traffic paint conforming to requirements in TxDOT specification Item 666, Type II.

The minimum wet film thickness for all painted areas shall be 15 mils. After sealer dries, apply paint in stripes equally spaced, straight and of uniform 4" width.

Allow bituminous pavement to cure for at least 21 days before paint is applied. Pavement shall be thoroughly clean and entirely free of loose sand, stones, dust, oil, grease, water, and other substances that will be deleterious to the paint or will adversely affect the adhesion of the paint. Do not apply paint during high wind (over 15 miles per hour) or high humidity (over 70 percent). Apply paint only when ambient temperature is 40 degrees F or above and rising but not more than 95 degrees F. Apply paint to a wet film thickness of 0.015 inch (15 mils) by means of conventional traffic line striping equipment. Traffic shall not be permitted to use the painted areas for a minimum of 30 minutes after painting of lines has been completed.

## Truncated Tile

Furnish truncated warning surface tile and install as indicated on drawings or specified.

ADA-C truncated cast in place tiles manufactured by Armor-Tile or approved equal. Tiles shall be Colonial Red in color.

## Concrete Curb and Gutters

All concrete products shall be designed, formed, transported, placed, tested, and finished in strict accordance with the American Society for Testing and Materials (ASTM) and the American Concrete Institute's (ACI) requirements.

Concrete and the equipment, workmanship and materials thereof, shall conform to applicable requirements of Division 3 of the contract specifications, except as hereinafter specified.

Concrete shall be standard-weight fiber mesh with minimum compressive strength of 4000 PSI at 28 days. Concrete shall have a slump of not more than 3 inches.

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

Expansion joint filler material shall be asphalt-impregnated fiber strips 1/2" thick unless otherwise shown on drawings, Celotex "Fexcell" or equal, and shall be cut and shaped to the cross section of the curb, gutter and combination curb and gutter. Expansion joints shall be provided at ends of all returns and shall be provided directly opposite expansion joints of abutting concrete pavement and shall be of same type and thickness as joints in the pavement. Where curb and combination curb and gutter do not abut concrete pavement, expansion joints at least 1/2" in width shall be provided at intervals not exceeding 100'-0" unless the Drawings indicate joints at closer intervals. Expansion joints in gutter sections shall be sealed using same material as used for concrete paving.

Contraction joints shall be constructed by means of 1/8" thick separators, or a section conforming to cross section of the curb and combination curb and gutter. Contraction joints shall be constructed directly opposite contraction joints in abutting concrete pavement. Where curb, and combination curb and gutter, do not butt concrete pavements, contraction joints shall be so placed the monolithic sections between curb returns will not be less than 5'-0" nor greater than 15'-0" in length, generally 10'-0" is acceptable. Separator shall be removed as soon as practicable after the concrete has set sufficiently to preserve width and shape of joint. After separator plates have been removed, all exposed edges of joints shall be rounded with proper edging tool to a radius of 1/4". Contraction joints may also be formed with a jointing tool after surface is finished to a minimum depth of 3/4".

Edges of gutter and top of curb shall be rounded with an edging tool to a radius of 1/4", and surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. The floated surfaces shall then be brushed with longitudinal strokes, using a fine-hair brush. Immediately after removing front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. While still wet, the surface shall be brushed in same manner as gutter and curb top. Top surface of gutter shall be finished to grade with a wood float. Except at grade changes or curbs, finished surfaces shall not vary, from testing edge of a 10-foot straight-edge, more than 1/8" for gutter and 1/4" for top and face of curb. Irregularities exceeding the above shall be satisfactorily corrected. Visible surfaces and edges shall be free of blemishes and form and tool marks, and shall be uniform in color, shape and appearance.

### **Trench Drain Covers**

Trench drains shall be the EJIW solid trench drain cover V7500 Series rated for vehicular travel. Trench drain covers shall be flush with the adjacent walking surface to not create a trip hazard.

### **Bollards**

If quick release bollards are specified, they shall be the Gorilla Post system. Bollards shall be 48"X7" diameter Gorilla Post Quick Release Bollard with white reflective stripes and black base.

If steel bollards set in concrete are specified, follow the TTU Grounds standard details. 6" or 8" steel bollards will be specified for transformers, generators, and various in ground equipment. Bollards will be set three feet below grade in 4,000 psi concrete with fiber and will extend to three feet above grade. Bollards will be constructed from Sch 40 steel pipe and be painted or powder coated TTU Bronze. Bollards will have a rounded steel cap welded in place with one layer of 2" wide white reflective tape.

