PART 1 GENERAL

1.1 SUMMARY

A. The work of this section includes, but is not limited to:

1. Preparation of Compacted Gravel Base Course and Subbase.
2. Stabilized Decomposed Granite.
3. Clean-up.

B. RELATED SECTIONS

1. The following items of related work are specified and included in other Sections of the Specifications:
   a. Section 31 20 00 Earth Moving
   b. Section 32 92 00 Lawn
   c. Section 32 93 00 Planting and Fine Grading.

1.2 ACTION SUBMITTALS

A. Product Information: Provide for each element of construction listed.

1. Decomposed Granite Aggregate. Provide sieve analysis using the specified sieve sizes. Include small bag color sample "ring" of manufacturer's standard colors.
2. Stabilizer

B. Samples for initial selection: Provide for each element of construction listed.

1. Decomposed Granite, one 3-lb bag. Provide up to five colors in 3-lb bags minimum.
2. Stabilizer, one 1-quart bag.

C. Samples for verification: Provide for each element of construction listed.

1. Decomposed Granite, final color mix and including stabilizer: 5 lb bag.
2. Provide sieve analysis to stabilizer manufacturer for the following purposes:
   a. Stabilizer manufacturer shall confirm that the gradation (sieve analysis) of crushed granite is acceptable for use with the stabilizer.
      1) If decomposed granite sample mix is not acceptable to the stabilizer manufacturer, resubmit additional decomposed granite samples until final mix is approved.
   b. Stabilizer manufacturer shall confirm the mix ratio of stabilizer to decomposed granite.

D. Qualification Data: In addition to requirements of Section 013323 "Submittal Procedures", provide installer's number of years of experience, and a minimum of three project references.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates.

1. Provide certification that the ratio of stabilizer to decomposed granite is acceptable to both the stabilizer manufacturer and the decomposed granite manufacturer.

2. Provide certification that the stabilizer manufacturer approves the decomposed granite particle size as compatible with the stabilizer product.

B. Manufacturer's Instructions: Provide for the following

1. Stabilizer, include instruction for blending with decomposed granite.

2. Stabilized Decomposed Granite.

a. Include maintenance instructions

C. Manufacturer's Field Reports: Provided by decomposed granite manufacturer.

D. CQC Accessibility Inspection Report for Walking Surfaces and Accessible Route: Provide at the following stages of Construction

1. Base course.

2. Following curing / hardening of the decomposed granite pavement.

1.4 QUALITY ASSURANCE

A. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section. Minimum years of experience with decomposed granite pavement: 5.

B. Pre-installation conference: A pre-installation conference with the Contracting Officer is required for the work of this Section.

C. Mockups: An independent mockup shall be constructed for the work of this Section.

1. Decomposed Granite Pavement, including 6' wide x 6' long and to the depths shown on the Drawings, using the selected sample materials.

a. Before mixing sample panel, confirm with stabilizer supplier that mix ratio specified is suitable for obtaining a stable, well-drained surface.

b. The Contracting Officer will check the performance of the material at one and two week intervals to determine if mix is hardening correctly. Coordinate schedule so that the mockup is performed at least nine weeks prior to beginning the final work.

c. The mockup shall demonstrate the method of hydrating the decomposed granite to be used in the final Work.

D. Manufacturer's Representative: A representative from the decomposed granite manufacturer shall be on-site during mockup and installation activities.

E. Testing: Perform gradation of crushed granite in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Coarse particles.

F. Stabilizer shall not be applied during, prior to, or immediately following rainfall or when the temperature is 40 degrees Fahrenheit and falling. Inclement weather and cold to freezing temperatures will cause an unsatisfactory installation.

G. Decomposed Granite Pavement shall meet the requirements of the Americans with Disabilities Act (ADA).

1.5 ACCEPTANCE

A. Finished surface of decomposed granite shall be smooth, uniform and solid. There shall be no evidence of chipping or cracking. Dried, cured, compacted installation shall be firm throughout profile with no spongy areas. Loose material shall not be present on the surface initially. Any significant irregularities in the surface shall be repaired to the uniformity of the entire installation.

1.6 DEMONSTRATION AND TRAINING

A. Provide demonstration and training to the Government in the method for repairing Decomposed Granite Surface. Demonstrate method on the sample panel after the panel has been accepted and the Work has been installed.

1.7 WARRANTY

A. Submit a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Premature wear and tear, provided the material is maintained in accordance with manufacturer's written maintenance instructions.
2. Improper drainage.
3. Failure of system to meet performance requirements.

B. Warranty Period: One Year from the date of Final Acceptance. Contractor shall provide warranty for the performance of the product.

C. Contractor shall provide, for a period of sixty days following substantial completion, unconditional maintenance and repairs of the stabilized surfacing as required.

PART 2 PRODUCTS

2.1 COMPACTED SUBGRADE AND GRAVEL BASE COURSE

A. Compacted subgrade and crushed base course shall conform to Section 31 20 00 "Earth Moving".

2.2 DECOMPOSED GRANITE PAVEMENT

A. Aggregate stone for decomposed granite paving shall conform to the following:

1. Clean, hard, durable particles or fragments of select crushed granite stone. Fines shall be evenly mixed throughout the aggregate. When produced from gravel, 50 percent, by weight, of the material retained on a No.4 sieve shall have one fractured face.

2. The portion retained on the No.4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96-77.

3. The portion passing a No.40 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81 and AASHTO T90-81, respectively.

4. Size shall be No. 4 to No.200 crushed granite screenings conforming to the following crushed stone sieve analysis for percentage of weight passing a square mesh sieve, ASTM C 136 – Method for Sieve Analysis for Fine and Course:

Sieve Designation	Range of % Passing
No. 3/8”	100%
No. 4	95 – 100%
No. 8	75 – 80%
No. 16	55 – 65 %
No. 30	40 – 50%
No. 50	25 – 35%
No. 100	15 – 20%
No. 200	10 – 15%

5. The crushed aggregate screenings shall be free from clay lumps, vegetable matter and deleterious material.

6. Manufacturers:
   a. Kafka Granite LLC, 101 S. Weber Ave., Stratford, WI 54484 USA, Telephone: 800.852.7415, www.kafkagranite.com
   b. Earthworks Inc., 4287 N. Hwy 51, Perryville, MO, Tel: 573.547.9097, www.ewgroupinc.com
   c. Or approved equal.

7. Color: A custom blend of standard colors in the tan / warm gray area of the color spectrum, determined by the Submittal process.

B. Stabilizer binder for paving shall conform to the following:

1. Binder shall be a natural, non-toxic, non-staining, environmentally safe, organic binder that is a colorless, odorless concentrated powder specifically manufactured to bind crushed granite or crushed aggregate. The powder shall be of a size that not more than 10% is retained on a U.S. Standard #40 mesh sieve.

2. Provide Organic-Lock by Envirobond Products Corp, Tel: 866-636-8476, www.envirobond.com or approved equal.
   a. Stabilizer shall be factory-mixed with the aggregate stone.

C. Mix Ratio: The estimated ratio for crushed granite pavement shall be approximately 35 lbs of stabilizer per ton of compacted aggregate screenings.

1. Mix ratio is approximate. The final mix ratio shall be determined by the stabilizer supplier by testing the specific granite approved for use on this project.

D. Contractor's Extra Stock: The Contractor shall hold an amount equivalent to 10% of the surface area in reserve to use for repairs prior to Final Acceptance or during the warranty period. The amount remaining shall become the Contractor's property at the termination of the warranty period.

PART 3 EXECUTION

3.1 EXAMINATION AND COORDINATION

A. The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contracting Officer in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, subgrades, previous work, and conditions.

B. Coordinate installation of decomposed granite with the Contracting Officer's approval of related items, including soil placement, irrigation, tree planting and bench installation.

3.2 COORDINATION

A. Coordinate installation of the Decomposed Granite Pavement with the installation of Bench Type 1B and Bench Type 3.

3.3 COMPACTED SUBGRADE AND GRAVEL BASE COURSE

A. Install compacted subgrade and aggregate base course in conformance with Section 31 20 00 "Earth Moving".

B. Gravel base course shall be installed parallel with the proposed finish grade and shall provide for a consistent thickness of decomposed granite to achieve the proposed finish grade.

3.4 DECOMPOSED GRANITE PAVEMENT

A. Pre-hydration of stabilized decomposed granite: Thoroughly mix stabilized decomposed granite with water in a drum vessel or equivalent in compliance with the manufacturer's instructions. Moisture content shall be 14%. Placing of dry stabilized decomposed granite and water with hoses, sprinklers or other such devices shall not be allowed.

B. Place the stabilized decomposed granite on prepared aggregate base and rake smooth using a steel tine rake to desired grade and cross section.

1. Do not install deeper than 3 inches in one lift, and install in equal lifts. Each lift shall be compacted separately.

C. Compaction: Roll each lift with a 1 ton hydrostatically driven tandem walk behind roller, making several passes.

1. Do not compact until moisture content of installed material is approved by the Manufacturer's Representative.

2. In areas where access with a roller is not possible, thoroughly tamp with a 8-10” hand tamper. Areas include the immediate (+/-12”) vicinity of the benches and the multistem trees.

D. After completion do not allow traffic of any kind on the finished surface course until it is completely dried through. Curing period is dependent on weather conditions. The Contractor shall expect a period up to four weeks, depending on weather conditions. The stabilized crushed stone paving must completely dry out one time before it can be put into service.

3.5 REPAIRS

A. Loose gravel on the surface, or unconsolidated crushed aggregate screenings below the surface, is evidence of improper bonding due to poor mixing or insufficient watering. Test the loose material for adequate stabilizer by wetting, then tamping, and allowing it to dry. If the material is still unconsolidated, stabilizer did not get mixed adequately throughout the crushed aggregate screenings. If the material is now solid, initial watering was insufficient.

1. Repair: Excavate damaged area to the full depth of the stabilized decomposed granite and square off sidewalls. If area is dry, moisten damaged portion lightly. Re-install the stabilized decomposed granite pavement in conformance with the specification.

B. Any significant irregularities shall be smoothed out prior to final acceptance of work. Smoothing shall be accomplished by rewetting/saturating rough areas thoroughly, and then rolling the paving again with a 1000 lbs, powered walk-behind roller.

C. Maintenance before Final Acceptance: Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed. Any plowing program required during winter months shall involve the use of a rubber baffle on the plow blade or wheels on the plow that lifts the blade 1/4" off the paving surface.

1. If cracking occurs, sweep fines into the cracks, water thoroughly and hand tamp with an 8” – 10” hand tamp plate. Repair only during weather conditions suitable for the original installation.

2. The Contractor shall monitor the site during the maintenance period and redistribute loose material, water thoroughly to a depth of 1” and re-compact with a 1000 lbs, powered walk-behind roller.

3.6 WASTE MANAGEMENT

A. Separate and dispose of waste in accordance with the Project’s Waste Management Plan.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work of this Section includes, but is not limited to, the following:

1. Stabilized flexible gravel paving system at pedestrian and vehicular areas (G1 and G2 Pavement Types).

B. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 12 93 00 – Site Furnishings
2. Section 31 20 00 – Earthwork
3. Section 31 05 16 – Aggregates for Earthwork
4. Section 32 13 13.13 – Exposed Aggregate Concrete Paving
5. Section 32 91 00 – Planting Soil System
6. Section 33 46 10 – Landscape Underdrainage

1.3 REFERENCES

A. Standards: The following referenced standards and standard specifications, referred to thereafter by designation only, form a part of this Section:

1. American Society for Testing and Materials (ASTM)
   (a) ASTM F 1951-08 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
   (b) ASTM D 638-10 Standard Test Method for Tensile Properties of Plastics
   (c) ASTM C 33 Standard Specification for Concrete Aggregates
2. AASHTO: American Associations of Highway Transportation Officials.
3. Standard Specifications shall mean the State of Arkansas Department of Transportation, latest edition.

1.4 SUBMITTALS

A. General: Refer to and comply with Division 1 Section 01 33 00 “Submittal Procedures”, for procedures and additional submittal criteria.

B. Product Data: Submit proposed sources of supply and material technical data, including the following:

1. For interlocking plastic cell Porous Flexible Paving Units
   (a) Submit test reports and descriptive data for paving units as manufactured, for each type and finish, and to confirm material composition and compliance with specification criteria.
2. For Setting/Installation Materials:
   (a) Submit material certification and analysis report for each type setting bed material components. Include, sand, aggregates, and decorative gravel.
   (b) Submit material certification and analysis report for setting/leveling course aggregate material and for each open graded stone for sub-base course material.
   (c) Submit for each accessory material item including fitting hardware, fastening devices, fillers, etc.

C. Samples for Initial Selection:

1. Plastic Interlocking Cell Paving Units: Manufacturer's color consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.
   (a) Submit two (2) 12” x 12” (min) samples of interlocking plastic cell paving units.
2. Decorative Gravel: Submit three (3) 1-gallon samples showing the range of colors available satisfying the material requirements.
3. Brick Chips: Submit three (3) 1-gallon samples showing the range of colors available satisfying the material requirements.
4. Glass Aggregate: Submit three (1) 1-gallon samples for each color indicated showing the range of colors available satisfying the material requirements.

D. Installation Instructions: Manufacturer’s printed installation instructions. Include methods for maintaining installed products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect paving units, aggregate, and other system components against soiling or contamination from earth and other materials during storage and construction.

B. Store products in manufacturer’s unopened packaging until ready for installation.

C. Protect units from damage during delivery and store rolls upright, under tarp, to protect from sunlight, when time for delivery to installation exceeds one week.

D. Handling: Protect materials during handling and installation to prevent damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas, including concrete walks is completed.

C. Install flexible porous paving units when ambient air temperatures is at least 55 degrees F (13 degrees C).

D. Do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.

E. Protect partially completed paving against damage from other construction traffic when work is in progress. Do not drive, park on, or use flexible porous paving system until system has been properly anchored and fully filled with gravel aggregate fill.

PART 2 PRODUCTS

2.1 POROUS FLEXIBLE PAVING UNITS

A. Source Limitations for Porous Flexible Paving System:

1. Vehicular Rated: Injection molded interlocking plastic cell paving units are specified to be manufactured by CORE Systems, P.O. Box 1545, Comox, BC Canada V9M 8A2 (Phone: 250.871.6840) as a “Basis of Design.”
   (a) Model: Core Gravel 60-40 HDR
   (b) Panel Size: 45.3” x 39.4” (1150mm x 1000mm)
   (c) Cell Size: 2.4” x 1.6”.
   (d) Cell Depth: 1.6 in. (40mm)
   (e) Cell Wall Thickness: 0.1” (2.5mm)
   (f) Loading Capacity: 62,000 lbs (filled)
2. Pedestrian Rated: Injection molded interlocking plastic cell paving units are specified to be manufactured by CORE Systems, P.O. Box 1545, Comox, BC Canada V9M 8A2 (Phone: 250.871.6840) as a “Basis of Design.”
   (a) Model: Core Gravel 50-35
   (b) Panel Size: 45.3” x 30.7” (1150mm x 1000mm)
   (c) Cell Size: 2.0” x 1.6”.
   (d) Cell Depth: 1.6 in. (40mm)
   (e) Cell Wall Thickness: 0.09” (2.3mm)
   (f) Loading Capacity: 51,200 lbs (filled)
3. Geotextile fabric backing injection molded to the grid system (50-35 only).
4. Color Uniformity: Uniform color throughout all unit rolls, UV stabilized.
5. Wheelchair Access testing for ADA Compliance: Passing ASTM F1951.

2.2 SYSTEM MATERIALS

A. Base Course / Setting Bed: Dense Graded Aggregate from local sources conforming to the following sieve analysis and requirements:

U.S. Sieve Size	% Passing Minimum	% Passing Maximum
1.5 inch	100	--
1 inch	85	100
1/2 inch	50	75
No. 8	20	45
10	45	55
40	25	35
200	0	3

B. Decorative Gravel Fill: Clean, washed, be sharp and angular (not rounded) decorative gravel. Maximum Size of stone: 3/16" to 3/8" (5 mm to 10 mm) and uniform in size - not graded.

1. Color: as selected by Landscape Architect.

PART 3 COLOR: AS INDICATED ON DRAWINGS. EXECUTION

3.1 INSPECTION

A. Examine subgrade and base course installed conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.

B. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Architect for resolution.

3.2 PREPARATION

A. Subgrade Preparation:

1. Prepare subgrade as specified in Section 32 10 00 - Earthwork. Verify subgrade in accordance with porous paving system manufacturer's instructions.
2. Excavate area allowing for unit thickness, the engineered base depth (where required), and 0.5 inch (1.25 cm) for 0.25 inch (6mm) gravel overfill and slight recession to contain gravel.
3. Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
4. Ensure in-place soil is relatively dry and free from standing water.
5. Uniformly grade base.
6. Level and clear base of large objects, such as rocks and pieces of wood.

B. Base Preparation:

1. Install Base as specified in Section 31 20 00 – Earthwork. Verify engineered base is installed in accordance with porous paving system manufacturer's instructions.

2. Coordinate base installation and preparation with subdrainage as indicated on the Drawings and per the requirements of Section 33 46 10 – Landscape Underdrains.

3. Place engineered base in lifts not to exceed 6 inches (150 mm), compacting each lift separately to 95 percent Modified Proctor.

4. For installation of 60-40 paving system, leave 2 inches (50 mm) of depth below final grade for porous paver unit (40mm) and overfill of gravel aggregate (10mm).

3.3 INSTALLATION

A. Install interlocking plastic cell paving units by placing units with rings facing up/fabric below, and using interlocking connectors provided along each edge to maintain proper spacing and interlock the units. Tops of rings shall be flush with the surface of adjacent hard surfaced pavements.

B. Place first row of panels against a stationary edge if possible. Stagger panels in a bricklayer pattern.

C. Install gravel into rings by hand, spread by hand with flat shovels and/or stiff bristle brooms.

D. Smooth surface of gravel to cover planting interlocking panels by 0.4” (1cm) minimum. Use a vibratory plate or small lawn roller to set gravel into cells and complete installation.

3.4 PROTECTION

A. Prohibit traffic on the flexible porous paving system until installation is completed. Any traffic on the unfilled or un-anchored system is a safety risk and subject to irreparable damage to the product.

3.5 FIELD QUALITY CONTROL

A. Remove and replace segments of plastic interlocking paving units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.

B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

3.6 MAINTENANCE

A. Keep area free of and remove organic material such as soil runoff, tree leaves, fruit, and other vegetation debris.

B. Broom or rake gravel smooth to no more than 6mm (0.25”) above the rings.

C. Refill areas with gravel aggregate where walls of the rings are more than 3mm (0.125”) exposed.

D. When snow removal is required, keep a metal edged plow blade a minimum of (0.1") above the gravel surface during plowing operations to avoid causing damage to the plastic interlocking paving units, use a plow blade with a flexible rubber edge or use a plow blade with skids on the lower outside corners set so the plow blade does not come in contact with the units.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

A. General provisions of Contract, including General and Supplementary Conditions and Division 1 General Requirements, apply to work specified in this Section.

1.2 SUMMARY OF WORK

A. The work of this Section consists of all paving and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to the following:

1. Preparation of a concrete base course.
2. Exposed aggregate concrete produced by exposing the coarse aggregate of a gap graded concrete mix.
3. Detectable Warning Plates.

B. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 31 20 00 – Earthwork.
2. Section 32 14 40 – Stone Paving
3. Section 32 16 13.43 – Stone Curbs
4. Section 32 91 00 – Planting Soil System.
5. Section 32 92 00 – Lawns.
6. Section 32 93 00 – Planting and Fine Grading.

1.3 REFERENCES AND STANDARDS

A. General: The following referenced standards and standard specifications, referred to thereafter by designation only, form a part of this Section. Materials and methods of construction shall comply with the following standards:

1. Standard Specifications: shall mean the State of Arkansas Department of Transportation, Standard Specifications for Road and Bridge Construction (latest edition), and addenda.
2. In the case of conflict between the Standard Specifications and the requirements of this Section, the more stringent requirements shall apply.

B. All standards shall include the latest additions and amendments as of the date of advertisement for bids. For each type of packaged material required for the Work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized approved laboratory made in strict compliance with the standards and procedures of the following:

1. American Association of State Highway and Transportation Officials (AASHTO).

2. American Concrete Institute (ACI)

3. American National Standards Institute (ANSI).

4. American Society for Testing and Materials (ASTM)
   (a) ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field
   (b) ASTM C33 - Specification for Concrete Aggregates
   (c) ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens
   (d) ASTM C42 -Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   (e) ASTM C94 - Specification for Ready-Mixed Concrete
   (f) ASTM C143 - Test Method for Slump of Hydraulic Cement Concrete
   (g) ASTM C150 - Specification for Portland Cement
   (h) ASTM C172 - Practice for Sampling Freshly Mixed Concrete
   (i) ASTM C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
   (j) ASTM C260 - Specification for Air-Entraining Admixtures for Concrete
   (k) ASTM C494 - Specification for Chemical Admixtures for Concrete
   (l) ASTM D994 - Specification for Preformed Expansion Joint Filler for Concrete

5. Concrete Reinforcing Steel Institute (CRSI)

6. Portland Cement Association (PCA).

1.4 SUBMITTALS

A. Comply with Division 01 requirements.

B. Qualifications: Candidate Contractor shall submit at least three project references including project address, dollar value, owner's and Landscape Architect's contact information (name, phone, and email).

1. Exposed Aggregate Paving Contractor shall have at least 10 years' experience installing exposed aggregate concrete pavements.

C. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements. Work includes but is not limited to:

1. Concrete Products.

2. Aggregates.

3. Form materials and forming accessories.

4. Admixtures.

5. Patching Compounds.

6. Chemical Surface Retarders.

7. Curing compound.
8. Sealants.
9. Bond Breaker Material.
10. Expansion Joint Material.
11. Detectable Warning Plates.
12. Liquid Nail Adhesive.

D. Manufacturer's color charts showing full range of colors available.
1. Detectable Warning Plates.

E. Samples: Prior to ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each material listed below showing full range of color variation, finish and texture that can be expected in the permanent work:
1. Exposed Aggregate Concrete Paving, Stone Mix, duplicate 1 gallon bag.
2. Bond Breaker Material, 12” square.
3. Expansion Joint Material, 6” length.
4. Chemical Surface Retarder: 1 gallon as packaged by manufacturer
5. Sealant: 1 gallon as packaged by manufacturer.
6. Detectable Warning Plates: Two (2) plate samples minimum 6”x6” of the kind proposed for use.

F. Concrete Mix Design: Submit certified mix designs at least three weeks prior to the beginning of work in accordance with ACI 301 for each class of concrete. Include the following information:
1. Results of testing or test data used to establish mix proportions.
2. Test to verify total chloride in content.
3. Certificates of compliance for:
   (a) Contractors design laboratory and ready mix concrete suppliers certificate of plant inspection.
   (b) Cement.
   (c) Aggregates, each type.
   (d) Admixtures.
   (e) Air entrainment.
   (f) Curing compounds.
   (g) Form Coating.
4. Reinforcement: submit certified mill test reports for metal reinforcement and welded wire fabric.

G. Paving sample panels (Mockups): Construct full-size panel of concrete pavement as specified herein to demonstrate the proficiency of the Contractor as well as demonstrate

typical joints, surface finish, texture, color, and degree of aggregate exposure. The quality of workmanship, joint treatment and cleanliness of paving sample panel shall be accepted by the Landscape Architect before permanent paving is started. If the original sample is not accepted, the Contractor shall provide additional samples, as required, at no cost to the Owner until an accepted sample is obtained. The approved sample shall become the standard for the entire job. Panel shall not be constructed on a location becoming part of the final paving and shall remain undisturbed until all paving is completed. Remove panel upon completion of paving.

1. Mock-up Panel: Prepare two (2) mock-up panels at the project site approximately 12’ x 12’ (minimum).
   (a) Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the Contractor.
   (b) Include Expansion and Control Joints in each sample panel, as well as adjacent items of construction as indicated in the Drawings.

H. Material Certificates: provide copies of materials certificates signed by material producers and Contractor, certifying that each material item complies with, or exceeds, specific requirements.

I. Pour Schedule: Contractor to indicate on plans locations sequence of pours for review by Landscape Architect.

J. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with the requirements of ACI 301.

B. Manufacturer Qualifications:

1. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   (a) Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
2. Manufacturer of with 10-years experience in manufacture of specified products.

C. Source Limitations:

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
2. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

D. Installer Qualifications: A qualified exposed aggregate concrete installer whose work has resulting in successful installation of exposed aggregate concrete pavements. Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

E. Workmanship: The Contractor is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, grading and finishes.

F. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, degree of aggregate exposure and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Landscape Architect.
2. Notify Landscape Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Landscape Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Landscape Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: One week prior to placement of concrete, a meeting shall be held to discuss the Project and application methods. Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
   (a) Landscape Architect
   (b) Construction Manager
   (c) General Contractor's superintendent.
   (d) Independent testing agency responsible for concrete design mixtures.
   (e) Ready-mix concrete producer.
   (f) Concrete pavement subcontractor.
   (g) Owner

H. Provide a schedule of concrete placements to the Owner and Landscape Architect so that formwork and reinforcement installations can be reviewed prior to concrete placements.

1. Notify the Owner and Landscape Architect at least 72 hours before placement of concrete for review of forms, form liners, and reinforcement. No concrete shall be placed without this review and acceptance by Landscape Architect.

I. Notification of Landscape Architect shall be given at least 1-week before start of Work.

J. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect’s approval for layout and grades.

1. Contractor shall make adjustments as determined by the Landscape Architect. Landscape Architect may make adjustments to grades and layout as is required to meet existing and proposed conditions without additional cost to the contract price.
2. The Contractor shall not proceed with the work of this Section without obtaining the Landscape Architect's written acceptance of layout and grading.
3. Comply with Section 01 71 23 – Field Engineering and Section 31 20 00 – Earthwork.

K. Tests for Concrete Materials: Materials and installed work may require testing and retesting, as directed by the Landscape Architect and the Construction Manager, at any time during the process of the work. Allow free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

L. Concrete Quality Control Testing During Construction:
1. An independent testing laboratory will be retained by the Construction Manager to perform all quality control tests and to submit test reports to the Landscape Architect and Construction Manager.
   (a) The independent firm will perform inspections, tests, and other services specified and as required by the Landscape Architect and Construction Manager.
   (b) Reports will be submitted by the independent firm to the Landscape Architect, Owner and Construction Manager indicating observations and results of tests and indicating compliance or noncompliance with contract documents.
   (c) The Contractor shall cooperate with the independent testing firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
      i) Notify Construction Manager, Landscape Architect, and independent firm 48 hours prior to expected time for operations requiring services.
      ii) Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
   (d) Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instruction by the Landscape Architect or Construction Manager. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum/Price.
2. Sample and test concrete during placement of concrete as follows:
   (a) Sampling Fresh Concrete: ASTM C172; except modified for slump to comply with ASTM C94.
   (b) Slump: ASTM C143; one test for each concrete load at point of discharge and one for each set of compressive strength test specimens.
   (c) Air Content: ASTM C231; pressure method; one for each set of compressive strength specimens.

(d) Compressive Strength Tests: ASTM C39; one (1) set for each 150 cubic yards or fractions thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; two (2) specimens tested seven (7) days, three (3) specimens tested 28 days and one (1) specimen retained in reserve for later testing if required.

1.6 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Owner's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.7 JOB CONDITIONS

A. Protection: The Contractor shall use all means necessary to protect the materials of this Section before, during, and after installation. In the event of damage, make all repairs and replacements necessary to the approval of the Landscape Architect and at no additional cost to the Owner. All work shall be executed in a manner so as to prevent any damage to existing wall, rails, paving, and plant materials.

B. Protection of existing planting soils: Planting soils next to paved areas will be in place. The Contractor shall take extreme measures to protect the planting soil at all times and shall adhere to the following procedures and precautions:

1. The storage and driving of machinery and equipment over planting soils is expressly prohibited. Prevent workers from walking on the surface of the planting soils.
2. No materials shall be stored or placed on the planting soils at any time.
3. Protect planting soils to prevent the intermingling of concrete materials before, during and after concrete placement. Review methods of protection with the Construction Manager before beginning work.
4. Where planting soils are damaged, contaminated, over compacted, or otherwise harmed, remove those soils and replace with the approved planting soils. The Landscape Architect and Owner shall be the sole authorities on determining the need for plant soil replacement.
5. Also refer to Section 32 91 19.13 – Planting Soil System Installation.

PART 2 PRODUCTS

2.1 SUBGRADE AND BASE MATERIALS

A. Subgrade preparation shall conform to the requirements of Section 32 12 00 – Earthwork and Section 32 91 00 – Planting Soil System.

B. Granular Fill for subbase course shall conform to the requirements of Section 31 20 00 – Earthwork.

2.2 FORMS

A. Unless otherwise indicated, construct formwork with plywood, metal, metal framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces.

1. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
2. Provide forms that comply with US Product Standard PS 1 and the following:
   (a) B-B High Density Overlaid Concrete Form, Class I.
   (b) B-B (Concrete Form) Plywood, Class I, exterior grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

C. Form Ties: Provide factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least l/2 inch inside concrete for steel ties and l/4 inch for wire ties.
2. Unless otherwise indicated, provide form ties that will not leave holes larger than 1-inch diameter in concrete surface.

2.3 REINFORCEMENT MATERIALS

A. General:

1. Where indicated on the Drawings, all reinforcing shall be epoxy-coated steel unless otherwise indicated.
2. Certified copies of mill reports for all reinforcing shall be submitted before reinforcing is placed.
3. Bars shall be correctly rolled to section and free from surface defects.
4. Splices in reinforcing shall be as specified in Part 3 Article “Placing Reinforcement”.
5. Reinforcement shall be kept clean from oil, dirt and loose mill scale or other coating.
6. Shop fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not rebend or straighten reinforcement in manner that will injure or weaken material

B. Epoxy-Coated Welded Wire Fabric: Comply with ASTM A884/A884M, Class A, plain steel epoxy coated. Wire fabric shall have a minimum ultimate strength of 70,000 psi.

C. Epoxy-Coated Reinforcement Bars: Comply with ASTM A775/A775M; and with ASTM A615/A615M, Grade 60 (Grade 420), deformed new billet steel bars.

D. Epoxy-Coated Wire: Comply with ASTM A884/A884M, Class A coated, plain steel.

E. Epoxy-Coated Joint Dowel Bars: Comply with ASTM A775/A775M; and with ASTM A615/A615M, Grade 60 (Grade 420), plain steel bars, epoxy coated.

F. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

G. Reinforcement Accessories:

1. Tie wire, plastic coated, for use with epoxy coated reinforcing.

2. Mechanical Reinforcing Bar Connectors: Comply with ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar. Coat connectors in accordance with the same requirements as reinforcing bars.

H. Other accessories, at the option of the Contractor, may be zinc coated, except on exposed surfaces which have plastic tipped accessories.

I. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block or pieces of concrete.

2. For concrete-on-grade, use supports with sand plates or horizontal runners if base material will not adequately support chair legs.

3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected, stainless steel protected, or special stainless complying with CRSI Classes, C, D, or E respectively.

4. The top wire of all spacers, bolsters and chairs shall be corrugated.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 Types I-II and III, “Low-Alkali” cement, unless otherwise specified. Use one brand of cement from the same manufacturer throughout project.

B. Aggregates: Aggregate for exposed aggregate concrete shall be 5/8" round, tan in color, as supplied by a source approved by Landscape Architect.

1. Aggregate to match Landscape Architect’s sample.

2. Aggregate shall be 5/8" round, tan in color, with the following sieve graduation:

U.S. Sieve Size	% Passing
1”	100
3/4”	100

5/8”	95-100
1/2"	50-65
3/8”	15-40
#4	0-10
#8	0-5

C. Water: Potable, clean, fresh, free from oil, acid, organic matter or other deleterious substances.

D. Admixtures: All admixtures shall be specified in the mix design.

1. Air-Entraining Admixture: Conforming to ASTM C-260.
2. Water-Reducing Admixture: ASTM C494, Type A.
3. Water-Reducing, Retarding Admixture: ASTM C494, Type D.
4. Chloride-containing admixtures are not permitted.

2.5 ACCESSORIES

A. Expansion Joint Material shall be Homex 300 Expansion Joint Filler, ½” thickness as manufactured by the Homasote Company, West Trenton, New Jersey, 800.257.9491 or approved equal.

B. Bond Breaker Fabric: Non-woven type polypropylene geotextile fabric, 4 oz. weight, shall be Mirafi 140N, or approved equal.

