SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

B. Related Sections include the following:

1. Division 01 Section "Summary" for limits placed on Contractor's use of the site.

2. Division 01 Section "Temporary Facilities and Controls" for temporary tree protection.

3. Division 31 Section "Earth Moving" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.

4. Division 32 Section "Plants" for tree and shrub planting, tree support systems, and soil materials.

5. Division 32 Section "Planting Irrigation" for tree and shrub planting irrigation systems.

1.3 DEFINITIONS

A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

C. Qualification Data: For tree service firm and arborist.

D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: A tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign a, qualified arborist to Project site during execution of tree protection and trimming.

B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Prior to any construction activity conduct a meeting at Project site with the Design Consultant and Contractor to tag the trees to be protected.

2. Prior tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Design Consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch-diameter wire; a minimum of 72 inches high; with 1.9-inch- diameter line posts; 2-3/8-inch- diameter terminal and corner posts; 1-5/8-inch- diameter top rail; and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system. Fence to be posted with a minimum 8.5" x 11" laminated sign stating: "Tree protection zone – this fence shall not be removed".

E. Organic Mulch: Shredded hardwood, free of deleterious materials.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate and clearly flag trees and vegetation to remain or to be relocated. Protect existing site improvements to remain from damage during construction.

B. Temporary Fencing: Prior to commencement of construction activities, install temporary fencing around tree protection zones to protect remaining trees and other vegetation to remain from construction damage. Maintain temporary fence and remove when construction is complete.

1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.

C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

D. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated.

1. Apply 6-inch (152-mm) average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

Maintain a 6" layer of chip mulch, free of deleterious materials, over the entire area of the TPZ for the duration of the construction phase. Mulch to be removed by the Contractor after project completion.

E. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.

F. Maintain tree protection zones free of weeds and trash.

G. Do not allow fires within tree protection zones.

H. Irrigation: Contractor shall supply fresh potable water in adequate amounts and rates of application as required to maintain the health of protected trees and vegetation throughout the duration of the construction operations. Contractor shall maintain a watering schedule and document dates and duration of irrigation applications.

1. Construct a temporary watering basin, as required, on the surface- of the- existing undisturbed grade, with imported soil, to aid in the retention of water around existing protected trees and planting.

I. Protect root systems of existing trees and vegetation from damage due to chemically injurious materials in solution caused by run-off or spillage during mixing or placement of construction materials, and drainage of stored materials. The Contractor shall insure that no foreign material and/or liquid, such as paint, concrete, cement, oil, turpentine, acid or the like, be deposited or allowed to be deposited on soil within the drip line (the outside edge of the foliage overhang) of tree or shrub within 6" of the trunk of a vine. Should such poisoning of the soil occur, the Contractor shall remove said soil as directed by the Design Consultant.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless approved, in writing, by the City's Representative.

C. Do not excavate within tree protection zones, unless otherwise indicated.

D. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

E. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Do not backfill against tree trunk.

B. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.

C. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist, unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

D. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

E. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on each side. For remainder of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.

2. Place filter fabric with edges overlapping 6 inches) minimum.

3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction.

B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

1. Type of Pruning: As directed by the Design Consultant.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Chip removed tree branches and dispose of off-site.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

B. Remove and replace trees indicated to remain that die or are damaged during construction operations that arborist determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced; plant and maintain as specified in Division 32 Section "Plants."

2. Provide new trees of 6-inch caliper size and of a species selected by Design Consultant when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced. Plant and maintain new trees as specified in Division 32 Section "Plants."

C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material and displaced trees from the property.

END OF SECTION

SECTION 32 13 16

DECORATIVE CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing of services, labor, materials, transportation, tools and equipment necessary to perform the work indicated on the Drawings and specified herein as required to properly complete the work in this contract.

B. This Section includes the following:
   1. Landscape concrete pavement.
   2. High Density Concrete

C. Related Sections include the following:
   1. Division 03 Section “Cast-In-Place Concrete” for formwork: material, fabrication, and installation requirements for steel reinforcement, and field quality control.
   2. Division 03 Section "Landscape Architectural Concrete" for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control
   3. Division 05 Section “Decorative Metal Railings” for fabrication and installation requirements for pipe and tube railings.
   4. Division 31 Section "Earth Moving" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials
   5. Division 32 Section “Plants” and “Netlon Turf System” for coordination with adjacent planting areas
   6. Division 32 Section “Planting Irrigation” for coordination with adjacent irrigation systems.

1.2 REFERENCES

A. Conform to the following codes and standards:
   1. American Institute (ACI)
   2. American Society" for Testing and Materials (ASTM): The specifications and standards hereinafter referred.
   3. Standard Specifications for Public Works Construction 2000

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Comply with Section 013300 Submittal Procedures and Section 018113.13 Sustainable Design Requirements.

B. Product Data: Furnish manufacturer's product specifications and installation instructions for the following and for each type of product indicated.
   1. Integral color/ color admixture
   2. Form release agent
   3. Dowels
   4. Curing agents
   5. Clear sealer
   6. Expansion joint filler material
   7. Fiber reinforcement
   8. Joint sealant
   9. Finish retardant

C. Products; Submit one pound samples, clearly identified, for each component used to prepare each paving type as indicated in drawings, including but not limited to:
   1. Hand-seeded Aggregate
   2. Exposed Aggregate

D. Design Mixtures: Furnish certified reports of proposed mix design for each type of concrete installation. For each decorative cement concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Provide documentation for each paving type specified on Drawings that will enable Owner's Representative's to better match replaced concrete:
   2. Submit laboratory test reports for concrete materials and a certificate with each concrete mixer truck, stating mix design, PSI, rating, slump, water and cement quantity, cement/water ration, fine and coarse aggregate and color additives.
      a. Cement:
         i. Manufacturer and plant location.
         ii. Cement type, i.e. Type I, II, III, or V.
      b. Admixtures:
         i. Manufacturer and plant location.
      c. Sand:
         i. Source and Type.
      d. Aggregates:
         i. Source and Type.
   3. Signed certification from a licensed structural engineer.

E. Laboratory and Cement Test Reports: Submit six (6) copies of laboratory test reports for concrete materials and a certificate with each concrete mixer truck, stating mix design, PSI, rating, slump, water and cement quantity, cement/water ration, fine and coarse aggregate and color additives.
   1. Cement:

      a. Manufacturer and plant location.

b. Cement type, i.e. Type I, II, III, or V.

2. Admixtures:

a. Manufacturer and plant location.

3. Sand:

a. Source and Type.

4. Aggregates:

a. Source and Type.

5. Sign certification from a licensed structural engineer.

F. Coordinate paragraph below with qualification requirements in Division 1 Section "Quality Control" and as supplemented in "Quality Assurance" Article.

1. Qualification Data: For Installer.

a. Installer: Provide evidence to indicate successful experience in providing patterned concrete work similar to that specified herein and can demonstrate successful experience through past Project documentation and references.

b. Experience: Minimum 5 years experience in the installation of patterned concrete paving.

c. Demonstration of Experience: 10 Projects which have been completed within the past 36 months utilizing similar products, scope and complexity.

d. Supervision: Perform placement and finishing of concrete work under supervision of a person having a minimum of 5 years of experience in placement and finishing of products specified herein.

2. Submit qualifications to Owner's Authorized Representative for information purposes. Submit a resume of Project Manager and Superintendent who will be overseeing the Work.

3. Minutes of preinstallation conference.

4. Delivery slips.

G. Certification that Owner's Representative's sample panels have been reviewed and that materials and processes provided will achieve intended effects indicated on Owner's Representative's sample panel.

H. Submittals for above items shall be made in one package. If submittals are judged incomplete or non-responsive to the directions of the Owner's Representative after three (3) submissions the Contractor shall be back charged for the Owner's Representatives costs to process additional Submittals. Additional Submittal Procedures are specified in Section 013300.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative cement concrete pavement systems.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer of High Density Concrete Finish. Provide a list of at least 5 projects of successfully installed HDCF with points of contact. Minimum size of each individual installation shall be 10,000 square feet. Provide two (2) color photos, 8”x10” size, of each installation listed above representing the installation.

C. Pre-Bid Conference: Prior to submitting bid, attend pre-bid conference with Owner’s Authorized Representative to review Owner’s Authorized Representative’s production run quality samples of all specified concrete colors and finishes and to review requirements and artistic effect desired.

D. Slip Resistance: Provide a finish surface slip resistance coefficient of friction equal or greater than 0.6 for flat surfaces and 0.8 for ramps, when tested in accordance with ASTM F 489.

E. Ready-Mix-Concrete Producer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Producer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

F. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

G. Source Limitations: Obtain decorative cement concrete pavement products and HDCF and each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate through one source.

H. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

J. Referee Panels: The Owner’s Representative will provide production run quality samples of all specified concrete paving colors and finishes to be used as Referee Panels to judge the Field Mock-ups. The Owner’s Representative will provide information and assist the Contractor on the mix design components used to achieve the Referee Panels.