### **Brick Pavers**

A mock up may be requested by the owner to demonstrate selections, aesthetics, and installation execution.

Do not use frozen materials or build on frozen subgrade or setting beds. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry. For Mortar and Grout, comply with cold and hot weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

Brick pavers to be 2 1/4" X 4" X 8" dense hard clay and manufactured by Kansas Brick and Tile Co or ACME Brick. Pavers to be equal to ACME Onyx Garden Paver (black) 0909161 and ACME Inca Red Garden Paver 0909091. Colors are to be blended one to one red solid and charcoal (black).

Graded Aggregate for base is to be sound, crushed stone or gravel. Sand for leveling course is to be sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate. Sand for joints is to be fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, ensuring that moisture content remains constant and density is loose and uniform until pavers are set and compacted. Treat leveling course with herbicide to inhibit growth of grass and weeds. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500 to 5000-lbf compaction force at 80 to 90 Hz. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

### **Porous Unit Paving (Concrete Grid Pavers)**

A mock up may be requested by the owner to demonstrate selections, aesthetics, and installation execution.

Concrete brick pavers to be Pavestone Grasstone II, 3 1/8" X 23 5/8" X 15 3/4" made from normal-weight aggregates complying with ASTM C 1319. Colors to be selected by Design Professional.

Graded aggregate for base course to be sound crushed stone or gravel. Sand for leveling course to be sound, sharp, washed, natural sand or crushed stone complying with requirements in ASTM C 33 for fine aggregate.

Soil for porous paving fill to be planting soil mix complying with requirements in Division 2 Section "Lawns and Grasses." Grass seed to comply with requirements in Division 2 Section "Lawns and Grasses."

Do not exceed 1/16-inch offset from flush in plane variation between adjacent Units (Lipping). Do not exceed 1/8" in 24" and 1/4" in 10 feet or a maximum of 1/2" in variation from level or indicated slope. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches. Place aggregate base, compact to 95 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated. Place leveling course and screed to a thickness of 1/2-inch, ensuring that moisture content remains constant and density is loose and constant until pavers are set and compacted.

Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- minimum and 1/8-inch- maximum joint width. Align pavers with string line. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. After filling pavers with soil, sow seed at half the rate specified for seeding lawns. Sweep seed from surfaces of pavers into voids and water with fine spray. Spread an additional 3/16 inch of soil fill over seed and soak with water. Contractor is to water newly planted grass and keep moist until grass is established.

### **Site Furnishings**

Steel benches shall be 6' Reading Series with back and armrest as manufactured by Keystone Ridge Designs or Victor Stanley. Benches shall be of steel construction with powder coat finish in a color to be selected by Texas Tech.

Steel picnic tables shall be as manufactured by Keystone Ridge Designs or Victor Stanley. Carousel tables and solstice umbrella shall be of steel construction with powder coat finish in a color to be selected by Texas Tech.

Steel trash receptacles shall be 30 gallon 25" X 33" top opening Scarborough Litter Receptacle. Trash receptacles shall be of steel construction with bronze colored powder coated finish.

Steel bicycle racks shall be provided adjacent to side or rear entrances of the building(s) in areas that are not visually obtrusive. Bicycle racks shall be of all steel construction with a powder-coated finish. Type and color to be selected by Texas Tech. Bicycle racks shall be manufactured by the TTU Grounds Maintenance Department.

Bollards to be located in the Historic and Moderate Historic Districts of the campus shall be of a traditional design and shall be constructed of a colored cast stone. In the HSC/Research District and the Museum District, bollard materials may be cast stone, concrete, or GFRC.

All products shall be covered against material and workmanship defects for three years from date of substantial completion.

## Irrigation Systems

Please reference the Texas Tech Office of Grounds Maintenance's Irrigation Systems Specification 32 84 00.

The sprinkler system shall use the most current models of Hunter sprinkler heads and Hunter ICV Series electric valves. Controller shall be Rainmaster Evolution DX with remote communications device. Any substitution request shall be submitted with samples, catalog sheets, and specifications to the Texas Tech Office of Grounds Maintenance no later than two weeks prior to bid date.