C. Bonding Agent: VOC compliant, high solids acrylic latex emulsion admixture, non-oxidizing, white pigment, dries clear.

D. Chemical Surface Retarders: Spray-applied, film forming top surface retarder, calibrated for specific sized aggregates and finish requirements without the use of a plastic covering.

1. Acceptable Materials:
   (a) SpecEtch as manufactured by SpecChem 1511 Baltimore Ave, Suite 600 Kansas City, MO 64108 www.specchemllc.com 866.791.8700
   (b) Or approved equal.

E. Surface Sealer: a clear, non-yellowing, liquid sealer with matte finish to protect surface from environmental effects and pedestrian and vehicular traffic.

F. Detectable Warning plates

1. Refer to Contract Drawings for shapes and dimensions. Radial sections shall be custom cut to match the curb and paving profiles.
2. Detectable warning plates shall be cast iron plates as manufactured by Neenah Foundry (800.558.5075), www.nfco.com.
3. Warning Plates shall be ADA Compliant.
4. Finish shall be powder-coated. Color to be selected by the Landscape Architect from the manufacturer’s full range of available colors.

2.6 CONCRETE MIX

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by laboratory trial mixes.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

1. Do not use Owner's field quality-control testing agency as the independent testing agency.

C. Exposed Coarse Aggregate Concrete: Use " Ready Mixed " concrete unless otherwise approved or specified; in accordance with ASTM C 94. Exposed Coarse Aggregate Concrete should meet or exceed the following criteria.

1. Compressive Strength: Minimum 4,500 psi strength at 28 days
2. Concrete shall be gap-graded with weathered rounded coarse aggregate
3. Water/Cement Ratio: Not greater than 0.40 by weight.
4. Slump: 5 inches, plus or minus 1 inch.
5. Air Content: Between 4.5% - 7.5%

2.7 CONCRETE SURFACE RETARDERS/FINISHING AIDS

A. Spray Applied, film forming top surface retarder, calibrated for specific sized aggregates and finish requirements without the use of a plastic covering.

1. Acceptable Materials:
   (a) SpecEtch as manufactured by SpecChem 1511 Baltimore Ave, Suite 600 Kansas City, MO 64108 www.specchemllc.com 866.791.8700
   (b) Or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. Construct exposed aggregate paving true to line, elevation, pitch and section. All paving shall pitch to drain. Concrete pavement shall be brought to true plane surfaces with a finished tolerance of 1/8" total in ten feet when measured with a ten-foot straight edge.

3.2 SURFACE CONDITIONS

A. Examination: Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that such Work is complete to the point where this installation may properly commence.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect.
2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.3 PREPARATION

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts previous work, and conditions.

B. Preparation of subgrade and aggregate subbase shall be in accordance with Section 31 20 00 – Earthwork

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

D. Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.

E. Confirm in writing that the Landscape Architect has accepted the layout and grades for walkways.

F. Notify Construction Manager of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

3.4 FORM SETTING

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.

B. Fabricate formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement 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.

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

E. All concrete edges for all pavement, foundations, curbs and other below grade work shall be formed or contained to prevent over pouring of concrete. Excess concrete shall be removed as directed by the Landscape Architect.

F. Set forms to provide the proper depth of compacted concrete as detailed on the Drawings, firmly stake in place, tops set at the exact finish grade.

G. Notify the Landscape Architect at least 72 hours before placement of concrete for review of forms, form liners, and reinforcement. Obtain Landscape Architect's approval of formwork prior to placing concrete. All formwork requires approval by Landscape Architect prior to placement of concrete. No concrete shall be placed without this review and acceptance.

1. Contractor shall make adjustments as determined by the Landscape Architect. Landscape Architect may make adjustments to grades and layout as is required to

meet existing and proposed conditions without additional cost to the contract price.

3.5 JOINTS

A. Control Joints: Contractor to provide a plan showing location of control joints to Landscape Architect for Approval before Concrete is placed. Saw cut to the depth shown on the Drawings. Strictly adhere to the pattern agreed to with Landscape Architect. Review layout of control joints in the field with the Landscape Architect before proceeding with work.

B. General: Construct construction, expansion, and control joints and tool edgings 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 pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
2. Joints in the topping slab above the joints in the base slab should match the locations of joints in the base slab, where possible.

C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at expansion joints.

1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Butt joint with dowels or use a thickened edge joint if construction joints occur at control joint locations.
3. Keyed joints with tie-bars shall be used if the joint occurs at any other location.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Review location of construction joints with the Landscape Architect.

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

1. Contractor to provide a plan showing location of expansion joints to Landscape Architect for Approval before Concrete is placed. Strictly adhere to patterning and layout agreed to with Landscape Architect when formwork is in place but before concrete is placed. If pattern cannot be achieved, or is unclear, consult with Landscape Architect before placing concrete. Do not proceed with concrete placement without approval from Landscape Architect on patterning. Do not proceed in uncertainty.
2. Extend expansion joint the full width and depth of joint. Set top of expansion joint flush with finish grade.
3. Install expansion joints flush with the finish grade of the exposed aggregate concrete.

4. Install expansion joints around buildings, and other vertical structures adjacent to the concrete.

5. Chemically fasten one side of expansion joint materials to one side of materials requiring separation. Fasten with "Liquid Nail", or equivalent, using formula appropriate to materials being fastened.

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

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

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

2. Contractor to provide a plan showing location of control joints to Landscape Architect for approval before Concrete is placed. Mark control joints on the form work. If pattern cannot be achieved, or is unclear, consult with Landscape Architect before placing concrete. Do not proceed with concrete placement without approval from Landscape Architect on patterning.

F. Edging: Tool edges of pavement and expansion joints in concrete after initial floating with a 1/4-inch radius edging tool. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces by lightly brooming or troweling. Windowpaning of concrete shall not be acceptable.

3.6 PLACING REINFORCING

A. General:

1. Where indicated on the Drawings, place reinforcing as specified herein.

2. Wherever embedded items interfere with placing of reinforcement notify the Landscape Architect and obtain approval before placing any concrete. Do not bend or field cut bars around openings or sleeves.

B. Placing:

1. Do not exceed the tolerances specified in ACI 117.

2. Dowels shall be tied securely in place before concrete is deposited. In the event there are no bars in position to which dowel may be tied, No 3 bars (minimum) shall be added to provide proper support and anchorage.

3. Install welded wire fabric in as long lengths 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.

C. Field bending or straightening in accordance with section 3.3.2.8 of ACI 301

D. Spacing of Reinforcing: Where Drawings do not show the spacing of the reinforcing, the minimum clear spacing shall conform to ACI318 Section 7.6.

E. Concrete Cover: Place reinforcement to obtain as a minimum the coverages for concrete protection specified in section 3.3.2.3 of ACI 301

F. Splicing: Make splices only at those locations shown on the Drawings or as accepted by the Landscape Architect. Stagger splices in adjacent bars wherever possible. Splicing shall conform to the requirements of ACI 310 and specified provisions.

G. Reinforcing Supports:

1. Reinforcement shall be accurately located in the forms and held in place by means of supports adequate to prevent displacement and to maintain reinforcement at proper distance from form face. The use of wood supports and spacers inside the forms is not permitted.

2. Support reinforcement supported from the ground on precast concrete reinforcement supports.

3. Do not use reinforcing supports or reinforcing to support concrete conveying equipment and similar construction loads.

H. Tying:

1. Reinforcing shall be rigidly and securely tied with steel tie wire. Tie wires, after cutting, shall be bent in such a manner that concrete placement will not force the wire ends to surface of exposed concrete.

2. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

3. Reinforcing in concrete members that have one or more surfaces exposed, whether painted or unpainted finish, shall be tied with galvanized wire. Uncoated tie wire in exposed members will not be accepted.

I. Install deformed bar anchors in accordance with the manufacturer's recommendations.

J. Install mechanical splices and reinforcing couplers in accordance with manufacturers' recommendations.

K. Installation of manufactured products as per Part 2 of this specification and according to manufacturers' recommendation.

L. Cleaning:

1. Clean reinforcement to remove loose rust and mill scale, earth and other materials which might reduce or destroy bond with concrete.

2. Where there is a potential of rust staining adjacent finish surfaces, take necessary steps to prevent staining.

3.7 MIXING CONCRETE

A. Ready Mix and Site Produced Concrete

1. Comply with ASTM C 94.

2. The batching plant shall be equipped with an electric metering device capable of determining moisture content of sand.

3. The addition of water at the site is contingent upon full time inspection of the process by the owners testing laboratory and the acceptance of the Inspector, Comply with ACI 301, section 4.3.2.1.

4. Begin the mixing operation within thirty minutes after the cement has been intermingled with the aggregates.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

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

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

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement without approval from the Landscape Architect and Owner's testing agency.

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

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form 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.

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

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 mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

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

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

3.9 DETECTABLE WARNING PLATE INSTALLATION

A. During Cast In Place Detectable/Tactile Warning Surface Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. Prior to placement of the Cast In Place Detectable/Tactile Warning Surface Tile system, review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer and Landscape Architect.

C. The specifications of the structural embedment flange system and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers. Not recommended for asphalt applications.

D. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.

E. The concrete pouring and finishing operations require typical mason’s tools, however, a 4’ long level with electronic slope readout, 25 lb. weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism such as that manufactured by Vibco can be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least 1 foot square.

F. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.

G. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.

H. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting, which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

I. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.

J. While concrete is workable, a 1/4" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile. All tool marks shall be removed by lightly brooming or troweling. Windowpaning of concrete shall not be acceptable.

K. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile that may rock the tile causing a void between the underside of tile and concrete.

L. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Two suitable weights of 25 lb each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.

M. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.

N. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.

O. Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

3.10 EXPOSED AGGREGATE FINISHING PROCESS

A. General: Do not use tools such as jitterbugs that force the aggregate away from surface.

1. After screeding and consolidating concrete slabs, do not work surface until ready for floating.

2. As soon as concrete will support the mason on knee-boards, float the surface to bring grout to the surface, completely surrounding the aggregate and filling all surface voids. Float to a uniform appearance.

B. Exposing Aggregate: Proceed as soon as the surface grout can be removed by simultaneous brushing and flushing with water without overexposing or dislodging the aggregate. Avoid traffic on the concrete during this operation. High pressure water may be used if desired finish is more easily achieved without harm to the concrete. Use same method of exposure, either with or without retarder, throughout the job. The exposed aggregate shall have a 3/16" depth of exposure. The depth of exposure shall be measured by laying a straight edge across the plane of the surface and measuring down to the concrete matrix.

C. Edging: Tool edges of pavement and expansion joints in concrete after initial floating with a 1/4-inch radius edging tool. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces by lightly brooming or troweling. Windowpaning of concrete shall not be acceptable.

D. Apply matte sealer as per approved mockup to protect surface from environmental effects and pedestrian and vehicular traffic.

3.11 CONCRETE PROTECTION AND CURING

A. General:

1. Protect Paving by not allowing use for a minimum of seven (7) days after installation is complete.

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

3. All rules and regulations governing respective utilities shall be observed in executing all work under this Section. All work shall be executed in such a manner as to prevent any damage to soils, curbs, paving, walls, stone work, utility lines, structures, plant materials and adjoining property.

4. For protection of soils, refer to Part 1 in this Section.

B. Strip forms seven (7) days after installation is complete.

3.12 REPAIRS

A. Patching Defective Areas: Immediately cut out honeycomb, rock pockets and voids over 1⁄4 inch (6mm) in any dimension as well as holes left by tie rods, bolts etc. down to solid concrete but, in no case to a depth less than 1 inch (25mm).

1. Cut edges perpendicular to concrete surface.

2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.

B. Remove and replace concrete with defective surfaces if defects cannot be repaired to the satisfaction of the Landscape Architect.

1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface as well as stains and other discolorations that cannot be removed by cleaning.

(a) Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout or apply concrete bonding agent.

(b) Mix Patching concrete of same materials to provide concrete of same type of class as original concrete.

(c) Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

C. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

1. Damaged concrete shall be removed to a full joint and replaced. Partial patching within the sidewalk shall not be accepted. Landscape Architect shall determine extent of removal and replacement.

D. Drill test cores where directed by Landscape Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

3.13 FINAL CORRECTION

A. The Landscape Architect reserves the right to inspect the work to determine if adjustments are necessary in grade, alignment or layout. The Contractor shall make such adjustments without further compensation.

3.14 PROTECTION OF FINISHED WORK

A. Protect concrete from damage until final inspection by the Landscape Architect and Final Acceptance of the Project.

B. Exclude traffic from pavement for at least 7 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

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

3.15 CLEAN-UP

A. The Contractor shall remove all debris, construction equipment and scrap material from all areas within the limit of work prior to the final inspection and acceptance.

B. The Contractor shall clean all stains from the surface of paving. Paving which cannot be cleaned shall be replaced. Landscape Architect shall be sole judge of whether staining is apparent and necessitates remediation.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. Work of this Section includes all labor, materials, equipment, and services necessary to provide complete stone assemblies for site paving and surfacing elements as shown on the Contract Drawings and/or specified herein, including, but not limited to, the following:

1. Stone material required for Project work as specified for type, color, strength, and durability.
2. Furnishing and installing stonework for paving and surfacing systems using a combination of different natural stone paving materials and patterns and different setting requirements:
   (a) Stone Paving – Pedestrian on Grade (S6B)
   (b) Stone Paving – Winter Terrace on Grade (S5)
   (c) Stone Paving – On Structure (S2A, S3, S4, S6A)
   (d) Stone Paving – Plaza on Grade (S2B, S7)
3. Fabricating, cutting, and finishing each type of stone to dimensions, and shapes of design, to approved color ranges, and to approved Shop Drawing details.
4. Anchors, including dowels, clamps, rods, clips, ties and bolts, and other fastening devices for stonework as required to securely anchor in place all the stone. Where such items are to be built-in or cast-in to the structure under other Sections, coordinate and ensure proper location of same.
5. Drilling, fitting and cutting of stonework as required for the proper completion of the work.
6. Accessories and hardware required for complete installation.
7. Protection of stone during transit, storage, erection and after installation.
8. Preparation of compacted aggregate subbase course.
9. Setting beds, concrete bases slabs, mortars, grouting/pointing mortars, and related setting accessories for complete installation.
10. Field measurements of adjacent and/or supporting construction and verification of existing conditions.
11. Coordination and provisions for and interfacing with adjoining construction.

12. Cleaning of stonework installed as part of the work of this Section after installation and prior to acceptance.

1.3 RELATED SECTIONS

A. Related Sections include the following:

1. Section 04 44 10 – Landscape Stonework
2. Section 31 20 00 – Earthwork
3. Section 32 13 13.13 – Exposed Aggregate Concrete Pavement
4. Section 32 16 13.43 – Stone Curbs
5. Section 32 91 00 – Planting Soil System
6. Contract work subject to Specifications not in Project Manual:
   (a) Standard Specifications of the State of Arkansas Department of Transportation (latest edition).

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction for Paving: Value for Level Surfaces shall be 0.6 minimum in accordance with ASTM C1028.

B. Structural Properties: Paving system work shall be furnished and installed to accommodate design load conditions and thermal expansion of the support system as may be anticipated for exterior conditions at Project site.

1.5 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself or herself of existing conditions of the site before submitting his bid and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Landscape Architect's and Owner’s knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.6 SUBMITTALS

A. Submittals shall conform to Division 1.

B. Product Data/ Certificates: Provide manufacturer’s data showing installation and limitations in use for each component each type and condition to include proposed sources of supply and material technical data. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements.

1. For Stone Pavers:

(a) Submit complete data on quarry facilities and fabrication facilities for each stone type specified. Include information of location, production capabilities, and the nature and character of each stone selected.

(b) Material properties data for each stone material type shall be submitted by the stone suppliers and certified as representative of the properties of stone material to be supplied for the Project. Include references to appropriate ASTM tests as conducted by a certified testing laboratory.

2. For Setting/Installation Materials:

(a) Submit material certification and analysis report for each type mortar setting bed material component. Include primers, adhesives, cements, admixtures, aggregates, dampproofing and sand.

(b) Submit material certification and analysis report for setting/leveling course aggregate material.

(c) Submit sieve analysis for sand setting bed materials, according to ASTM C136.

(d) Submit material certification, analysis report, and product data for each type joint treatment and joint mortar/grout material component. Include cements, admixtures, color additives, aggregates, and sand.

(e) Submit for each accessory material item including fitting hardware, fastening devices, fillers, etc.

3. For Cleaning Paving Unit Surfaces: Submit product information and description of compatible and safe method(s) for cleaning each type of paving unit of this Section during work of installation and at completion.

C. Samples: After acceptance of Product Data and prior to ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architects' approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each type listed below showing full range of color variation, finish and texture that can be expected in the permanent work. Deliver one sample to Landscape Architect and keep one on the job site.

1. Stone Pavers. Provide four (4) samples of each paver indicated. Sample size shall be 12" x 12" x 2" or standard paver size if smaller.

2. Joint Treatment Material (mortar): Submit for each condition of use to show selected color(s). Dry materials (i.e.: sand) shall be submitted in one (1) pound packages.

3. Sealants. Apply to (2) of the (4) stone samples.

D. Shop Drawings: Provide Shop Drawings that show all details including sizes, materials, patterns, quantities and manner of assembling the various members, properly coordinated with the related work. Shop Drawings shall show true profiles, methods of anchoring hardware, if any, and all other necessary information. Take accurate field measurements before preparation of shop drawings and specifications

1. For Stone Pavers System:

(a) Submit general setting layout based on surveyed control points and dimensions to confirm paving patterns and joint spacing, locations, and alignments with adjacent conditions.

(b) Identify and show location, type, and extent of anticipated field cutting and confirm that units to be cut are not less than specified minimum sizes for cutting.

(c) Indicate extent of dampproofing required for stone pavement and adjacent conditions.

E. Mock-ups: Upon approval of all samples, materials, and shop drawings, the Contractor shall construct sample panels (mock-ups) at a location determined by the Landscape Architect in the minimum size indicated below. Each sample panel shall be large enough to display typical characteristics of each item and type of work. Except as noted in Section 01 30 00 – Submittal Procedures, construct mock-ups concurrently with other required samples to aid in review of all materials. Contractor shall confer with Landscape Architect to determine which mock-ups from all sections shall be concurrently constructed. Notify Landscape Architect seven days in advance of dates and times when mock-ups will be constructed. Mock-ups shall be placed in a location approved by the Landscape Architect. The Landscape Architect must approve the visual characteristics, quality of workmanship, and installation before final work is started. If the original mock-up is not approved, the Contractor shall provide additional mock-ups, as required, at no cost to the Owner until an approved sample is obtained. The approved mock-up shall become the standard for the entire job. Mock-up shall be independent of the final work, unless otherwise noted, and shall remain undisturbed until all work is completed. Demolish and remove mock-ups at a time approved by the Construction Manager and when no longer required to serve as a standard of work. The Landscape Architect reserves the right to adjust the size of the sample panels/mock-up as needed to show full condition

F.

1. Stone Paving – (all types): 12 feet x 12 feet panel for each type, containing stone in size ranges for overall pattern as indicated on the Drawings. Full concrete base slab thickness required. Include adjacent Stone Curb along one side for paving types (for S2B paving only). Refer to Section 32 16 13.43 – Stone Curbs.

G. Quality Control Submittals:

1. Design Data, Concrete Mix Design:

(a) Submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, and admixtures; and applicable reference specifications.

(b) Submit copies of test reports showing that the design mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.

2. Compatibility and Adhesion Test Reports: From Landscape Architect approved latex-additive manufacturer (as specified in Article “Quality Assurance” herein) indicating the following:

(a) Setting mortar and joint mortar/grout containing latex additives have been tested with pavers for compatibility and adhesion.

(b) Interpretation of test results relative to setting mortar and joint mortar/grout performance and written recommendations for installation practices needed for adhesion.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Unit paver installations shall be by an experienced firm/installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project; can exhibit proof of a minimum of five (5) years prior successful experience with paving installations; and whose work has resulted in construction of equivalent type with a record of successful in-service performance.

1. Paving Installation Foreman: Installation firm for paving and surfacing of this Project shall have on staff a supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have at least 10 years total unit paving installation experience and with at least 5 years experience in paving installations of equivalent or more extensive type and scope to this Project. Submit detailed resume of past experience with dates, duration and scope identification, Project Name and location, and work function of previous projects worked on.

2. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with specific requirements and methods needed for performance of the work of this Section.

B. Source Limitations for Unit Paving Systems Materials: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Pre-construction Compatibility and Adhesion Testing: Furnish to latex-additive product manufacturer (Landscape Architect approved), for testing indicated below, samples of paving materials that will contact with, or will be affected by, setting mortar and joint mortar/grout mixes that contain latex additives.

1. Use manufacturer's standard test methods to determine and/or confirm setting mortar and joint mortar/grout materials that are required to obtain optimum adhesion with installed pavers and will be non-staining to paver units and other materials a part of or in contact with paver installations.

2. Paver manufacturer shall furnish a sufficient number of pavers and other materials involved in installation to allow comprehensive testing.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain mortar and grout manufacturer's written instructions for corrective measures, including the use of alternative materials to obtain optimum bond and to prevent staining.

D. Contractor, by commencing the work of this Section, assumes overall responsibility as part of Contractor’s warranty of the work to assure that all assemblies, components, and parts shown or required within the work of this Section, comply with the Contract Documents. Contractor shall further warrant:

1. That all components, specified or required to satisfactorily complete the installation, are compatible with each other and with the conditions of installation and expected use.

2. The overall effective integration and correctness of individual parts and the whole of the system.

3. Compatibility with adjoining substrates, materials and work of other trades.

4. There shall be no premature material failure due to improper manufacture or fabrication and installation of the paving units. All materials are to fully perform to their normal life expectancy.

5. Each and every paver piece shall be subject to the Landscape Architect or Architect's approval, and any piece or pieces which may be rejected after having been set shall be carefully cut out and replaced with new suitable paver unit without delay, and without cost to the Owner. Any piece or pieces damaged in the removal and resetting of defective pieces shall also be removed, and suitable, approved pieces provided and set.

E. Pre-Installation Conference

1. Contractor, with Construction Manager, shall schedule a meeting with the paver unit manufacturer(s)/fabricator(s) and paving installer and the Landscape Architect at a time sufficiently in advance of paving installations to permit coordination. In addition, include in appropriate sequence, representatives of other related work.

2. At the meeting, review paving system quality control requirements including details of construction, outstanding submittals, contract drawings and specifications, and on site conditions affecting or which may affect installations.

3. As applicable, establish coordinated and scheduled time frame for installation sealant in paving unit joints and between paving unit(s) and penetrating construction with allowance for correct curing time of mortar setting bed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.

1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stone.

2. Store sand materials on elevated platforms, under cover, and in a dry location. Do not use materials that have become damp.

3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

4. Store liquids in tightly closed containers protected from freezing

B. Handle each paving unit material to prevent chipping, breakage, soiling, or other damage.

1.9 PROJECT CONDITIONS

A. Environmental Requirements:

1. Hot-Weather Requirements: Protect paver work when temperature and humidity conditions produce excessive evaporation of water from setting beds and joint mortar/grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply setting or joint mortar to substrates with temperatures of 100 degrees F or higher.

2. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen sub-grade or setting beds. Remove and replace unit paver work damaged by frost or freezing. Comply with cold weather limitations and requirements specified herein.

3. Cold-Weather Limitations for Stonework:

   (a) Protect stone paving material and components against freezing when atmospheric temperature is 40 degrees F and falling. When conditions require, heat materials to provide mortar and grout temperatures between 40 and 120 degrees F.

   (b) Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 degrees F, cover with weather-resistant membrane; below 25 degrees F, cover with insulating blankets; below 20 degrees F, provide enclosure and temporary heat to maintain temperature above 32 deg F.

   (c) Maintain minimum ambient temperatures of 50 degrees F during installation of stone paving and for 7 days after completion, unless higher temperatures are required by fabricator's or supplier's instructions.

4. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until stone masonry has dried out, but not less than 7 days after completing cleaning.

B. Field Measurements: Coordinate site paving area layouts with the building and take additional field measurements as necessary.

C. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with Landscape Architect prior to starting work and as work progresses.

PART 2 PRODUCTS

2.1 GENERAL

A. Selection of material at source: The Landscape Architect will inspect stone at the quarry for compliance with requirements for quality. The Landscape Architect retains the right to inspect stone further for latent defects and to reject unsatisfactory or defective material at any time during progress of work even if previously inspected and approved. Remove and replace rejected stone immediately from Project site at no charge to the Owner.

1. Selection: Representative stone shall be tagged at the quarry by the Landscape Architect prior to quarrying. The Landscape Architect shall clearly mark suitable stone at the quarry.

2.2 SUBBASE PREPARATION AND BASE MATERIALS

A. Compacted aggregate subbase shall be used as a base course material under pavements only as indicated on the Drawings. Refer to Section 31 20 00 – Earthwork.

B. Structural Soils shall be used as base course material under pavement as indicated on the drawings and shall conform to Section 32 91 00 – Planting Soil System.

C. Concrete Base shall be used as base course material under pavement as indicated on the Drawings.

2.3 STONE FABRICATION

A. General: Fabricate stone paving in sizes and shapes required to comply with requirements indicated, including details on Contract Documents.

B. Stone shall be cut to sizes, shapes, dimensions, and details shown on the Contract Drawings and to fit stone pattern as indicated.

C. Exposed surfaces and edges of stone units shall be free from cracks, broken corners, chipped edges, scratches, or defects affecting appearances. No patching or hiding of defects will be permitted.

D. Stone Finishing: Finish shall be as indicated on the Drawings.

2.4 STONE PAVEMENT – GENERAL

A. Stone paving shall be produced from Oklahoma or Arkansas flagstone (sandstone), free from seams and other structural imperfections or flaws that would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curb is obtained will be permitted.

1. Match Landscape Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
2. Color: Stones shall be in range of colors including tawny-beige and brown as selected by the Landscape Architect at the quarry per Article 2.1 of this Section.
3. Size in accordance with Drawings and approved Shop Drawings.

B. Characteristics and Quality:

1. All stone shall be carefully selected from sound stock and shall be free from defects impairing strength, durability, function, or appearance, such as cracks, seams, starts, holes, flaws or imperfections which have been patched or filled.
2. Stone shall exhibit the full range of color, value, graining texture, and other features to extent inherent in each stone type.
   (a) Color and value variations shall be within ranges established by approved samples.
   (b) Graining and texture variations, whether highly figured or uniform, shall be consistent in all material supplied.
3. Variations from trueplane or other surfaces shall not exceed ¼".
4. Provide stone from a single quarry for each variety required.

C. Quarrying Supervision

1. Quarrying of stone shall be supervised and coordinated by the stone fabricator to insure that the as-quarried block orientations will yield finished stone material with characteristics as specified.

2. Stone for each designated type or grouped types shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved stone shall not be permitted, except by written permission of the Architect.

D. Provisions for Examinations

1. Examination at the Quarry: Quarried stone blocks shall be made available for inspection at Landscape Architect's request.

2. Examination at the Fabrication Plant: Production units of stone shall be made available for inspection at Landscape Architect's request. To this end, the Contractor shall, after approval of final shop drawings, advise the Landscape Architect when production has begun and of the earliest possible opportunity to inspect a representative sampling of stone production work.

3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination of stone to the satisfaction of the Landscape Architect.

2.5 FLAGSTONE PAVEMENT

A. Material:

1. Type: Oklahoma or Arkansas Sandstone

2. Color: Tawny-beige to brown.

3. Finish: as indicated on Drawings.

4. Sources:

(a) Bluebird Stone
PO Box 125 Lathum Road
Shady Point, OK 74956
Tel: 918.647.7161
www.bluebirdstone.com

(b) Green Country Stone
10727 State Hwy 120
Cameron, OK 74932
Tel: 918.654.3627
www.greencountrystone.com

(c) Ibison Stone Supply
10520 Hwy 10 W
Hackett, AR 72937
Tel: 479.638.8678
www.ibisonstonesupply.com

(d) or approved equal.

2.6 INSTALLATION MATERIALS

A. Portland Cement Setting Mortar and Joint Mortar/Grout Materials (for Stone Pavers):

1. Portland Cement: ASTM C150, Type I or II. For joint mortar/grout provide of natural color or white as required to mix with mortar pigments and produce joint color required. Cement shall in no case contain more than .03% by weight of soluble alkali (calculated as Na20). Submit mill certificates of cement and certified analysis from an approved testing laboratory.

2. Hydrated Lime: ASTM C207, Type S.

3. Aggregate: ASTM C144, graded to comply with latex-additive manufacturer's requirements.

4. Latex Additive: Styrene-butadiene-rubber or acrylic-resin water emulsion serving as replacement for part or all of gauging water, of type specifically recommended by admixture manufacturer for use with job-mixed Portland cement and aggregate, and not containing a retarder.

   (a) Provide Latex Additive material as manufactured by:

      i) Boiardi Products Corp.

      ii) Custom Building Products.

      iii) Laticrete International, Inc.

      iv) Or approved equal.

   (b) Latex Additive material manufacturer shall perform preconstruction compatibility and adhesion testing of mixed setting bed and joint mortars/grouts with stone material as specified.

5. Colored Mortar Pigments for Joint Mortar/Grout: Natural and synthetic iron and chromium oxides, compounded for use in joint mortar/grout mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in Portland cement mixes with latex admixtures. Provide integral, non-fading colorant made by Davis Colors, Los Angeles, CA, 800.356.4848 www.daviscolors.com, LM Scofield, Los Angeles, CA 800.800.9900, www.scofield.com or approved equal; color selected by the Landscape Architect.

6. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar/grout.

B. Non-Shrink Grout: Use premixed, non-shrink, non-staining grout for setting stone fixing devices and for other conditions required.

1. Grout shall be capable of developing minimum compressive strength of 5000 psi (34 MPa) in 28 days.

2. Grout shall show no shrinkage prior to initial setting in accordance with ASTM C827 and after hardening in accordance with ASTM C157.

2.7 MISCELLANEOUS MATERIAL

A. Expansion Joint material, where indicated in the Drawings shall be:

1. Homex 300 Expansion Joint Filler, 1/2” thickness or as shown on the Drawings as manufactured by the Homasote Company, West Trenton, New Jersey, 800.257.9491.

2. Or approved equal.

B. JOINT SEALANT

1. Joint Sealants For Horizontal Applications

(a) Polyurethane Sealant: For horizontal joint conditions with joint widths less than one (1) inch and with slopes up to 10 percent and subject to compliance with ASTM C920, Type M, Grade P, Class 25 Use T; provide one of the following multi component polyurethane sealants capable of bulk-loading gun application:

i) Sonolastic SL2 (slope grade – fast cure) or Sonolastic NP2 by Sonneborn Building Products Div., ChemRex, Inc. (Degussa).

ii) Sikaflex-2cNS (non sag) by Sika Corporation.

iii) Vulkem 245 by Tremco Inc.

iv) Or approved equal.

2. Polyurethane Sealant, Pourable (Self Leveling): For horizontal joint conditions with joint widths greater than one (1) inch and less than 2 & ½ inches, with slopes up to 10 percent or otherwise required as approved by Landscape Architect; and subject to compliance with ASTM C920, Type M, Grade P, Class 25; provide one of the following multi component polyurethane sealants capable of pourable self leveling application

(a) Sonolastic SL2 (self leveling grade) by Sonneborn Building Products Division, ChemRex, Inc.(Degussa).

(b) Sikaflex 2cSL by Sika Corporation.

(c) THC-900 by Tremco Inc.

(d) Or approved equal.

C. JOINT-SEALANT BACKER MATERIALS

1. General: Provide joint-sealant backer materials that are closed cell, non-absorbent and non staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved by joint sealant manufacturer for applications indicated and materials to be used based on field experience and laboratory testing.

2. Backer Strips for Sealants: ASTM D5249; Type 2; of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

3. Joint backer rods shall be larger in diameter than joint width as recommended by sealant manufacturer.

D. SAND

1. Sand shall be washed fine aggregate concrete sand conforming to the requirements of ASTM C-33.

E. MASONRY CLEANERS

1. Job-Mixed Detergent Solution (General Cleaning): Solution of 1/2-cup (0.14-L) dry-measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry-measure laundry detergent dissolved in 1 gal. (4 L) of water.