K. Mockups:
   1. Cast one or two (refer to drawings) 60-inches by 60-inches mockups of each concrete paving type to demonstrate typical pattern, texture, surface

finish, color, joints, and standard of workmanship.

2. Build mockups in the location and of the size indicated or, if not indicated, as directed by Owner's Representative. Include joints and joint materials, caulking, and scoring treatments specified on the plans.
3. If multiple colors and finishes are specified, all samples shall be prepared for review at the same time.
4. In presence of Owner's Representative, damage part of the exposed surface of decorative cement concrete pavement for each finish, color, and texture required, and demonstrate materials and techniques proposed for repair to match adjacent undamaged surfaces.
5. The Mock-ups shall be reviewed and approved by The Owner's Representative before proceeding with the work. Mock-ups will be judged against the appearance of the Referee Panels. Mock-ups that do not match the Referee Panels and do not demonstrate all specified joints and joint materials, caulking, and scoring treatments will be rejected. Remove and reconstruct the mock-ups until approved. The Contractor shall be back charged for the costs of the Owner's Representative to review more than two (2) mock-up attempts. Approved mock-ups shall serve as standard of acceptance for paving work and remain available for the duration of the project.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Saw-cut (2) two 12"x12" samples from each mockup for the landscape architect project records
8. Demolish and remove mock-ups at the completion of the project.

L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings" and Quality Control."

1. Before submitting design mixtures, review decorative cement concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and decorative cement concrete pavement construction practices. Require representatives of each entity directly concerned with decorative cement concrete pavement to attend, including the following:

   a. Contractor's superintendent.

   b. Independent testing agency responsible for concrete design mixes.

   c. Ready-mix concrete producer.

   d. Decorative cement concrete pavement Installer.

2. Manufacturer's representative of decorative cement concrete pavement system.

M. Formwork: Comply with Recommended Practice for Concrete Formwork, ACI 347.

1.6 PROJECT CONDITIONS

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

for other construction activities.

1.7 DELIVERY AND HANDLING

A. Conform to Section 016000 Product Requirements.

B. Deliver, store, and handle reinforcement to prevent damage.

1.8 REGULATORY REQUIREMENTS

A. Testing: Slump tests shall be taken to certify compliance with mix design. Slump shall be in accordance

B. Mix design shall be in accordance with ACI 211-6.with ASTM C 143.

C. Conform to applicable laws, codes, and regulations required by authorities having jurisdiction over the work.

1.9 SITE CONDITIONS

A. Do not place concrete when subbase surface temperature is less than 40 degrees F, nor when surface is wet.

1.10 COORDINATION

A. In accordance with Section 013100.

B. Ensure that irrigation sleeves, electrical conduit, food cart outlets, and other utility elements are accommodated and as-built located prior to pouring concrete.

1.11 INSPECTION OF SITE

A. Verify conditions at site affect Work of this Section, and take field measurements as requires. Report major discrepancies between Drawings and field dimensions to Owner's Authorized Representative prior to commencing work.

PART 2 – PRODUCTS

1.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. Products: Subject to compliance with requirements, provide one of the products specified.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1.2 FORMS

A. Form Materials: Either steel or wood, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are free of distortion and defects.

B. Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or curved forms for curves of a radius 100 feet or less.
   2. Flexible spring steel forms, laminated boards, or bender boards to form radius bends as required.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
   1. Form work to be new, #2 grade Douglas Fir, free of knots, checks, bows, and cracks.

D. Form-Release Agent: A non-staining form release compound that will not discolor or deface the surface of the concrete. Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets. 6 x 6 x W4.0 x W4.0 conforming to ASTM A 185. Furnished in flat sheets, not rolls, unless otherwise accepted by the Owner's Representative.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
   1. Grade 40 or 60 billet steel conforming to ASTM A 626/615M. Bending process shall conform to the Manual of Standard Practice of the Concrete Reinforcing Steel Institute. Kinked bars shall not be used.
   2. Reinforcing Steel: Conforming to ASTM A 615, clean and free of rust, dirt, grease or oils.

C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

D. Plain Steel Wire: ASTM A 82, as drawn.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Plastic dowel alignment sleeves Products:
   1. Speed Dowel or equal (no known equal).

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

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

I. Polypropylene Fiber Reinforcement: 100% virgin multifilament polypropylene fibers, engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116 - Type III.
   1. Acceptable Manufacturers:
      a. Fibermix®; Stealth® Fibers – 1/4" long (423)892-8080 or www.fibermesh.com.
      b. Forta Fiber; Microfiber (800)245-0306.
      c. Grace Construction Products; MicrofiberTM (800)433-0020 or www.grace.com.
   2. Application Rate: 1/2 lb./cy of mix.

1.4 CONCRETE MATERIALS

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Gray Portland Cement: ASTM C 150, Type II

B. Refer to Drawings for specific paving finishes requiring different cement types, to include Type II cements (unless otherwise identified in the Drawings) conforming to ASTM C 150.

C. Use same brand of cement from single source throughout entire Project for each paving type.

D. Refer to Statement of Mix Design for cement type used.

E. Fly Ash: ASTM C 618, Class F.

F. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

G. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

H. Maximum Aggregate Size: Refer to Drawings for maximum aggregate size.

I. Coarse Aggregate: Aggregate composed of gravel, crushed rock, or a blended mixture conforming to Standard Specifications Section 200-1.4. Aggregates shall be washed clean, uniformly screen graded, and contain not more than 2% by weight of deleterious materials such as shale, schist, alkali, clay lumps, earth loam, mica, or similar materials.

J. Clean, hard, and durable coarse aggregate, conforming to ASTM C 33.

K. Use same coarse aggregate from single source throughout entire Project.

L. Refer to Statement of Mix Design for coarse aggregate type used.

M. Aggregates shall be washed clean, uniformly screen graded, and contain not more than 2% by weight of deleterious materials such as shale, schist, alkali, clay lumps, earth loam, mica, or similar materials.

N. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
1. Sand shall consist of a natural or manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Sand shall be washed and conform to Standard Specifications Section 200-1.5.3.

O. Clean, hard, and durable washed concrete sand, conforming to ASTM C 33.

P. Use same fine aggregate from single source throughout the entire Project.

Q. Refer to Statement of Mix Design for fine aggregate type used.

R. Sand shall be free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended.

S. Base Material: Washed concrete sand, uniformly graded and meeting the requirements of Standard Specifications Section 200-2.2. At the time of spreading, the material shall have a moisture content sufficient to obtain the required compaction.

T. Structural Soil Base: Structural “CU” soil base material available through Hanson Aggregatres (refer to Structural Soil specification Division 32). Refer to drawings for extend of concrete paving on structural soil.

U. Water: Potable and complying with ASTM C 94/C 94M. Free from deleterious materials such as oils, acids, and organic matter.

V. Air-Entraining Admixture: ASTM C 260.

W. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

1.5 ADMIXTURES

A. Provide concrete admixtures that contain not more that 1 percent chloride ions and no calcium chloride.

B. Water-Reducing Admixture: ASTM 4 94, Type A.

C. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

Water-Reducing and Retarding Admixture: ASTM C 494, Type D or E.

D. Acceptable Manufacturers:

1. Water-Reducing Admixtures:

a. ChemMasters Corp; Chemtard.

b. Cormix Construction Chemicals: Type A Series.

c. Euclid Chemical Company; Eucon WR-75.

2. High-Range Water-reducing Admixtures:

a. Anti-Hydro Co. Inc.: super P.

b. Cormix Construction Chemicals: Cormix 2000, PSI Super.

c. Euclid Chemical Company; Eucon 37.

3. Water-Reducing and Acceleration Admixtures:

a. Conspec Marketing & Manufacturing Company; Q-Set.

b. Cormix Construction Chemicals; Gilco Accelerator or Lub NCR.

c. Euclid Chemical Company; Lithochrome Surface Retarder.

1.6 COLOR MATERIALS

A. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[free of carbon black, nonfading, and resistant to lime and other alkalis.

B. Integral Color: Integrally color concrete in colors, blending mixtures and application rates necessary to create colors, gradations, and variations to match Owner's Representative's mock-up.

C. Manufacturers:
1. As listed on the Drawings

1.7 CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following complying with ASTM C 171:
1. Waterproofing paper.
2. Polyethylene film.
3. White burlap-polyethylene sheeting.

C. Clear, Waterborne Membrane-Forming Curing Compounds:
   1. Provide curing materials that have a maximum volatile organic compound (VOC) rating of 350 g/l.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
   1. Clear, Waterborne Membrane-Forming Curing Compounds Acceptable Manufacturers:

      a. Anti-Hydro Company; Clear Cure Water Base.

      b. The Burke Company; Spartan Cote WB.

      c. Cormix Construction Chemicals; Sealco VOC.

   2. Acceptable Evaporation Control Manufacturers:

      a. Conspec Marketing and MFG. Company; Aquafilm.

      b. Euclid Chemical Company; Eucobar.

      c. L&M Construction Chemicals; E-Con.

E. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, complying with ASTM C 171.

F. Surface Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products:

      a. Top Cast/Top Face by Grace Products

      b. Rugasol

G. Sealer: Waterbased Clear siloxane or silane penetrating sealer. Shall be matte finish. Acceptable products include the following or approved equal:

   a. Aquapel Plus, L&M Construction Chemicals.(800) 362-3331

   b. CureSeal Curing Agent and Clear Sealer. L.M. Scofield Company

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, specifically manufactured for use with colored concrete.
   1. Products:

      a. Cureseal, Scofield

1.8 JOINT MATERIALS

A. Expansion- and Isolation-Joint Materials:

1. Filler Strips: Premoulded material, 3/8” thick, depth as required by slab, of resilient, non-bituminous material, depth as required by slab.

1.9 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1.10 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301and ACI 318, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
   1. Mix design shall be the responsibility of the Contractor.
   2. Contractor shall employ a Testing Laboratory approved by the Owner’s Representative under the active direction of the Civil Engineer, who shall determine mix designs to fulfill the specified requirements for strength, aggregate size and workability of concrete, and such designs shall be used in proportioning all structural concrete.
   3. Mix designs shall be submitted to the Owner’s Representative for review at least 10 days prior to scheduled concrete pour.
   4. Review by the Owner’s Representative shall not be considered unqualified approval, and shall not relieve the Contractor of his responsibility to furnish concrete of proper consistency and specified strengths.
   5. Provide concrete of the strengths indicated in the structural general notes
   6. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): per Geotechnical Report recommendation, minimum 3000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.61Select slump limit from options in subparagraph below or revise to suit Project.
   3. Slump Limit: 5 inches.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 2 percent

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water reducing admixture and retarding admixture [and accelerating admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

1.11 PAVING TYPES

A. Concrete Paving Type: Refer to the Drawings.

B. Color Pigment: Add color pigment or colored water-reducing admixture to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

1.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M.Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the site and verify that no defects or errors are present that would cause defective installation or latent defects in the workmanship and function. Report unsatisfactory conditions to the Owner's Representative. Do not begin paving work until unsatisfactory conditions have been corrected and the area is ready to receive the work. Continuing with the installation constitutes acceptance of the unsatisfactory conditions and responsibility for satisfactory performance.

B. Verify that paving subgrade consists of a minimum of 4-inches of compacted washed concrete sand, passes less than 7% through a #200 sieve, and is compacted to at least 95% of the materials ASTM D 1557 maximum dry density for its full depth.

C. Verify that paving subgrade extends 1-foot beyond the outside edge of paving or curbing and has positive outfall for trapped water.

D. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

E. Remove loose material from compacted subbase immediately before placing concrete.

F. Provide necessary chairs or supports, and maintain position of reinforcing bars.

G. Wet surface of sand subgrade prior to placing concrete.

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

I. Proof-roll prepared subbase surface with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

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

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

L. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/4 inch require correction according to requirements in Division 2 Section "Earthwork."

M. Proceed with decorative cement concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

N. Synthetic Fiber reinforcement; ½ lb. per cubic yard of mix added at batch plant.

O. Adjustment to Concrete Mixes: Mix design adjustments may be required by Contractor when characteristics of material, Project conditions, weather, test results, or other circumstances warrant.

P. Coordinate with other trades, placement of accessories, chases, and other embedded items. Provide sufficient time to complete installation of their work.

4.2 SURFACE PREPARATION

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

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

C. Subgrade Preparation: Unless noted otherwise, subgrades shall be compacted to a relative density as specified in the soils report, and to elevations necessary to achieve the finished surface indicated. Semi-porous subgrades shall be sprinkled sufficiently with water to eliminate suction and extremely porous subgrades shall be sealed in an approved manner.

D. Base Preparation: Where indicated, washed concrete sand or structural “CU soil base material shall be deposited at a uniform quantity that will provide the required compacted thickness within ¼” above or below the grade determined from the Drawings. The relative compaction of the base material shall not be less than specified in the soils report. Compacted areas that do not conform to the requirements specified, shall be reworked, watered, and thoroughly re-compacted to conform to the specified requirements.

4.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Shall conform to the shape, lines, and dimensions as called for on the Drawings.

B. Completed formwork shall be free of hardened concrete, washed clean and shall have excess water removed, reinforcement secured in place, expansion joint material and other embedded items positioned, forms shall be thoroughly

cleaned, washed out with water, and made tight. Before reinforcing steel is placed on top of or adjacent to forms that have been sealed, the surface sealer shall be wiped off so that none may be tracked over, or in any way come in contact with the reinforcing steel. Bottoms of forms shall be cleaned and wet down before placing concrete.

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. Check completed formwork and screeds for grade and alignment to following tolerances:
   1. Top of Forms: Not more that 1/8-inch in 10-feet.
   2. Vertical Face on Longitudinal Axis: Not more that ¼-inch in 10-feet.
   3. Joints and Corners: Construct forms such that joints occur at approved locations. Form intersecting planes to provide true, crisp corner with no edge grain of forms exposed to the face of the concrete. Construct exposed corners to produce smooth, solid, unbroken lines.

4.4 STEEL REINFORCEMENT

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

B. Sized and placed where indicated on the Drawings.

C. The complete work shall be in place and approved a minimum of one (1) working day prior to placing of concrete.

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

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

F. Wire Mesh: Panels shall be spliced not less than two (2) mesh openings, and shall be in placed on (1) working day prior to placing concrete. While the concrete is still plastic, the mesh shall be carefully lifted into position as specified on the Drawings.

G. Install welded wire reinforcement in lengths as long as practicable. Flat sheets, not rolls unless otherwise accepted by Owner’s Representative. 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.

H. Reinforcing Bars: Bars shall be place in accordance with the size and spacing shown of the Drawings. The bars shall be firmly and securely wired together and held in place with concrete or metal chairs. The complete work shall be in place

and approve a minimum of one (1) working day prior to placing of concrete.

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

J. Dowel: Speed Dowels, or equal (no known equal).Before reinforcing steel is placed on top of or adjacent to forms that have been sealed, the surface sealer shall be wiped off so that none may be tracked over, or in any way come in contact with the reinforcing steel. Bottoms of forms shall be cleaned and wet down before placing concrete.

4.5 JOINTS

A. General: Construct construction, isolation, and contraction 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. Locate as indicated on the Drawings.

B. Construction Joints or Expansion 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 isolation joints.
1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Dowels: Provide steel dowels across construction joints to reduce differential movement across the joint. Utilize steel dowels based upon the following:

a. 6-inch Thick Pavement:

Diameter: ½-inch.

Length: 24-inch.

On-center Spacing: Per reinforcing schedule.

b. 4-inch Thick Pavement:

Diameter: ½-inch.

Length: 24-inch.

On-center Spacing: Per reinforcing schedule.

4. To assist in correct alignment of steel dowels along construction joints use Speed Dowel™ plastic dowel alignment sleeves:

   a. Insure that wood edge forms are true to line ands grade prior to installing plastic dowel alignment sleeves.

   b. Install plastic dowel sleeves on wood forms at the specified on-center dowel spacing, centered between top and bottom of wood farm.

C. Expansion/ Isolation 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. Expansion material shall be placed at the appropriate elevation to achieve the depth of the sealant indicated on the Drawings. The top of the finished sealant shall be between 1/8" and 1/4" below the finished surface.
   2. Locate expansion joints at intervals as indicated on drawings, unless otherwise indicated.
   3. Extend joint fillers full width and depth of joint.
   4. Terminate joint filler, as indicated on drawings, below finished surface if joint sealant is indicated.
   5. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   6. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints or Scorelines: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows as indicated in the Drawings.
   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. Provide machine-sawn Contraction joints as soon as concrete has sufficient strength to support sawing equipment.
   3. Joints shall meet the size and depth indicated on the drawings. Joints shall be true to lines and shapes shown on the Drawings and not vary from true. Grooves shall be smooth and uniform.
   4. The completed groove at the finished surface shall not vary more than 1/32" of the width indicated.

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

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

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

D. Do not add water to concrete during delivery or at Project site.

E. Do not add water to fresh concrete after testing.

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

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

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

J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

K. 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 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.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature 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.

M. At the end of a work day, or when more than two hours may elapse between concrete pours, installation shall terminate at an expansion joint or other transition as shown on the Drawings.

N. Removal of Forms: The supporting forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal with safety.

4.7 CONCRETE FINISHING

A. General: Paving finishes to match approved mock-up finishes.

4.8 SEEDED WASHED AGGREGATE

A. Finished surface shall match the approved mock-up panel in color and texture. Surfaces shall be free of ruts, grooves, dimples and have a uniform distribution of exposed coarse and fine aggregate over the entire surface area. Edges shall be crisp and true to lines, and have a finish consistent with the field area.