Valve boxes for electric, manual, and gate valves shall be 18-inch diameter, 24-inch depth and shall have corrugated galvanized steel sides with cast iron tops and lids.

Controller shall be enclosed in an 18-gauge Jet Coat cold rolled steel cabinet with a powder-coated polyurethane finish suitable for wall or pedestal mounting.

The main supply lines shall be Class 200 PVC pipe approved with Schedule-40 PVC fittings approved for potable water systems. All fittings 6 inches and larger, ring-tite pipe shall conform to commercial standard CS-256-63 and be furnished with ring-tite joints. The ring-tite joint shall be an integral part of the pipe with thickened wall at the bell. All pipe and couplings shall be joined by means of rubber ring gaskets. The lateral water lines shall be Class 200 PVC pipe approved for potable water systems. All PVC pipe shall conform to commercial standard CS-256-63 and be furnished with solvent weld joints. Concrete thrust blocks are required at all turns, dead-ends, etc., on pipe sizes 3 inches and above in diameter and on pipe of smaller size, if so directed by the University Representative so that pipe will not be forced out of slip joints of fittings as a result of internal water pressure and/or expansion and contraction.

Provide reduced pressure backflow preventer meeting City, County, State and Federal requirements. Backflow assemblies shall be tested upon installation by a recognized Backflow Prevention Assembly tester and certified to be operational within specifications. A copy of the test report shall be submitted to the Owner with the completed as-built drawings. A copy of the test report shall be submitted to the City of Lubbock.

Ground or common wire shall be No. 12, white, Type UF Copper direct bury type made for the irrigation industry. Power wire for operation of equipment shall be No. 14, red, Type UF copper direct bury type made for the irrigation industry. Wiring shall be taped together at ten (10) foot intervals. Wiring shall be coiled at fifty (50) feet intervals. An electrical wiring plan shall be included with the As Built drawings.

The Contractor shall be a current Texas-licensed Landscape Irrigator who has completed irrigation systems similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

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The Contractor is responsible for providing the line tap and meter or tie-in to University irrigation mains. Meter location or irrigation well tie-ins are indicated on the drawings. The meter size shall be as required to supply the irrigation system with adequate water volume and pressure. Water meter may be obtained from the City of Lubbock or from local authority having jurisdiction for placement on the Texas Tech University Campus at no additional charge.

Do not commence installation of underground irrigation system until equipment has been submitted and approved by the Texas Tech Office of Grounds Maintenance. A Licensed Irrigator or a Licensed Irrigation Technician employed by the irrigator shall be on the jobsite daily for direct supervision of employees on design, installation, maintenance or repair of the irrigation system including the connection of such system to the water supply.

Before installation is started, the Contractor shall place a flag where each and every sprinkler is to be located in accordance with the plans and the flagging shall be approved in writing by the Texas Tech Office of Grounds Maintenance before installation is started. Sprinkler heads and quick couplers shall be located 12 inches from any adjacent hard surface such as curbs, sidewalks, or buildings.

Contractor shall work in harmony with the University. Watering of plants and lawns shall be accomplished in conformity with the intent of the sprinkler system design. Contractor will not be allowed any extra compensation for any extra sprinklers, pipe, fittings, labor, etc., that may be necessary to accomplish full coverage due to any shifting of trees, plants and shrubs from the location on the plan for aesthetic reasons.

No machine trenching is to be done within the drip line of trees. Trenching shall be accomplished by hand, by tunneling, or by boring under the root system by a method approved beforehand by the Texas Tech Office of Grounds Maintenance. It is understood that the piping layout drawing is diagrammatic, and that piping will be routed around trees and shrubs in such a manner as to avoid damaging plant materials. Where roots are encountered, no root over  $\frac{3}{4}$  inches in diameter shall be cut without approval by the Texas Tech Office of Grounds Maintenance. Any cuts shall be clean, without frayed ends. Any roots encountered that are 2 inches and greater shall be tunneled under.

In situations where trenching within the drip line of a tree is approved by Texas Tech Office of Grounds Maintenance, the initial cut of the side of the trench closest to the tree shall be made with a rock saw, to create a minimum 2 inch wide cut to the required depth; the remainder of the trench can then be excavated normally.