2. Proprietary Acidic Cleaner (Difficult Stains): Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by stone producer.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Construction Manager and Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

1. Proceed with installation after unsatisfactory conditions have been corrected.

B. Where pavers are to be installed over below grade structures, examine waterproofing installation, with Waterproofing installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

3.2 PREPARATION

A. Verify all measurements and dimensions and coordinate the installation of supporting construction for each paving system. Coordinate and schedule installations with the work of other trades and contracts. Give particular attention to the location and size of cutouts required to accommodate utility and other work or adjoining construction.

B. Preparation of subgrade shall be in accordance with Section 312000 – Earthwork. Subgrade shall be set to indicated grades and shall be acceptable to paving systems Installer. Coordinate installation and advise corrections as necessary.

C. Concrete base slab is to be provided in accordance with Section 03 30 05 – Cast-in-Place Concrete – Site. Slab shall have a broom finish and shall be acceptable to paving systems Installer. Coordinate with work of concrete placement and advise corrections as necessary.

D. Layout of Work: Accurately lay out paving work to patterns and to fit conditions as indicated, encountered on site, and specified for installation. Comply with set out control points as indicated and coordinate with other work of Project. Provide additional control points and stakeouts as required to effect correct alignments and grade elevations. Advise Construction Manager of any discrepancies or on-site conditions detrimental to critical layouts and obtain approved correction.

1. After staking out the work, and before beginning final construction, obtain the Landscape Architect’s approval for layout and grades.

2. The Landscape Architect reserves the right to make adjustments to layout and grade without the Contractor submitting claims for extra compensation.

3. Landscape Architect shall provide additional direction in the field during placement of unit pavers to achieve the desired patterns as indicated.

4. The Contractor shall not proceed with the work of this Section without obtaining the Landscape Architect's written acceptance of layout and grading.

E. Prior to setting bed placements, verify base slab placement to correct line and grade and with correct finish and clean base surface.

1. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

2. Remove substances from concrete substrates that could impair mortar bond including curing and sealing compounds, form oil, and laitance.

F. Clean unit paver surfaces that have become dirty or stained by removing soil, stains and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clean water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

G. Coordinate with work specified elsewhere by separate contract for sealant work between stone units and between stonework and adjacent dissimilar material as indicated or otherwise required to complete installation.

H. Advise installers of other contract work about specific requirements for placement of anchors, ties, flashing, and similar items to be built into pavement systems and stonework.

3.3 INSTALLATION, GENERAL

A. Do not use paving materials with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work. Clean paving units (especially backs and edges) before setting.

B. Execute the work by skilled mechanics, and employ skilled fitters/cutters at site for necessary field cutting, as paving units are set.

C. At conditions where required to field fit work, cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. Scribe and field cut pavers as necessary to fit at obstructions. Produce tight and neat joints.

2. In cutting and fitting, carefully cut and grind edges to a neat tight fit. Do cutting in such manner so as not to impair strength or appearance of paving unit. Use physical templates for all cutting and drilling and obtain required templates from appropriate trades.

3. Cut paving units shall not have any dimension less than 1/3 full unit size.

4. Joint Pattern: Strictly follow patterns shown on the Drawings or approved Shop Drawings. Report conflicts to Landscape Architect. Do not proceed in uncertainty.

D. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

E. Provide for sealant-filled joints at locations and of widths indicated. Provide joint filler as backing for sealant-filled joints.

3.4 MORTAR SETTING BED APPLICATIONS

A. Saturate concrete base slab with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply cement-paste bond coat over surface of concrete base slab about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.

C. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed setting bed to uniform minimum thickness as shown on Contract Drawings and at sub-grade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Cut back with bevel edge and remove and discard setting-bed material that has reached initial set before placing pavers.

E. Layout paver units before setting in mortar to avoid cutting units in any area. If cutting is required, cut units shall be not less than 1/3 full unit size in any dimension.

1. Spaced Joint Widths: See Contract Drawings.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers on setting bed, apply uniform 1/16-inch thick, slurry bond coat to bed or to back of each paver unit with a flat trowel.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set and disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Expansion joints in paving shall occur as shown on Contract Drawings and shall be either expressed at finish grade surface (full-depth expansion joint) or not expressed at finish grade surface (sub-slab expansion joint). Full-depth expansion joints shall align with expansion joints in the sub-slab. Full-depth expansion joints shall occur from top of stone paver to top of concrete sub-slab and shall be filled with compressible filler as backing for subsequent backer rod and sealant installation as indicated in the Drawings. Joint sealants and backer rod shall occur over compressible foam filler as specified in Article 2.10.

I. Pointing:

1. Prepare stone joint surfaces for pointing with grout/mortar by removing dust and mortar particles. If joint treatment installations are performed more than two (2) days after paver unit installation or at such other times as conditions warrant, use a powered air blower to clean paving joints of debris before applying joint treatment.

2. Apply pointing grout/mortar by placing and compacting in layers not greater than 3/16 inch (5 mm) until a uniform depth is formed in the raked out joint.

3. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

4. Tool joints of pointing grout/mortar to thumbprint hard surface condition. Use a smooth jointing tool to produce a smooth, flat face slightly below edges of stone.

3.5 ADJUSTING

A. Remove and replace stone not matching final samples and mockups.

B. Remove and replace stone not complying with requirements.

3.6 REPAIR, CLEANING, AND PROTECTION

A. Prohibit traffic from installed unit paver installations for a minimum of 72 hours.

B. In-progress cleaning: clean stonework and other paving units as work progresses. Remove grout/mortar fins and smears before tooling joints.

C. Examine all work and repair all damage. Clean soiled or stained surfaces. Remove excess grout from exposed paver surfaces; wash and scrub clean. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to owner.

D. Remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

E. Protect finished paving surface from ongoing construction activity. If construction activity must cross surfaces of finished paved surfaces, place clean plywood or planks in line of traffic flow and restrict flow to protected areas.

3.7 FINAL CORRECTIONS

A. The Landscape Architect reserves the right to inspect the work to determine if adjustments are necessary in grade, alignment or layout. The Contractor shall make such adjusts without further compensation.

END OF SECTION.

PART 1 GENERAL

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. Work of this Section includes all labor, materials, equipment, and services necessary to provide complete site curb masonry assemblies as shown on the Contract Drawings and/or specified herein, including, but not limited to, the following:

1. Stone curbs.
2. Concrete support, setting beds, mortars, grouting/pointing mortars, and related setting accessories for complete installation.
3. Coordination and provisions for and interfacing with adjoining construction.

1.3 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. The following Items of related work are specified and included in other Sections of the Specifications:

1. Section 31 20 00 – Earthwork.
2. Section 32 13 13 – Concrete Paving.
3. Section 32 13 13.13 – Exposed Aggregate Concrete Paving.
4. Section 32 14 40 – Stone Paving.

1.4 REFERENCES AND STANDARDS

A. General: The following referenced standards and standard specifications, referred to thereafter by designation only, form a part of this Section. Materials and methods of construction shall comply with the following standards:

1. Standard Specifications: shall mean the State of Arkansas Department of Transportation, latest edition.
2. In the case of conflict between the Standard Specifications and the requirements of this Section, the more stringent requirements shall apply.

B. All standards shall include the latest additions and amendments as of the date of advertisement for bids. For each type of packaged material required for the Work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized approved laboratory made in strict compliance with the standards and procedures of the following:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Concrete Institute (ACI)
   (a) ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
3. American National Standards Institute (ANSI).
4. American Society for Testing and Materials (ASTM)
   (a) ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field
   (b) ASTM C33 - Specification for Concrete Aggregates
   (c) ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens
   (d) ASTM C42 -Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   (e) ASTM C94 - Specification for Ready-Mixed Concrete
   (f) ASTM C143 - Test Method for Slump of Hydraulic Cement Concrete
   (g) ASTM C150 - Specification for Portland Cement
   (h) ASTM C172 - Practice for Sampling Freshly Mixed Concrete
   (i) ASTM C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
   (j) ASTM C260 - Specification for Air-Entraining Admixtures for Concrete
   (k) ASTM C494 - Specification for Chemical Admixtures for Concrete
   (l) ASTM D994 - Specification for Preformed Expansion Joint Filler

1.5 SUBMITTALS

A. Submittals shall conform to Division 1 requirements.

B. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements. Work includes but is not limited to:

1. For Stone Types Furnished:
   (a) Submit complete data on quarry facilities for each stone type and on fabrication facilities for stonework. Include information of location, production capabilities, and the nature and character of each stone selected.
   (b) Material properties data for each stone type shall be submitted by the stone suppliers and certified as representative of the properties of stone material to be supplied for the Project. Include references to appropriate ASTM tests as conducted by a certified testing laboratory.
2. Concrete Products.
3. Aggregates.
4. Form materials and forming accessories.
5. For Setting Bed Materials and Joint Filler:

(a) Submit for mortar mix material of color to be used in installation of all stonework. Include material certification and analysis reports.

(b) For mortar coloring system: submit product data and color charts for selection by the Landscape Architect. Submit color charts concurrently with paver samples as specified in this Section.

6. Submit for each material item of this section including fitting hardware, fastening devices, accessories, grouts, sealants, fillers, expansion joint material, etc.

7. For Cleaning Stone: Submit product information and description of method(s) for cleaning masonry during work and at completion.

C. Samples: Prior to ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each material listed below showing full range of color variation, finish and texture that can be expected in the permanent work:

1. Stone Curbs: Submit two (2) partial size curbs, min. 12” length by required width and height, showing the full range of color and finishes expected in the final work.

2. Mortar: Color Chart and Sample, 6” length.

3. Bond Breaker Material, 12” square.

4. Expansion Joint Material, 6” length.

D. Shop Drawings: Provide Shop Drawings that show all details including sizes, materials, patterns, quantities and manner of assembling the various members, properly coordinated with the related work. Shop Drawings shall show true profiles, methods of anchoring hardware, if any, and all other necessary information. Take accurate field measurements before preparation of shop drawings and specifications.

1. Layout plan for mock-up.

2. Stone Curb layout plan. Indicate straight lengths of curb and size variations to accommodate curved alignments of differing radii as per requirements specified herein.

3. Setting Drawings: Submit setting drawings showing the relationship to adjoining construction and, after final selection, indicating the location of stone units as indicated on Contract Drawings.

(a) Show location layouts and patterns coordinated with Contract Drawings and related to survey control points and dimensions to confirm alignment with adjacent conditions. Establish and verify dimensions with concrete work of on-site walls, base slabs, pavements, layouts and patterns of other work, and other like conditions. Include details to confirm how stone units will be installed, including single unit placements and any modification/deviations from conditions indicated by Contract Documents.

4. Coordination (Composite) Drawings:

(a) Include coordination details for related, supporting, and adjoining work; as well as erection/installation diagrams. Show relative layout for all

adjacent pavements, walls, foundation materials, etc. all correctly dimensioned.

E. Mock-Ups for Stone Curbs: Construct at earliest possible time and at an approved location before proceeding with respective work and after the Landscape Architect's approval of samples for verification. Construct to demonstrate aesthetic effects with full range of stone and qualities of materials and execution.

1. Notify Construction Manager at least seven days in advance of dates and times when field sample/mockup will be constructed.

2. Construct to comply with the following requirements, using materials indicated for the completed work, including same base construction, special features for expansion joints, and contiguous work as indicated:

   (a) Construct representative stone samples/mockups in a location as approved by the Construction Manager and Landscape Architect.

   (b) Prepare full size field assemblies for methods to demonstrate aesthetic effects and qualities of materials and execution; sizing as described below:

      i) Stone Curb: Mockup shall be a minimum of thirty (30) feet in length and shall include a full profile curb and a section along a curved path/edge alignment, as well as changes in direction, both vertical and horizontal. Landscape Architect shall approve layout of mockup prior to its construction.

3. Obtain Landscape Architect's approval of field sample/mockup before starting construction.

4. Maintain mockups during construction in an undisturbed condition as a standard for judging the subsequent completed work.

5. Field Samples/Mock-Ups may be used as part of completed work if material and installation if approved by Landscape Architect, otherwise demolish and remove field sample/mock up at a time approved by the Construction Manager and when no longer required to serve as a standard of work.

1.6 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself or herself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Landscape Architect's and Owner's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

C. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Landscape Architect in writing of all deficiencies

and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of stone, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Materials and methods of construction shall comply with the following standards:

1. ACI: American Concrete Institute
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing and Materials
4. BSI: Building Stone Institute
5. FS: Federal Specifications
6. PCA: Portland Cement Association
7. Standard Specifications: shall mean the State of Arkansas Department of Transportation, Standard Specifications for Road and Bridge Construction (latest edition), and addenda.

C. Installer Qualifications: Installations of paving system shall be by firm that can exhibit proof of a minimum five (5) years of prior successful experience with paving installations of equivalent type and similar scope of this Project.

1. Installation Foreman: Installation firm for stone installation for this Project shall have on staff a supervising Foreman assigned full time to this Project, for time of mock-up installations, who shall have at least 10 years stone installation experience.
2. Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

D. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect’s approval for layout and grades.

1. The Contractor shall stake out the work (horizontal and vertical) in sufficient detail for evaluation by the Landscape Architect.
2. The Landscape Architect shall be permitted to make reasonable adjustments to layout and grading without further compensation to the Contractor.

E. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with Landscape Architect prior to starting work and as work progresses.

F. Also refer to Section 01 73 00 – Execution Requirements.

G. Preinstallation Conference: Conduct pre-installation conference at project site to verify project requirements, installation instructions, fabrication schedule and coordination with other items. The meeting shall be held at least three weeks before the start of the installation. In attendance shall be parties directly affecting the work of this Section,

including the Contractor and Landscape Architect. Review during the meeting the installation and coordination with other work.

H. Stain Protection: Immediately remove and clean off residue of mortar and soil to prevent staining of stone.

I. Mockups: Refer to Article 1.5, E.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and Loading: Finished stone curbs shall be carefully packed and loaded for shipment using all reasonable and customary precautions against damage in transit. No material that may cause staining or discoloration shall be used for blocking or packing.

B. Site Storage: Upon receipt at the building site or storage yard, the stone curbs shall be stacked on timber or platforms at least 4" above the ground, and extreme care should be taken to prevent staining during storage. If storage is to be for a prolonged period, polyurethane or other suitable plastic film shall be placed between wood and finished surfaces, and shall also be used as an overall protective covering. Salt shall not be used for melting of ice formed on stone curb pieces or for any purpose involving its contact with stone curb.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.9 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace paver, setts, curb, stair or bench damaged by frost or freezing.

B. Weather Limitations for Mortar:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

   (a) When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

C. Stain Protection: Immediately remove and clean off residue of mortar and soil to prevent staining of stone.

PART 2 PRODUCTS

2.1 GENERAL

A. Selection of material at source: The Landscape Architect will inspect stone at the quarry for compliance with requirements for quality. The Landscape Architect retains the right to inspect stone further for latent defects and to reject unsatisfactory or defective material at any time during progress of work even if previously inspected and approved. Remove and replace rejected stone immediately from Project site at no charge to the Owner.

1. Selection: Representative stones shall be tagged at the quarry or quarries by the Landscape Architect prior to quarrying. The Landscape Architect shall clearly mark suitable stones at the quarry or quarries.

2.2 BASE MATERIALS

A. Compacted aggregate subbase shall be used as a base course material under curbs only as indicated on the Drawings. Refer to Section 31 20 00 – Earthwork.

B. Concrete shall be used as base course material and/or cradle for curbs as indicated on the Drawings.

1. Proportion normal weight concrete mixture as follows:
   (a) Minimum Compressive Strength: 4,000 psi at 28 days.
   (b) Maximum Water-Cementitious Material Ratio: 0.44.
   (c) Slump Limit: 4 inches, plus or minus 1 inch.
   (d) Maximum Coarse Aggregate Size: 1 inch.
   (e) Air Content: 6 percent, plus or minus 1.5 percent.

2.3 STONE FABRICATION

A. General: Fabricate stone paving in sizes and shapes required to comply with requirements indicated, including details on Contract Documents.

B. Stone shall be cut to sizes, shapes, dimensions, and details shown on the Contract Drawings and to fit stone pattern as indicated.

C. Exposed surfaces and edges of stone units shall be free from cracks, broken corners, chipped edges, scratches, or defects affecting appearances. No patching or hiding of defects will be permitted.

2.4 STONE CURBS – GENERAL

A. Stone curbing shall be produced from Oklahoma or Arkansas (sandstone), free from seams and other structural imperfections or flaws that would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curb is obtained will be permitted.

1. Match Landscape Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2. Color: Stones shall be in range of colors including tawny-beige and brown as selected by the Landscape Architect at the quarry per Article 2.1 of this Section.

3. Size in accordance with Drawings and approved Shop Drawings.

B. Characteristics and Quality:

1. All stone shall be carefully selected from sound stock and shall be free from defects impairing strength, durability, function, or appearance, such as cracks, seams, starts, holes, flaws or imperfections which have been patched or filled.

2. Stone shall exhibit the full range of color, value, graining texture, and other features to extent inherent in each stone type.

   (a) Color and value variations shall be within ranges established by approved samples.

   (b) Graining and texture variations, whether highly figured or uniform, shall be consistent in all material supplied.

3. Variations from trueplane or other surfaces shall not exceed ¼".

4. Provide stone from a single quarry for each variety required.

C. Quarrying Supervision

1. Quarrying of stone shall be supervised and coordinated by the stone fabricator to insure that the as-quarried block orientations will yield finished stone material with characteristics as specified.

2. Stone for each designated type or grouped types shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved stone shall not be permitted, except by written permission of the Architect.

D. Provisions for Examinations

1. Examination at the Quarry: Quarried stone blocks shall be made available for inspection at Landscape Architect's per Article 2.1 of this Section.

2. Examination at the Fabrication Plant: Production units of stone shall be made available for inspection at Landscape Architect's request. To this end, the Contractor shall, after approval of final shop drawings, advise the Landscape Architect when production has begun and of the earliest possible opportunity to inspect a representative sampling of stone production work.

3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination of stone to the satisfaction of the Landscape Architect.

4. Suppliers: Acceptable suppliers include the following:

   (a) Bluebird Stone
   PO Box 125 Lathum Road
   Shady Point, OK 74956
   Tel: 918.647.7161

   (b) Green Country Stone
   10727 State Hwy 120
   Cameron, OK 74932
   Tel: 918.654.3627

   (c) Ibison Stone Supply

10520 Hwy 10 W
Hackett, AR 72937
Tel: 479.638.8678

(d) or approved equal.

2.5 STONE CURBS

A. Stone Curb sizes shall comply with requirements specified herein and in accordance with approved Shop Drawings.

1. The stones for the curb shall be split/cut to the following dimensions except as required by curvature requirements specified hereinafter:

Width	Length [(a)]		Height
	Minimum	Maximum	
4 Inches	3 Feet	5 Feet	14 Inches
6 Inches	4 Feet	5 Feet	18 Inches

(a) Stone Curbs to be set on an curved path / edge alignment shall be cut to shorter lengths as per approved Shop Drawings subject the following minimum length requirements:

Path Edge Radius	Minimum Length	Maximum Length
Under 5 Feet	6 Inches	12 Inches
5 Feet – 15 Feet	12 Inches	2 Feet
15 Feet – 25 Feet	2 Feet	4 Feet
Over 25 feet	As noted above	

2. Finish:

(a) Top and Bottom: Curbs shall be sawn finish and free from drill holes, tool marks, cracks and defects.

(b) Back Faces: Curb faces shall be sawn finish to an approximately true plane, free from drill holes, tool marks, cracks and defects.

i) The front and back faces shall be at right angles to the planes of the top and ends of the curb unit and shall be sawn.

ii) The ends of all stones shall be sawn square.

(c) Front Faces: Curb faces shall be bed face finish to an approximately true plane, free from drill holes, tool marks, cracks and defects and shall have no projections or depressions greater than 1/4 inch.

i) The front and back faces shall be at right angles to the planes of the top and ends of the curb unit and shall be sawn.

ii) The ends of all stones shall be sawn square.

2.6 STONE INSTALLATION MATERIALS

A. Portland Cement Setting Mortar and Joint Mortar/Grout Materials:

1. Portland Cement: Comply with ASTM C150, Type I or II. For joint mortar/grout, provide of natural color or white as required to produce joint color required. Cement shall in no case contain more than .03% by weight of soluble alkali (calculated as Na20). Submit mill certificates of cement and certified analysis from an approved testing laboratory.

2. Hydrated Lime: Comply with ASTM C207, Type S.

3. Aggregate: Comply with ASTM C144, except graded with 100% passing No. 16 sieve, non-staining or otherwise graded to comply with latex-additive manufacturer's requirements.

   (a) Colored Aggregate: Ground marble, granite, or other sound stone; selected to produce required grout color.

4. Latex Additive: Styrene-butadiene-rubber or acrylic-resin water emulsion serving as replacement for part or all of gauging water, of type specifically recommended by admixture manufacturer for use with job-mixed Portland cement and aggregate, and not containing a retarder.

   (a) Provide Latex Additive material as manufactured by:

      i) Boiardi Products Corp.

      ii) Custom Building Products.

      iii) Laticrete International, Inc.

      iv) Or approved equal.

   (b) Latex Additive material manufacturer shall perform pre-construction compatibility and adhesion testing of mixed setting bed and joint mortars/grouts with stone material as specified.

5. Colored Mortar Pigments for Joint Mortar/Grout: Natural and synthetic iron and chromium oxides, compounded for use in joint mortar/grout mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in Portland cement mixes with latex admixtures. Provide integral, non-fading colorant made by Davis Colors, Scoffield, or approved equal; color selected by the Architect.

6. Water: Potable, clear and free of deleterious materials that would impair the quality of the mortar/grout.

7. Latex-Portland Cement Grout: Comply with ANSI A118.6, composition as follows:

   (a) Packaged, dry grout mix consisting of Portland cement, graded aggregate, and ethylene vinyl acetate in the form of a reemulsifiable powder to which only water is added at Project site.

   (b) Dry Grout Mixture: Factory-mixed or job-mixed sanded grout consisting of the following:

      i) Portland Cement.

      ii) Aggregate.

      iii) Colored Mortar Pigments for Grout.

B. Non-Shrink Grout: Use premixed, non-shrink, non-staining epoxy type grout for setting stone fixing devices and for other conditions required.

1. Grout shall be capable of developing minimum compressive strength of 5000 psi (34 MPa) in 28 days.
2. Grout shall show no shrinkage prior to initial setting in accordance with ASTM C827 and after hardening in accordance with ASTM C157.

PART 3 EXECUTION

3.1 EXAMINATION

A. Pre-Installation Examination Required: The contractor shall examine previous work, related work, and conditions under which this work is to be performed and notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts concrete slab, waterproofing, previous work and conditions. Examination includes, but is not limited to:

1. Layout of curbs adjacent features including sidewalks and building columns.
2. Utilities, including but not limited to, catch basins, manholes and area drains

3.2 PREPARATION

A. Prior to installation, examine surfaces to receive stonework and do not proceed until any defects detrimental to the finished work are corrected.

B. Verify all measurements and dimensions and coordinate the installation of supporting construction for stonework. Coordinate and schedule stonework fabrications and installations with the work of other trades and contracts. Give particular attention to the location and size of cutouts required to accommodate utility and other work or adjoining construction.

C. Gravel / crushed aggregate sub-bases are to be provided in accordance with Section 31 20 00 – Earthwork.

D. Layout of Work: Accurately lay out stone curbs to patterns and to fit conditions as indicated, encountered on site, and specified for installation. Comply with set out control points as indicated and coordinate with other work of Project. Provide additional control points and stakeouts as required to effect correct alignments and grade elevations. Advise Construction Manager of any discrepancies or on-site conditions detrimental to critical layouts and obtain approved correction.

1. After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout and grades.
2. The Landscape Architect reserves the right to make adjustments to layout and grade without the Contractor submitting claims for extra compensation.
3. Landscape Architect shall provide additional direction in the field during placement of curbs to achieve the desired patterns as indicated.
4. The Contractor shall not proceed with the work of this Section without obtaining the Landscape Architect's written acceptance of layout and grading.

E. Prior to setting bed placements, verify subgrade and sub-base placement to correct line and grade and with correct finish and clean base surface.

1. Remove substances, from concrete substrates, that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

2. Clean stone curb surfaces that have become dirty or stained by removing soil, stains and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clean water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

F. Install curbs before installing adjacent pavement.

3.3 INSTALLATION

A. General:

1. Do not use stone with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

2. Execute the work by skilled mechanics and employ skilled stone fitters / cutters at site for necessary field cutting as stone is set.

3. Clean stone (especially edges) before setting.

4. Set stone in accordance with Contact Documents and final approved shop drawings. Provide anchors, supports, fasteners, and other attachments shown, or necessary to secure stone in place. Shim and adjust accessories as required for proper and correct setting of stone.

5. Mix curbs from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures. Review orientation of grain on pavers.

6. No stone shall be laid in inclement weather or when the temperature is below 40 degrees F., and dropping, nor shall any work be done on rising temperatures until the temperature reaches 40 degrees F. The use of frozen materials is strictly prohibited.

B. Setting Stone Curbs: Set units, with dowel pins as indicated, in full foundation bed of cement mortar as indicated. Joint grout shall be applied as a separate operation specified in Article “Pointing” herein and shall be of color selected and approved by Landscape Architect.

1. Joint Pattern for all stonework: As indicated on approved shop drawings. Strictly adhere to pattern.

2. Arrange stones for good fit with joint widths within tolerances indicated, and to provide offset between vertical joints as indicated.

3. Review all cut conditions at edges and vertical surfaces.

4. Setting tolerances:

(a) Finished curb shall not vary from prescribed line and grade more than 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.

(b) Do not exceed 1/8-inch unit-to-unit offset from flush (lippage).

C. Prepare footing and/or cradle and set a guideline at the desired height of curb. Lay blocks alongside the footing. Place concrete into footing. Set block in concrete even with the guideline.

D. Expansion Joints: Install sealant-filled joints at locations and to the widths indicated on the Drawings and in all locations where horizontal and vertical surfaces meet.

3.4 POINTING

A. Prepare stone joint surfaces for pointing with grout/mortar by removing dust and mortar particles. Joints to be cleaned and damp prior to pointing.

B. Maximum joint width is as indicated on the Drawings. Joints shall be pointed with cement mortar composed of one part Portland cement and two parts of sand by volume with sufficient water to form a workable mix. Cement shall be Portland cement ASTM C150, Type II. Joints to extend to front and back of the curb.

C. Apply pointing grout/mortar by placing and compacting in layers not greater than 3/8 inch (10 mm) until a uniform depth is formed in the raked out joint.

D. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

E. Tool joints of pointing grout/mortar to thumbprint hard surface condition. Use a smooth jointing tool to produce a smooth, flat face slightly below edges of stone.

3.5 PROTECTION OF STONEWORK

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Immediately remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. During installation, cover tops/surfaces and projections that may be subject to washout or damage with waterproof sheeting at the end of each day's work. Cover partially completed stonework when construction is not in progress.

C. Protect all stonework from other materials that will cause staining or defacement. Stone subject to damage after setting shall be properly covered or protected.

1. Lumber or other material liable to stain or deface the stone shall not be used in contact with stone.

D. After installation, protect stonework from damage during subsequent construction activities.

1. Provide additional protection for finished work including, but not limited to, exposed edges, corners, and all other stone liable to physical injury or staining.
2. Protection shall include but is not limited to non-staining approved coverings, and clean non-staining wood boxing. All fastenings or hold-back devices shall be stainless steel. Fastening to stone joints is prohibited.

E. At Substantial Completion of Project construction work or as directed by Construction Manager, remove all temporary protection installed as work of this Section.

F. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure stonework is without damage and deterioration at the time of Project Substantial Completion.

3.6 ADJUSTING, CLEANING, AND REPAIRING

A. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to Owner.

B. Remove and replace stonework of the following description:

1. Defective, broken, chipped, stained, or otherwise damaged stone units installed as work of this Section.
2. Unfilled or defective joints.
3. Stone masonry and joints not matching approved samples and mockups.

C. Replace in a manner that results in stonework matching approved samples and mockups.

D. In-Progress Cleaning: Clean stonework as work progresses. Remove grout/mortar fins and smears before tooling joints.

E. Final Cleaning: After setting mortar and, as applicable, grout is thoroughly set and cured, clean stonework as follows:

1. After completion of any repair work, clean exposed surfaces of all stone surfaces and units installed as work of this Section with clean water and stiff fiber brushes until all dirt, stains, efflorescence, grout/mortar, and other defacements are removed. Use cleaner and procedures recommend by stone quarry and stone fabricator and approved by Landscape Architect. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning operations.

F. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

G. Test cleaning methods on mockup; leave one-half of panel un-cleaned for comparison purposes. Obtain Landscape Architect's approval of sample cleaning before proceeding with cleaning of each area or element of stonework.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes mechanically stabilized earth retaining walls.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for excavation for mechanically stabilized earth retaining walls.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For mechanically stabilized earth retaining walls.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Certificates: For each type of mechanically stabilized earth retaining wall unit and soil reinforcement from manufacturer.
   1. Include test data for shear strength between mechanically stabilized earth retaining wall units according to ASTM D6916.
   2. Include test data for connection strength between mechanically stabilized earth retaining wall units and soil reinforcement according to ASTM D6638.

C. Product Test Reports: For each type of mechanically stabilized earth retaining wall unit and soil reinforcement, for tests performed by a qualified testing agency.
   1. Include test data for freeze-thaw durability of mechanically stabilized earth retaining wall units.
   2. Include test data for shear strength between mechanically stabilized earth retaining wall units according to ASTM D6916.

3. Include test data for connection strength between mechanically stabilized earth retaining wall units and soil reinforcement according to ASTM D6638.

D. Research/Evaluation Reports: For mechanically stabilized earth retaining wall units and soil reinforcement, from ICC-ES.

E. Preconstruction test reports.

F. Source quality-control reports.

G. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.
1. Build mockup of mechanically stabilized earth retaining wall.
   a. Include typical soil reinforcement.
   b. Include typical base and cap or finished top construction.
   c. Include backfill to typical finished grades at both sides of wall.
   d. Include typical end construction at one end of mockup.
   e. Include 36-inch return at one end of mockup, with typical corner construction.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:
1. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D6706.
2. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D5321.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them. Verify identification of geosynthetics before use and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Basis of Design: Design of mechanically stabilized earth retaining walls is based on products indicated. If comparable products of another manufacturer are proposed, engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mechanically stabilized earth retaining walls.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mechanically stabilized earth retaining walls.

C. Compliance Review: Qualified professional engineer responsible for mechanically stabilized earth retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.

D. Structural Performance: Engineering design shall be based on the following loads and be according to NCMA's "Design Manual for Mechanically stabilized earth Retaining Walls."
   1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
   2. Superimposed loads (surcharge) indicated on Drawings.

2.02 MECHANICALLY STABILIZED EARTH RETAINING WALL UNITS

A. Concrete Units: ASTM C1372, Normal Weight units shall not differ in height more than plus or minus 1/16 inch from specified dimension.
   1. Provide units that comply with requirements in ASTM C1372 for freeze-thaw durability.
   2. Provide units that interlock with courses above and below.

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

C. Shape and Texture: Provide units as selected by Architect.

D. Shape and Texture: Provide units matching basic shape, dimensions, and face texture of basis-of-design product.

E. Shape and Texture: Provide units of any basic shape and dimensions that produce mechanically stabilized earth retaining walls of dimensions and profiles indicated without interfering with other elements of the Work.

F. Special Units: Provide corner units, end units, and other shapes as needed to produce mechanically stabilized earth retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces as indicated on the drawings.

2.03 INSTALLATION MATERIALS

A. Pins: Product supplied by mechanically stabilized earth retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by mechanically stabilized earth retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by mechanically stabilized earth retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base drainage course.
   1. Leveling Course: Lean concrete with a compressive strength of not more than 500 psi.

E. Drainage Fill: Comply with requirements in Section 312000 "Earth Moving" for drainage course.

F. Reinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

G. Reinforced-Soil Fill: ASTM D2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; complying with the following gradation according to ASTM C136: 20 to 100 percent passing No. 4 sieve, zero to 60 percent passing No. 40 sieve, zero to 35 percent passing No. 200 sieve, and with fine fraction having a plasticity index of less than 20.

H. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

J. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.
   1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D4751.
   2. Minimum Grab Tensile Strength: 110 lb; ASTM D4632.
   3. Minimum Weight: 4 oz./sq. yd..

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement

2.04 SOURCE QUALITY CONTROL

A. Factory test and inspect each roll of soil reinforcement for minimum average roll values for geosynthetic index property tests, including the following:
   1. Weight.
   2. Grab or single-rib strength.
   3. Aperture opening.