1. Refer to drawings for aggregate coverage

4.9 QUARRY STONE

A. Finished surface shall match the approved mock-up panel in color and texture. Surfaces shall be free of ruts, grooves, dimples and have a uniform distribution of exposed coarse and fine aggregate over the entire surface area. Edges shall be crisp and true to lines, and have a finish consistent with the field area.

1. Light:
   a. Light Quarry Stone finish paving to match approved mock-up.

4.10 BROOM FINISH

4.11 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 305R for hot weather and ACI 306R for cold weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid

moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

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

D. Curing Methods: Cure concrete by moisture curing, moisture retaining cover, curing compound, or combination of following:
   1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with following materials:
      a. Water.
      b. Continuous water fog spray.
      c. Absorptive cover, water saturated, kept continuously wet.
   2. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
   3. Curing Compound:
      a. Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions.
      b. Recoat areas subjected to heavy rainfall within three hours of initial application.
      c. Maintain continuity of coating and repair damage during curing period.
      d.

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

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

G. Protection and Curing: Provide and apply a sheet curing material that conforms to ASTM C 171, Standard Specifications for Sheet Material Curing Concrete. Protect concrete from defacement. All defaced concrete shall be replaced between expansion joints at no additional expense to the Owner.

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

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

J. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to

manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after application. Maintain continuity of coating and repair damage during curing period.

1. Cure integrally colored concrete with a pigmented curing compound.
2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

K. Sealers: Prepare the finished surface and apply the penetrating sealer as recommended by the manufacturer.

L. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

M. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over pavement edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

4.12 SEALER

A. Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90-degrees to the direction of the first coat using same application methods and rates.

1. Begin sealing dry surface no sooner than 14 days after concrete placement or per the manufacturer’s recommendations.
2. Allow stained concrete surfaces to dry before applying sealer.

B. Mix slip-resistant additive thoroughly in sealer before application according to manufacturer's written instructions. Stir sealer occasionally during application to joint sealant.

C. Prior to applying the sealant, the joints shall be cleaned of all mortar, laitance, scale, dirt, dust, oil, curing compound, and other foreign materials. The joints and adjacent surfaces shall be dry and where called for by the manufacturer, prepared with a primer. The joints shall be filled from bottom to top without voids. All adjoining surfaces shall be protected during the sealing operations and any stains, marks, or damage resulting from the sealant operations shall be corrected.

4.13 PAVEMENT TOLERANCES

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

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Dowels: 1 inch.

5. Vertical Alignment of Dowels: 1/4 inch.
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
7. Joint Spacing: 3 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

4.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

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

C. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
1. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

D. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

E. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

F. Concrete Temperature: ASTM C 1064/C 1064M; 1 test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and 1 test for each composite sample.

G. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

H. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days for information and 2 specimens at 28 days.
1. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

I. Strength of each concrete mix will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

J. Test results shall be reported in writing to Owner’s Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency,

location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

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

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

M. Remove and replace decorative cement concrete pavement where test results indicate that it does not comply with specified requirements.

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

4.15 REPAIRS AND PROTECTION

A. Remove and replace decorative cement concrete pavement that is broken, damaged, or does not comply with requirements in this Section in complete sections from joint to joint, unless otherwise approved by Owner's Representative.

B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 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.

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

END OF SECTION 32 13 16

SECTION 02810

LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.

C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.

E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

A. Submittals Materials List:
   1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
   2. The submittals materials list shall include the following information:
      a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
      b. An index sheet showing the item number (i.e. 1,2,3, etc.); an item description (i.e. sprinkler head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
      c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
      d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
      e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
   3. Submittal materials list format requirements:
      a. Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
      b. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.
      c. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.

d. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.

B. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
1. Provide a written statement indicating the reason for making the substitution.
2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
3. Provide in writing the difference in installed price if the item is accepted.

C. The Landscape Architect or Owner’s authorized representative will allow no substitutions without prior written acceptance.

D. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

E. The Landscape Architect or Owner’s authorized representative will not review the submittal package unless provided in the format described above.
1.

1.5 EXISTING CONDITIONS

A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and telephone line connection to the irrigation system.

B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.

C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.

D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.

E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.

F. The Contractor shall verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.

G. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.

H. Contractor shall notify Owner's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.

I. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner's Representative.

J. The contractor shall provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.6 INSPECTIONS

A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.

B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.

C. Inspections will be required for the following at a minimum:
   1. Pre-construction meeting.
   2. System layout.
   3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
   4. Coverage test of irrigation system. Test shall be performed prior to any planting.
   5. Final inspection prior to start of maintenance period.
   6. Final acceptance prior to turnover.

D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must complete and up to date for each site visit.

E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and

governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to Owner.

1.7 STORAGE AND HANDLING

A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.

B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Owner's authorized representative.

B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

A. Record Drawings:
   1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
   2. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.
   3. All record drawings shall be prepared using AutoCAD 2010 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or Owner's authorized representative.
   4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
   5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or Owner's authorized representative. After acceptance by the Landscape Architect, City Inspector or Owner’s authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2010 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.

a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.

6. Show locations and depths of the following items:
   a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
   b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
   c. Isolation valves
   d. Automatic remote control valves (indicate station number and size)
   e. Quick coupling valves
   f. Drip air relief and flush valves
   g. Routing of control wires where separate from irrigation mainline
   h. Irrigation controllers (indicate controller number and station count)
   i. Related equipment (as may be directed)

B. Controller Charts:
1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:
1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
   a. Operating and maintenance instructions for all equipment.

b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:
1. Supply as a part of this contract the following items:
a. Two keys for each automatic controller.
b. Two quick coupler keys with a 3/4" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
c. One valve box cover key or wrench.
d. Six extra sprinkler heads of each size and type.
e. One hundred feet dripline of each size and type.
f. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

1.10 COMPLETION

A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or Owner’s Authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.

B. The Owner's authorized representative shall have final authority on all portions of the work.

C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the Owner's satisfaction by the Contractor without any additional expense to the Owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitutes an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's

expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owner by the Contractor, all at no additional cost to the Owner.

C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:
PROJECT LOCATION:

CONTRACTOR NAME:
ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS

2.1 SUMMARY

A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

2.2 PIPE

A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.

B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.

C. Pressure supply lines 1 1/2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.

D. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.

E. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.3 METAL PIPE AND FITTINGS

A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.

B. Fittings shall be medium brass, screwed 125-pound class.

C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

2.4 PLASTIC PIPE AND FITTINGS

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete

thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

H. PVC fittings used with UVR pipe shall be Schedule 40 UVR PVC type.

2.5 VALVES

A. Ball Valves:
1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.
2. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

B. Quick Coupler Valves:
1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1” female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.
3. Vinyl quick coupler cover to be purple in color with the words “Warning-Recycled Water-Do Not Drink” permanently marked on lid.

C. Automatic Control Valves:
1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.

2.6 VALVE BOXES

A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.

B. The valve box cover shall be green in color and secured with a hidden latch mechanism or bolts.

C. The cover and box shall be capable of sustaining a load of 1,500 pounds.

D. Valve box extensions shall be by the same manufacturer as the valve box.

E. The plastic irrigation valve box cover shall be an overlapping type.

F. Automatic control valve, master valve, flow sensor, and gate/ball valve boxes shall be 17"x11"x12" ‘nominal’ rectangular size. Valve box covers shall be marked "RCV" with the valve identification number, or “MV”, “FS”, “GV”, “BV” "heat branded" onto the cover in 1-1/4 inch high letters / numbers.

G. Drip flush valve and Air relief valve boxes shall be 6" circular size. Valve box covers shall be marked with "FV" or “ARV” "heat branded" onto the cover in 1-1/4 inch high letters.

H. Quick coupler valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" "heat branded" onto the cover in 1-1/4 inch high letters.

2.7 AUTOMATIC CONTROLLER

A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.

B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.

C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.8 ELECTRICAL

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

2.9 LOW VOLTAGE CONTROL WIRING

A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.

B. Connections shall of the manufacturer, size, and type indicated on the drawings.

C. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).

D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.10 IRRIGATION HEADS AND INLINE DRIP TUBING

A. Irrigation heads, and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.

B. Irrigation heads, and inline drip tubing shall be used as indicated on the drawings.

C. Irrigation heads shall have purple recycled water warning cover.

2.11 DRIP IRRIGATION EQUIPMENT

A. Drip tubing equipment such as flush valves, air relief valves, wye strainers and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

2.12 MISCELLANEOUS EQUIPMENT

A. Landscape Fabric:
   1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
   2. Type: DeWitt Pro 5 Weed Barrier or approved equal.

B. Equipment such as flow sensors, rain sensors, freeze sensors, flush valves, air relief valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Inspections:
   1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
   2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:
   1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
   2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:
   1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
   2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.

3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:
1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.

F. Layout:
1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:
1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.

H. Electrical Service:
1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
3. Contractor shall make electrical connections to the irrigation controller. 230-volt single-phase electrical power source to pump assembly location shall be provided by others per NEC codes.

3.2 TRENCHING

A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.