Trenching shall be to a depth to insure that main lines have 24 inch cover and the lateral lines have 18 inch cover. All trench backfill shall be flooded in order to prevent settling. All settling and low areas that occur within the first twelve (12) months will be the responsibility of the Contractor to fill and level. All trenches shall be examined by the Texas Tech Office of Grounds Maintenance before backfilling. All trenches shall be backfilled with the material removed except where special backfill specifications of



certain pipe may specify otherwise. In this case, the special backfill specifications shall take precedence over this general specification. All trench backfill shall be flooded in order to prevent after settling. All settling and low areas that occur within the first twelve (12) months will be the responsibility of the Contractor to fill and level.

It is understood that piping layout is diagrammatic and piping shall be routed around trees and shrubs in such manner as to avoid damage to plantings.

Provide drip irrigation near buildings and hardscape areas. Provide a sand filter for systems containing drip irrigation.

Provide 7 days written notice in advance of system start up and demonstration.

Before final acceptance of the installed system, the Contractor shall make the following tests under the supervision of the Texas Tech Office of Grounds Maintenance.

1. Perform hydrostatic test of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work. Cap and subject the piping system to a static water pressure of 50 psi above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand 4 hours. Leaks or a loss of more than 4 psi in test pressure constitute defects that must be repaired.
2. Each section of sprinklers shall be tested for coverage. Tests shall be made by actual measurement of the radius of spray of sprinklers.
3. Each section of sprinklers shall be tested for operating pressure at the sprinkler heads.

All tests shall be completed prior to backfilling. However, sufficient backfill material may be placed in trenches between fittings to insure the stability of the line under pressure. In all cases, fittings and couplings must be opened to visual inspection for a full period of the test.

Provide two additional sprinkler heads of each type, two adjustment wrenches, two controller cabinet keys, and two cover lifting devices for valve boxes to Owner. Provide record drawings, two copies of product data cut sheets, and operating and maintenance instructions to Owner.

Contractor is to provide a minimum one-year warranty on all products and workmanship and one-year of maintenance on the system.

## **Landscaping**

Provide 6 inches of topsoil and fine grading of areas to receive seed and 18 inches of topsoil with organic material incorporated for all planting beds. Perform Heavy aeration or disking of the sub soil to break up hard pan before adding new top soil.

Topsoil shall be fertile agricultural soil, typical of the locality capable of sustaining plant growth and taken from a drained site, free of subsoil, rocks larger than 2 inches. Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil. Soil amendment shall include a minimum of 6 cubic yards compost per 1000 square feet of bed area and 10 pounds of pre-plant fertilizer (15-12-13). 8-12 Agriform tablets shall be applied to all tree planting pits.

Provide seeding for all lawn areas as a base price unless owner recommends areas for lawn sod. Provide trees, shrubs, groundcovers, vines, perennials, organic mulch and any miscellaneous landscape material such as weed control fabric or stone mulch as noted on plans.

Lawn seed shall be fresh, clean and a new crop seed mixture labeled in accordance with the Federal Seed Act. Sod shall be viable certified turf grass without thatch, disease, nematodes, insects and weeds. Bermuda seed and sod shall be typical of grass used on the Texas Tech campus. Contractor is to provide Initial maintenance of all lawn areas and planting beds until final acceptance.

Contractor is to provide a one-year full replacement warranty of all plant materials.

Provide concrete splash block at downspouts along building perimeters inside planter beds and sodded areas where not discharging onto a concrete or asphalt surface.

No more than 10% of the project landscape area shall utilize decomposed granite (DG) as a finish material. The areas that will have DG shall be broken into sub-areas in some fashion. All DG solutions shall be approved by the VC of FP&C. DG shall not be used as an infill between small plantings such as native grasses, shrubs, etc. All landscape architects and architects must indicate the percentage of DG coverage in SD, DD, and CD sets of drawings.

## **Lawns and Grasses**

Seed is to be delivered in original sealed, labeled, and undamaged containers. If sod is required, harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. May 15th to August 31<sup>st</sup> for Bermuda seeding.
2. Overseeding – Annual Rye Grass
  - a. If Bermuda seeding cannot be established by September 15, lawn areas are to be

over-seeded with annual rye grass at a rate of 4-lbs/1,000sf. If this is required, the Contractor shall maintain the annual grass lawn, as needed, including, but not limited to irrigation and, mowing to maintain a maximum height of 3", and edging, as required.