4. Rib or yarn size.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of the Work.

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

3.02 RETAINING WALL INSTALLATION

A. General: Place units according to NCMA's "Mechanically stabilized earth Retaining Wall Installation Guide" and mechanically stabilized earth retaining wall unit manufacturer's written instructions.
   1. Lay units in bond pattern indicated.

B. Do not use units with chips, cracks, or other defects that are visible at a distance of 20 feet where such defects are exposed in the completed Work.

C. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D698.
   1. Leveling Course: Compact and screed concrete to a smooth, level surface.

D. First Course: Place first course of mechanically stabilized earth retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.
   1. Tamp units into leveling base as necessary to bring tops of units into a level plane.

E. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
   1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
   2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
   3. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
   4. For units with pins, install pins and align units.
   5. For units with clips, install clips and align units.

F. Cap Units: Place cap units and secure with cap adhesive.

3.03 FILL PLACEMENT

A. General: Comply with requirements in Section 312000 "Earth Moving," with NCMA's "Mechanically stabilized earth Retaining Wall Installation Guide," and with mechanically stabilized earth retaining wall unit manufacturer's written instructions.

B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.

C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall, and place and spread fills toward embankment.
   1. Use only hand-operated compaction equipment within 48 inches of wall, or one-half of height above bottom of wall, whichever is greater.
   2. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D698.
      a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D698.
      b. In areas where fill height exceeds 15 feet compact reinforced-soil fill that will be more than 15 feet below finished grade to not less than 98 percent maximum dry unit weight according to ASTM D698.
      c. In areas where fill height exceeds 30 feet compact reinforced-soil fill that will be more than 30 feet below finished grade to not less than 100 percent maximum dry unit weight according to ASTM D698.
   3. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."

D. Place drainage geotextile against back of wall, and place layer of drainage fill. Place another layer of drainage geotextile between drainage fill and soil fill.

E. Place a layer of drainage fill behind wall. Place a layer of drainage geotextile between drainage fill and soil fill.

F. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated sloped not less than 0.5 percent to drain.

G. Place impervious fill over top edge of drainage fill layer.

H. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at wall base away from wall. Provide uniform slopes that prevent ponding.

I. Place soil reinforcement in horizontal joints of retaining wall where indicated and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.
   1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
   2. Place geosynthetics with seams, if any, oriented perpendicular to mechanically stabilized earth retaining walls.

3. Do not dump fill material directly from trucks onto geosynthetics.
4. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.
5. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

3.04 CONSTRUCTION TOLERANCES

A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet, 3 inches maximum.

B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet.

C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.

D. Maximum Gap between Units: 1/8 inch.

3.05 FIELD QUALITY CONTROL

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

B. Comply with requirements in Section 312000 "Earth Moving" for field quality control.
1. In each compacted backfill layer, perform at least one field in-place compaction test for each 150 feet or less of mechanically stabilized earth retaining wall length.
2. In each compacted backfill layer, perform at least one field in-place compaction test for each 24 inches of fill depth and each 50 feet or less of mechanically stabilized earth retaining wall length.

3.06 ADJUSTING

A. Remove and replace mechanically stabilized earth retaining wall construction of the following descriptions:
1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.
2. Mechanically stabilized earth retaining walls that do not match approved Samples and mockups.
3. Mechanically stabilized earth retaining walls that do not comply with other requirements indicated.

B. Replace units so mechanically stabilized earth retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. General Description Includes:
1. Underground irrigation systems.
2. Pipe and fittings, valves, sprinkler heads, drip tubing, quick couplers, accessories.
3. Automatic control system.
4. Excavation and backfilling for installation of underground system.
5. All necessary permits, licenses, and fees.

1.2 SYSTEM DESCRIPTION

1. Full and complete coverage is a requirement. Contractor shall, at no additional costs to the Owner, modify layout, make necessary adjustments, as needed to obtain full coverage without overthrow on roadways, pavements, structures, furniture, fountains or buildings and to protect trees and shrubs from close high spray velocity.
2. Provide irrigation layout with separate plant type zones:
   a. Park lawn (seed and sod)
   b. Plant beds containing groundcover, perennials, shrubs
   c. Trees (supplemental)
3. Provide flow velocities that do not exceed 5.0 ft. per second.
4. Provide irrigation of lawn areas with no overspray into planting beds or pavements, unless so designed on the drawings.
5. Provide independent irrigation of individual bed zones or planters.

1.3 SUBMITTALS - REVIEW

A. Product Data: Submit manufacturer's technical data and installation instructions for all components and equipment used.

B. Shop Drawings:
1. Indicate piping layout to water source.
2. Include piping layout and details illustrating location and types of valves and wiring diagram showing routes, wire sizes, wiring details and source of current and connections, and schedule of fittings.
3. Indicate location of sleeves under pavements and conflicts with existing utilities.

1.4 SUBMITTALS - CLOSEOUT

A. Comply with the requirements of the General Conditions.

B. Record Drawings:
1. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. "As-built" drawings must be approved before charts are prepared.
2. At the time of the irrigation mainline test, provide a preliminary set of "Record" drawings to the Owner.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Single firm specializing in irrigation work with a minimum of five years of experience properly installing irrigation systems of comparable size. Crew leader is to hold a certification of competence in irrigation design or installation (example, CLIA, CIC, CID from Irrigation Association).

1. Provide references of your last five consecutive systems, and five systems of comparable size with bid proposal.

B. Multiple units: when two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.

C. Materials, equipment, and methods of installation shall comply with the following codes and standards:
1. State of Arkansas Building Codes.
2. American Society for Testing and Materials (ASTM).
3. National Sanitation Foundation (NSF).

D. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

E. Requirements of Regulatory Agencies:
1. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Building Code and other applicable laws or regulations, including any local Plumbing Codes.
2. Should the Contract documents be at variance with the rules and regulations, notify the Owner for instructions before proceeding with work affected.

F. Testing:
1. Preliminary review of completed main line and wire installation will be made prior to backfilling of trenches and hydrostatic testing.
2. Final review and testing shall be made in conjunction with the final review of lawn, shrub, and tree planting. The irrigation system must be operational for 14 days prior to this final inspection. Any failures are to be corrected and the testing cycle is to be repeated.
3. Contractor is to notify Landscape Architect three days prior to testing.

G. Permits and Inspections:
1. Any permits for the installation or construction of any work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the contractor, each at the proper time.
2. The Contractor shall also arrange for and pay all costs in connection with any inspection and examination required by these authorities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver irrigation system components in manufacturer's original, undamaged, and unopened containers, with labels intact and legible.

B. Deliver plastic pipe in bundles, packaged to provide adequate protection of pipe ends.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure, locked storage for valves, wire, and similar components that cannot be immediately replaced to prevent installation delays.

E. Contractor is responsible for materials through final acceptance.

1.7 PROJECT CONDITIONS

A. Protect existing trees, plants, and lawns and other features designated to remain as part of the final landscape.

B. The Contractor shall carefully coordinate with the landscape work and other site developments, including all new and existing utilities.

C. The Contractor shall verify the correctness of all finish grades within the work area to ensure the proper soil coverage of the irrigation pipes.

D. Irrigation system layout is diagrammatic. Exact location of piping, valves, and other components shall be established by Contractor in the field at time of installation.

E. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.

F. Locate existing utilities in areas of work. If utilities are to remain, provide adequate means of protection during the system installation. Repair utilities damaged during the work to the satisfaction of the Utility Owner and at the Contractor's expense. Notify local Utilities Protection Service 48 hours before start of construction.

G. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, notify the Owner immediately for direction as to procedure. Cooperate with the Owner and Utility companies in keeping active services and facilities in operation.

H. Minor adjustments in system layout will be permitted to clear existing field obstruction. Final system layout shall be acceptable to the Landscape Architect.

1.8 WARRANTY

A. Warranties are subject to the General Conditions and Supplementary Agreements.

B. The Contractor shall guarantee all parts and labor for a period of one year from the date of final inspection. If within that period settlement occurs, and adjustments in pipes, valves and sprinkler heads, lawn areas or paving are necessary to bring the system, grade or paving to the proper level of the permanent grades, the Contractor, as part of the work under his Contract, shall make all adjustments without extra cost to the Owner, including the restoration of all damaged planting, paving or other improvements of any kind.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyl (PCB) or other hazardous materials identified by the Owner.

2.2 IRRIGATION SYSTEM MANUFACTURERS

A. All irrigation system components shall be supplied by regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all aspects.

2.3 MATERIALS

A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of this system.

B. Plastic Pipe

1. All piping shall be from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles, and dents. All pipes shall be National Sanitation Foundation (NSF) approved.
2. For all piping 3" and over, use SDR 21, Class 200 gasketed PVC bell and spigot pipe.
3. For all piping 2.5" and under, use polyvinyl chloride (PVC) Schedule 40 sized to maintain a maximum flow velocity of less than 5 ft. per second (FPS).
4. Outside diameter of pipe shall be the same as iron pipe.
5. Pipe shall be marked at intervals (not to exceed 5') with the following information: Manufacturer's name or trademark, nominal pipe size, schedule, PVC type and grade (i.e., PVC SCH40), rating class, working pressure at 73 degrees F. and NSF approval.
6. When connection is plastic to metal, male adapters shall be used.
7. Comply with pipe sizes indicated on drawings. No substitution of smaller pipe will be permitted. Larger sizes may be used subject to acceptance of the Landscape Architect. Remove damaged and defective pipe from site.
8. All PVC pipe to be furnished in 20' lengths.
9. Acceptable Manufacturer:
   a. Silverline Plastics

C. Piping for Sleeving
1. For sleeves less than six inches in size, use high impact type, polyvinyl chloride (PVC) 1120, minimum Schedule 40.
2. Sleeves six inches and above in size shall be Polyvinyl Chloride (PVC) 1120 Class 200.
3. Irrigation Contractor shall be responsible for the coordination of sleeves for all piping passing through concrete curbing, under paved areas, concrete or masonry walls and floors while the same are under construction.
4. Acceptable Manufacturer:
   a. Silverline Plastics

D. Ductile Iron Fittings (3")
1. Fittings shall be manufactured of ductile iron. Fittings shall have deep bell push-on joints with gaskets.
2. Transition gaskets are not allowed.
3. Acceptable Manufacturer:
   a. Harco

E. Lubricant for Assembling Gasket Pipe and Fittings
1. Water soluble, non-toxic, and shall be non-objectionable to taste and odor imparted to the fluid contained therein, non-supporting to bacteria growth, and shall have no deteriorating effect on PVC and rubber gaskets.

F. PVC Fittings
1. Schedule 40 or 80, polyvinyl chloride (PVC), injection molded fittings suitable for solvent weld or threaded connections for PVC pipe size 2" and under. Fittings made of other materials are not permitted.
2. Threaded PVC nipples shall be Schedule 80. Use high quality grade of Teflon tape for threaded fittings.
   (a) Saddle fittings are not permitted.
   (b) Use high quality grade of Teflon tape for threaded connections.
3. Acceptable Manufacturer:
   a. Spears Manufacturing

G. Isolation Valves (Under 3")
1. Valves under 3" shall be 200 PSI rated W.O.G. 200 domestically manufactured with bronze bodies. Valves shall be equipped with tee handles.
2. The valve shall have a 100% urethane coated wedge insuring a bubble-tight seal up to 200 PSI. The valve shall be fusion-bonded epoxy coated with PVC push-on, threaded or mechanical connections and a two-inch square nut for vertical valve stem key.
3. Acceptable Manufacturer:
   a. Watts Regulator

H. Isolation Valves (3")
1. Valves 3" and larger shall be 200 PSI rated with iron bodies. Valves shall be equipped with square nut handles.
2. The valve shall have a double-disc inclined seat and non-rising stem, meeting AWWA Standard C509.
3. Acceptable Manufacturer:
   a. Clow Valve Company

I. Quick Coupling Valves
1. Valve shall be of two-piece construction with a one-inch female thread with vinyl cover.
2. Furnish one valve key fitted with one-inch swivel hose ells.
3. All quick coupling valve keys and hose swivels shall be of the same manufacturer as the quick coupler.
4. Acceptable Product:
   a. Hunter HQ5

J. Valve Boxes
1. Tapered rib reinforcement enclosure of rigid tensile strength plastic material components chemically inert and unaffected by moisture, ultraviolet light, corrosion, and temperature changes. Lid and base shall withstand normal loads exerted by turf equipment without collapsing. Box and lid to be black.
2. For Isolation valves use 10" circular turf box.
3. Acceptable Manufacturer:
   a. NDS

K. Fixed Spray Sprinklers
1. Full or part circle pop-up fixed spray sprinkler.
2. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultra-violet resistant plastic. It shall have a heavy-duty stainless steel retract spring for positive pop-down and a ratcheting system for easy alignment of the pattern. The sprinkler shall have a soft elastic pressure-activated co-molded wiper seal for cleaning debris from the pop-up stem as it retracts into the case to prevent the sprinkler from sticking up to minimize "flow-by." The sprinkler shall have a matched precipitation rate (MPR) plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be capable of housing under the nozzle; protective, non-clogging filter screens or pressure compensating screens. The screen shall be used in conjunction with the regulating screw for regulating.
3. The sprinkler shall have a flush plug reinstalled. The plug shall prevent debris from clogging the sprinkler during installation and allow for system to be flushed before installing nozzles.
4. The 4", 6" or 12" high pop-up spray sprinklers shall also include an integral check valve and an integral pressure-regulating device.

5. The check valve shall prevent low-head drainage of up to 8 feet of head. The pressure regulating device shall prevent high pressure fogging of the nozzle stream by regulating the nozzle pressure to 30 PSI for inlet pressure from 35 to 70 PSI
6. Spray nozzles for sprinkler heads shall be of the same manufacturer as the spray head.
7. Acceptable Product:
   a. Hunter PRO-S-PRS30-CV

L. Rotator Nozzles
1. The rotary nozzle shall have an adjustable arc of between 90 and 210 degrees and shall be capable of covering a 10-30' radius at 30 PSI.
2. The rotary nozzle shall have multiple arced streams and have a matched precipitation rate of 0.60 in/hr.
3. The rotary nozzle shall be constructed of UV-resistant plastic. The radius adjustment screw shall be of stainless steel and shall include a removable mesh screen to protect the nozzle against clogging.
4. Acceptable Products:
   a. Hunter MP Series

M. Medium Range Rotors
1. The full or part circle rotor sprinkler shall be a single stream, water lubricated, gear drive.
2. The part circle sprinkler shall have adjustable arc coverage from 30 to 350 degrees.
3. The sprinkler shall have a thread-on nozzle assembly whose installation shall not require any tools. The arc adjustment shall not require any tools.
4. The sprinkler shall have a pressure-activated multi-function wiper seal that positively seals against the nozzle flange to keep debris out of the rotor and to clean debris from the pop-up stem as it retracts.
5. The sprinkler shall have a screen attached to the drive housing to filter inlet water, protect the drive from clogging and simplify its removal for cleaning and flushing of the system. It shall have a 3/4" bottom inlet.
6. The sprinkler shall have a stainless steel retract spring for positive pop down.
7. The sprinkler shall have an adjusting screw capable of reducing the radius by up to 25%.
8. Pop-up heights: 4 inches and 12 inches (see drawings).
9. Acceptable Products:
   a. Hunter PGP

N. Long-Range Rotors
1. The part or full circle sprinkler shall be a single stream, water lubricated, gear drive type.
2. The sprinkler shall have a rotating nozzle turret independent of the riser stem. The portion of the riser stem that is in contact with the wiper seal shall be non-rotating.
3. The sprinkler shall have a pressure activated, multi-function, wiper seal that will clean debris form the pop-up stem as it retracts.
4. The sprinkler shall have a screen attached to the drive housing to filter inlet water, protect the drive from clogging and simplify its removal for cleaning and flushing of the system.
5. The sprinkler shall have a front-loading nozzle assembly, which will allow the nozzle to be installed without a stator bushing change.
6. The sprinkler shall have a standard check valve capable of holding up to 8'of head.
7. Pop-up heights: 4 inches and 12 inches (see drawings).
8. Acceptable product:

a. Hunter I-20

O. Drip Tubing
1. Drip tubing shall be continuously self-flushing and pressure compensating. It shall consist of nominal sized one-half inch low density, linear polyethylene tubing, housing internal pressure compensating, continuously self-flushing, integral drip emitters.
2. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.67 inches, and an inside diameter (I.D.) of 0.57 inches. The emitters shall have the ability to independently regulate discharge rates, with an output pressure of seven to seventy PSI, at a constant flow.
3. The emitter discharge rate shall be 0.61 gallons per hour (GPH), utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The emitters shall continuously clean themselves while in operation. The tubing shall have 18" spacing between emitters as noted on drawing.
4. Acceptable Product:
   a. Netfim TLCV-06-18

P. Automatic Controller
1. The controller shall be a full-featured commercial-industrial product for the purpose of irrigation management and monitoring of control valves, flow, and sensors, via two-wire decoder connections. The controller shall be a 75-station base model expandable with 75-station input modules up to 225 stations.
2. The controller shall have 32 independent programs with unique day schedules, start times, and station run times.
3. Each program shall allow Day of Week, Interval, or Odd/Even schedule types.
4. Each program shall offer up to 10 start times. Each program may be allowed to overlap, stack, or SmartStack™ to a user-specified maximum number of simultaneous programs.
5. Each program may have programmable Non-Water Windows, during which automatic irrigation will not be allowed.
6. Missed irrigation because of water window violations is logged and announced as an alarm.
7. Manual irrigation for maintenance purposes shall not be inhibited by Non-Water Windows.
8. Programs may be configured as Automatic, Start to End, or Manual only.
9. Start to End programs shall cycle continuously from a start time to an end time.
10. Manual programs are only initiated by the user from a command, remote control, or Conditional Response statement.
11. Each station shall be programmable in hours, minutes, and seconds of run time, from 1 second to 12 hours.
12. The controller shall allow the creation of up to 64 "blocks" of up to 8 stations each, used to facilitate programming and operation of larger systems.
13. The blocks may be assigned a single run time within a program, and all stations will run together as a group.
14. Each program may be assigned a programmable delay between stations, to allow for slow-closing valves or pressure recharging.
15. Each station or block may be assigned Cycle and Soak settings to prevent runoff and waste by dividing run times into absorbable increments.
16. The controller shall feature a separate decoder diagnostic menu with functions to:
    a. Program decoders.

b. View status or configuration of individual decoders.
c. Assign stations from one decoder output module to another.
d. Create a decoder inventory.
e. Perform diagnostic tests and display current amp draw for all components.

17. Acceptable Product:
    a. Hunter ACC2-75D-M

Q. Central Control

1. The Irrigation Management Platform from shall consist of cloud-based control software capable of remote monitoring and management of compatible Hunter residential and commercial irrigation controllers via Wi-Fi, Ethernet (LAN), or 4G LTE cellular connections.
2. The central control software shall be accessible via internet browser and display the activity of all managed controllers in list and/or map overviews.
3. All controllers shall be visible on a live, online map and located automatically based on the user-supplied controller addresses.
4. The map shall automatically size to the extents of the controller locations to show all controllers, and users may zoom, pan, and navigate freely throughout the map for controller selection purposes.
5. The central control software shall permit selection of any controller, and then offer full remote programming of all controller features in the browser, including irrigation scheduling, controller settings, and weather-based watering adjustments.
6. The central control software shall allow the user full remote-control capabilities, including starting and stopping individual stations and programs, or setting the controller to Off for a user-defined number of days. The system shall also allow quick adjustment of irrigation amounts by a percentage value.
7. The central control software shall be compatible with locally installed smart weather adjustment sensors, which can adjust each controller's irrigation schedule automatically based on local climate conditions. The software shall also report controller shutdowns due to active rain, freeze, soil moisture, or other sensors.
8. The central control software shall display the forecast weather for each controller several days in advance and shall enable automatic shutdowns of irrigation when the forecast temperature or chance of rainfall exceed a user-specified threshold.
9. The central control software shall have multi-user permissions for maintenance organizations, where each controller shall have a designated owner who may then grant control access for specified controllers to other authorized personnel by email address.
10. Access may be granted or canceled at any time (by individual or group) by the designated owner.
11. The central control software shall automatically alert owners and/or designated crewmembers via SMS text messages when selected alarms occur at a controller location, indicating the controller and the type of alarm for rapid response or repair.
12. The central control software shall detect any settings or scheduling conflict between the software and the controller hardware and shall alert the user if a conflict is detected. The software shall have the ability to identify and display any conflicts and allow the user to decide which settings shall be used.
13. Irrigation controllers shall be connected to the internet and central control software via Ethernet (LAN). Ethernet connections shall be standard RJ-45 hardwired jack to the network via approved cable (CAT 5, CAT 5e, CAT 6, or equal).
14. Communications modules shall be installed internally or attached to the host controller.

15. Acceptable Product:
    a. Hunter Centralus with LANKIT

R. Line Decoders
1. The factory pre-coded decoders shall be fully waterproof and have a working range shall be 0 degrees C to 50 degrees C at up to 100% humidity.
2. Decoders shall be capable of operating from one to six solenoids depending on the model specified on the Drawings
3. Acceptable Product:
    a. Hunter ICD

S. Surge Protection
1. Line surge protection compatible with the irrigation controller and grounded via 8' copper rods or grounding plates shall be installed every 500' along the wire path, at the end of every wire run, or as suggested by the controller manufacturer's latest printed instructions.
2. Grounding rods and plates shall not be installed in the same valve box as the zone control valves.

T. Control Wire
1. Two conductors of single strand solid copper wire type, with PVC jacket. UF 600-volt AWG #14 minimum approved for direct burial. For runs over 2,000 L.F. use AWG #12. Contractor is to verify that wire sizes are within recommended wire run lengths for proper solenoid operation.
2. Hot or control wires are to be red in color. Common wires are to be white in color. Spare wires are to be blue in color.

U. Flow Sensor
1. The flow sensor shall be an in-line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part, compatible with the controller. The electronics housing shall be glass-filled PPS. The impeller shall be glass-filled nylon. The shaft material shall be tungsten carbide.
2. The electronics housing shall have two, ethylene propylene O-Rings and shall be easily removed from the meter body. The sensor electronics will be potted in an epoxy compound designed for prolonged immersion.
3. Electrical connections shall be 2 single conductor 18 AWG leads 48 inches long. Insulation shall be direct burial "UF" type colored red for the positive lead and black for the negative lead.
4. The sensor shall be capable of operating in line pressure up to 100 PSI and liquid temperatures up to 140° F and operating in flows of ½ foot per second to 30 feet per second with linearity of ±1% and repeatability of ±1%.
5. Acceptable Product:
    a. Hunter HFS-200

V. Flow Sensor Cable
1. Direct-burial, polymer coated aluminum shielded, insulated, 1 pair multi conductor, with polyethylene outer jacket for connecting flow sensors with satellite controllers.
2. Two 20 AWG foil shield w/drain, black jacket, rated for direct burial BLK, WHT. Two conductor direct burial shielded cable used with all field sensor connections to satellites such as flow sensors. Cables not to exceed 609 meters (2000 feet) in length.

W. Sensor Cable Splice and Cap
1. A three-part, rigid-body closure that self-encapsulates two and five pair buried service wire. It has a built-in bonding system that bonds the buried service wire shield as the

splice is put together. The special formulated sealant is a one part, no mix, non-urethane product containing no grease.

X. Rain Shutoff
1. One device shall be provided for each controller. Install per manufacturer's latest printed instructions.
2. Verify with Landscape Architect as to final location of rain shutoff.
3. Acceptable Product:
   a. Hunter Mini-Clik

Y. Master Valve
1. The electric control valve shall be a normally open 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe/angle pattern design. The valve pressure rating shall be at least 150 PSI.
2. The valve body and bonnet shall be constructed of brass with stainless steel screws.
3. The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
4. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing.
5. The valve shall feature a self-cleaning inlet orifice with metering rod allows only "clean water" to enter upper diaphragm chamber offering consistent, trouble-free operation. The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
6. Acceptable Product:
   a. Buckner Superior model 3100 or approved equivalent

Z. Control Valves (Sprinklers)
1. The electric remote-control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe/angle pattern design. The valve pressure rating shall not be less than 150 PSI.
2. The valve body and bonnet shall be constructed of high-impact, water-resistant PVC for the body and glass-filled nylon for the bonnet with stainless steel screws.
3. The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
4. The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24-VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 150 PSI. At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.
5. The valve shall have a flow control stem for accurate manual regulation and/or shut from outlet flow. The valve must open or close in less than 1 minute at 150PSI and less than 30 seconds at 20 PSI.
6. The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ringed plug for installation in either globe or angle configuration.
7. Acceptable Product:
   a. Hunter ICV-G

AA. Control Valves (Drip)
1. The control valve shall be normally closed 24 VAC 50/60-cycle solenoid actuated globe pattern. The pressure rating shall not be less than 150 PSI.

2. The valve body and bonnet shall be constructed of UV-resistant plastic and have stainless steel screws; diaphragm shall be of nylon reinforced nitrile rubber.
3. The valve shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
4. The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24-VAC 50/60 Hz solenoid shall open with 19.6-volt minimum at 150 PSI. At 24 VAC average inrush current shall not exceed .23 amps.
5. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
6. The complete valve control kit shall consist of the electric valve, a 200-mesh stainless steel filter screen, and a 30-PSI pressure regulator.
7. See Drawings for size of valves.
8. Acceptable Product:
   a. Hunter ICZ-101

BB. Accessory materials
1. Drainage fill at valve boxes:
   (a) Provide 1" washed pea gravel in each valve box.
2. Suitable excavated materials removed to accommodate the irrigation system work shall be used as fill materials provided it conforms to the requirements of fill as noted above.

CC. PVC Solvent Cement:
1. Provide professional grade cement, Whitlam #PR32 or approved equivalent for PVC pipe and fittings.

DD. PVC Primer/Cleaner
1. Provide professional grade primer/cleaner, Whitlam #PP32 or approved equivalent (purple) primer.

PART 3 - EXECUTION

3.1 GENERAL

A. Lay out work as accurately as possible to Drawings. Drawings are diagrammatic to the extent that swing joints, offsets, and fittings are not shown.

B. The Irrigation Contractor shall carefully schedule his work with the Landscape Contractor and all other site developments.

C. Sleeves are required wherever piping or electrical wires are placed under paved surfaces (installed as part of other sections and Contract). Irrigation Contractor is responsible for coordination of all sleeves.

D. Full and completed coverage is required. Contractor shall make any necessary minor adjustments to layout as required to achieve full coverage of irrigated areas at no additional cost to the Owner.

E. Where piping is shown on drawings to be under paved areas but running parallel and adjacent to planted areas, the intent is to install piping in planted areas. Do not install directly over another line in the same trench.

F. It shall be the Contractor's responsibility to establish the location of all sprinkler heads to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on drawings. No substitution of smaller pipe sizes will be permitted, but substitutions of larger sixes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

G. Install irrigation system after completion of site grading, the irrigation system shall be installed and completely operational three days prior to the installation of any planting operations.

3.2 POINT OF CONNECTION

A. Provide irrigation system complete from points of connection. See Drawings for Points of Connection (POC).

3.3 EXCAVATING

A. All piping is to be trenched. Pipe-pulling (vibratory plow) is not allowed.

B. In areas where tree roots exist and are designated to be protected, all trenching must be done by hand.

C. No tree roots over 3" in diameter may be cut.

D. Excavate to depths required to provide six inches of Granular Fill bedding material under paved surfaces.

E. Should utilities not shown on the plans be found during excavations, the Contractor shall promptly notify the Owner for instructions as to further actions required. Failure to do so will make Contractor liable for all damage thereto arising from his operations after discovery of such utilities. Indicate such utility crossings on the record drawings promptly.

F. Install main line irrigation lines with a minimum cover of twenty-four inches and a maximum cover of forty-eight inches based on finished grades.

G. Install lateral irrigation lines with a minimum cover of twelve inches and a maximum cover of twenty-four inches based on finished grades.

H. Tracer wire shall be installed with all irrigation mainlines under concrete or asphalt. End of tracer wire shall terminate at edges of hardscape and be labeled in 6" irrigation box.

I. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.

J. Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide adequate space for backfilling and compacting.

K. When two pipes are to be placed in the same trench, a six-inch space is to be maintained between the pipes. The Contractor shall not install two pipes with one directly above the other.

L. The Contractor shall cut trenches for pipe to required grade lines and compact trench bottom to prove accurate grade and uniform bearing for the full length of the line.

M. The Contractor shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts.

3.4 PIPELINE ASSEMBLY

A. General
1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
2. Clean all pipes and fittings of dirt, scales, and moistures before assembly.
3. All pipe, fittings, and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when laying is not in progress, open ends of pipe shall be closed by approved means.
4. All lateral connections to the main line as well as all other connections shall be made to the side of the main line pipe. No connections to the top of the line shall be allowed.

B. Solvent-Welded Joints for PVC Pipe
1. Use solvents and methods approved by solvent and pipe manufacturers.
2. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty-four hours before placing the joint under water pressure, unless otherwise specified by the manufacturer. Cut all pipe with square ends and remove burrs, ridges, and dirt. Check dry fit pipe and fitting. Clean pipe and fitting with purple primer and apply thin coat of cement to fitting with a liberal coat to pipe. Quickly push pipe fully into fitting using a ¼ turning motion. Hold pipe and fitting together a minimum of 30 seconds, wipe off excess with cloth.

C. Threaded Joints for PVC Pipe
1. Use Teflon tape on all threaded PVC fittings.
2. Use strap-style friction wrench only. Do not use metal-jawed wrench.

D. Joint Restraints for Gasketed Fittings
1. Provide on pipe fittings greater than or equal to 3-inch diameter or rubber gasketed pipe.
2. Thrust Blocks: Concrete, 20 MPa (3,000 psi) No. 4 rebar.
3. Joint Restraint Harness: Provide joint restraint harness where joints not positively restrained by flanged fittings, threaded fittings, or retainer glands and thrust blocks. Provide on ductile iron fittings 3-inch and larger, transition fittings between metal and PVC pipe, where thrust block is not allowed, or where extra support is required to retain fitting or joint.
4. Provide joint restraint harness or retainer glands with preset torque shearing set screws on mainline gate valve assemblies 3-inch and larger.
5. Provide stainless steel bolts, nuts, retaining clamps, all thread, or other joint restraint harness materials retainer, and high strength, low alloy steel bolts and connecting hardware.

E. Laying of Pipe
1. Pipes shall be bedded in at least in at least two inches of finely divided material with no rocks or clods over one-inch diameter to provide a uniform bearing.
2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
3. Do not lay PVC pipe when there is water in the trench.
4. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner to ensure that a square cut. Burrs at end cuts shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

5. All plastic-to-plastic joints will be solvent-weld joints or slip seal joints. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.
6. Zone pipes for sports fields must be installed prior to placement of engineered soils.

3.5 PVC SLEEVES AND ELECTRICAL CONDUIT

A. Provide all sleeves indicated and as otherwise required for the successful completion of the irrigation system. Coordinate sleeving efforts with General Contractor and the Owner.

B. All PVC sleeves shall be a minimum of twice the diameter of pipe to be sleeved.

C. All PVC control wire conduit shall be of sufficient size to hold the required quantity of control and common wires. Electrical wires are not to be placed in the same trench with water pipes.

3.6 SPRINKLER HEADS

A. All sprinkler heads shall be pop-up type heads. Permanent shrub risers are not permitted.

B. All sprinkler heads within a zone shall have matched precipitation rates.

C. Install plumb to within 1/16", unless otherwise noted (see detail for heads on sloped areas on detail sheet). Top of collar (not nozzle) should be flush with finish grade.

D. Place part-circle pop-up sprinkler heads at least two inches and no more than six inches from edge of adjacent walks, curbs and mowing bands, or paved areas at time of installation.

E. Install pop-up sprinkler heads, and accessories in accordance with manufacturer's latest printed instructions, except as otherwise noted.

F. All sprinkler nozzles shall be adjusted for the proper radius and direction of spray pattern. Adjust where possible to prevent over spraying onto walks, pavement, or buildings.

G. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw as required for proper radius.

H. Swing joints for sports field sprinklers must be installed prior to placement of engineered soils. Sprinkler heads only may be installed after engineered soil is placed.

3.7 DRIP TUBING

A. Tubing is designed for use in surface and sub-surface applications utilizing a grid design, the result being a complete wetted area within the grid. It can also be installed as single or "snaked" lines where grids are not justified. The most uniform way to install tubing is sub-surface at a uniform depth as specified.