B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.

C. Provide minimum cover of 18 inches for control wires within planters.

D. Provide minimum cover of 24 inches for control wires within sleeves below paving.

E. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.

F. Provide minimum cover of 12 inches for non-pressure lines.

G. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.3 THRUST BLOCKS

A. Thrust blocks must be constructed of Class “B” concrete.

B. Thrust blocks shall be poured against undisturbed site soil.

C. PVC fitting joints shall be kept free of concrete. Do not encase fitting in concrete.

D. Thrust blocking shall be sized to provide the minimum bearing areas as shown below. Bearing areas indicated have been calculated for Class 200 PVC pipe at a test pressure of 150 PSI in soil with 2,000 PSI bearing capacity. Increase thrust block sizing as necessary for varying soil conditions.
   1. Provide a minimum thrust block bearing area of 2.0 square feet on all bends (all degrees) and tees installed on pressure supply lines 4 inches and smaller.

3.4 BACKFILLING

A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.

B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

C. Flooding in lieu of tamping is not allowed.

D. Under no circumstances shall truck wheels be used to compact backfill.

E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.5 PIPING

A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.

B. Cutting or breaking of existing pavement is not permitted.

C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

D. Remove all dented and damaged pipe sections.

E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.

F. Parallel lines shall not be installed directly over each other.

G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.

I. Center load all plastic pipe prior to pressure testing.

J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope an all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

3.6 CONTROLLER

A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.

B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.

C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.7 CONTROL WIRING

A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.

C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.

D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.

E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.8 VALVES

A. Automatic control valves, quick coupler, and gate valves are to be installed in the approximate locations indicated on the drawings.

B. Valve shall be installed in shrub areas whenever possible.

C. Install all valves as indicated in the detail drawings.

D. Valves to be installed in valve boxes shall be installed one valve per box.

E. Provide valve ID tags for each remote control valve with valve number.

3.9 VALVE BOXES

A. Valve boxes shall be installed in shrub areas whenever possible.

B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

3.10 IRRIGATION HEADS AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters and inline drip tubing shall be installed as indicated on the drawings.

B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.

C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.11 BACKFLOW PREVENTION UNITS

A. The contractor shall be responsible for the testing and certification of the existing backflow device for proper operation. Testing and certification shall be performed by a state qualified backflow tester.

3.12 MISCELLANEOUS EQUIPMENT

A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.

B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.

C. Install devices such as rain sensors, freeze sensors, flush valves, and air relief valves, master valves and flow sensors as indicated on the drawings and as recommended by the manufacturer.

3.13 FLUSHING THE SYSTEM

A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.

B. Irrigation heads shall be installed after flushing the system has been completed.

3.14 ADJUSTING THE SYSTEM

A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.

B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.

C. The entire system shall be operating properly before any planting operations commence.

D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters and inline drip tubing operate at the pressure recommended by the manufacturer.

3.15 TESTING AND OBSERVATION

A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and governing agencies.

B. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.

C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.

D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.

E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, Owner, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.

F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the contractor at no additional cost to the owner.

G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.16 MAINTENANCE

A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.17 COMPLETION CLEANING

A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils and soil amendments
3. Soil Preparation.
4. Imported planting soil mix for raised planters
5. Bioswale mix.
6. Landscape Mulches
7. Tree stabilization.
8. Root Barrier
9. Maintenance and Guarantee.

B. Related Sections:

1. Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Division 12 Section "Site Furnishings" for exterior planters.
3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Division 32 Section “Planting Irrigation” for planting irrigation systems

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Compost: mixture of various decaying highly organic substances such as dead leaves, but free of animal wastes, used to improve soil structure and provide nutrients.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Date of Acceptance: Date at the end of the warranty periods (as specified herein) when written acceptance is provided by the Owner.

E. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

F. Finish Grade: Elevation of finished surface of planting soil (not mulch) within 1/10th of an inch. Unless other wise noted soil finish shall be:
1. 2 ½" below hardscape /pavement areas
2. 5" below topcut curb or planter wall
3. 1" below hardscape/ pavement areas (at lawn assembly)

G. Manufactured or Import Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Native Soil: Existing soil found in place on the site. Soil is defined as the unconsolidated mineral or organic matter on the immediate surface of the earth which serves as a natural medium for the growth of plants.

I. Notice of Completion: The date at the close of the Maintenance Period when the work has been completed, checked, accepted and written approval of the work has been given by the Owner's Representative.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted or covered with mulches not intended for pedestrian or vehicular circulation.

M. Planting Soil: Existing, in-place surface soil or imported topsoil that is modified with soil amendments and fertilizers per the specifications to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Raised Planter: Planted areas that are bounded by any wall or curb 12" or higher than the adjacent grade or surface. To be filled with import topsoil to the full and complete depth of the planter.

P. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

Q. Soil Amendment: elements added to the soil, such as compost, peat moss, or fertilizer, to improve its capacity to support plant life, such materials are usually intended to improve structure, drainage or aeration, or add nutrients to the soil.

R. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

S. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

T. To Remain: Planting areas identified in the Drawings to be protected and maintained in place.

1.4 SUBMITTALS

A. Comply with Section 13 33 00 Submittal Procedures and Section 01 18 13-Sustainable Design Requirements.

B. Soil Test Results:
1. Agronomic Soil Fertility Testing: Soil analysis test reports shall be completed after rough grading to determine actual recommended soil amendments. Refer to Part 3: SOIL TESTING.
2. Bioswale Soil Mix: Test for physical and chemical composition to meet permeability rate and specification requirement, as described herein Part 2: PLANTING SOILS.
3. Soil Percolation Testing, as described herein Part 3: PERCOLATION TESTING.

C. Submittals for items shall be made in one package. Contractor shall submit no later than thirty (30) days after award of Contract, four (4) bound booklets. If submittals are judged incomplete or non-responsive to the directions of the Owner's Representative after three (3) submittals, the Contractor shall be back-charged for the Owner's Representative's costs to process additional Submittals.

D. Submittals will be rejected without the benefit of review by the Owner's Representative if they are difficult to read, incomplete or if the required information in not presented in format required.

E. Product Data:
1. For each type of product listed in Part 2 of this specification.
2. Plant Materials: Include quantities, sizes, quality, and nursery sources for plant materials.
3. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
4. Plant Photographs: For each plant specified, include (2) colored photo quality color photographs at 8 ½ x11 size format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For trees include a minimum of three photographs of each species. Pictures shall be without stakes, trees shall be able to stand without stakes by themselves. Identify each photograph with the full scientific name of the plant, container size, height

and spread, and name of the growing nursery. Review of plant photographs does not indicate acceptance of the plant material as delivered to the Project Site.

5. Planting Schedule: Submit anticipated planting dates for each type of planting.
6. Delivery Slips for all products included in submittal, slips should indicate quantity delivered.

F. Samples for Verification: For each of the following:
1. Revise subparagraphs below to suit Project. Insert other samples if required.
2. Organic Mulch: ¼ lb bagged samples of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Mineral Mulch: 1 lb bagged sample of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of name, source, size, and color range of the material.
4. Stone 1”-3” diameter: Submit nine (9) stones for each type and/or size range. Label shipping container with an accurate indication of name, source, size and color range of the material.
5. Stone 3”-8” diameter: Submit three (3) stones for each type and/or size range. Label shipping container with an accurate indication of name, source, size and color range of the material.
6. Stone over 8” diameter: Submit three (3) photo quality color images at 8 ½ x11 size format of each required stone. Label each image with an accurate indication of name, source, size and color range of the material.
7. One 12” long of all specified Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
8. One 12” long sample of timber wall material.
9. 24” long sample of Root Control Barrier for each type.
10. ¼ lb bagged samples of each Soil Conditioner, Imported Amended Topsoil, Biowswale Growing Medium and Organic Soil Amendment and Fertilizer, etc.
11. On-Structure planting soil mix: (3) ¼ lb bagged samples with laboratory test verifications.
12. 12”x12” square panel of filter fabric for on-structure planters.

G. Qualification Data: For qualified Landscape Installer and qualified Native Plantings Landscape Subcontractor (if applicable). Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, year completed and include names and addresses of owners/ contact persons. Refer to the “Quality Assurance” section Part 1 of this specification for additional information.

H. Material Test Reports:
1. Soil Analysis Test Reports: Testing for all planting soils including on-structure planting soil mix, import Topsoil, bioswale soil mix and existing or stockpiled soil to be used during backfill operations. Refer to Soil Testing section in Part 3 testing procedures. Soil testing shall be completed after rough grading operations. See Part 1 Quality Assurance for additional requirements. The results of the soil testing must be submitted to the Owner’s Representative for review and approval.

2. Percolation Test Reports: Refer to Percolation Testing section in Part 3 for testing procedures. The results of the percolation testing must be submitted to the Owner's Representative for review and approval.