- b. This annual rye grass maintenance shall be considered as a separate item from the 90-day maintenance period specified for the seeded Bermuda grass.
- c. The Contractor shall apply a minimum of two applications of Roundup herbicide to the annual rye grass in early spring in preparation for Bermuda grass seeding. The two applications should be separated by a period of 10-14 days and Contractor should notify the Landscape Architect of the schedule of Roundup application.
- d. After sufficient annual grass kill has been verified by the Landscape Architect, lawn areas should be tilled to a depth of 2"-3" prior to seeding the Bermuda grass as specified.

Begin maintenance immediately after each area is planted and continue until acceptable lawn is established but not for less than 60 days from date of Substantial Completion.

Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Bermuda grass (*Cynodon dactylon*) (Note: Celebration Bermuda is only available as sod).
2. Annual Ryegrass (*Lolium multiflorum*).

Turfgrass Sod Species to be Tiftonio Bermudagrass (*Cynodon dactylon*) "Tifton 10".

Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones  $\frac{3}{4}$  inch or larger in any dimension or other extraneous materials harmful to plant growth.

1. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
  - a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from playa lake areas.

## **Exterior Plants**

The landscape installer must be qualified with three years previous experience of size and scope commensurate with this project and whose work has resulted in successful establishment of exterior plants.

Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock" and any additional comments listed on the plans.

Landscape Architect may observe trees and shrubs at place of growth, supplier, or approved remote site before planting for compliance with requirements for genus, species, variety, size, and quality.

Landscape Architect retains the right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site and supply acceptable material at no additional cost.

1. Notify Landscape Architect of sources of planting materials fourteen days in advance of delivery to site.

Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches for roots tip-to-tip.

Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of exterior plants stored on-site with a fine mist spray. Water as often as necessary to maintain root systems in a moist condition.

Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: February 1 to June 15.
2. Fall Planting: September 1 to October 31.

For trees and shrubs, maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

1. Maintenance Period: Six months from date of Substantial Completion. Remove all tree staking from trees one year from Substantial Completion.

For ground cover and plants, maintain for the following maintenance period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings:

1. Maintenance Period: Six months from date of Substantial Completion

Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.

1. Warranty Period for Trees and Shrubs: One year from date of Substantial Completion.
2. Warranty Period for Ground Cover and Plants: One year from date of Substantial Completion.
3. Remove dead exterior plants as directed by Landscape Architect. Replace immediately unless required to plant in the succeeding planting season.
4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
5. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

All trees, shrubs, grasses, mulch, and all compost shall be manufactured within 500 miles of the project site from materials that have been extracted, harvested, or recovered, as well as manufactured within, 500 miles.

#### Planting Bed Establishment

1. Loosen subgrade of planting beds to a minimum depth of 12 inches. Remove stones larger than  $\frac{3}{4}$  inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - a. Apply fertilizer directly to subgrade before loosening.
  - b. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    1. Delay mixing fertilizer with planting soil if planting will not proceed within five days.
  - c. Spread planting soil mix to specified depths, but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen muddy, or excessively wet.
    1. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.
2. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
3. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

### Tree and Shrub Planting

1. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
  - a. Remove burlap and wire baskets from tops of root balls and partially form sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - b. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
2. Set balled and potted and container-grown stock plum and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
  - a. Carefully remove root ball from container without damaging root ball or plant.
  - b. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
3. Set fabric bag-grown stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
  - a. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - b. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pickets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
4. Organic Mulching: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 6 inches of trunks or stems.
5. Wrap trees of 2-inch caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half of width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping.

### Tree and Shrub Pruning

1. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.
2. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

## Fertilizer

Slow-Release Fertilizer: Granular or pellet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

## Mulches

Non-Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: 4" depth Fairland Pink, available from Collier Materials, Inc., 201 CR 121, Marble Falls, Texas 78654, 877.603.3030.
2. Type: 4" depth ¼" minus decomposed granite gravel, available from Collier Materials, Inc., 201 CR 121, Marble Falls, Texas 78654, 877.603.3030.

Mulch backfilled surfaces of planting beds and other areas indicated.

1. Apply 4-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

## Stakes and Guys

Stakes and guys shall be the ROOT ANCHOR™ underground tree staking system from Tree Stake Solutions. You can find their product at <http://www.treestakesolutions.com/>.