B. Tubing shall be staked down using 6" galvanized sod staples. Staples shall be spaced no further than 24" on center, but the contractor will place staples as closely as necessary to ensure that tubing will not work its way to the surface.

3.8 ISOLATION VALVES

A. Shall be in the following locations:
1. After backflow preventer and prior to main supply loop.
2. Between main line and each quick coupler valve.

3. Between the main line and each valve or group of valves on a submain.
4. As located on irrigation system drawings within lawn areas.

B. Install each isolation valve in an individual valve box with a six-inch (deep) layer of washed gravel below the bottom of the valve.

C. Seal threaded connections with Teflon tape.

3.9 QUICK COUPLING VALVES

A. Shall be set a minimum of twelve inches from walks, curbs, or paved areas where applicable or as otherwise noted. Quick coupling valves shall be housed in standard size valve boxes.

B. All quick coupler valves shall be installed on to ductile iron service tee.

C. Install one-inch bronze gate valve on pressure side of each quick coupler valve. Locate in valve box with quick coupler valve.

D. Valves shall be installed on a three-elbow PVC Schedule 80 swing joint assembly.

E. Provide six-inch (deep) layer of washed gravel below the bottom of the valve. Top of quick coupler valves shall be as close to the top of the valve box as possible. Top of gravel layer shall be three inches below the top of the valve.

F. Quick coupling valves shall be set perpendicular to finished grade unless otherwise designated on the plans.

G. Quick coupler locations are to be staked in the field by installer for approval by Landscape Architect prior to installation.

3.10 CONTROL VALVES

A. Coordinate location of all valve boxes with Landscape Architect. Do not proceed in uncertainty.

B. All irrigation control valve clusters on 3” pipe shall be installed with ductile iron service tees.

C. Install each electric control valve in an individual valve box with a six-inch (deep) layer of washed gravel below the bottom of the valve.

D. Seal threaded connections with Teflon tape.

E. Valves shall be installed as shown in details and in accordance with manufacturer’s instructions and specifications.

3.11 VALVE BOXES

A. Valve boxes shall be set flush with grade in lawn areas and one-half inch above finish grade in ground cover and shrub bed areas.

B. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the valve box.

3.12 AUTOMATIC CONTROLLER

A. Mount the controller flush with the mounting surface. Controller should be level with the surface of the floor or concrete mounting pad.

B. Mount the controller pedestal with the mounting hardware and template supplied.

C. The automatic controller shall be installed at the approximate location shown on the Drawings. (Suitable power supply will be supplied as part of other sections and Contract).

D. All local and other applicable codes shall take precedence in connecting the 110-volt electrical service to the controller.

E. Install per local code, manufacturer's latest printed instructions, and as detailed.

F. Valve control wires shall be numbered at the terminal strip.

3.13 CONTROL WIRING

A. All electrical equipment and wiring shall comply with local and state codes and be installed by those skilled and licensed in the trade.

B. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines whenever possible and shall have a minimum of twelve inches cover.

C. Control wires shall be installed to the side of the main line whenever possible. Placement over pipes is not permitted.

D. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of twenty feet.

E. An expansion curl shall be provided within three feet of each wire connection and at least every one-hundred feet of wire length on runs of more than one hundred feet in length. Expansion curls shall be formed by wrapping at least five turns of wire around a one-inch diameter pipe, then withdrawing pipe.

F. Control wire splices at stubs for suture to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than five hundred and they must be in ten-inch round splice boxes that are green in color. The connector shall be 3M DBY splice kit by 3M Corporation, or accepted substitute. Use one splice per connector sealing pack.

3.14 CLOSING OF PIPE AND FLUSHING OF LINES

A. Trenches over mainlines must not be backfilled until mainline has been pressurized and checked for leaks and verified by Owner's representative.

B. All testing shall be done under the supervision of the Landscape Architect and Owner. Submit written requests for inspections to the Owner at least three days prior to the anticipated inspection date.
   1. Thoroughly flush out all water lines under a full head of water. Maintain flushing for a minimum of three minutes at the valve located furthest from water supply.
   2. After flushing, cap or plug all openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation.
   3. Test as specified below.
   4. Upon completion of testing complete assembly and adjust sprinklers for proper distribution.

3.15 TESTING

A. Make hydrostatic when welded PVC joints have cured as per manufacturer's instructions.
   1. Pressurized mainlines:
      (a) Completely install water meter, mains, isolation valves and control valves.

(b) Open all isolation valves.
(c) Fill all lines with water and shut off at source.
(d) Test piping at hydraulic pressure of 70 PSIG for one-half hour. Maximum loss shall be five PSI.
(e) Inspect each joint and repair any leaks.
(f) Tests shall be repeated until the system passes.

3.16 INSPECTIONS

A. The contractor shall maintain proper facilities and provide safe access for inspection to all parts of the work.

B. Irrigation inspection shall consist of a minimum of:
1. Mainline pressure test.
2. Final irrigation inspection.

C. The contractor shall be solely responsible for notifying the Owner and Landscape Architect where and when such work is in readiness or testing.

D. If any work should be covered up without the approval of the Owner and Landscape Architect it must be uncovered, if required, for examination at the contractor's expense.

E. No inspection will commence without "Record" drawings and without completing previously corrections, or without preparing the system for inspection.

3.17 BACKFILLING AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches.
1. Restore all surfaces to match adjacent surfaces.

B. Granular fill shall be placed initially on all lines with a minimum of three inches cover. No foreign matter larger than one-half inch in size shall be permitted in the initial backfill.
1. Trenches located under paving shall be backfilled and compacted in layers.
2. Coordinate backfilling of planting soils with the Landscape Contractor. Care should be taken to restore the planting soil profile in accordance with the Contract Documents. The Landscape Architect shall be the sole judge as to the suitability of the soils for reuse.
3. Surplus subgrade and planting soils remaining after backfilling shall be legally disposed of off-site by the contractor.

3.18 CLEANING AND DISPOSAL OF WASTE MATERIAL

A. Perform clean up during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment as fast as it accumulates.

B. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

END OF SECTION

PART 1- GENERAL

1.01 SUMMARY

A. The scope of work to be completed under this section includes furnishing all labor, materials, tools and equipment for protection and restoration of existing soils disturbed by construction and for the preparation and placement of Planting Soil Mixes that will be imported for project areas as specified herein. Such work shall include but is not limited to the following:

1. Existing Soils
   a. Protection of existing soils that will not be disturbed by construction
      1) Fencing
      2) Soil cover or mats
   b. Salvage of Native Soils in areas that will be disturbed by construction
   c. Restoration of existing soils that will be disturbed during construction
      1) Compaction
      2) Soil profiles
   d. Prepare Existing Silt Loam
2. Imported Soil Materials
   a. Furnish Planting Soil Mix Components:
      1) Loamy Sand
      2) Dry Screened Sand
      3) Compost
      4) Biochar
      5) Bentonite clay
      6) Microlife Ultimate 8-4-6 fertilizer
   b. Prepare Planting Soils
      1) Planting Subsoil
      2) Native Planting Soil
      3) Wetland Soil
      4) Structural Soil

1.02 TESTING AND ANALYSIS FOR SPECIFICATION CONFORMANCE

A. Planting Soil Mixes

B. Record-keeping Log

C. Preparation of or delivery of Planting Soil Mixes to the Project Site

D. Coordination with the Installation Contractors who are responsible for providing a schedule indicating delivery needs

1.03 REFERENCE STANDARDS FOR ANALYSIS AND TESTING

A. All standards shall include the latest additions and amendments as of the date of advertisement for bids. For each type of packaged material required for the work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards and procedures of the following:

1. American Society for Testing Material (ASTM).
2. American Society of Agronomy - Soil Science Society of America Methods of Soil Analysis, Parts 1 through 5 (1996)

3. Association of Official Agricultural Chemists (AOAC)
4. U.S. Composting Council Test Method for the Examination of Composting and Compost (TMECC)

1.04 DEFINITIONS

A. Anaerobic Soil: Soil devoid of oxygen in which non-desirable chemical and biological changes in soil composition can occur, typically in water-saturated conditions, or soils without proper aeration or ventilation.

B. Compaction: Compaction of the soil is reduction of the soil volume, thereby increasing composite solid matter density and reducing pore space.

C. Dry Soil: The condition of the soil at or below the wilting point of plant available water in which the soil is powdery and subject to blowing.

D. Moist Soil: A condition of the soil where it can be compressed and formed into a ball and maintain its shape. Free water is not visible and is usually considered the point between the wilting point and field capacity of the soil.

E. Field Capacity: The percentage of water remaining in a soil at approximately two or three days after having been saturated and after free gravimetric drainage has ceased.

F. Frozen Soil: The point at which the soil water has frozen and the soil has become very hard and brittle. Ice crystals can be seen in the pore spaces of the soil.

G. Saturated Soil: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile. Moisture contents for the Planting Soil on the Project are defined in Part 3 of this Specification.

H. Wet Soils: For the purpose of this project, soils are considered wet when they are easily deformed by hand pressure and exhibit plastic cohesiveness that is maintained with applied pressure, and free water may be but is not always visible within the pore spaces.

I. Project: Refers to the Alice L. Walton School of Medicine construction site.

J. Scarification: The loosening of the surface of a soil lift by mechanical or manual means to alleviate compaction or smoothed surfaces of the soil. Depth of scarification is dependent on material and extent of compaction. Depths are noted within the specifications.

K. Subsoil: The soil horizon directly below topsoil that typically exhibits lower organic matter content, and often lower nutrient supply capacity than the topsoil.

L. Subgrade: The in-situ soil material that the planting soil will be installed upon.

1.05 SUBMITTALS

A. Submittals for Quality Assurance review and approval shall include the following:

1. Laboratory Test Reports: Submit certified reports for tests as described in this Section.
2. Samples:
   a. Concurrently with the submission of laboratory test reports, the Contractor shall submit one gallon sample bags to the landscape architect and/or soil scientist for examination and approval:
      1) Native Soil
      2) Imported Loamy Sand
      3) Compost
      4) Planting Soil Mixes

3. Certificates: Provide certificates of product composition and quality for soil amendments that will be used for this project.
4. Production Schedule: Provide production schedule that reflects project needs. Submit an updated production schedule as requested by the Construction Manager.
5. Record keeping log: Submit to Construction Manager two times per month.

1.06 QUALITY ASSURANCE

A. Long Lead Time Item: For imported soils, the Landscape Contractor shall be advised that the sourcing, testing, procurement, and blending of planting components and soil is a CRITICAL PATH item, requiring timely attention to meet the requirements of the Documents. The Landscape Contractor shall consider planting soil mixes to be A LONG LEAD TIME ITEM. Work must begin immediately after the award of the contract. Soil Blending Contractor's failure to heed this notice shall not be a reason for substitution of unacceptable material(s).

1. Landscape Contractors shall provide a 3-month lead time for initial soil delivery, thirty (30) day anticipated delivery schedule provided monthly, and one (1) week notice for deliveries to the Project Site.

B. Pre-Construction Conference: A pre-construction conference with the Construction Manager, the Landscape Architect, and the Soil Scientist to discuss the work of this Section shall be held prior to beginning submittals for this Section.

C. Record-keeping Log: Maintain an activity log tracking the following:

1. Planting Soil Preparation: date, weather, type of soil produced, volume, in cubic yards of soil produced.
2. Record-keeping log is cumulative; every update is appended to the previous submission.
3. Volume of planting soil prepared or delivered to the Project Site. Record:
   a. Soil Installation Contractor receiving the material.
   b. Type(s) of Planting Soil Mixes delivered.
   c. Total volume in cubic yards, for each Planting Soil Mix delivered.
4. Testing. Include for each soil material: material type, test type, date, and interval or location. Record both acceptable and unacceptable findings. Immediately report unacceptable test reports to the Construction Manager. Submit all test reports to the Construction Manager.
5. Submit a complete record-keeping log to the Construction Manager at closeout.

1.07 TESTING METHODS

A. General:

1. Samples of all soil materials and soil mixes to be imported for the project shall be submitted for testing and analysis to the approved testing laboratory. All soil materials and soil mixes shall be tested to confirm the specified characteristics.
2. Maintain clear, concise records for all testing and sampling procedures and log activities and results in the record keeping log.
3. For each test type, use the same testing laboratory throughout the work. Notify Construction Manager of any change in laboratory and do not proceed until the Landscape Architect and Soil Scientist have approved the change.
4. Laboratory shall be an independent laboratory, with experience and capability to conduct the testing indicated and that specializes in the types of tests to be performed.

5. The following testing facilities have been pre-approved for testing of planting soil components and blended planting soil mixes. Testing agencies not listed below shall be approved by the Soil Scientist.
    a. Soil Physical Parameters:
        1) Turf Diagnostics & Design, Inc., 613 East 1st Street, Linwood, KS 66052, Phone: 913-723-3700, Fax: 913-723-3701, www.turfdiag.com.
        2) Or approved equal
    b. Compost Testing:
        1) Woods End Research Laboratory, 290 Belgrade Road, Mt Vernon ME 04352, Phone: 207-293-2457, Fax: 207-293-2488, www.woodsend.org
        2) Ward Laboratories. 4007 Cherry Ave, Kearney, NE 68847 Phone: (800) 887-7645
        3) Or approved equivalent
    c. Soil Nutrient/Micronutrient Testing:
        1) Regen Ag Lab LLC, 31740 NE-10, Pleasanton, NE 68866 Phone: (806) 763-4278
        2) Ward Laboratories. 4007 Cherry Ave, Kearney, NE 68847 Phone: (800) 887-7645
        3) Or approved equal

1.08 TESTS DEFINITIONS AND METHODS:

A. Soil Density

1. Soil compaction shall be tested after soil is installed. All soil types must be tested to determine maximum dry density and associated soil moisture levels to achieve maximum dry density using ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
2. After soils are installed, soils shall be tested for soil density to conform with the specifications ASTM 6938-17 Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depths).
3. Installed soils shall be tested using a static cone penetrometer following ASTM D3441-16 Standard Test Method for Mechanical Cone Penetration Testing of Soils

B. Mechanical Gradation

1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System for sieve screen sizes 4, 10, 18, 35, 60, 140, and 270.
2. Tests for silt and clay shall be by combined hydrometer and wet sieving in compliance with ASTM D-422-63, hydrometer method. Percent clay and silt shall be tested and reported as separate particles.
3. The results of gradation must be reported at the specified particle size breaks listed in this Section and by plotting as a particle size distribution curve on a five cycle semi-log graph.

C. Soil Chemical Properties

1. General: Testing shall be conducted in accordance with Methods and Method References in association with the North American Proficiency Testing Program and/or the Agricultural Lab Testing Association Program.
2. Testing for soil chemistry shall include Total Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Aluminum, Manganese, Cation Exchange Capacity (CEC), Soluble Salts, and soil reaction (soil pH – including both active and buffer pH).

a. Test for soil nutrients shall be determined as described by approved analytical methods as detailed in American Society of Agronomy Methods of Soil Analysis, part 3, 1996.

3. Total Organic Matter
   a. Test for soil organic matter content using the Loss on Ignition Method.

D. Compost:

1. Maturity Index: Maturity shall be assessed in one of the following methods. Protocols for each method are specified by the "U.S. Composting Council Seal of Testing Assurance" and the Solvita manual (version 3.5).
   a. CO_2 Evolution test (respirometry)
   b. Reheating test: Use the Dewar self-heating test
   c. Solvita test
2. Compost: Physical and Chemical Requirements
   a. Reaction (pH) in 1:1 water
   b. Carbon/Nitrogen ratio (C:N)
   c. Foreign Material on a dry weight basis
   d. Organic Matter percent on a dry weight basis
   e. Ammonium-N
   f. Salinity using a 1:1 water/paste method
   g. Content of the nutrients Phosphorous (P), Potassium (K), Calcium (Ca), and Magnesium (Mg)
   h. *E. coli*, in conformance with USDA testing procedures

1.09 SAMPLING AND TESTING FOR APPROVAL

A. Sample and perform soil tests to demonstrate that materials meet the specifications. Approved tests shall become the base standard for the project to which subsequent testing will be compared for consistency and quality assurance.

1. No planting soil components, including Native Soil, Compost, Imported Loamy Sand, or Planting Soil Mix shall be used until certified test reports by an approved Testing Agency have been approved by the Soil Scientist. Native Soil samples shall be collected from the source site.
2. The Construction Manager may request additional testing by the Soil Blending Contractor for confirmation of mix quality and/or soil mix amendments at any time until delivery to the site.
3. If, at any time during the project, the planting soil components, including existing or imported soil components, or planting soil mixes require adjustment to meet the specifications and/or performance criteria then the Soil Blending Contractor shall submit the adjusted soil components and/or mixes for testing as specified herein.
4. Additional testing for re-approval shall be required should any of the material sources change after initial approval.

B. Sampling Methods:

1. Compost and Planting Soil Mixes: All samples shall be composite samples that are assembled from a minimum of 6 subsamples collected from locations representing the top, middle, and bottom of the stockpiled material, and from a minimum of 18 inches below the stockpile surface. Blend samples together and submit for testing the quantity required by the testing agency.
   a. Compost samples shall be taken from the interior of the stockpile.
2. Testing shall be sequenced such that approvals build upon prior successful tests, as follows:

a. Gain the Soil Scientist's acceptance of testing for Planting Soil Components (Imported Loamy Sand Soil, Compost, Dry Screened Sand) prior to testing of Planting Soil Mixes for approval.
b. Gain the Soil Scientist's acceptance of the Existing Native Soil testing prior to testing Planting Soil Mixes for approval.
c. Gain the Soil Scientist's acceptance of each Planting Soil Mix test (Planting Subsoil, Native Planting Soil) prior to producing a particular Planting Soil Mix.

C. Testing of Planting Soil Components

1. Native Soil shall be tested for Soil Chemical Properties (Section 1.8.C).
   a. Samples shall be collected from the 0" to 12" depth interval of the soil source area and labeled with source name, sample location (at source), and depth interval. Samples should be collected from each acre of soil source area.
2. Imported Loamy Sand shall be tested for Mechanical Gradation (Section 1.8.B) and Soil Chemical Properties (Section 1.8.C).
3. Compost shall be tested for Compost Maturity (Section 1.8.D.1), Compost Chemical and Physical Requirements (Section 1.8.D.2).
4. Biochar shall be tested for Soil Chemical Properties (Section 1.8.C)
   a. Biochar must be delivered with a certificate of analysis from the manufacturer.
5. Sand sources shall be tested for Mechanical Gradations (Section 1.8.B).

D. Testing of Planting Soil Mixes

1. Planting soils for all soil types shall be sampled and tested immediately after preparation for approval. Tests required shall include:
   a. Native Planting Soil (S1-NP) and Planting Subsoil (S2-PS): Chemical properties (Section 1.8.C).
   b. Wetland Planting Soil (S1-EW and S1-SW): Chemical properties (Section 1.8.C) and Mechanical Gradation (1.8.B)
   c. Structural Soil (S1-S, S2-W): Mechanical Gradation (Section 1.8.B)
   d. Sand Cap: Mechanical Gradation (Section 1.8.B)
2. Testing of prepared soil mixes (both blends of Native Soil/Compost blends and Imported Planting Soil Blends) shall be conducted on composite samples consisting of 10 subsamples from each 500 cubic yards of prepared soil.

1.010 ACCEPTANCE

A. The Landscape Architect and the Soil Scientist shall evaluate all of the test results and reserves the right to reject, at any time, any soil that does not meet the baseline criteria for acceptance.

1. The baseline criterion for acceptance is established by the Soil Scientist when the initial tests for components, base loam and planting soil mixes are approved.
   a. Rejected planting soil components or mixes shall not be released or distributed to the Project Site.

PART 2- PRODUCTS

2.01 NATIVE SOILS

A. Salvaged Native Soil

1. Salvaged Native Soil shall be collected from existing areas that will be disturbed for construction as described below. After collection and stockpiling, the soils shall be referred to as "Native Soil" in subsequent specification sections.

2. Native soil shall consist of soil at the ground surface extending to 9 to 14 inches below the ground surface that has silt loam texture with medium to dark brown color. The silt loam surface soil shall not be excavated from too deep in the profile that it mixes with the clay loam subgrade soil (the subgrade clay loam soil has a lighter, greyish brown color).
3. The Native Soil must be free from sticky clay, brush, litter, and other deleterious substances. If these substances are found to exist in topsoil, they will be removed and disposed.
4. Native Soil Testing: Samples of Native Soils shall be collected and analyzed for the soil chemical parameters as described in Part 1.8.C of this Section. One composite soil sample will be collected from every 500 cubic yards of soil salvaged from on-site. Soil chemical qualities shall be within the rages shown below:

Parameter	Range
Soil pH	4.6 – 7.0
Soluble Salts (Electrical conductivity) (mS cm-1)	< 1.0
Organic Matter (percent)	>1.5
Cation Exchange Capacity (cmolc kg-1)	>5
Inorganic nitrogen (mg kg-1)	>3
Phosphorus (mg kg-1)	>5
Potassium (mg kg-1)	>20
Sodium (mg kg-1)	<100
Calcium (mg kg-1)	>200
Magnesium (mg kg-1)	>30
Sulfate-S (mg kg-1)	>5.0
Iron (mg kg-1)	>10
Manganese (mg kg-1)	<70
Copper (mg kg-1)	<5.0

2.02 IMPORTED SOIL – LOAMY SAND

A. Loamy Sand soil shall be imported for use in emergent wetlands, submerged wetlands, and for structural soils. The Imported Loamy Sand shall consist of uniform Loamy Sand from a clean source with the following requirements:

1. Loamy Sand soil shall have approximately 75 to 85 percent sand, 2 to 8 percent clay, and 7 to 13 percent silt. Gradation shall conform to the following grain size distribution:

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
10	98	100
18	88	100
35	60	85
60	52	68
140	20	52
270	15	25
0.002 mm	2	8

2. Chemical Properties:

Parameter	Range
pH	4.5 – 8.0
Organic matter (Percent)	<1.0
Salt concentration (mS.cm-1)	<1.0
Total nitrogen (mg kg-1)	<100
Total phosphorus (mg kg-1)	<20
CEC (meq/100 gm)	<5

3. Imported Loamy Sand soil shall not contain objects larger than 1/2" in any dimension, including clay clods, gravel, or other foreign matter.

2.03 DRY SCREENED SAND

A. Sand shall be a uniformly graded coarse sand consisting of clean, inert, sub-angular or rounded grains of quartz or other durable rock free from loam or clay, surface coatings, mica, and other deleterious materials.

1. Sand shall be from native river sources. Manufactured sand shall not be used.

B. Mechanical Gradation: Dry screened sand shall have the following gradation for material passing a Number 4 Sieve for washed sieving:

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
4	98	100
10	87	100
18	67	90
35	35	72
60	10	38
140	0	10
270	0	2
0.002 mm	0	1

2.04 COMPOST

A. Compost shall be a stable, humus-like material produced from the aerobic decomposition and curing of organic vegetative residues derived from feedstock consisting of woody stems, leaves, grass cuttings, and livestock manure (up to and no more than 10 percent manure of the compost mix by volume). NO FOOD WASTES/PRODUCTS, PAPER PRODUCTS, OR PROCESSED LUMBER ARE ACCEPTABLE IN THE COMPOST FEEDSTOCK. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices with no visible free water or dust, with no unpleasant odor. Compost must be prepared such that composting process temperatures are sustained for a sufficient period of time to kill weed seeds present in the initial feedstock material.

1. Chemical Properties: Compost shall conform to the following values:

Parameter	Units	Range
Organic matter	Percent	>35

Total nitrogen	mg kg-1	≥10,000
Extractable nitrate	mg kg-1	20 - 200
Total phosphorus	mg kg-1	50 - 2000
Available phosphorus	mg kg-1	5 - 200
pH		5.5 - 8.0
Salt concentration	dS.m-1	<6
Moisture	% wt	30-55
Carbon: Nitrogen Ratio		10:1 – 25:1

a. Organic matter content of compost shall be at least 35 percent (dry weight).
b. Additional tests defined in Part I as Chemical Properties shall be performed and the results will be utilized to evaluate amendments to the planting soil mixes that may be required.

2. Physical Properties
   a. Particle size distribution
      1) 100% of compost material shall pass a 5/8" screen
      2) 60% of compost material shall pass a 3/8" screen
      3) 40% of compost material shall pass a 1/4" screen
      4) No more than 3% of compost material shall pass a 1 mm (No. 18) sieve
   b. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt, or masonry shall not be visible and shall not exceed one percent dry weight.
3. Maturity:
   a. CO_2 test: Compost respiration shall be no more than 6 mg CO2-ClgBVS day.
   b. Reheating test: The maximum heat rise shall be no greater than 9 degrees C above room temperature (20 to 25 degrees C).
   c. Solvita test: The compost must achieve a maturity index of 6 or more.
4. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32.

2.05 BIOCHAR

A. Biochar shall be a high carbon, granular product produced from carbonized softwoods using a continuous flow pyrolysis system that heats the feedstock to greater than 700ºC in a low oxygen environment.

1. Biochar Properties: Biochar shall conform to the following values

Parameter	Units	Range
Total nitrogen	mg kg-1	3000 - 5000
pH		7.0 - 9.0
Salt concentration	dS.m-1	<6
Moisture	% wt	3-5

2. Biochar shall be delivered with a certificate of analysis from the manufacturer.

2.06 BENTONITE CLAY

A. Bentonite Clay shall be imported for use in emergent wetlands and submergent wetlands. The Bentonite Clay shall consist of certified, uniform bentonite clay obtained from a clean source or potential vendor.

2.07 SOURCES FOR PLANTING SOIL COMPONENTS

A. General: Sources for planting soil components include the providers listed below. No guarantee is made or implied that the source listed will be able to meet the soil material specifications.

1. Imported Loamy Sand Soil:
    a. Potential source to be determined.
2. Dry Screened Sand
    a. Potential source to be determined.
3. Compost
    a. Potential source to be determined.
4. Biochar
    a. Wakefield Biochar, 1826 Clay Rd, Valdosta, GA (573) 479- 0468
    b. Or approved equivalent
5. Bentonite Clay
    a. Potential source to be determined.

2.08 NATIVE PLANTING SOIL

A. Native Planting Soil shall consist of Native Soil blended with biochar and compost in a ratio of 4 parts Native Soil to 1 part blend of compost and biochar. The compost/biochar blend shall consist of 3 parts compost to 1 part biochar. A consistent Planting Soil shall be used for all areas of the project site, minimizing the need to manage varying soil types. The contractor shall not make claim for additional costs if ratios are adjusted. Native Planting Soil will be produced according to Section 3.3 Planting Soil Preparation. The soil particle size distribution shall be consistent with the Salvaged Native Soil.

1. Chemical qualities of the soil shall conform to the following:

Parameter	Range
Soil pH	5.2 – 7.0
Soluble Salts (Electrical conductivity) (mS cm-1)	< 1.0
Organic Matter (percent)	3.5 – 6.5
Cation Exchange Capacity (cmolc kg-1)	>10.0
Inorganic nitrogen (mg kg-1)	>15.0
Phosphorus (mg kg-1)	>15
Potassium (mg kg-1)	>70
Sodium (mg kg-1)	<100
Calcium (mg kg-1)	>400
Magnesium (mg kg-1)	>50
Sulfate-S (mg kg-1)	>5.0
Iron (mg kg-1)	>30
Manganese (mg kg-1)	<70
Copper (mg kg-1)	<5.0

2.09 PLANTING SUBSOIL

A. Planting Subsoil shall be blended with compost where topsoil has been disturbed and consist of 6 parts of the existing in situ soil blended with 1 part compost by volume. Blending of compost with the subsoil shall be completed by placement of 2 inch of compost uniformly spread over the surface of the *in situ* soil and blending into the soil to a depth of 12 inches using an agricultural implement (deep ripper and disc). Blending of compost into the in situ soil shall not be completed using trackhoe buckets (bucket blending) or rototillers.

1. Planting Subsoil shall be a uniform, homogenized mixture of the soil components conforming to the following chemical qualities:

Parameter	Range
Soil pH	5.2 – 6.0
Soluble Salts (Electrical conductivity) (mS cm^{-1})	< 1.0
Organic Matter (percent)	>1.5
Cation Exchange Capacity (cmolc kg^{-1})	>5.0
Inorganic nitrogen (cmolc kg^{-1})	>5.0
Phosphorus (mg kg^{-1})	>10
Potassium (mg kg^{-1})	>50
Sodium (mg kg^{-1})	<30
Calcium (mg kg^{-1})	>400
Magnesium (mg kg^{-1})	>50
Sulfate-S (mg kg^{-1})	>5.0
Iron (mg kg^{-1})	>30
Manganese (mg kg^{-1})	<70
Copper (mg kg^{-1})	<5.0

2.010 WETLAND SOIL (EMERGENT AND SUBMERGENT)

A. Wetland Soil shall be used for both emergent and submergent wetland bases and shall consist of Imported Loamy Sand. Wetland Soil shall have consistent soil texture and structure.

1. Wetland Soil shall have particle size distribution similar to the loamy sand soil source.
2. Chemical Properties shall meet the following:

Parameter	Range
Soil pH	5.5 – 7.0
Soluble Salts (Electrical conductivity) (mS cm^{-1})	< 1.0
Organic Matter (percent)	<1.5
Cation Exchange Capacity (cmolc kg^{-1})	>5.0
Inorganic nitrogen (mg kg^{-1})	>5.0
Phosphorus (mg kg^{-1})	>10
Potassium (mg kg^{-1})	>50
Sodium (mg kg^{-1})	<30
Calcium (mg kg^{-1})	>400
Magnesium (mg kg^{-1})	>50
Sulfate-S (mg kg^{-1})	>5.0

2.011 STRUCTURAL SOIL

A. Structural Soil blending shall consist of Imported Loamy Sand blended with compost in a ratio of 9 parts Loamy Sand soil to 1 part compost

B. Structural Soil shall be a uniform, homogenized mixture of the soil components with a gradation conforming to the particle size distribution for Imported Loamy Sand (Part 2.2).

PART 3- EXECUTION

3.01 PROTECTION OF VSPZ SOILS

A. Soils within vegetation and soil protection zones (VSPZs) shall be protected from disturbance, compaction, and contamination during construction activities. VSPZ soils includes the following:

1. Fencing: Orange construction fence shall be installed around all VSPZ areas in which no equipment, materials, or vehicles will be allowed to enter.
2. For VSPZ areas in which vegetation will be planted, corridors for movement of equipment, tools, and materials will be identified and established.
   a. Soils in corridors shall be protected by placement of a layer of mulch or soil mats to protect soils from compaction.
   b. Only tracked, low-ground pressure equipment will be allowed on VSPZ soils in areas or corridors identified in the site construction plan.
   c. Movement of equipment and materials in identified corridors shall be minimized to one ingress and one egress per day.
   d. Construction work shall not be conducted on VSPZ soils that are wet (greater than approximately 25 to 30 percent moisture as determined using a nuclear soil density and moisture gauge).
3. Soil will not be stripped within VSPZ areas.
4. Soils and vegetation damaged in VSPZs by unnecessary or excessive equipment use shall be repaired or replaced at no cost to the Owner.

3.02 STRIPPING AND STOCKPILING SOIL

A. The Contractor shall harvest all suitable topsoil from the site at locations provided by the Landscape Architect.

1. The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and notify the Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work.
   a. Inspect all surfaces to check for consistent soil conditions, including soil texture, unstable areas, and areas requiring additional removal of debris, plants, or excess soil. During the inspection, use a soil probe to assess soil quality with depth to be certain that uniform soil texture and structure (friable, granular structure) extends at least 6 inches below the soil surface. At their discretion, and at no cost to the owner, the Contractor may collect and analyze soil samples to help determine the proper depth of excavation. Harvested topsoil that does not meet the planting soils requirements will be disposed of at no expense to the Owner.
   b. The Landscape Contractor shall be responsible for verification, in writing, that all of the project areas to be stripped have been identified and mapped properly. Verify that subgrade and drainage components of the areas scheduled to be stripped are without ponded water or saturated soil. Submit any and all noted discrepancies which will impact the proper installation or execution of the work to the Owner prior to beginning soil conditioning processes.
   c. The contractor assumes responsibility for all soil salvage stripping and conditions upon beginning soil stripping operations.
   d. The contractor shall be responsible to ensure no soil compaction will occur from construction traffic or other soil stripping activities. Damage caused by

construction equipment or other construction activities will be repaired by the landscape contractor at no additional cost to the Owner.

e. Determine depth of stripping by taking soil cores at several locations within each area to be stripped.

f. Verify that the surface moisture content is suitable for soil stripping and stockpiling. Under no circumstances shall the contractor strip and stockpile soil when the soil is wet (when the soil can form a ball that does not break into many smaller pieces with hand pressure).