I. Maintenance Instructions: Contractor shall furnish to the Owner recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
1. Instructions should include but not be limited to the following tasks: Fertilizing, irrigation schedule, dead heading, mulch or other inert groundcover replenishment, pruning of shrubs to maintain design intent and 3 year tree maintenance schedule.
2. Instructions shall be submitted to Owner's Representative for approval before submittal to the Owner and prior to the expiration of the Maintenance period.

J. Landscape Planting Plan As built Drawings Contractor mark ups.

K. Warranty: Submit written warranties on the Contractor's or subcontractor's letterhead, addressed to the Owner. Submit all warranties in duplicate and in the form shown in the General Conditions, or modified as approved by the Owner's Representative to suit the conditions pertaining to the warranty. Refer to Warranty and Replacement section, Part 1 for more information.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
1. Confirmation that the Contractor has been in business for a minimum of five years complete with a company profile including relevant projects and references from planting on structure projects. Consistent with the size and scope of this contract.
2. All work shall be performed by a trained crew in accordance with the standards and practices related to the trade.
3. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
4. Experience: Ten years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements." Provide client list with contact names, phone numbers and date planting was installed.
5. License: Single entity subcontractor holding a valid C-27 California Contractor's license.
6. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
7. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
    a. Certified Landscape Technician - Exterior, with installation, maintenance and irrigation specialty area(s).
    b. Certified Ornamental Landscape Professional, designated COLP.
8. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

A. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants or within driplines of existing trees.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, 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. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

C. Handle planting stock by root ball.

D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
   1. Plants shall not be allowed to remain on site longer than 5 days prior to planting.
   2. Do not remove container-grown stock from containers before time of planting.
   3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.7 PROJECT CONDITIONS

A. Field Measurements: Prior to excavation for planting or placing of plant materials, verify actual grade elevations, service and utility locations, underground and overhead lines, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work. In the vent of a conflict the Contractor shall notify the Owner's Representative and the owner.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.

2. Do not proceed with interruption of services or utilities without Owner's written permission.

C. 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 and warranty requirements.

D. Site Draining: Established site drainage shall be maintained by the Contractor during all phase of the Work. Grade areas as needed to insure proper grades and drainage as indicated on Drawings. Final finish grade shall insure positive drainage with surface drainage away from buildings, walls and toward driveways, drainlets and catch basins.

E. Errors and Omission: Refer to errors and/or discrepancies in or between plans, specifications, lists or notes to the Owner's Representative for adjustments before proceeding with the Work. The Contractor shall assume responsibility for proceeding with the Work without referring. In the event of a conflict, the Owner's Representative shall interpret the meaning of the Contract Drawings and Contract Specifications and their decision shall be final.

F. Excavation: When conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions, cease planting operations and notify the Owner's Representative for further direction.

G. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization, edgings, tree grates, improper planting, and failure to water sufficiently.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
e. Damages done to plant material during construction.

2. Warranty Periods from Date of Notice of Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 6 months.
c. Specialty Plants (Palms, succulents, bamboo): 24 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants within 14 days and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. Replacement plants shall be of the same size, species and variety as specified in the Drawings. Replacement includes restoration of surrounding area to match the existing conditions.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.9 MAINTENANCE SERVICE

A. The Maintenance Period shall commence on the first day after landscape work on the project is completed and verified by the Owner's Representative. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
1. Maintenance Period: 180 days from date of Notice of Completion.

B. Within one week, prior to authorization start of maintenance, submit a Maintenance Schedule to the Owner's Representative listing the days when maintenance crews will be on site. Include a contact person and emergency phone number.

C. The maintenance period shall be extended when in the opinion of the Owner's Representative, dead or dying plant materials, poor or unhealthy growing conditions or improper maintenance practices are evident within the maintenance period. The extended period shall be provided at no additional cost to the Owner and shall be extended until the work is complete and acceptable to the Owner's Representative.

D. The Contractor shall continuously maintain the involved areas of the Contract during the progress of the Work, and during the Maintenance Period, until Final Acceptance of Work is granted:

1. Maintain trees, and shrubs, ground covers, grasses (turf and ornamental), and other plants and site conditions by pruning, cultivating, watering, weeding, cutting, trimming, edging, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray with pesticides and or herbicides, as required, to maintain plant materials free of insects and/or disease.

2. Maintenance operations shall also include filling and replanting of low areas which may cause standing water, adjusting of sprinkler head height and watering pattern, filling and recompacting eroded areas or areas with depressions caused by vehicles, bicycles, foot traffic, or unnatural soil settling or soil compaction, damage caused by rodents, deer, or other animals, and weekly removal of trash, litter, clippings, and foreign debris.

E. At the end of Maintenance Schedules: Provide complete maintenance specifications including general design maintenance intent of plant material and fertilizing schedule based on planting design.

1.10 REJECTION AND SUBSTITUTION

A. Products or materials, whether installed or not, not conforming to the requirements herein specified shall be considered defective, and be marked as rejected. Materials shall be removed and replaced with approved materials at no additional cost to the Owner.

B. Submit written request for each proposed substitution. Provide data substantiating the request as well as a Certificate of Suitability certifying that the proposed substitution is equal or better in all respects to that specified and that it will in all respects perform the function for which it is intended. Include with request all required samples.

1.11 SITE OBSERVATIONS

A. Schedule and coordinate site observation visits for the following construction activities. Reviews shall be performed by the Owner's Representative an notification shall be given in advance notice as noted:

Item	Advance Notice
1. Protection of existing plant materials	48 hours
2. Rough grade	48 hours
3. Soil preparation and finish grade	48 hours
4. Inspection of plant material delivered on site.	48 hours
5. Spotting of Trees prior to excavation of planting holes	48 hours
6. Plant material review	48 hours
7. Plant layout and installation	48 hours
8. Substantial Completion Punch List	7 days
9. Punch List Completion	7 days
10. Maintenance Completion	7 days

1.12 TEMPORARY UTILITIES

A. Provide all temporary piping, wiring, meters, panels and other related appurtenances required between the source of supply and the point of use of utilities.

B. Permission to shut off in-use utilities must be obtained 48 hours in advance or as required for Medical Center and/or renovation projects, in writing from the Owner's Representative. The Owner's Representative shall determine the length of time for each shut-off.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of weeds, disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
   1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling or kinked roots will be rejected.
   2. Plants shall have normal well-developed, vigorous and fibrous root systems which are neither root, nor container bound.
   3. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.

C. Labeling: Label five plants of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

D. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

E. Provide healthy, weed and disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

F. Plants shall be grown in their container for at least six months, but not over two years.

G. Groundcover plants grown in flats shall be healthy vigorous rooted cuttings grown in flats for at least 3 months but not over six months.

H. Succulents: Succulents shall be acquired from a licensed nursery. Succulents shall be free of insects, mottled leaves, broken or split branches or trunks, scarring or any other uncharacteristic growth patterns.

2.2 INORGANIC SOIL AMENDMENTS

A. Sulfur: Pelletized, biodegradable, commercially processed and packaged, and containing a minimum of 90 percent sulfur capable of oxidizing over time and providing nutrient sulfur with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.
   1. Acceptable Manufacturers:
      a. “Tiger 90 CR”, John Deere Landscapes (800) 233-6933

B. Iron Sulfate: a non-staining iron with micronutrients, pelletized, slow release, environmentally safe; 40% Iron, 1% Manganese, 1% Zinc, 1% Magnesium, 6% Sulfur; 2% Humic Acids
   1. Acceptable Manufacturers:
      a. “Premium Green Iron 40% Fe”, Gro-Power®, Inc. (800) 473-1307

C. Agricultural Gypsum: Minimum 90 percent calcium sulfate (CaSo4, H2O), a commercially processed and packaged gypsum, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

D. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.3 COMPOST

A. Humus material shall have an acid-soluble ash content of no less than 5% and no more than 20%. Organic matter shall be at least 90% on a dry weight basis.

B. The pH of the material shall be between 6 and 8

C. The salt content shall be less than 10 millimho/cm @ 25° C. in a saturated paste extract.

D. Boron content of the saturated extract shall be less than 1.0 parts per million.

E. Silicon content (acid-insoluble ash) shall be less than 50%.

F. Organic matter shall be at least 90% on a dry weight basis.

G. Calcium carbonate shall not be present if to be applied on alkaline soils.

H. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.

I. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.

J. Sludge-based materials are not acceptable.

K. Carbon:nitrogen ratio shall be less than 25:1.

L. The compost shall be aerobic without malodorous presence of decomposition products.

M. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending. The maximum particle size shall be 0.25 inch for hydroseeding.