2. Prior to stripping topsoils for salvage and re-use, existing vegetation shall be removed from the soil.
   a. Confirm locations where existing vegetation is to be removed with the Landscape Architect
   b. Existing herbaceous vegetation will be treated with 4 sequential, non-selective herbicide applications prior to removal, if possible.
      1) Herbicide applications will be done by a qualified professional.
      2) Herbicide applications will occur approximately 30 days apart.
   c. Cut vegetation. Cutting involves removal of above ground plant matter as close to the ground as possible. If possible, excess thatch and root matter shall also be removed.
3. The Contractor shall remove and dispose of the top 2 inches of soil, including existing vegetation and roots.
4. All planned erosion and sediment control practices shall be in place and functioning properly prior to stripping.
5. All soil stripping shall be completed with minimal damage to surface soil structure (compaction, smearing, balling). Soil stripping shall not be conducted with soil is wet, or within 24 hours of a rainfall of ½-inch or more.

B. Stockpiles: Stockpile each Soil Material separately and provide large, clear signage identifying the contents of each pile, for example, “Sand” or “Native Soil” or “Wetland Soil”. Provide perforated ventilation pipe at the base and at 6-foot vertical intervals within the soil stockpiles.

1. Height of pile: Soil stockpiles shall not exceed 8 feet in height.
2. Construct storage piles to allow free drainage of surface water. Slope top of pile a minimum of 3%. Stockpile side slopes shall be approximately 2 horizontal to 1 vertical rise.
3. Ventilation Pipe: Provide 4” diameter Schedule 40, smooth, rigid, perforated HDPE pipe.
   a. Layout: Lay aeration pipe horizontally in the soil stockpile. Pipe shall extend from the face of the stockpile by a minimum of 18”. Provide 2 layers of pipes: one at ground level, and one at 4 feet above the ground surface (approximate mid-height of the stockpile). Ventilation pipes will be placed 8 feet apart for each layer. Slope pipes at 1.0%.
   b. The requirement for Ventilation pipe will be waived if the height of the stockpile does not exceed 6 feet.
4. Protection:
   a. Cover storage piles if required to prevent windblown dust and protect against erosion.
   b. If stockpiled soil will not be used for a period greater than 1 month, establish a cover crop on the soil stockpile. The preferred cover crop is Virginia wild rye (*Elymus virginicus*), partridge pea (*Chamaecrista fasciculata*), and sideoats grama (*Bouteloua curtipendula*).

c. Protect stockpiles from contamination of any sort.
d. Prohibit wheel-driven vehicles and pedestrian traffic on or around stockpiled soil materials.
    1) Only low ground pressure vehicles (less than 6 psi) are permitted to drive on stockpiles.
e. In no case shall the stockpiled soil be allowed to become anaerobic as this condition renders the soil unacceptable for planting. The Contractor shall keep logs for soil management while it is in stockpiles. If the Contractor suspects that stockpiled soils have become anaerobic, notify the Construction Manager and wait for further instructions before aerating stockpiles.

3.03 PLANTING SOIL PREPARATION

A. Coordination

1. Coordinate with the Construction Manager for quantities and date required of Planting Soils to be installed at the Project Site.

B. Storage and Handling.

1. Soils shall not be handled or hauled when it is wet or frozen. Soil should be handled only when the moisture content is less than 80 percent of the optimum moisture to determine maximum dry density as determined by Standard Proctor Testing. The Soil Scientist shall be consulted to determine if the soil is too wet to handle.
    a. The Soil Vendor shall not move or deliver planting soil mixes at the Project Site if the mixes are wet or frozen.
    b. Soil Material that is handled wet shall be discarded at no cost to the Owner.
2. All blending of planting soil mixes shall be accomplished when the soil moisture content is less than 80% of the optimum moisture content to achieve maximum dry density as determined from Standard Proctor testing.
3. Blending of soil amendments into in situ, existing soils shall be conducted as described in Part 3.04
4. Blending of soil amendments into harvested existing soils for planting soil mixes must provide a uniform, homogenous mix using initial bucket blending of the soil and associated amendments, follow with use of a vibrating screen (with minimum 1.5-inch openings) methods to produce the final, uniform planting soil mix.
5. Hammer mills or blending knives are not permitted in preparation of the soil as these processes reduce soil structural stability.
6. Compost shall be maintained dry to moist, not wet, during mixing.
7. No amendments shall be added unless approved by the Soil Scientist and additional tests have been conducted to verify type and quantity of amendments acceptable.

3.04 INSTALLATION OF PLANTING SOILS

A. Pre-examination and Examination of site conditions

1. A Pre-installation Examination with the Construction Manager is required for the work of this section. Schedule the examination at least five days before the installation process begins.
2. Upon receipt of delivery of planting soil mixes, the Contractor shall visually inspect the soil for moisture content, non-aggregated soil particles, clumping, debris, deleterious or foreign materials, or any other physical conditions that could affect the quality of the planting soil and the Contractor's installation operations.
    a. The Contractor shall immediately notify the Construction Manager of any soil deliveries that exhibit any of the physical conditions noted above.

b. The Contractor shall not accept or use soil that exhibits any of the physical conditions noted above.

3. The Contractor shall be responsible for verification that all of the planting areas receiving Planting Soil Mixes have been prepared in conformance with the Contract Documents.
   a. Verify that the rough grading has been accepted by the Construction Manager.
   b. Verify that utilities have been installed and accepted.
   c. Verify that irrigation structures have been installed.
   d. Prior to preparation of rootball pedestals for tree plantings, verify that plant locations have been accepted by the Landscape Architect.
   e. Examine subgrade for deficiencies including:
      1) Construction debris present within the area to received planting soil mix.
      2) Puddling of water, muddy soil conditions, or expressing of water from the subgrade or adjacent areas.
      3) The subgrade is not at the correct depths for installing the designated planting soil mix.
      4) Incomplete utility, irrigation, and /or subsurface drainage installation.
4. Insufficient compaction of subgrade. Refer to Section 31 20 00 "Earthwork."
   a. Submit all noted deficiencies that will impact the proper installation or execution of the Work to the Construction Manager in writing prior to beginning soil installation operations. The Contractor assumes responsibility for all subgrade work and conditions upon beginning soil installation operations.

B. Preparation of subgrade

1. Subgrade shall be scarified, where applicable, to a depth of 3" to create an uneven, broken surface in which the subgrade can be mixed with the first lift of planting soil placed. Scarification can be accomplished using manual or mechanical equipment that does not result in the formation of subsoil pans or slickened faces. Use of rototillers is discouraged. If rototillers must be used, rototiller tynes must have a 'C' configuration, not the standard 'L' configuration.
2. Perform infiltration and density tests on subsoil as described in Part 1 of this Section.
   a. Infiltration rate for subgrade, Min: 0.25" per hour
   b. Compaction rate for subgrade, nuclear density method: Refer to Section 31 20 00 "Earthwork"
   c. Compaction rate for subgrade, static cone penetrometer method:
      1) 0"-6" Depth: Range 120 to 180 pounds per square inch (psi).
      2) 6"-12" Depth: Range 200 to 250 psi.

C. Soil Placement, General

1. Notify the Construction Manager of soil placement operations at least seven calendar days prior to the beginning of work.
2. Prior to installation of Planting Soils, test soils for nutrient content for determination of potential fertilizer (Microlife Ultimate 8-4-6) amendment in specific planting areas.
3. Soil types shall be installed by order of their place within the soil profiles, as shown on the Drawings.
   a. Plan work to limit traffic on and compaction of soil during and after installation. Prevention of compacted soils can be accomplished by beginning the work in the center of planting area locations, against walls or the center of isolated beds, and progressing outwards towards the borders.

b. If traffic is necessary, use tracked equipment that exerts less than 6 psi pressure and limit traffic to defined pathways. Wheel-driven vehicles are prohibited in all planting areas.
c. Traffic on or installation of wet or frozen soils is expressly prohibited.

4. Back-blading of soils is prohibited. Back-blading causes sealing of the soil surface and inhibits air and moisture from penetrating the planting soil mix.
5. ALL installed soil types shall be tested for soil density and compaction using nuclear methods described in ASTM 6938-17 Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depths).
   a. Soils shall be tested for soil density for each soil area or, in larger areas greater than 500 square yards, one test for each 500 square yards (4,500 square feet).
   b. All testing reports shall be recorded and submitted as part of field documentation for quality assurance and approval by the Landscape Architect and/or Soil Scientist.
6. All installed soil layers shall be tested for compacted layers using a static cone penetrometer using the method described in ASTM D3441-16 Standard Test Method for Mechanical Cone Penetration Testing of Soils.

3.05 INSTALLATION OF SOIL PROFILES

A. Install soil mixes to the depths shown on the Drawings.

1. Individual soil lifts shall not exceed 8 inches in thickness.
2. Place each lift and compact to the soil density as described in this Section. Rake each lift to an even, smooth surface to break or remove clods and fill low spots or voids. After each lift has been raked smooth, scarify the surface to a depth of 1- to 1.5 inches before placement of the next lift.

B. Lawn Soil

1. The Lawn Soil shall consist of a Planting Subsoil layer, a Native Planting Soil layer, and a Sand cap layer.
2. The surface of the existing subsoil shall be graded to planned elevations.
3. The Planting Subsoil shall be prepared in place by applying 2 inches of compost over the surface of the exposed, existing subsoil. The compost shall be blended into the top 12 inches of the existing subsoil using agricultural implements (deep tiller and disc). Multiple passes of the tillage equipment may be necessary to fully integrate the compost into the soil. The Planting Subsoil shall be graded to a smooth and even surface and compacted to approximately 80 to 84 percent of maximum dry density as determined by Standard Proctor testing. After preparation and compaction of the Planting Subsoil, the surface shall be scarified to a depth of approximately 1 inch.
4. Previously harvested Native Planting Soil shall be placed above the Planting Subsoil. The Planting Soil shall be installed as a single 6” lift and compacted to approximately 80 to 84 percent of maximum dry density as determined from Standard Proctor Testing. The surface shall be scarified to a depth of approximately 1 inch.
5. The Sand Cap layer shall be placed above the Native Planting soil in a single 2” lift to the planned grade elevation and compacted to approximately 80 to 84 of maximum dry density as determined from Standard Proctor testing.
6. The completed Lawn Planting Soil shall be graded smooth to the planned elevations, and scarified to produce a firm, friable seed/planting bed.
7. After soils have been installed, topdress fertilizer amendment with amounts necessary to achieve the recommended nutrient needs for turf grass growth.
   a. Estimated amount of fertilizer amendment added to the soil would be equal to the analyzed nutrient concentrations in the installed soil subtracted from the total

recommended turf grass nutrient need (estimated to be 3.5 pounds of nitrogen per 1,000 square feet).

C. Tree Soil Profile

1. The Tree Soil profile shall consist of replaced subgrade soils, a 12” Native Planting Soil layer, and a 3” mulch or compost cap around the final tree.
2. Tree Installation
   a. Trees shall be planted into pits excavated into the native soil to the depth of the tree rootball and 3 times the diameter of the tree rootball.
   b. Excavated soil shall be stockpiled from the tree pit as it is excavated, taking care to segregate silt loam soil from clay loam soil deeper in the soil profile (expected to begin at approximately 16 inches below ground surface). The planters shall be established to the depth of respective tree rootballs as shown in the drawings.
   c. If necessary, a soil pedestal shall be installed to assure that the tree is planted at the proper elevation.
3. The replaced subgrade shall consist of excavated subsoil returned to the soil tree pit in reverse order from which it was excavated (soils removed from the deepest parts of the pit shall be returned first). Soil shall be restored into each tree pit in 8-inch lifts and packed firmly around the soil rootball. After the placement of each lift of soil, the surface of the lift shall be scarified to a depth of 1 inch.
   a. Excavated soil shall be installed as described above to approximately 12” below the final design grade elevation.
   b. The final lift of excavated soil shall be amended with 1.5 inches of compost and scarified to a depth of 1.5 to 2 inches before installation of the Planting Soil.
4. The Native Planting Soil shall be installed around the tree rootball in two 6” lifts. Each lift of the Planting Soil shall be compacted by hand tamping to achieve a soil density of approximately 83 to 85 percent of maximum dry density as determined from Standard Proctor testing. After placement, the surface of each soil lift shall be scarified to a depth of 1 inch.
   a. After the Native Planting Soil profile has been installed, a 2- to 3-inch layer of mulch and/or compost shall be installed over the excavated area.

D. Meadow Soil

1. The Meadow Soil profile shall consist of the following a Planting Subsoil layer and a Native Planting Soil layer.
2. The Planting Subsoil shall consist of a 12” layer of existing native soil that has been amended with compost. The existing, in situ soil shall have a 2-inch layer of compost placed over the surface of the exposed, existing subsoil. The compost shall be blended into the top 12 inches of the existing subsoil using agricultural implements (deep tiller and disc). Several passes of the tillage equipment may be necessary to fully integrate the compost into the soil. The subsoil shall then be compacted to approximately 80 to 84 percent of maximum dry density as determined from Standard Proctor testing using a 500-pound steel roller and scarified to a depth of 1.5 to 2 inches.
3. The Native planting soil layer shall consist of 12” Native Planting Soil layer shall be installed over the Planting Subsoil. The Native Planting Soil shall be placed in two 6” lifts compacted to approximately 80 to 84 percent of maximum dry density as determined from Standard Proctor testing. The surface of each lift shall be scarified to a depth of 2” prior to placement of each lift, or for preparation of a firm, friable planting bed as the surface of the Planter Soil profile.

4. After final installation of Meadow Planting soils, topdress the prepared soil with the equivalent of 0.5 pound of nitrogen per 1,000 square feet of area, or 6 pounds of Microlife Ultimate 8-4-6 fertilizer per 1,000 square feet.

E. Emergent Wetland Soil Profile.

1. The Emergent Wetland Soil profile shall of consist a 2-inch bentonite clay liner, 12-inch to 30 inch sand layer, and a 6-inch Wetland Planting Soil layer over the fine sand.
   a. If the wetland is excavated into deeper sandier layers, then bentonite clay liner shall be installed to a depth of 4 inches above the sandy subgrade soil.
2. The bentonite liner shall consist of approved bentonite clay compacted to the manufacturer's specifications.
3. The sand layer shall consist of Dry Screened Sand. The correct depth of the sand layer shall be indicated in the Drawings.
4. The Wetland Planting Soil shall consist of wetland soil, installed over the sand layer. The 6-inch layer of Wetland Planting soil shall be installed as a single lift and graded even with the planned surface elevation. The Wetland Planting soil layer shall be compacted to 80 to 84 percent of maximum dry density as determined from Standard Proctor testing.
   a. Voids or hollows in the soil layer will be filled with additional Wetland Planting soil to create an even, smooth surface.
   b. The surface of the Wetland Planting Soil shall be scarified to provide a firm, friable planting surface.

F. Submerged Wetland Planting Soil Profile

1. The Submerged Wetland Planting soil profile shall consist of a 3-inch bentonite liner, compacted according to the manufacturer's instruction, a 12-inch sand layer, and a 6-inch Wetland Planting Soil .
   a. If the wetland is excavated into deeper sandier layers, then bentonite clay shall installed to a depth of 4 inches above the sandy subgrade soil.
2. The bentonite liner shall consist of approved bentonite clay compacted to the manufacturer's specifications.
3. The sand layer shall consist of Dry Screened Sand placed in a single 12-inch lift.
4. The Wetland Planting Soil shall consist of wetland soil, installed over the sand layer. The 6-inch layer of Wetland Planting soil shall be installed as a single lift and graded even with the planned surface elevation. The Wetland Planting soil layer shall be compacted to 80 to 84 percent of maximum dry density as determined from Standard Proctor testing.
   a. Voids or hollows in the soil layer will be filled with additional Wetland Planting soil to create an even, smooth surface.
   b. The surface of the Wetland Planting Soil shall be scarified to provide a firm, friable planting surface.

G. Structural Soil

1. The Structural Soil profile shall be installed as shown on the plans. Preparation of the areas shall where Structural Soils will be installed include excavation of soils to the existing clay loam layer of the native soil profile. The Structural Soil profile shall consist of Structural Soil in approximate 24-inch lifts.
   a. The Structural Soil shall be installed in successive 12-inch lifts. Each lift shall be installed, graded smooth and even, and compacted to approximately 90 percent of maximum dry density as determined from Standard Proctor testing. The

surface of each lift shall be scarified to a depth of 1 inch before the installation of each successive lift.

b. The final Structural Soil lift shall not be scarified.

3.06 QUALITY ASSURANCE

A. Quality assurance testing shall be completed for all soil components and Planting Soil Mixes, and for all soils after installation as described in Parts 1.7, 1.8, and 1.9 of this Section.

3.07 PROTECTION AND REPAIRS

A. The Contractor shall take every precaution to ensure the integrity of the underdrainage, aeration and irrigation systems during and after soil placement. Any damage caused by the Contractor shall be repaired at no additional expense to the Owner.

B. The Contractor shall be responsible to ensure that no soil disturbance will occur from construction traffic or other construction activities after placement of planting soil mixes is complete. Disturbance shall be repaired by the Contractor at no additional expense to the Owner.

C. The Contractor shall place barricades to prevent compaction of planting soil mixes from vehicles, equipment, or pedestrian traffic.

D. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities following soil placement.

1. Protect newly graded areas from traffic and erosion. Keep free of trash, debris or construction materials from other work.
2. Repair and re-establish grades where completed or partially competed surfaces become eroded, rutted or compacted. Scarify, or, if directed by the Construction Manager, remove and replace soil to a depth as directed by the Soil Scientist or Landscape Architect. Reshape and re-compact at optimum moisture content to the required density.
3. Where settling occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Landscape Architect.

E. Repaired or restored areas shall follow the same procedures as specified for installation of new Planting Soil Mixes.

3.08 EXCESS MATERIALS

A. After all work for the Project is completed and accepted, the Soil Blending Contractor shall be responsible for legal disposal of all unused soil components and mixes that are stored at the Blending Contractors facility.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work of this Section consists of all site preparation work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Review of conditions and materials affecting lawns.
2. Sodding lawns.
3. Coordination with other trades.
4. Testing.
5. Clean-up.
6. Restoring all lawn areas within the limit of work that are disturbed by the work of the Contract.

1.3 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements that affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 01 7 123 – Site Field Engineering.
2. Section 02 41 43 – Site Preparation, Clearing, and Protections.
3. Section 31 20 00 – Earthwork.
4. Section 32 80 00 – Irrigation.
5. Section 32 91 00 – Planting Soil System.
6. Section 32 92 01 – Prairies, Meadows and Wetlands.
7. Section 32 93 00 – Planting and Fine Grading.
8. Section 33 46 00 – Landscape Underdrainage.

1.4 LIMITS OF WORK

A. All areas within the limits of work that have been disturbed and are not otherwise indicated to be improved shall be grassed. All areas beyond limits of work shall be

restored to the satisfaction of the Owner and the Landscape Architect. Refer to the Drawings.

1.5 LINES AND GRADES

A. The Contractor shall verify that the subgrade and finish grade lines and grade are consistent with the Drawings and acceptable to the Landscape Architect. The Contractor shall make adjustments as necessary to establish finish grades.

B. Grades: If present, protect and maintain grade stakes and location stakes until removal is acceptable to Landscape Architect and all parties involved in this project. If grade stakes are not present, establish grade stakes to ensure that grades shown on the Drawings are being met.

C. The location and limits of lawns shall be located prior to planting.

1.6 SUBMITTALS

A. The planting soil shall meet the specifications noted in this Section and in Section 32 91 13.19 – Planting Soils Procurement and Section 32 91 19.13 – Planting Soils Placement.

B. Sources for Sod: Submit sod grower location and contact information.

C. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements. Work includes but is not limited to:

1. Sod Mix.
2. Lime, if necessary and approved by the Landscape Architect.
3. Fertilizer.
4. Erosion Control.
5. Miscellaneous materials.

D. Certificates: Submit inspection certificates required by authorities having jurisdiction. Provide certifications stating that materials comply with requirements for the following products:

1. Sod: Certify species and source, Certification shall clearly indicate deviations from the specified sod grass species and any proposed substitutions.
2. Soil amendments and fertilizers.

E. Samples: Before ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architect approval has been obtained. Delivered materials shall closely match the approved samples.

1. (2) 12" x 12" Sod samples.

F. Maintenance Instructions: Provide clear, concise typewritten maintenance instructions and recommendations for year round care of all work provided under this Section.

1. Maintenance Instructions shall include the following information plus any special instructions deemed necessary by the Contractor, Landscape Architect, and Construction Manager:
   (a) Title and location of project; date of project; name, address, and telephone/ fax number of Landscape Contractor and Landscape Architect.
   (b) Lawn Sod covered by the maintenance instructions.
   (c) Identify by calendar month the maintenance requirements for fertilizing, irrigation, pest/ disease control, mowing, and general maintenance. Indicate type and quantity of fertilizer to be used, which pests/ diseases can be anticipated for lawns, and quantity of water needed.

1.7 QUALITY ASSURANCE/ DEFINITIONS

A. Analysis of Materials: For each type of packaged material required for the work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards of the Association of Official Agricultural Chemists.

B. Testing laboratory Qualifications: An independent laboratory with the experience and capability to conduct the testing indicated and that specializes in the types of tests to be performed.
   1. Employ at Contractor’s expense an independent testing agency acceptable to the Landscape Architect to perform tests and certifications indicated. Tests shall be made in strict compliance with the standards of the Association of Official Agricultural Chemists.

C. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of turf on at least three projects of similar size and complexity. Minimum experience for Foreman and Installer shall be five years.
   1. Installer shall have experience with the installation and handling of manufactured planting soils.

D. Sod Source: Permit the Landscape Architect to inspect sod at the place of growth.
   1. At the Landscape Architect’s option and/ or request, the Contractor shall supply the Landscape Architect with photographs of sod for the project. The photographs shall be taken at the sod farm. Photographs shall include images showing the full range of sod characteristics including detailed photographs of the sod and blades. Images shall include a measuring device to indicate true size.

E. Inspection: The Landscape Architect reserves the right to re-inspect sodding at any time and to reject unsatisfactory materials and/or installation at any time during the progress of the work even if previously inspected and approved. The Contractor shall replace rejected materials at no change in Contract Amount.
   1. The Landscape Architect shall have the right to reject any sod source if he/ she determines, before, during or after inspecting or receipt of sod, any of the following:
      (a) The sod does not meet quality standards set forth herein.
      (b) The sod does not meet the intended visual characteristics of the lawn as determined by the Landscape Architect.

(c) The sod supplier cannot supply the specified seed or acceptable substitute species.

(d) The sod supplier's cultural practices or maintenance procedures do not meet specified standards.

2. The Landscape Architect has endeavored to locate sources for the sod indicated. However, the Landscape Architect makes no claim that the materials will be available at the sources researched. The Contractor shall submit to the Landscape Architect any questions regarding the source of sod.

1.8 STANDARDS AND SPECIFICATIONS

A. Materials and methods of construction shall comply with the following standards:

1. ASTM: American Society for Testing and Materials.

2. ANLA: American Nursery & Landscape Association. (Formerly: AAN – American Association of Nurserymen.

3. ANSI: American National Standards Institute

4. AOAH: Association of Official Agricultural Chemists.

5. International Society of Arboriculture.

(a) Also refer to Section 32 93 00 – Planting and Fine Grading.

1.9 DELIVERY, STORAGE AND HANDLING

A. Handle all sod materials in strict compliance with supplier's / manufacturer's instructions and recommendations. Protect all materials from damage, injury, and theft.

B. Sequence deliveries to avoid delay. Deliver materials and sod only after preparations for sodding have been completed and accepted, including but not limited to: subdrainage system, irrigation, rough grading, utilities, decompaction or remediation of soils. The Landscape Architect shall determine if the site is acceptable for sodding.

C. Prohibit vehicular and pedestrian traffic on or around areas to be sodded.

D. Vehicular access to the site is restricted. Prior to construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and access to the site.

1.10 PROJECT CONDITIONS AND COORDINATION

A. Utilities: Determine and mark the location of below grade utilities before project staking. The Contractor shall field locate all utilities before starting work. Hand excavate as necessary to avoid damage. Repair all damage and restore items to their original condition as approved by the Landscape Architect and authorities having jurisdiction at no change in Contract Amount.

B. Concealed Conditions: Notify Construction Manager before planting when below grade conditions detrimental to proper plant growth are encountered. Do not proceed with sodding without specific written instructions from the Landscape Architect.

C. Sequence of Installation: Sequence installation so that trees and shrubs are installed before lawns, unless otherwise approved by the Landscape Architect. Restore damaged

lawns and groundcover beds if tree and shrub planting is delayed. Complete planting work as quickly as possible on portions of the site as they become available for planting.

1. Coordinate installation of sodded areas with installation of planting soils.

D. Verify that irrigation work is installed and available for watering at time of installation. Do not proceed with work until irrigation is available. If water service is discontinued, for any reason, before final acceptance, provide water as needed to maintain sodded areas in a healthy condition. Provide all accessories required for watering. Watering and equipment shall be included in the base bid.

E. Painting: Do not paint vegetation or lawns for any reason.

1.11 PLANTING SEASONS

A. Planting season for sod shall be as limited below, however the actual planting of the sod shall be done only during periods within this season that are normal for such work as determined by weather conditions and by accepted practice in this locality. At his option and on his responsibility, the Contractor may plant sod under unseasonable conditions without compensation but subject to Landscape Architect's approval as to time and methods:

Plant Material	Planting Season
Lawn Sod	March 15 to September 30

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.12 ACCEPTANCE AND MAINTENANCE

A. Request for Acceptance: In writing, request Landscape Architect's inspection for acceptance at least 10 days in advance of preferred inspection date. Do not request inspection for acceptance until work is 100% complete (not including maintenance) and in compliance with the Contract requirements.

1. Partial Acceptance: Acceptance of partial areas or portions of the total work may be granted, at the Landscape Architect's option, if the area to be inspected for acceptance is large, well defined, and easily described. The Owner and Landscape Architect are not obligated to provide partial acceptance of the work.

2. Final Acceptance is defined as the time at which all work has been performed and accepted by the Landscape Architect, including any work noted on the "Punch List".

B. Acceptance Criteria for Lawn Areas: Create an acceptable lawn which is defined to mean a uniform, smooth lawn with well established, close stands of grass, with no bare or dead spots over 3" in maximum dimension, with not more than one bare spot for each square yard of lawn area. Sodded lawn shall have an average of at least 6 thriving grass plants per square inch. To be acceptable, the lawn shall be free from weeds, disease, and detrimental insect infestation. Roots should extend two inches into new root zone.

C. Lawn Maintenance: Provide complete maintenance and service as required to promote and maintain healthy growth including, without limitation, watering, fertilizing, weeding, mowing, trimming, rolling, regrading, fallen leaf removal, treating for insects and disease, and other operations and work. Mow lawn as required.

1. Length of Maintenance Required: Completely maintain lawns until 60 days after Final Acceptance of project.

D. Lawn Replacement: Replace defective lawn with new lawn of same species, character, and quality of originally accepted work. If a replacement is unacceptable during its one year warranty, the Contractor shall provide another replacement or, when approved by the Construction Manager, equivalent cash payment.

1. Replacement Planting Seasons: Planting for replacement and warranty work for lawns shall comply with the Planting Seasons specified herein.

1.13 WARRANTY

A. Provide written warranty agreeing to remove and replace work that exhibits defects in materials or workmanship for the specified periods. "Defects" is defined to include, but is not limited to, death, unsatisfactory growth, failure to adequately root into soil, disease, abnormal foliage density, abnormal size, abnormal color, failure to thrive, and other unsatisfactory characteristics.

1. Lawn Replacement: Replace defective lawn with new lawn of same species, character, and quality of originally accepted work. If a replacement is unacceptable during its one year warranty, the Contractor shall provide another replacement or, when approved by the Construction Manager, equivalent cash payment.

B. Warranty Period for Lawns:

1. Two (2) years from date of Final Acceptance.

PART 2 PRODUCTS

2.1 LAWN SOD

A. Grass Sod: Provide strongly rooted, mature, vigorous, healthy, commercially grown sod free of weeds, other grasses, insects, pests, diseases, gravel and other deleterious matter, be of firm, tough texture, having a compact growth of grass and good root development; of a minimum two years growth. The sod root zone shall be of good, fertile, natural field soil and free from stones and debris, and the sod shall contain sufficient moisture to maintain its vitality during transportation.

B. Composition: Nursery grown sod composed of Latitude-36 Bermudagrass (Cynodon dactylon Burtt-Davy x. transvaalensis (L.) Pers).

C. Sources for Sod: Only sod growers with extensive experience in sod production shall be considered. Sod grower shall provide certification that they can produce sod of the quantities required for this project.

D. Mowing Height: Before harvesting, grass sod shall be mowed uniformly at the following height: 1 inch.

E. Moisture Content: Sod shall not be harvested or transplanted when its moisture content (excessively dry or wet) may adversely affect its survival.

F. Stripping: Provide sod machine cut to 3/4", thickness, excluding top growth and thatch. Sod to be mowed not more than seven days prior to being cut. Provide only non-dormant, viable sod in uniform sized pads. Sod must be capable of supporting its own weight when held vertically within the top 10%. Roll or fold sod prior to lifting and handle in a manner to prevent tearing, breaking, drying, or any other damage. Deliver sod to site and begin installation within 24 hours after stripping.

G. Contractor shall submit certification from sod supplier indicating that sod shall be obtained from that supplier.

H. Observation:

1. Notify the Landscape Architect prior to Stripping. The Landscape Architect reserves the right to inspect the sod at the source nursery. Areas which fail to meet approval shall not be stripped or shipped to the site. The Landscape Architect shall be permitted to take representative samples from the site.

2. The Landscape Architect reserves the right to reject material not conforming to specification after shipment to the site. The Contractor shall remove such material immediately and replace within the project schedule, at no additional cost to this contract. Rejected material shall include sod which is not fresh and green, dried out, burned, inferior in quality or not of equal material to samples.

2.2 PLANTING SOIL MIXTURE

A. Soil Mix: Refer to Section 32 91 13.19 “Planting Soil System Procurement”. The Contractor shall strictly adhere to soil specification composition for each section of the Work.

B. Coordinate installation of soil mixes and plants to meet requirements of Sections 32 91 19.13, 32 92 01 and 32 93 00.

2.3 SOIL ADDITIVES

A. Refer to Section 32 92 13.19 “Planting Soil System Procurement” for all additives and amendments to the planting soils.

2.4 CHEMICALS AND INSECTICIDES

A. Herbicides, pesticides and related chemicals for weed, fungus and pest control are expressly prohibited.

2.5 MISCELLANEOUS MATERIALS

A. Soil and Pavement Protection. The driving of vehicles over planted areas is expressly prohibited. Protect sub-grade, planting soils and pavements using one of the following:

1. Plywood: Provide 3/4" Grade C or better plywood for use as planking when driving vehicles or moving equipment over areas to be planted.

2. Oriented Strand Board (OSB): Two (2) Layers of ¾" OSB on top of 6" mulch. Provide Filter Fabric under mulch layer.

PART 3 EXECUTION

3.1 INSPECTION AND ACCEPTANCE

A. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and notify the Construction Manager in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not commence work associated with the installation of Lawns until all work in adjacent areas is complete and accepted by the Landscape Architect. The Contractor shall confirm that:

1. Subgrade is accepted.

2. Landscape Subdrainage is installed and accepted.

3. Subsoil Amendments have been installed and accepted.

4. Utilities have been installed and accepted.

5. Irrigation main lines have been installed and accepted.

6. Area is free of invasive species of the type and to the extent described in Article 3.6 of this Section

3.2 PREPARATION

A. Provide and set sufficient grade stakes, as determined by the Landscape Architect, to insure correct line and grade of finish grade.

B. Immediately before placing planting soils, any sticks, stones, or foreign material three inches or greater shall be removed from the subgrade. Large stones and/or boulders shall be buried eighteen inches below finished grade.

C. Harrow or otherwise loosen the surface of the subgrade to a depth of 3-4 inches.

D. In areas that have been severely compacted, as determined by the Landscape Architect, scarify to a depth of 12 inches by approved methods. Perform percolation tests to confirm soils have been de-compacted to create an acceptable free draining condition for the lawn soils.

E. Protect new existing site improvements from damage due to planting operations. Repair all damage and restore items to their original condition as approved by Landscape Architect at no change in Contract Amount.