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic	20	copper	150	selenium	50
cadmium	15	lead	200	silver	10
chromium	300	mercury	10	vanadium	400
cobalt	50	molybdenum	20	zinc	250
		nickel	100		

N. Higher amounts of salinity or boron to be pre-leached to reduce the excess.

O. Acceptable Manufacturers:

1. “Humic Compost”, AgriService (760) 439-9920
2. “Forest Floor Humus”, Aguiñaga Fertilizer 909/424-1400
3. “Washed Steer Humus”, Earthworks 951-782-0260
4. “Economix”, Agromin 805/432-5265

2.4 FERTILIZERS

A. Pre-plant Fertilizer for plants and lawns: (5-3-1) with Soil Penetrant Added. Fertilizer and soil conditioner derived from organic materials consisting of higher plant form life, composted beyond the fibrous stage. Shall not contain any of the following: poultry, animal or human waste, pathogenic viruses, fly larvae, insecticides, herbicides, fungicides or poisonous chemicals that would inhibit plant growth. Physical properties: A uniform "Beaded" homogenous mixture - 100.00% passing through a #4 mesh screen - a water soluble bio-degradable binder is used to insure fast breakdown.

Nitrogen	5%	minimum
Phosphoric Acid	3%	minimum
Water Soluble Potash	1%	minimum
Humus	70%	minimum
Humic Acids	15%	minimum
Soluble Metallic Iron	1%	minimum
Soil Penetrant: (Alkyl Naphthalene Sodium Sulfonate.)	1%	minimum

Bacterial "stimulator": (Common soil and airborne organisms - aerobic, anaerobic, yeast and mold) 60,000 per 100 gram minimum

1. Acceptable Manufacturers:
   a. “Gro-Power Plus 5-3-1”, Gro-Power®, Inc. (800) 473-1307

B. Pre-plant Fertilizer for plants and lawns (6-20-20): an organic based, long lasting, non burning, slow release, free flowing, uniform in composition fertilizer, suitable for application with approved equipment, and containing the following minimum available percentages of weight of plant food with trace minerals of 2% iron (expressed metallic) and 7% sulfur (elemental), Zinc .15% and Manganese .15%.

Nitrogen	6%	minimum
Phosphoric Acid	20%	minimum
Soluble Potash	20%	minimum

1. Acceptable Manufacturers:
   a. “Best 6-20-20 XB”, John Deere Landscapes (800) 233-6933.

C. Pre-plant Balanced Fertilizer for Phosphorous or potassium deficient soils. (12-12-12): a balanced formula with all nutrients in each pellet (homogenous) to prevent streaking due to particle segregation. Contains Sulfur and Calcium to help withstand weather extremes, improved unproductive soils and improve overall color and disease resistance.

Nitrogen	12%	minimum
Phosphoric Acid	12%	minimum
Soluble Potash	12%	minimum
Sulfur	15%	minimum
Calcium	2.1%	minimum

1. Acceptable Manufacturers:
   a. “Best Triple Twelve 12-12-12”, John Deere Landscapes (800) 233-6933.

D. Lawn Post-plant Fertilizer: (18-3-7): with 40% of the nitrogen a slow release SCU. 20% humus, 4% humic Acids, 4% sulfur, 1% iron, 0.50% soil penetrant, and soil enhancers. Nitrogen source: 5.94% Ammoniacal Nitrogen, 4.86% Nitrate Nitrogen, 5.40% Sulphur Coated Slow-Release Nitrogen,1.08% Urea Nitrogen. Gro-Power bacterial "stimulator" included -bacteria (common soil and airborne organisms - aerobic, anaerobic,) yeast and mold, minimum 60,000 per 100 gram.

Nitrogen	18%	minimum
Phosphoric Acid	3%	minimum
Soluble Potash	7%	minimum

1. Acceptable Manufacturers:
   a. “Gro-Power Premium Hi-Nitrogen 18-3-7”, Gro-Power®, Inc. (800) 473-1307

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots. Slow release fertilizer tablets, soil conditioner, 24-month formulation with trace elements, composted organic higher plant form life and mineral matter. Shall not contain any poultry, animal or human waste.

1. Nutrient Composition:

Nitrogen (total)	20%	minimum
Ammonical Nitrogen	2%	
Water Soluable Organic Nitrogen	5.3%	
Water Insoluable Organic Nitrogen	12.7%	
Phosphoric Acid	10%	minimum
Soluable Potash	5%	minimum
Calcium	3.5%	
Sulphur	2.5%	minimum
Iron (Fe)	2%	minimum
Manganese	0.05%	minimum
Zinc	0.05%	minimum
Humic Acids (derived from compost)	2.5%	minimum

2. Acceptable Manufacturers:
   a. “Gro-Power (20-10-5) Planting Tablets”, Gro-Power®, Inc. (800) 473-1307

2.5 MYCORRHIZAL SOIL CONDITIONER AND HUMIC ACIDS

A. Mycorrhizal Inoculum / Soil Conditioner: Inculum shall be both Endo and Ecto (granular), with consititing of propagules (spores, fragments of fungal mycelium, and pieces of mycorrhizal roots capable of colonizing host plant roots) of the vesicular arbuscular mycorrhizal species Glomus intraradices, Glomus aggregatum, Glomus mosseae, combined with other species and/or additional genera including, Sclerocyctis, Gigaspora, Scutellospora, Entrophospora, and Acaulospora. Ectomycorrhiza include Pisolithus and 4 species of Rhizopogon. Soil Conditioner portion shall consist of organic materials consisting of higher plant form life, composted beyond the fiberous stage, to humus. Also shall have humic acids and beneficial soil bacteria strains. It shall NOT contain poultry, animal or human waste (i.e., sewage sludge), pathogenic viruses, fly larvae, insecticides, herbicides, fungicide or poisonous chemicals that would inhibit plant growth.

1. Nutrient Composition:

Ingredients	percentage (minimum)
Mycorrhizal Inoculum	6,500/55,00 progagules per lb.*
Humus	65%
Humic Acids	25%

2. Acceptable Manufacturers
   a. “GroLife Granular”, Gro-Power®, Inc (800) 473-1307

B. Humic Acids (from Leonardite) 70 .00 %

1. Nutrient Composition: Per random sample of material.

Organic matter		40.00 %
Carbon		40.00 %
Nitrogen	0.05	%
Phosphoric Acid	0.07	%
Potash	0.13	%
Sulfur	0.21	%
Magnesium	0.18	%
Calcium	0.32	%
pH	4.0	
Soluble Salts	1.8	

2. Acceptable Manufacturers
   a. “Tri-C Premium Humate” (800) 927-3311.

2.6 SOIL PENETRATING AGENT

A. Acceptable Manufacturers
   1. "Sarvon", John Deere Landscapes (800) 233-6933.

2.7 PLANTING SOILS

A. Import Topsoil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of [**2**] percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.
   1. Import topsoil to be supplied for the full depth of raised planters indicated below and in Planting Cells of Grasscrete Porous Paving: Submit Amended Imported Topsoil to Owner’s Representative for evaluation. Provide Imported Topsoil from off-site sources, obtained from naturally well-drained site; do not obtain from bogs or marshes; see Part 1 for definition of raised planters.
   2. Import topsoil also to be used on-grade as required for fill operations or as specified in the drawings.
   3. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption rate (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be no greater than 1 part per million as measured on the saturation extract.
   4. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch (25 mm) or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest

eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

5. Submit results of agricultural soils analysis testing for review and approval by the Owner's Representative.
6. Provide Amended Imported Topsoil in sufficient quantities which allow for natural settling and compaction of the topsoil mix in the Raised Planters, and flush with the top of the Grasscrete Porous Paving cells. Prioir to planting plant materials, Raised Planters and Grasscrete cells shall be compacted to 90% density to minimize settling. Set Amended Imported Topsoil and compact accordingly in 6" lift to within 2" of top of the Raised Planters.
   a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      1) A-1 San Diego Select Topsoil, Hanson Aggregates A-1 Soils.
      2) Topsoil Mix #5, Agromin Horticultural Products.

B. Bioswale Growing Medium: Suitable Import, Borrow Topsoil or Reclaimed soil

1. General - Topsoil shall be free of roots, clods, stones larger than 1-inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.
2. Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil.
3. Gradation limits - soil shall be a sandy loam or loam. The definition of soil texture shall be the USDA classification scheme. Gravel over ¼-inch in diameter shall be less than 10% by weight.
4. Permeability Rate - Hydraulic conductivity rate shall be not less than five inches per hour no more than 10 inches per hour when tested in accordance with the USDA Handbook Number 60, method 34b or other approved methods.
5. Fertility - The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/DTPA Extraction

parts per million (mg/kilogram

dry weight basis

phosphorus	2 - 40
potassium	40 - 220
iron	2 - 35

manganese	0.3 - 6
zinc	0.6 - 8
copper	0.1 - 5
boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 2

6. Soil may need to be amended and conditioned to optimize plant growth. The above listed fertility is for soil selection.

7. Concentration of nutrients for final acceptance.
Ammonium Bicarbonate/DTPA Extraction

parts per million (mg/kilogram

dry weight basis

phosphorus	10 - 40
potassium	100 - 220
iron	24- 35
manganese	0.6 - 6
zinc	1 - 8
copper	0.3 - 5
boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 2

Acidity - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 - 7.9.

Salinity - The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 0.5 - 2.5 dS/m.