3.3 PLACING PLANTING SOIL

A. Refer to Section 32 91 13.19 – Planting Soil System Procurement and Section 32 91 19.13 – Planting Soil System Placement.

B. Place and spread approved planting soil from site stockpiles or newly furnished materials over approved areas to a depth sufficiently greater than the depth required for sod areas so that after natural settlement and light rolling, the completed work will conform to the lines, grades and elevations indicated, and shall assure proper drainage in an uninterrupted pattern free of hollows and pockets.

C. After approved planting soil has been spread, prepare it carefully by scarifying or harrowing and raking. Remove all stiff clods, lumps, litter and other foreign material and stones over 1 inch in diameter and dispose of legally off the site. Areas of planting soil shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect. Roll the entire surface with a hand roller weighing approximately 100 per foot of width. During the rolling fill all depressions caused by settlement with additional planting soil and then regrade and roll until the surface presents a smooth, even and uniform finish and is up to the required grade.

D. No subsoil or loam shall be handled in any way if it is in a wet or frozen condition. Excess planting soil, if any, shall be stockpiled on site where directed.

E. Maintain at all times during the planting operations at least one stockpile of each type of plant soil mixture, as specified in 32 91 13.19 – Planting Soil System Procurement and as approved by the Landscape Architect and Soil Scientist.

3.4 APPLICATION OF PLANTING SOIL ADDITIVES / SOIL TREATMENTS

A. Refer to Section 32 91 19.13 – Planting Soil System Placement for application of additives, amendments, and treatments to the planting soil.

3.5 LAWN INSTALLATION

A. General: Limit of sodding shall be as shown on the Drawings. All areas on the plan are to be sodded only after written approval of the finished grading or as directed by the Landscape Architect.

B. Sodding: Obtain Landscape Architect's approval of fine grading prior to placing sod. Cut, deliver and install sod within a 24-hour period. Do not harvest or transport sod when moisture content may adversely affect sod survival. Protect sod from sun, wind, and dehydration prior to installation. Do not lay dormant sod or install sod on saturated or frozen soil. Do not tear, stretch, or drop sod during handling and installation. Loosen topsoil of loam to be sodded and place sod immediately. Sod to be placed only by experienced workers under supervision of a qualified foreman

1. Sod Placement: Moisten the upper 5 to 6 inches of soil several days before sodding and ensure soil is damp immediately prior to placing sod. Install initial row of sod in a straight line, beginning at bottom of slopes, and lay sod perpendicular to slope direction. Place subsequent rows parallel to and lightly against the previously installed row. Lay sod to form a solid mass with close joints. No space between joints should be greater than 1/2" by 1/2". Fill any space between joints to level with root zone soil. Butt ends and sides of sod strips; do not overlay edges. Stagger strips to offset joints in adjacent courses. Provide sod pad top flush with adjacent curbs, sidewalks and drains.

2. Rolling: Press sod firmly into contact with the sod bed by tamping, rolling, or by other methods approved by Landscape Architect to eliminate air pockets, provide

true and even surfaces, ensure knitting and protect all exposed sod edges, but without displacement of the sod or deformation of the sod surface. Sod surface shall be smooth and free of depressions or lumps, and without gaps, seams and bare patches.

3. Watering: Water sod thoroughly at the rate of 5 gallons per square yard with a fine spray to keep the upper 2 inches of soil moist.

4. Mowing: The first mowing of sodded areas shall not be done until the sod is firmly rooted, as determined by the Landscape Architect, and securely in place. Not more than 33% of the grass leaf shall be removed by the initial or subsequent mowing.

5. Aeration: After sod has rooted sufficiently, as determined by the Landscape Architect, aerate the sod with a hollow tine aerator using 3/4 in tines on 2-inch spacing. The aerator should be a piston type aerator. A disk or rolling aerator is not acceptable. Harvest and discard aeration cores using sweepers or other approved devices. Topdress using sufficient original root zone soil mix to fill aeration holes and provide an additional 1/4" of root zone soil over entire area. Broom topdressing to smooth surface.

3.6 INVASIVE SPECIES CONTROL

A. Inspect all sodded areas, disturbed areas and areas throughout the site and within 1,500 linear feet of all edges of the Limit of Work which are accessible to the Contractor every two weeks during the construction and establishment period to check for the presence of invasive or weedy species. Remove/kill material within 14 days by hand pulling. If visibly flowering, the weed must be physically removed. Bag and remove off-site. Do not compost on site.

B. Common weeds include, but are not restricted to, the following:

Dallies grass (Paspalum dilatatum)

Johnsongrass (Sorghum halapense)

Buffelgrass (Cenchrus ciliaris)

Bermudagrass (Cynodon dactylon)

Giant ragweed (Ambrosia trifida)

Thistles (Cirsium spp.)

Bastard cabbage (Rapistrum rugosum)

Cocklebur (Xanthium strumariu)

King Ranch bluestem (Bothriochloa ischaemum)

Old World bluestems (Dicanthium spp.)

Sandbur (Cenchrus spinifex)

Junglerice/barnyardgrass (Echinochloa spp.)

Pigweed (Amaranthus spp.)

3.7 EROSION CONTROL

A. For soil left bare prior to sodding, refer to Section 02 41 13 – Site Preparation, Clearing & Protection.

3.8 WATERING

A. Watering of Lawn Areas

1. First Week: The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least 2 inches.

2. Second and Subsequent Weeks: The Contractor shall water the lawn as required to maintain adequate moisture, in the upper 5 inches of soil, necessary for the promotion of deep root growth.

3. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one complete coverage to the sodded areas in an 8 hour period.

3.9 REPAIR OF INSTALLED LAWNS

A. If lawn is damaged, remove damaged materials and replace with new sod.

B. If lawns exhibit unsatisfactory growth, perform soil testing for chemical properties, compaction and infiltration rates. Adhere to Landscape Architect's recommended remediation. Remediation may include, but are not limited to, soil amendments, Liquid Biological Amendments (LBA) treatments or soil decompaction.

3.10 CLEANUP, PROTECTION AND EXCESS MATERIALS

A. Following the acceptance of lawns, the Contractor shall immediately remove from the site all materials and equipment not required for any other planting or maintenance work.

B. Store materials and equipment remaining on site in locations which do not interfere with the Owner's maintenance of accepted lawns or other construction operations.

C. The Contractor shall be responsible for keeping all paving and building surfaces clean during placement of topsoil and sodding operations.

D. All excess stones, debris and soil resulting from work under this Section which have not previously been cleaned up shall be cleaned up and removed from the project site at no additional cost to the owner.

E. Protection of Drainage System: Protect existing drainage protection system at all drain inlets to prevent silt, materials or debris caused by planting operations from entering the drainage system. If drainage protection system is not present, establish weed-free straw bales, siltation fencing or other devices as required to prevent siltation of the drainage system.

PART 4 ESTABLISHMENT AND MAINTENANCE

4.1 MOWING

A. When grass has grown to at least 1/3 of an inch higher than the recommended height of 1 to 2 inches (i.e., grass has grown to 2 1/2 inches tall versus a recommended height of 2 inches), begin mowing.

B. Avoid removing more than 1/3 of the total grass blade length at any single mowing.

C. Certify all mowing equipment meets emissions levels set by the EPA.

D. For required Project maintenance, see Article 1.12 of this Section.

END OF SECTION

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Description
   1. Work included: the soil preparation, coordination with the placement of inert materials and meadow seeding. See plans for the project limits.
   2. Coordinate this work with other Subcontractors working on the Project site.
   3. Related work described elsewhere:
      a. Section 04 44 10 – Landscape Stonework
      b. Section 31 23 23.43 - Geofoam
      c. Section 32 13 13.13 – Exposed Aggregate Concrete Paving
      d. Section 32 14 40 – Stone Paving
      e. Section 32 16 13.43 – Stone Curbs
      f. Section 32 91 00 – Planting Soil System
      g. Section 32 93 00 – Planting and Fine Grading

1.02 METHODOLOGY

A. The method specified herein is used for plant establishment following soil preparation for seeding using the material specified herein. This method is designed for irrigated or temporary-irrigated conditions.

B. Work Specified Herein – The work of this Section shall include all labor, material, equipment, and services necessary to complete the work as detailed and specified, and all work incidental thereto.

C. Pre-Construction Conference – The Contractor may schedule a pre-construction conference with the Subcontractor at least seven (7) days prior to beginning work under this Section. Purpose of this conference is to review questions the Subcontractor may have regarding the work, administrative procedures during construction and project work schedule.

D. Samples and Tests –The Owner reserves the right to obtain and analyze samples of materials for conformity to specifications at any time. Subcontractor shall furnish samples upon request by The Owner. Rejected materials shall be immediately removed from the site and replaced at the Subcontractor's expense. Cost of testing of materials not meeting specification shall be paid by Subcontractor.

E. Permits and Fees – Obtain all permits and pay required fees to any Governmental Agency having jurisdiction over the work. Arrange inspections required by local agencies and ordinances during the course of construction as required.

F. Coordination and Responsibility – Coordinate and cooperate with other Subcontractors working on the site for successful completion of the project. Before commencing work on the site become thoroughly acquainted with layout of all underground utilities and

structures over the entire site. All requisite repairs to damage caused by work of this Section shall be at the Subcontractor's expense.

G. Personnel – Seeding shall be performed by experienced workmen familiar with no till drilling seeding procedure and under the supervision of a qualified foreman. The foreman shall be on the job site whenever planting is in progress.

H. Restoring native plant communities is a long-term process. It is imperative that a qualified contractor, with at least 5 years of experience with native plant community installation and maintenance, within the vicinity of the project locationperform the installation and maintenance of restoration areas for the duration of the maintenance/warranty period.

I. Weather – No seeding shall occur or will be permitted during weather conditions which will adversely affect materials, nor will it be permitted when soil is in a muddy or frozen condition.

J. All existing plant material,save for those deemed to be undesirable or unwanted, shall be protected as necessary to ensure survival to the greatest extent possible.

1.03 SITE EVALUATION AND SOIL TESTING

A. Bidder shall visit and inspect the site to become thoroughly informed of all existing conditions. Any discrepancies between existing conditions and those identified in the specifications should be immediately brought to the attention of the Owner for clarification.

B. Soils shall be tested by approved laboratories for
   1. Biological activity (microorganisms)
   2. Chemical and physical characteristics.

C. The site shall be evaluated at the onset of the project and prior to seeding operations to determine biotic potential and limiting growth factors. Testing will be used to determine quantities of organic and chemical amendments needed for optimum growth. This will supersede the standard fertilizer applications. For sites deemed low in biotic potential such as sterile cuts and fills, an organic amendment requirement shall be determined as an optional supplement (see optional materials).

D. A minimum of five (5) soil samples shall be tested; these samples are to be taken from various areas of the site which are to receive hydroseed with the objective of identifying differing soil conditions. The location of each sample is to be identified on a map and a written summary. Each individual sample is to be prepared and presented to the Owner's Representative. In addition to the analysis of the soil conditions the testing lab is to identify specific recommendations for supplementing and improving the soil to provide an optimal germination and growing condition. Coordinate soil testing requirements with Section 329100 Planting Soil System.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials shall reflect evidence of proper storage and handling. Any materials with indications of improper storage and handling, (water, heat, chemical damage and the like) will be removed from the site and replaced by the Subcontractor. All materials shall be fresh and delivered in unopened containers. All materials shall be labeled or supplied with test information concerning the analysis of the various components. All work shall be performed in a professional manner. Workmanship shall be performed to the best industry standards. Care shall be taken to avoid drift and displacement of material or any damage to structures and landscape. Protective covering shall be used where material would be objectionable. Cleanup shall be done daily. Seeded areas shall be protected from traffic and construction activities with fencing.

B. Any plant species substitutions shall not be made without the express consent and approval of the Landscape Architect. Species substitutions must be presented to the Landscape Architect within a time frame that allows for review and approval. Changes to the Plans or Specifications must be approved in writing by the Landscape Architect or Ecologist. The Landscape Architect and Ecologist are in no way responsible for problems resulting from any changes to the design made by any party without their written approval.

C. All species being seeded shall be supplied as pure live seed. Submit to the Owner lab germination test results for all species. For species that are not typically tested, submit an affidavit that describes estimated purity.

D. Seed shall be native to Arkansas and seed source origin shall be from within a 250-mile radius of the project site unless denoted by Ecologist and Landscape Architect and approved by the Owner.

E. Store seed in original packages in a conditioned, dry environment. Seed shall be inspected for mold and disease upon arrival. Seed tags shall be provided with each seed mix. Should seed show any form of mold, mildew, or disease, the Landscape Architect or Ecologist may reject the use of said seed.

F. All native seed mixes to be applied at the rates and quantities of seeds per acre specified on the Drawings

G. Equipment having low unit pressure ground contact shall be utilized within planting areas.

1. Topsoil compaction shall not exceed 80% standard proctor density (ASTM D698).

2. Subsoil compaction shall not exceed 92% standard proctor density (ASTM D698).

H. Contractor shall schedule seeding after herbicide application only with approval of Ecologist and Landscape Architect.

I. PREFERRED NATIVE PLANT SEED SUPPLIERS

1. Native plant seed shall be supplied by one or more of the following pre-qualified seed suppliers. Owner approval must be obtained prior to installation for seed purchased by a nursery not listed below.

   Roundstone Native Seed
   9764 Raider Hollow Rd.
   Upton, KY 42784

   Native American Seed
   3791 US-377
   Junction, TX 76849

   Douglas King Seed
   4627 Emil St
   San Antonio, TX 78219

J. Seed: Seed shall be specified site specific seed mix added at pure live seed (PLS) rates. All seed used shall be clearly tagged or labeled showing the type of seed, purity, germination, test date, and weed content. Tetrazilium staining shall be acceptable for germination of hard seed. Cut or fill testing will not be allowed. Certificate of analysis shall be provided in addition to seed tags. Seed shall contain no more than 1% common weed seed or other crop. For purpose of this specification, weed shall be designated as all other seed including other crop not specified for seeding purposes. Other crop seed specifically considered (but not limited to) as weed shall be bermuda grass, Cynodon dactylon, African lovegrasses, Eragrostis spp., and bufflegrass, Pennisetum cilare. No noxious weed seed shall be permitted within seed mixes. Seed providers shall provide seed testing and content data for single species seed and seed mixes.

K. Specific Seed mix: See Planting Plans for specific varieties and quantities.

L. Fertilizer: Slow release, organic MicroLife Ultimate (8-4-6) fertilizer is to be used at a rate of 40 lbs per 1000 square feet. It is likely fertilizer applications will occur with a higher frequency during establishment until plants and soil biota stabilize. In order to best manage applications, contractor will submit soil samples for testing to best determine fertilizer application schedules.

   1. Fertilization Program to Establish a Bid Price:

      a. Fertilize ground cover every month for first three months, then twice per spring and fall.
      b. Uniformly apply 40 lbs of granular MicroLife Ultimate (8-4-6) per 1000 square feet.
      c. Granular fertilizer should initially watered in, with irrigation occuring in short cycles so that run-off does not occur, but that plants and soil receive even coverage.
      d. Prior to each fertilizer application, conduct a minimum of two soil tests in areas of intended application to determine necessary fertilizer requirements. Soil tests should include both the macro and micro soil nutrients.

   2. Fertilizer Application:

a. Apply fertilizer as specified by landscape architect/ecologist following inspection and/or soil analysis.
b. Meet requirements of fertilizer manufacturer's current printed instructions.
c. Apply fertilizers evenly over planting areas by spreading half the fertilizer in one direction and half in a direction 90 degrees to the first direction to assure even application.
d. Apply MicroLife Ultimate (8-4-6) granular organic fertilizer at rate of 40 lbs per 1000 square feet.

2.02 OPTIONAL MATERIALS:

A. Additional materials shall be added based upon site evaluation and soil testing. The following types and quantities of materials are added as standard supplements. Professional site evaluation and soil testing shall determine the specific types and quantities to be used.

B. Organic Amendments: Based upon site evaluation and soil testing, additional soil conditioners may be required. These materials are added to augment soil nutrients and biotic potential on sites severely deficient in these factors such as deep cuts and sterile fills. Use well composted natural organic materials high in humus, soil microbes, and plant nutrients. Refer to Section 32 91 00 Planting Soil System.

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

    a. 100% (volume) pass through 5/8" screen
    b. minimum 95% pass through 3/8" screen
    c. minimum 90% pass through ¼" screen
    d. maximum particle length 1.0"
    e. Stability - less than 0.5 mg CO2 carbon/g compost carbon/day
    f. Active Bacterial greater than 100 (µg/g)*
    g. Total Bacterial greater than 200 (µg/g)*
    h. Active Fungal greater 100 (µg/g)*
    i. Total Fungal greater than 200 (µg/g)*
    j. Organic Matter greater than 40%

    *as measured by the Compost Foodweb analysis (Earthfort Laboratory Analysis)

2. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

3. Contractor will be to secure necessary amounts up to a year before application to ensure best product is available In amounts required.

C. Additional Amendments: As a supplement to other organic materials, add one or more of the following soil conditioners:

1. Granular humus base organic soil conditioner shall be added at 1000 lbs. per acre to the hydromulch slurry during seeding operations and shall meet the following minimum requirements:

Total Humus 50% minimum

Total humic acid 15% minimum

2. Liquid humic acid base soil conditioner shall be added at 15 gallons per acre to the hydroseeding slurry during seeding operations and shall meet the following minimum requirements:

Total humic acid 6% minimum

3. Slow Release Nitrogen: Slow release nitrogen fertilizer shall be applied at 25 lbs. per acre total N as water insoluble nitrogen such as methylene urea (38-0-0) or equivalent.

PART 3 – EXECUTION

3.1 PREPARATION

A. Prior to seeding, all site seed bed preparation is to be approved by the Landscape Architect and Ecologist. Any seeding may not proceed without the express consent and approval of the Landscape Architect and Ecologist.

B. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from seeding operations.

2. Protect grade stakes set by others until directed to remove them.

C. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Ensure runoff is diverted from Adjacent waterways. Contractor shall ensure that water quality will not be adversely affected from construction runoff.

E. Description: Create a, evenly roughened, friable seedbed to capture and retain water and establish micro-habitat for seed germination and seedling establishment. Seeding Contractor is to coordinate with the Landscape Contractor and the Owner to coordinate surface material placement and grading prior to application of seed.

F. Soil Amendments: Apply pre-plant soil amendments (e.g., compost, biochar) prior to tillage operations (refer to site evaluation and soil test).

G. Tillage: Till soil by contour chisel rip furrowing a minimum of 4 inches deep. Ripper shanks shall be set 3 inches apart with a minimum of 5 shanks in operation on each pass. Using sufficiently sized machinery, rip soil along natural site contours to a minimum depth of 6 inches. Incorporate soil amendments into the soil profile. Do not pulverize the soil. Cultipack or lightly harrow to break up large clods or fill soil voids if necessary. Leave contour furrows, do not smooth finish. Remove obtrusive and hazardous rocks and debris. Standard proctor density ranges shall not be exceeded.

H. Examine areas to receive seeding for compliance with requirements outlined above. Check that finish grades slope to drain, are free of depressions or other irregularities after thorough settlement and compaction of soil and are uniform in slope between grading controls and the elevations indicated in the Plans. If finish grades are determined by the Landscape Architect or Ecologist or Owner to be insufficient for seeding, the Contractor shall re-grade areas as directed by the Landscape Architect or Ecologist or Owner.

I. Within seeding and planting areas (see plans), ensure ground layer is cleared of leaf litter and other duff prior to seeding. Submit to the Owner for approval the method for making seed contact with the soil where the soil will not be graded or otherwise disturbed prior to seeding.

J. Ensure any imported soils are uniformly distributed in a quantity sufficient to provide a suitable seeding surface after subgrading and compaction, and was spread, cultivated, lightly compacted to prevent future settlement, dragged, and graded to finish grade.

K. Proceed with installation only after unsatisfactory conditions have been corrected. Obtain approval from Landscape Architect and Ecologist regarding pre-installation conditions before proceeding.

3.2 SEEDING

A. PLANTING RESTRICTIONS: Planting is preferred during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion. Climate can expand and condense these periods. Consult with Owner, Landscape Architect or Ecologist for approval to install seed other than during the preferred planting periods.

1. Planting Windows:
    a) Spring Planting: Between March 1 and May 31.
    b) Fall Planting: Between October 1 and November 17.
    c) NO SEEDING: June to Mid September, December to February.
2. Seeding operations must occur when soil moisture is appropriate, and areas are in a friable condition and neither hard nor muddy.
3. Do not seed against existing trees in critical root zones. Limit extent of seed to outside edge of planting saucer.

B. The Contractor shall install all seed with a rangeland no-till planter or type grain drill, such as by Truax or Dew Drop, or equivalent where conditions permit. Hand broadcast seed IS ONLY ALLOWED in areas that are difficult to access with large equipment or by approval of Landscape Architect and Ecologist. Contractor shall submit a plan

demonstrating any zones that may require hand seeding for approval by Landscape Architect and Ecologist and will wait for approval before moving forward with hand seeding. Contractor shall have experience with not till drills and how to calibrate equipment to ensure seeds are planted at appropriate depths. DO NOT BURY SEED TOO DEEPLY OR GERMINATION WILL NOT OCCUR.

C. Seeding shall occur no sooner than ten days after herbicide application and no greater than 14 days after herbicide application. See Material Safety and Data Sheet of applied herbicide for guidance on herbicide residual activity. Do not proceed with seeding or planting until adequate time has elapsed as stated in Material Safety and Data Sheet.

D. Sow seed with no till drill or seeding machine.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Contractor shall install seed in one pass and then follow with second pass perpendicular to first pass so that coverage by no till drill is even.

E. Sow seed mixes at rates as indicated on the drawings.

F. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

G. Make sure seed is integrated into soil surface, but not buried deeper than top 1/8 inch of soil.

H. In areas with critical root zones, soil shall be loosened to 6” by air spade. Soil amendments (e.g., compost, biochar) shall be placed onto surface and lightly hand mixed with native soil to ensure integration of amendments into top 4” of native soil. Seed will then be hand broadcast and lightly raked in to ensure integration of seed into top ¼” of amended soil.

I. Lightly roll seeded areas with a cultipack roller and irrigate according to irrigation establishment specifications. Do not let seed dry out for a minimum of ten days.

J. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence.

K. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions. Erosion control fiber mesh shall be fabricated from seed free, loose, aspen fiber. (see www.erosion-control-products.com)

L. Sequence installation so that trees and shrubs that are within seeded areas are installed prior to seeding, unless otherwise approved by the Owner, Landscape Architect, and Ecologist. Complete planting work as quickly as possible on portions of the site as they become available for planting.

M. Verify that temporary irrigation work is installed and available for watering at time of installation. Do not proceed with work until irrigation is available. If water service is discontinued, for any reason, before final acceptance, provide water as needed to maintain seeded areas in a healthy condition and immediately notify Ecologist and Landscape Architect.

N. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

O. ESTABLISHMENT IRRIGATION SCHEDULE – Seed and soil should be kept moist, not allowed to dry out, for a minimum of ten (10) days. Thereafter:

1. Irrigation event equivalent of 1" rain event should occur every other day for the first three (3) weeks post seeding.

2. Irrigation event equivalent of 1" rain event should occur twice (2) a week for the next two weeks.

3. Irrigation event equivalent of 1" rain event should occur once (1) a week per month for remainder of growing season.

P. After seeding, establishment irrigation schedule should be strictly adhered to as seed must stay adequately moist. Failure to adhere to establishment irrigation schedule can result in seedling mortality. Contractor will be responsible for correcting all establishment issues resulting from deviation from establishment irrigation schedule which can translate into reworking soils, reseeding, irrigation, and longer establishment timeline.

3.3 MAINTENANCE AND MONITORING

A. The site shall be maintained and monitored for a minimum of two years. Seeded areas shall be regularly inspected for germination and vigor of seeded species. Weeds shall be identified and removed prior to setting seed or spreading. Irrigated areas shall be carefully monitored to avoid under and over watering. Surfaces with loss of materials, eroded or damaged shall be repaired and reseeded. The Ecologist will prepare inspection reports based on the quarterly site visits and assess landscape health as well as address any problems.

B. The Subcontractor shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair, at his expense, any damage to the seeded areas caused by: pedestrian or vehicular traffic, flooding or erosion as a result of irrigation runoffs or other causes.

C. NATIVE SEED MAINTENANCE

1. Maintain and establish native seed areas for two full growing seasons following Provisional Acceptance by watering, weeding, applying herbicide, mowing, trimming, reseeding, replanting, and other operations as specified in the approved "Annual Maintenance Plans."

2. Areas with herbaceous meadow species and understory canopy herbaceous components shall be reseeded by hand every 3-5 years to ensure continuing diversity.

3. Meadow areas will be monitored four times annually by the Owner or its representative(s) for a minimum period of two years.

(a) Reports will be prepared by the Landscape Architect and Ecologist and submitted to the Owner after each quarterly inspection. Each report shall address establishment and grassland maturation trajectory and whether disturbed areas are revegetating adequately and not suffering erosion damage. Each report shall include photographs and a description of the state of the landscape as well as directions for correcting any issues.

(b) Monitoring shall be conducted by ecologist and maintenance contractor.

(i) Representative photographs for each ecotype shall be collected during monitoring and included in reports. Designate photo stations to collect photographic data from the same areas to capture change over time.

(ii) Monitoring will identify: 1) species within each seeding zone, 2) the five most dominant plant species within each seeding zone, 3) the percent coverage by non-native or invasive species in each seeding zone, 4) erosion and sedimentation issues, or drainage problems.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work of this Section includes, but is not limited to:

1. Woody plants, Balled & Burlaped and Containerized.
2. Herbaceous plants, Pots and Plugs.
3. Mulch.
4. Plant anchoring systems.
5. Post-installation maintenance.
6. Coordination with other trades.
7. Warranty and Maintenance.
8. Temporary Erosion Control
9. Fine Grading
10. Clean up.

B. Extent of Landscaping Work: In addition to the work indicated, Landscape work includes restoring all areas within the limit of work disturbed by work of the Contract and coordination of work with other subcontractors.

1.3 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 31 20 00 – Earthwork.
2. Section 32 84 00 – Irrigation.
3. Section 32 91 00 – Planting Soil System.
4. Section 32 92 00 – Lawns.
5. Section 32 92 01 – Prairies, Meadows and Wetlands.
6. Section 33 46 10 – Landscape Underdrainage.

1.4 REFERENCES

A. Hortus Third, The Staff of the L.H. Bailey Hortorium. 1976. MacMillan Publishing Co., New York.

B. Standardized Plant Names, American Joint Committee on Horticultural Nomenclature, latest edition.

1.5 APPLICABLE STANDARDS

A. The references listed herein shall be the standards used for the Work, unless noted otherwise: All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1. AmericanHort: American Horticulture Industry Association

(a) American Standard for Nursery Stock, ANSI Z60.1-2014

B. American National Standards for Tree Care Operations, ANSI A300. American National Standards Institute, 11 West 42nd Street, New York, N.Y. 10036.

1.6 DEFINITIONS

A. Balled and Burlapped Stock (B&B): Exterior plants dug with firm, natural balls of earth in which they are grown; wrapped, tied, rigidly supported, drum-laced and sized as recommended by ANSI Z60.1.

B. Containerized or Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold rootball shape and protect root mass during shipping and shall be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

C. Final Acceptance: Date at which all Work, including work identified in the ”Punch List”, is completed and accepted by the Landscape Architect. Warranty periods do not begin until Final Acceptance.

D. Finish Grade: Elevation of finished fine graded surface of planting soil.

E. Girdling Root: A root that has become wrapped around the trunk of the plant that over time will inhibit the uptake of nutrients and produce structural failure, eventually leading to death of the plant.

F. Long Term Storage (of Plants): Equal to a period of three weeks or more after digging of the plants at the nursery, or a period of one week or more after receipt of plants at the Project Site.

G. Planting Soil for Soil Profiles: Soil produced on- or off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil. See Section 32 91 19.13 – Planting Soil System Installation.

H. Plugs: A seedling raised in a manufactured soil mix in individual cells ready for transplanting.

I. Root Flare: Also referred to as trunk flare, root crown, or root collar. The transition zone between the main stem and the root system, visible as the outwardly curving base of a tree where it joins the roots, often distinguishable as individual root buttresses.

J. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil. See Section 31 20 00 "Earthwork".

K. Tagging / Tagged / Tag: The Landscape Architect's selection of plant material at the nursery. An individually numbered seal is placed on the north-facing branches of a tagged plant.

1.7 ACTION SUBMITTALS

A. Product Data: Provide for each element of construction listed.

1. Plant Anchoring Systems.
2. Natural burlap.
3. Geotextile reinforcement mat
4. Organic fertilizers, herbicides and pesticides

B. Samples: Provide for each element of construction listed.

1. Mulch: At least three pint-bags of aged milled leaf mulch of the type to be used on this project.
2. Tree Stakes
3. Arbor Ties
4. Plant anchoring system, all components.

C. Installer Qualifications: In addition to requirements of Section 01 33 00 "Submittal Procedures," provide qualifications for the Project Manager and Foreman/Site Supervisor showing a minimum of 5 years of experience, and a minimum of three project references. For each reference list client, design or engineering professional hired by the client, type, cost and duration of project and role of personnel.

D. Planting Schedule: Indicating anticipated planting dates for performing all Work within this Section, coordinated with the Project. Coordinate and incorporate work in Sections 32 91 19.13 – Planting Soil System Installation, and Section 32 84 00 "Irrigation".

E. Plant Species and Source List: The Contractor shall submit for approval plant species and source list indicating the plant botanical and common name, size, quantity, form, rootball, identification of fall dig hazards, limb height (if applicable), nursery source, including contact information, and Landscape Architect's seal number.

1. Plant list shall clearly indicate deviations from the specified plant list and any proposed substitutions. Substitutions shall not be accepted without prior approval by the Landscape Architect.
2. Contractor shall confirm nursery source and plant species and size intended prior to scheduling tagging trip.

3. As the project progresses and plants are located and sealed, revise and re-submit the plant list submittal.

F. Photographs of Plants taken at the Nursery Source: Provide representative images of plants prior to scheduling tagging trips and as the basis for the Landscape Architect to select plants.

1. Contractor shall label each photograph with the plant species botanical name, nursery name, and date of photograph.

2. Photographs shall include images showing the full range of characteristics of each plant including detailed photographs of the bark, the base of the tree (rootball, root flare and crown), leaves if present, branching structure, form, and habit.

3. Images shall include a scale figure or measuring device to indicate true size.

4. Photographs may be transmitted electronically but the title of electronic files must bear the plant name, nursery, and date.

5. For container plants, also provide close up photographs of the roots with the container removed.

(a) Quantity: 5% of the total number specified are sufficient for shrubs, container perennials, and plug perennials. For perennials, remove containers to photograph root development of the plant.

1.8 INFORMATIONAL SUBMITTALS

A. Periodic Construction Images: In addition to the requirements in Section 01 32 00 "Construction Progress Documentation," provide the following images:

1. Rootball immediately prior to backfill.

(a) Frequency: During planting operations, provide images of a half-dozen trees two times a week during planting activities.

B. Plant Species and Source List: As the project progresses and plants are located and sealed, revise and re-submit the plant source list submittal. The Contractor shall maintain an up-to-date plant species and source list indicating the plant botanical and common name, size, quantity, form, rootball, identification of fall dig hazards, limb height (if applicable), nursery source, including contact information, pending or approved substitutions (if applicable) and Landscape Architect's seal number.

C. Planting Schedule Updates: As the project progresses, resubmit approved planting schedule updated to indicate anticipated planting dates for performing all Work within this Section, coordinated with the Project. Coordinate and incorporate work in Section 32 91 19.13 "Planting Soil System Installation and Section 32 84 00 "Irrigation".

1.9 QUALITY ASSURANCE

A. Pre-installation Conference: A pre-installation conference with the Landscape Architect is required for the work of this Section.

B. Mockups

1. Refer to Section 01 43 38 – Landscape Mockups for additional requirements for composite construction mockups.

2. General:
   (a) Mockups shall be In-Situ, and the approved mockup shall become part of the final Work.
   (b) The Mockups will be reviewed at each stage of construction. The Contractor shall not cover installed work until approved by the Landscape Architect.
   (c) Work with the Landscape Architect to select the location and extent of the mockup. Each mockup shall be approximately 1600 SF in extent, and shall include 2 trees of 3" caliper minimum.
3. Mockup #1: Soil Installation and Tree Planting in Existing Tree (SC) Area. The mockup shall demonstrate all materials and methods used to build the planted slope including:
   (a) Underdrains.
   (b) Protection of Existing Soil within the Vegetation and Soil Protection Fence.
   (c) Repair to existing soils disturbed as part of the Work.
   (d) Soil Profile Installation.
   (e) Tree Planting.
4. Mockup #2: Meadow Mockup. The mockup shall demonstrate all materials and methods used to install a planted meadow including;
   (a) Soil remediation
   (b) Seeding
   (c) Plug and perennial planting meadow seeding
   (d) Shrub and tree planting within meadow seeding

C. Installer Qualifications: In addition to the requirements of Section 01 40 00 "Quality Requirements", provide the following:
1. The Contractor shall have been in business a minimum of two years.
2. The Contractor's record of successful in-service performance shall include the installation of manufactured planting soils similar to the specification in Section 32 91 19.13 – Planting Soil System – Installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress. Field Supervisor shall have a minimum of five years' experience.
4. Herbicide and pesticide controls shall be recommended and applied under advisement of a licensed pest control applicator. Notify Owner prior to any application.
5. Tree branch and root pruning shall be performed by a certified arborist.

D. Labeling: Label at least one specimen of each variety and size with a securely attached, waterproof tag bearing legible designation of botanical and common name in compliance with the recommendations of the American Nursery & Landscape Association.

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes.

Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Pruning: Unless otherwise noted, pruning of plants before, during or after installation shall be prohibited except to remove dead or broken branches and limbs. Confer with the Landscape Architect before any pruning.

1. Pruning plants after the Landscape Architect's selection and prior to delivery to the site shall be cause for rejection.

1.10 PROJECT CONDITIONS AND COORDINATION

A. Utilities: The Contractor shall locate and verify all existing and new underground utilities including subdrainage, before project staking and planting. Report any conflicts to Construction Manager. Hand excavate as necessary to avoid damage to unground utilities.

B. Concealed Conditions: Notify Landscape Architect before planting when below grade conditions detrimental to proper plant growth are encountered. Do not proceed with planting without specific written instructions from the Landscape Architect.

C. Sequence of Planting: Plant trees and shrubs after finish grades are established and before planting lawns, prairies or meadows, unless otherwise approved by the Landscape Architect. Complete landscaping work as quickly as possible on portions of the site as they become available for landscaping.

1. If the Contractor is permitted by the Landscape Architect to plant trees and shrubs after lawns, prairies meadows, protect these areas and promptly repair damage caused by planting operations.

D. Planting Seasons and Weather Restrictions: Work only within seasonal limitations for proper planting noted below. The Contractor shall, however, take into consideration seasonal weather conditions that would affect the planting period and shall not proceed if planting in these conditions would affect the short and/or long term health of the plants:

Item	Spring Season	Fall / Winter Season
Deciduous (container)	2/15 to 5/15	10/1 to 2/15
Deciduous (balled and burlapped)	2/15 to 5/15	10/1 to 2/15
Deciduous (bare root)	2/15 to 4/15	N/A
Broad Leaf Evergreens	2/15 to 5/15	N/A
Evergreens	2/15 to 5/15	10/1 to 2/15
Groundcover	3/1 to 5/30	10/1 to 10/31
Perennials	3/1 to 5/30	10/1 to 10/31
Bulbs	N/A	10/1 to 12/1

Regardless of the specified planting season dates, suspend work when the temperature is below 25 °F, the wind velocity is over 25 mph, the ground or planting soil is frozen or wet, or the continuation of prevailing weather will damage plant materials, including

sustained periods of above-normal high temperatures. Complete planting operations as early in the specified season as possible.

E. Fall Dig Hazard: Some species of trees and shrubs are considered "Fall Transplanting Hazards" by the nursery trade. The Contractor shall identify Fall Transplanting Hazards from the plant schedule, and factor the proper handling of these trees into the overall sequencing of construction and Project schedule. The Contractor shall notify the Landscape Architect of any conflicts arising from this analysis of the plant list and schedule.

F. Water:

1. Water shall be tested for presence of chloramine and other potential hazards. If levels are determined to exceed acceptable levels, provide an alternate source for water.

2. Water connections may be available on site. The Contractor shall immediately notify the Construction Manager and Landscape Architect in writing if water is insufficient for work and maintenance operations.

3. Provide water as needed from sources free from impurities injurious to vegetation.

4. Provide all hoses and equipment as needed to distribute water to area of landscape work and areas needing watering. Provide water tank trucks if water service is interrupted. Prior to providing water tank trucks, submit to Landscape Architect for review and approval.

5. The Contractor shall employ conservation practices for all water use and shall instruct all of his/her installers to abide by this requirement.

G. Painting: Do not paint vegetation for any reason.

1.11 ACCEPTANCE AND MAINTENANCE

A. Request for Acceptance: In writing, request Landscape Architect's inspection for acceptance at least 10 days in advance of preferred inspection date. Do not request inspection for acceptance until work is 100% complete (not including maintenance) and in compliance with the Contract requirements.

1. Final Acceptance is defined as the time at which 100% of the work has been performed and accepted by the Landscape Architect (excluding post project maintenance) including any work noted on the "Punch List".

2. Partial Acceptance: Acceptance of partial areas or portions of the total work may be granted, at the Landscape Architect's option, if the area to be inspected for acceptance is large, well defined, and easily described. The Landscape Architect is not obligated to provide partial acceptance of the work.

B. Maintenance Period: Completely maintain plants and trees from date of receipt from nursery until 60 days after Final Acceptance.

1. Plant and Tree Maintenance: Begin maintenance immediately after planting. Provide complete maintenance and service as required to promote and maintain healthy growth including, without limitation, watering, weeding, fallen leaf removal, treatment for insects and disease, resetting plants to proper grade and upright position, and other operations and maintenance work. Throughout the

maintenance period, restore planting saucers and mulch, and keep mulch beds weed free. Tighten and adjust rootball fixing system to keep trees in vertical position.

(a) Watering: Flood all plants during the construction and maintenance periods at least twice each week. If present and operational, coordinate programming of irrigation system to meet watering needs. If irrigation system is not operational, provide hand watering as needed to maintain healthy growth. At each watering, thoroughly saturate the soil around each tree and shrub. If sufficient moisture is retained in the soil as determined by the Landscape Architect, the required watering may be reduced. Trees will require a minimum of twenty gallons of water for each watering. Shrubs will require a minimum of ten gallons of water for each watering.

i) Winter Watering: Lack of adequate soil moisture is often a major cause of winter damage. All plants, but especially narrowleaf and broadleaf evergreens, use water during winter. Moisture must be available below the frost line or frozen soil.

a) Plants should be watered thoroughly in the fall to prepare them for the winter months.

b) During dry winters, broadleaf evergreens should be watered about once each month.

(b) Application of insecticides and herbicides may occur only under express consent and approval of the Landscape Architect and Owner.

1.12 WARRANTY

A. Warranty: Provide written warranty agreeing to remove and replace work that exhibits defects in materials or workmanship for the specified periods. "Defects" is defined to include death, unsatisfactory growth, disease, insect infestation, abnormal foliage density, abnormal size, abnormal color, failure to thrive, and other unsatisfactory characteristics.

1. Warranty Period: Two (2) years from date of Final Acceptance.

2. If the Contractor disagrees with the planting practices herein specified, he/she shall state them in writing at least 60 days before planting work commences. Failure to present this written notice shall be interpreted as acceptance of the planting practices specified herein.

3. Replacement: Replace defective work with new material of same species, size, character, and quality of originally accepted work. With each replacement material, provide a new one-year warranty for the replacement work. If a replacement is unacceptable during this second one-year warranty period, the Contractor shall provide another replacement or, when approved by the Owner, equivalent cash payment.

4. Replacement Planting Seasons: The replacement period for plant warranty work shall comply with the Planting Seasons specified herein. Electing to plant outside of the specified Planting Seasons shall not absolve the Contractor from providing the warranty.

5. Repair of Adjacent Work After Warranty Replacement: Contractor shall return all adjacent elements and systems modified during removal and replacement of

plants to the condition in which they were found, including shrub and perennial planting, planting soils and drainage.

6. Owner's Responsibility and Warranty Exclusions: The Contractor's warranty shall exclude problems due to improper or inadequate maintenance, vandalism or acts of nature.

   (a) During the warranty period, the Contractor shall visit the site at least every other month to review the conditions of the accepted work. The Contractor shall submit in writing to the Owner regarding the Owner's maintenance practices and/ or any vandalism. The content of this notice shall include a list of specific plants involved, the presumed problem, and a method of remedy for the problem(s) cited. The Owner shall make reasonable efforts to correct the problems cited by the Contractor but the Owner shall not be held responsible for the Contractor's defects in materials or workmanship that result in decline or death to plants.

   (b) Failure of the Contractor to make the required reviews of the site during the warranty period and to submit written notice to the Owner of maintenance defects shall negate the Contractor's ability to make a claim against the Owner for negligence of maintenance.

PART 2 PRODUCTS

2.1 PLANT MATERIALS - GENERAL

A. General: Furnish specimen nursery-grown plants of genus, species, and cultivar specified complying with ANSI Z60.1, with healthy root systems well provided with fibrous roots developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement. All parts of the plant shall be moist and show active green cambium when cut. Plants will be densely foliated when in leaf.

B. Grade: Provide plants of specified height, caliper, sizes and grades complying with ANSI Z60.1 for type of plants required.

   1. Larger Stock: Plants larger than required may be used if approved by the Landscape Architect if rootball is proportionately larger, and if there is no change in Contract Price.

   2. Undersize Stock: If approved by the Landscape Architect, plants may be undersized as long as not more than 10% of plants smaller than required are used. If more than 10% undersized plants are used, then an 25% of the undersized plants shall be provided at no additional expense to the Owner.

C. Hardiness: Provide plant stock certified to have been grown within hardiness Zones 2 through 6 as established by the USDA's Plant Hardiness Zone Map. Submit certification if so requested by the Landscape Architect.

D. Plant Character: All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Form and size shall comply with ANSI Z60.1.

1. Canopy Trees: Well-defined trunk flare, straight trunk, and single stem. Co-dominant leaders shall not be accepted. Evidence of equal increments of growth over the prior three seasons shall be discernible.

2. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1

3. Shrubs: Multi-stemmed plants complying with ANSI Z60.1 for the species indicated.

4. Groundcover: Provide groundcover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

5. Herbaceous Plants: Provide healthy plants from a commercial nursery, of species and variety shown or listed.

   (a) Upon award of Bid, the Contractor shall arrange for all species or quantities of species require contract growing.

6. Herbaceous Plugs: All plants shall be typical of their species or variety and shall have a normal habit of growth.

   (a) Provide fully rooted, vigorous plugs showing rooting appropriate for species at specified period of development.

E. Trunk: The height of the trees shall be in accordance with ANSI Z60.1. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety, for example 'S' curves shall not be allowed. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire or other causes. No pruning wounds shall be present having a diameter exceeding one inch and such wounds must show vigorous bark on all edges.

F. Rootballs:

1. General:

   (a) The diameter and depth of rootballs shall be sufficient to encompass the fibrous and root feeding system necessary for the healthy development of the plant in accordance with ANSI Z60.1., or the minimum rootball diameter shown, whichever is larger. Rootball size shall comply with size specified within the Plant Schedule.

      i) If the root flare is buried 2" or more, provide a larger diameter or greater depth rootball to compensate for the buried root flare, as the soil overburden shall be removed prior to planting, which effectively reduces the size of the rootball.

   (b) No plant will be accepted when the ball of earth surrounding its roots has been cracked or broken prior to or during the process of planting or after the burlap, staves, ropes or platform required in connection with its transplanting have been removed. The rootballs shall remain intact during all operations.

   (c) Girdled Roots: Inspect root crown for girdling roots. Inspection for girdled roots shall be done at the nursery to the extent possible. If girdled roots are not visible at the nursery and are revealed before acceptance, any plant with a girdled root over 1/2" shall be rejected.

G. Balled and Burlapped: All plants to be moved balled and burlapped shall be moved with the root systems as solid units with balls of earth firmly wrapped with burlap, firmly held in place by a stout cord and drum lacing, or wire basket. Burlap for containing rootballs shall be untreated, made from biodegradable natural fibers. Balled and burlapped material shall not be moved from the nursery when overly wet or dry to prevent compression or disintegration of the rootball.

H. Container Stock: Container stock shall have a full container with a well-developed root system. Plants loose in the container are not acceptable. The root zone shall be free of circling or kinked roots. Large matted roots at the sides or bottom of the container will not be accepted. Staked plants must be self-supporting when unfastened from the stake. Container grown plants may be substituted for balled and burlapped material if approved by the Landscape Architect.

2.2 PLANT SOURCES

A. The Contractor shall submit to the Landscape Architect any questions regarding the source of any plant.

B. Contract growing of some plants may be required. The Contractor shall identify plant species in need of contract growing within four weeks of beginning work.

2.3 DIGGING SEASON

A. Plants shall be delivered freshly dug from the nursery source. Plants that have been pre-dug the previous season and held at the nursery or another off-site location shall not be accepted.

1. Spring Dig: Plants shall be dug as early as possible and as determined by the nursery owner, and no later than bud break.
   (a) Do not transport plants within 14 days after bud break.
2. Fall Dig: Plants shall be dug while dormant, generally following leaf senescence.
   (a) Fall Dig Hazard: Some species of trees or shrubs are considered “Fall Transplanting Hazards” by the nursery trade. The Contractor shall identify Fall Transplanting Hazards from the plant schedule, and factor the proper handling of these trees into the overall sequencing of construction and Project schedule. The Contractor shall notify the Landscape Architect of any conflicts arising from this analysis of the plant list and schedule.

2.4 SELECTION AND INSPECTION OF PLANTS

A. The Landscape Architect will review plant and select plant materials at the nursery source prior to digging. At the Landscape Architect’s discretion, plant material may be selected through photographs provided by the Contractor prior. All plants brought to the site will have been reviewed in this manner. Plants that do not have the Landscape Architect’s approval shall be removed from the site.

1. Tagging: At least three weeks prior to the expected planting date, request, in writing, the Landscape Architect’s inspection of plant material at the nursery. Provide photographs beforehand if requested by the Landscape Architect.
   (a) The Landscape Architect will make his/her own travel arrangements to the nursery.

(b) Seals placed on the selected plants at the nursery shall remain on the plants until Final Acceptance of the work.

2. The Landscape Architect's basis of plant selection will include:
   (a) Conformance with specified genus, species, variety, size, form, rootball and quality.
   (b) The visual characteristics of the plants.
   (c) Plant health.
   (d) Adherence of the nursery to cultural practices and maintenance procedures that are at or above industry standard.

3. On-Site Inspection:
   (a) The Contractor shall permit the Landscape Architect to inspect plants upon their arrival to the project site and at any time prior to planting. The Landscape Architect will inspect the plant materials for size and condition of rootballs and/or root systems, insects, injuries, defoliation, wind burn and latent defects. The Contractor shall remove plant material that is unsatisfactory or defective, as determined by Landscape Architect, and replace the plants at no additional cost to the Owner.
   (b) The Landscape Architect may reject a specific nursery source and associated plants if he/she determines before, during or after receipt of plants, any of the following:
      i) The nursery stock does not meet health standards set forth herein, including disease and infestation.
      ii) The nursery stock does not meet the requirements of the Landscape Architect's basis of selection as stated herein.
      iii) The nursery cannot supply the specified plant(s) or an acceptable substitute cultivar or species.

B. Substitutions

1. In the event that the Contractor is unable to obtain the plant material specified, either because of unavailability or the failure of the plant material to meet the quality requirements of this Section, the Contractor shall provide substitute plants of equal size, quality, character, overall form, branching habit, color, time of bloom and value to the plant originally specified. The substitute plants shall conform to all requirements of this Section and must be approved in advance of installation or procurement by the Landscape Architect.

2.5 PLANTING SOIL MIXTURE AND AMENDMENTS

A. See Section 32 91 13.19 – Planting Soil System Procurement and Section 32 91 19.13 – Planting Soil System Installation for planting soil mixture requirements. The Contractor shall strictly adhere to soil specification composition for each section of the Work.

B. Coordinate installation of soil mixes and plants to meet requirements of this Section and Section 32 91 19.13 – Planting Soil System Installation.

2.6 MULCH

A. Milled Leaf Mulch: Provide partially decomposed, minimum six-month-aged, finely shredded leaf mulch that is free of weeds, excessive fine particles and stringy material. Provide leaf mulch approved by the Landscape Architect.

2.7 TREE STAKING AND ANCHORING MATERIALS

A. Wood Stakes: 2" Ø unpeeled stakes, 8'-0" min. length, Eastern Redcedar (Juniperus virginiana) or approved equivalent. Provide three (3) stakes per tree or as otherwise indicated in the Drawings.

B. Guying straps: ¾" wide "ArborTie" flat polypropylene strap with break strength of 900lbs (min). Color: dark green or black. As manufactured by:

1. DeepRoot Green Infrastructure, LLC
   101 Montgomery Street, Suite 2850
   San Francisco, CA 94104
   info@deeproot.com
   Tel: 415.781.9700 / Toll Free: 800 458 7668
   Fax: 415.781.0191
2. Platipus Anchors, Inc..
   2008 Garner Station Boulevard
   Raleigh, NC 27603
   Tel: 866.752.8478
   Fax: 919.662.0998
3. Or approved equal.

C. Guy-wire and Accessories: 3/16" gavinized cable, ratchet tensioners and shrouds, and black PVC tubing suitable for securing vegetation.

D. Bamboo Stakes: Provide ¾" diameter Bamboo Stakes, 8' feet (min) in length.

E. Earth Anchors: Aluminum alloy anchor specifically designed for tree guying systems. Size shall be suitable for tree sizes and types, as manufactured by:

1. Foresight Products, LLC
   6430 East 49th Drive
   Commerce City, CO 80022
   Tel: 800.325.5360
   Fax: 303.287.3866
   www.earthanchor.com
2. or approved equivalent.

F. Large Tree Anchroing System: Rootball anchoring system shall be as manufactured by Platipus Anchors, Inc., 2008 Garner Station Boulevard, Raleigh, NC 27603, Tel: 866.752.8478, or approved equal. System shall be Platipus rootball fixing system, including Plati-Mat, Model # RF2RP.

1. Work with manufacturer to confirm the correct size of anchoring system for specified trees.

G. Deadman Anchors: 12 x 12 x 12'-0"L black locust timber or approved equal. Provide four (4) per tree as indicated in the Drawings.

2.8 MISCELLANEOUS MATERIALS

A. Natural Burlap: Provide medium weight (7 ounce per square yard) natural burlap.

B. Anti-Erosion Mulch or weed-free Straw Bales. Materials shall conform to Section 02220 Site Protection, Clearing, Salvage and Protections."

C. Siltation Fence. Materials shall conform to Section 02220 "Site Protection, Clearing, Salvage and Protections".

D. Anti-Desiccant: Provide emulsion type, film forming agent designed to permit vapor transmission but retard excessive moisture loss. Use anti-desiccant only with the approval of the Landscape Architect. Acceptable Manufacturers:

1. "Wilt-Pruf NCF" anti-desiccant as manufactured by Wilt-Pruf Products, Inc., P.O. Box 469, Essex CT 06426-0469. Tel: 860.767.7033, 800.972.0726. www.wiltpruf.com.
2. "Cloud Cover" as manufactured by Easy Gardener, P.O. Box 21025, Waco, TX 76702-1025. Tel: 254.753.5353. www.easygardener.com.
3. "Transfilm" as manufactured by PBI/ Gordon Corporation, 1217 West 12th Street, Kansas City, MO 64101. Tel: 816.421.4070, 800.821.7925. www.pbigordon.com.

E. Soil and Pavement Protection. The driving of vehicles over planted areas is expressly prohibited. Protect sub-grade, planting soils and pavements using one of the following:

1. Plywood: Provide 3/4" Grade C or better plywood for use as planking when driving vehicles or moving equipment over areas to be planted.
2. Oriented Strand Board (OSB): Two (2) Layers of ¾" OSB on top of 6" mulch. Provide Filter Fabric under mulch layer.

PART 3 EXECUTION

3.1 PREPARATION AND EXAMINATION

A. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and notify the Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any plants or planting soil mixtures until all work in adjacent areas is complete and accepted by the Landscape Architect.

B. Concealed Conditions: Notify Landscape Architect before planting when below grade or on-structure conditions detrimental to proper plant growth are encountered. Do not

proceed with planting without specific written instructions from the Landscape Architect. At the Landscape Architect's direction and at no additional expense to the Owner, plants shall be relocated to avoid the obstruction.

C. Deliver materials and plants only after preparations for planting have been completed and accepted, including but not limited to: planting soil system, irrigation (minimum: Mainline), rough grading, utilities, decompaction or remediation of soils. The Landscape Architect will determine when the site is acceptable for planting.

3.2 HANDLING OF PLANTS

A. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape.

B. Provide a double tarp protective covering over exterior plants during transport.

C. Do not drop exterior plants during delivery.

D. Do not loosen drum-lacing nor remove container-grown stock from containers before time of planting.

E. Do not move trees if rootballs are saturated.

F. Handle planting stock by supporting the rootball or container.

3.3 TEMPORARY STORAGE OF PLANTS

A. Storage – General

1. For plants stored on or off-site for more than 24 hours, the Contractor shall keep a log that records dates of watering.
2. The contractor shall fully inspect and maintain plants for the entire duration of the storage period.
3. All stored plants shall remain the property of the Contractor and shall be replaced in kind to meet the standards defined herein for healthy plants and the character and habit defined herein. The Landscape Architect shall be the sole evaluator of whether replacement plants match the originally stored plants.
4. No plant shall be stored more than four weeks without prior written acceptance by the Landscape Architect.

B. Storage of plants less than one week:

1. If planting is delayed more than six hours after delivery of plants to the site, the contractor shall adhere to the following practices:
   (a) Set plants in shade, protect from weather and mechanical damage, and keep roots moist.
   (b) Store plants upright with room between rootballs.
   (c) Closely monitor plants for sufficient root moisture.

(d) Store all plant materials in a secure and clean location, free from conditions that would be harmful and/or deleterious to the immediate or long-term health of the trees.

C. Storage of plants more than one week:

1. The Contractor shall store plants at a location mutually agreed upon by the Contractor and Landscape Architect.

2. Space plants sufficiently apart to prevent damage or death to branches and leaves. During all seasons, set balled stock upright and plumb on firm ground and cover the ball with fully aged and decomposed wood mulch or other material acceptable to the Landscape Architect

3. During the growing season, stored plant material shall be watered and the rootballs kept moist with an automatic drip irrigation system to prevent drying out. Mist plants several times a day as necessary to reduce transpiration in sunny or windy locations.

4. During the dormant season, rootballs shall be insulated against freezing and cold weather damage. Plants shall be protected from wind and ice damage

(a) During winter months, stored plant material shall also be monitored for soil moisture and watered as needed to prevent desiccation. Plants shall generally be watered about once each month to keep the soil moist, but not wet.

5. During the storage period, inspect all plants for pests and diseases and, if found, have them evaluated by an arborist certified in the state where the project is located.

(a) Before proceeding, report on the presence of any diseases or pests.

(b) Before proceeding, report on issues and recommended treatment to the Landscape Architect for review and approval.

(c) Whenever possible, select and use organic treatments.

(d) Isolate trees with diseases or pests and remove and replace if the Landscape Architect determines that the plants are unusable.

3.4 PLANT LAYOUT

A. Horizontal Layout: The plant locations shown on the Drawings are approximate. The Contractor shall layout the final location of individual plants by stake or flag and obtain the Landscape Architect's approval of locations before starting installation. After staking is accepted, set plants in place for final review and acceptance by the Landscape Architect. The Contractor shall make revisions and adjustments as directed by the Landscape Architect.

1. Contractor shall not stake plant locations until proper subgrade, drainage, and subsoil layers are installed and beds are free and clear of deleterious materials.

2. Contractor shall verify the locations of all unground utilities before staking plant locations.

3. Indicate the species and size of plant on the stake or flag.

4. Contractor shall make adjustments as determined by the Landscape Architect without additional cost to the Owner.

B. Vertical Layout: Set the elevation of trees through the use of string lines or by instrumentation. Demonstrate to the Landscape Architect through the use of stakes and string that trees have been set at the correct elevation prior to completing planting and installing the upper soil horizon, if requested.

3.5 PLANTING WOODY PLANTS

A. General

1. Sequence of Planting: Plant trees and shrubs after the subgrade has been accepted and concurrently with the Horticultural Subsoil planting soil layer unless otherwise approved by the Landscape Architect. Complete landscaping work as quickly as possible on portions of the site as they become available for landscaping.
2. If plants are installed in planting pits, scarify sides of pits before placing trees.
3. Grade stakes: If present, protect and maintain grade stakes and location stakes until removal is acceptable to the Landscape Architect and all parties involved in this project. If grade stakes are not present, establish grade stakes to ensure that grades shown on the Drawings are being met.
4. Painting: Do not paint vegetation for any reason.

B. Rootball and Rootflare

1. Rootball Pedestals: Provide a rootball pedestal composed of subgrade fill immediately beneath the ball or root mass. Pedestal shall provide the relationship to finish grade described below and prevent settlement of the plant. Compact pedestal to 95% Standard Proctor.
2. Identifying and Exposing the Root Flare: Prior to setting the height of the rootball pedestal, the Contractor shall remove burlap and twine from the top of the rootball and inspect each plant to determine if the trunk flare is buried within the rootball. If buried, the Contractor shall expose the trunk flare by removing excess fill on top of rootball, taking care not to damage the bark or roots while removing the soil overburden. Adventitious roots and girdling roots shall be removed with sharp pruners. Adjust the rootball pedestal to position the trunk flare 2”-3” higher than the proposed finished grade.
3. Wire Baskets: Once set, completely remove top two-thirds of wire basket. Cleanly cut each tier of all horizontal wires making one cut centered between each set of vertical wires.
   (a) Burlap: Completely remove top one-third of burlap.
4. Drum lacing and Burlap: Once set, remove top one-third of lacing and burlap.
5. Containerized plants: Completely remove container. Cut out container with a sharp blade if container does not readily separate from the rootball.
6. Scarification of Balled and Burlapped Plants: The Landscape Architect will examine the exposed rootball and determine if the Contractor shall scarify the sides of the rootball. Scarification shall result in no additional expense to the Owner.
7. Scarification of Containerized Plants: The Contractor shall scarify the rootballs of container plants with a sharp blade 2” in length. Rest the plant on its side and

scarify an 'X' on the bottom of the root mass. Then make vertical cuts that are the full height of the rootball every 3" o.c of the full circumference.

8. Rootballs shall be kept in a moist, but not wet, condition. Protect rootballs from damage due to sun and wind. Contractor shall strictly limit the time between exposing the rootball and backfilling. Protect exposed rootballs with burlap or other shading device until backfilled.

C. Placement of Planting Soil Mixture at Woody Plants: Place planting soil mix to levels shown on Drawings and described in Section 32 91 00 – Planting Soil System.

1. Maintain at all times during the planting operations at least one stockpile of each approved type of plant soil mixture. Refer to Section 329100 for Planting Soil System.

2. Planting soil shall be in full contact with the rootball, with no voids or air pockets. Where burlap is present, burlap shall be tightly pressed between backfill and rootball. Folded or bunched burlap will create an obstruction to backfill and rootball contact and shall be removed.

3. Backfilling of Tree Pits in Existing Soil Areas (SC): Backfill with planting soil mix in 6" layers. Handtamp each layer to eliminate voids and air pockets before placing subsequent layers. Continue until backfill has reached finish grade shown on the Drawings.

4. Watering Dish and Mulch: Construct a watering dish as shown to promote water infiltration into the root zone.. Hand tamp edges of watering dish to be firm and withstand hose pressure. Cover watering dish with mulch, leaving a 4" gap between mulch and the trunk. .

D. Watering:

1. Flood all plants with water twice within the first 24 hours after planting. Take care to avoid saturating adjacent soils where planting operations are ongoing. Monitor water pressure. Displacement of soil materials including watering dish by watering shall not be acceptable.

2. Flood all plants during the construction and maintenance periods at least twice each week. If present and operational, coordinate programming of irrigation system to meet watering needs. If irrigation system is not operational, provide hand watering as needed to maintain healthy growth. At each watering, thoroughly saturate the soil around each tree and shrub. If sufficient moisture is retained in the soil as determined by the Landscape Architect, the required watering may be reduced. Trees will require a minimum of twenty gallons of water for each watering. Shrubs will require a minimum of ten gallons of water for each watering.

(a) Winter Watering: Lack of adequate soil moisture is often a major cause of winter damage. All plants, but especially narrowleaf and broadleaf evergreens, use water during winter. Moisture must be available below the frost line or frozen soil.

i) Plants should be watered thoroughly in the fall to prepare them for the winter months.

ii) During dry winters, broadleaf evergreens should be watered about once each month.

E. Plant Anchoring System: Install tree stakes immediately after planting to maintain trunk plumb. Adjust and reset stakes and guys during maintenance period as necessary. Remove stakes and at the end of the warranty period.

3.6 PLANTING POTTED HERBACEOUS PLANTS

A. The Contractor shall scarify the rootballs of container plants. Using a sharp knife, make vertical cuts the full height of the rootball at a depth of 2" and every 3" o.c.

3.7 PLANTING HERBACEOUS PLUGS

A. Install the plug so the stem base is at or slightly above finish grade. Plant plugs fully into planting soil, not mulch.

B. Install plugs to their full depth. A "J-Root" installation shall not be acceptable.

C. Tamp each plug in place so that it is firmly seated in the soil, with no air pockets.

3.8 SOIL DIAGNOSTICS DURING THE MAINTENANCE PERIOD

A. If plants exhibit unsatisfactory growth during the maintenance period, perform soil testing for chemical properties, compaction and infiltration rates. See Section 32 92 00 "Lawns" for testing definitions. Adhere to Landscape Architect's recommend remediation. Remediation may include, but are not limited to, soil amendments, Liquid Biological Amendments (LBA) treatments, or soil decompaction.

3.9 TEMPORARY EROSION CONTROL

A. The construction of the site will initiate with the installation of measures sufficient to control sediment deposits and erosion. All sediment control measures will be maintained until all upstream ground within the construction area has been completely stabilized with permanent vegetation and all walks have been paved.

B. The Contractor shall remove accumulated sediments when they reach half the capacity of the erosion control devices. Sediment/erosion control devices must be checked after each storm event.

C. The Contractor is responsible for cleaning any and all sediment leaving the site. The Contractor shall be responsible for repairing all damages caused by the accumulation of sediment.

D. Failure to install, operate, or maintain all erosion control measures will result in the cessation of all construction until such measures are corrected to the local jurisdiction or city standards.

3.10 FINE GRADING

A. Prior to fine grading, Contractor shall verify that the rough grading, under drainage system, planting soil mixes, planting of woody plants and irrigation system have been accepted.

B. Fine Grading: Set finished grades by instrumentation. At minimum, set stakes at the bottom, middle, and top of slopes and at the edges and centers of plant beds. Connect contours and spot elevations with an even slope.

1. Fine grade planted areas shall have an even surface free from ridges, rills or depressions. Surface of planting soil shall be free draining have a fine texture.

2. All large stiff clods, lumps, brush, roots, litter and other foreign matter, and stones over one inch in diameter, shall be removed from the planting soil surface. Planting soil shall be free of smaller stones in excessive quantities as determined by the Landscape Architect.

3.11 PROTECTION, REPAIR AND CLEANUP

A. Protect new and existing site improvements from damage due to planting operations.

1. Underdrainage and Irrigation: Underdrainage and elements of the Irrigation System will be in place when planting activities begin. The contractor shall coordinate with the work of those Sections, and shall take all precautions to prevent damage to them. If damage occurs, the Contractor shall stop work and immediately report the damages to the Owner's Representative and Landscape Architect. Work shall not resume until all work is repaired, inspected and accepted by the Landscape Architect

2. The Contractor shall pay for all remediation to damages.

B. Limit all conditions that retard the growth of the plants, whether installed or when in storage.

C. The Contractor shall be strictly prohibited from tracking or driving over newly planted areas.

1. In areas where tracking or driving cannot be avoided, the Contractor shall install a protective barrier between the vehicle and the soil surface as approved by the Landscape Architect.

D. Restore areas disturbed by planting activities, or if otherwise eroded, settled, or disturbed after fine grading, and prior to lawn installation.

E. Tags: Remove all identification labels, seals and tags at Final Acceptance of the project.

END OF SECTION