Chloride - The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

Boron - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

Sodium Adsorption Ratio (SAR) - The maximum SAR shall be 3 measured per Method 20b, USDA Handbook Number 60.

Aluminum – Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 3 parts per million.

Soil Organic Matter Content - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter. The desirable range is 3% to 5%. The carbon:nitrogen ratio should be about 10. A high carbon:nitrogen ratio can indicate the presence of hydrocarbons or non-humified organic matter.

Calcium Carbonate Content - Free calcium carbonate (limestone) shall not be present for acid-loving plants.

Heavy Metals - The maximum permissible elemental concentration in the soil shall not exceed the following concentrations:

Ammonium Bicarbonate/DTPA Extraction

parts per million (mg/kilogram)

dry weight basis

arsenic	1
cadmium	1
chromium	10
cobalt	2
lead	30
mercury	1
nickel	5
selenium	3
silver	0.5
vanadium	3

8. If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

9. Phytotoxic constituent, herbicides, hydrocarbons etc. - Germination and growth of monocots and dicots shall not be restricted more than 10% compared to the reference soil. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Methods No. 8020.

10. Submit results of agricultural soils analysis for review and approval by the Owner's representative.

2.8 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: " Forest Fines" Brush Mulch, fine-grained, fibrous, dark brown product.
      a. Size Range: Particle size shall be 1-1/2" minus
      b. Acceptable Manufacturer:
         1) Agri-service (800) 262-4167, or equal.

B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:

   2. Decomposed Granite Mulch and aggregate stone and cobble mulch in sizes and colors indicated on the Drawings.
      a. Refer to drawings for type, size and color.
      b. Acceptable Manufacturers:
         1) Decorative Stone Solutions (800) 699-1878.
         2) KRC Rock (619) 443-8153, or equal

2.9 FILTER FABRIC

A. Filter Fabric for site: Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

2.10 PESTICIDES

A. Prior to using pesticides, contractor shall review procedures with the Owner's Representative and obtain written approval prior to using any pesticides.

B. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

C. Contractor shall be licensed by the County to perform pesticide applications.

D. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
   1. Acceptable Manufacturers:
      a. Treflan
      b. Surfland
      c. Eptan

E. Post-Emergent Herbicide: Round-up

2.11 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Wood Stakes: Shaved, sound, new lodgepole pine, free of knots, branches, holes, cross grain, and other defects, of the length indicated on the Drawings, pointed at one end.
   a. Stakes for 24" box trees or smaller shall be no less than 10 feet in length and 2" in diameter.
   b. Stakes for 36" box trees and larger shall be no less than 12 feet in length and 3" in diameter.
   c. Acceptable Manufacturers:
      1) Villa Root Barrier, Inc. (800) 654-4067.
2. Tree Ties: Flexible non-deteriorating self fastening, black vinyl ties of sizes required to adequately support trees.
   a. Acceptable Manufacturers:
      1) Gro-Straight ties
      2) Cinch-Ties
3. Guying Materials: 3/16" braided steel cable, 6" open turnbuckles, ½" pvc pipe, Duckbill Anchors or 2 x 4 x 24" redwood deadman or approved equal.
4. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

B. Tree Support Root Guying System

1. Pre-assembled, pre-packaged, tree anchoring system, specifically designed and manufactured to hold the tree's rootball in place, with only the tree protruding from the ground. System components (sized accordingly to tree caliper) include anchors, wire rope, turn buckles, tree collars, and wire rope clamps.

   a. Provide for trees as indicated on drawings

2. Product and Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Duckbill Tree Anchor System, Foresight Products, LLC, 6430 E. 49th Drive, Commerce City, CO 80022, 800-325-5360.

3. Product Application:

   a. For trees up to 3" caliper, Duckbill Tree Anchor System #68RBK.
   b. For trees up to 6" caliper, Duckbill Tree Anchor System #88RBK.

2.12 LANDSCAPE EDGINGS

A. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Basis-of-Design Product: Subject to compliance with requirements, provide "Duraedge" or comparable product by one of the following:
   a. Russell, J. D. Company (The).
2. All steel curbing shall be ¼" thick by 5" deep with stakes per detail
3. Stakes: Tapered steel, a minimum of 12 inches (300 mm) long.
4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: Painted Steel
   a. Paint Color: TBD

2.13 AERATION TUBES AND PLANTER PIPE CLEAN OUT

A. Tubes: 4" dia. Schedule 40 PVC perforated pipe cut to lengths as shown on the Drawings.
   1. Acceptable Manufacturer: Plastic Pipe & Supply, Inc. (401)-467-9370.

B. Grates: 4"dia.
   1. For Bark Chip Planting areas: round, black, plastic atrium drain grates;
   2. For Lawn areas: round, green, flat plastic drain grates;
   3. For Gravel and stone mulch planting areas: round, brown, flat plastic drain grates.
   4. Acceptable Manufacturer: National Diversified Sales (NDS).

C. Filter fabric "sock": Spunbond, Typar 3341, Geoscape Landscape Fabric - 2.5 oz., Commercial Grade"
   1. Acceptable Manufacturer: ADS (800) 821-6710.

2.14 ROOT BARRIER

A. Root barrier shall be "Typar Biobarrier" root control root fabric in 39" width with Treflan unless otherwise noted in the plans, manufactured by Dow Elanco., as supplied by John Deere Landscapes (800) 233-6933.

2.15 EROSION CONTROL MATERIALS

A. Erosion Control Jute Mesh: Jute mesh shall be new and shall be of a uniform, open, plain-weave mesh. The mesh shall be made from unbleached single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than half its normal diameter. Jute mesh shall be furnished in rolled strips and shall conform to the following provisions.
   1. Width - 1200 mm {48 inches}, with a tolerance of ± 25 mm {± one inch}
   2. Warp ends - 78, minimum, per width.
   3. Weft ends - 44, minimum, per meter {yard}
   4. Mass - 0.57 to 0.63-kg/m {1.16 to 1.28 pounds per yard}
   5. Include manufacturer's recommended steel wire staples, U- shaped, 8 gauge, 8 inches long.

6. Acceptable Manufacturer - Anti-Wash Geojute, Belton Ind. Dist. By John Deere Landscapes (800) 233-6933.

B. Provide at slopes 3:1 or greater or as otherwise indicated in the Drawings.

2.16 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
1. Acceptable Manufacturer: Wilt Pruf

C. Burlap: Non-synthetic, biodegradable.

D. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with [ASTM D 448 for Size No. 8].

E. Tree Protection Material: Enclosure: 5’ tall chain link fence with a minimum 1½” dia. posts and 1” top and bottom rails. Caution tape, or twine and flags are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. No work under this section shall commence until all submittals have been reviewed and approved. Do not proceed with installation until all unsatisfactory conditions have been corrected.

B. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

D. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.

3.2 SOILS TESTS

A. On-Site Soil Testing: At the conclusion of rough grading, collect minimum (5) five soil samples per indicated on drawings. Locations and depths to gather the representative soil samples shall be accomplished by the Contractor under the direction of the Owner's Representative. Submit the samples to an approved agricultural soils laboratory for testing.
   1. Each Sample shall be delivered to the laboratory in a separate, resealable, one (1) gallon plastic bag with permanent numbers for identification purposes. Location map with sample numbers shall be provided as part of test results.

B. Bioswale Growing Medium Soil Testing:

   1. Send one (1) 5-gallon planting soil mix sample for soil testing.
      a. Include the Drawings planting legend and specification and send along with growing medium sample to the Lab.
      b. Report suitability of growing medium for plant growth. State recommended quantities of nitrogen, phosphorus and potash nutrients and soil amendments and fertilizer to be added to produce satisfactory bioswale growing medium.

   2. Verify permeability rate meets the requirement stated in Part 2.

   3. Verify soil texture and composition, mineral content meets the requirement stated in Part 2.

   4. At least 30 days prior to growing medium work, submit the laboratory's written test report including the laboratory's growing medium analysis data and amendment recommendations to the Owner's Representative for review.

   5. The Owner's Representative will determine the final amendment program based on the test report, which may differ from the growing medium mix test report amendment recommendations.

C. Soil testing shall be conducted by a reputable, certified, approved, agronomic soils laboratory, and shall be a member of the Council on Soil Testing and Plant Analysis:

   1. Soil and Plant Laboratory, Orange, CA, phone 714-282-8777.
   2. Wallace Laboratories, El Segundo, CA, phone 310-615-0116.

D. Submit the test results and laboratory recommendations to the Owner's Representative for review. No amendments shall be applied prior to receipt of test results. Test recommendations shall include the amendments listed in this specification.

E. The Owner's Representative shall recommend changes to the amendments and/or procedure listed herein, after review of the test results.

F. Costs for testing and retesting the soil shall be included in the base bid.

G. Soil testing is considered a long lead item, retesting may be required to confirm that recommended remediation measures were successful and soil test results are within the acceptable ranges for plant growth. The time frame for this work shall not be shortened because adequate time was not allowed for testing and retesting of the soils. The soils will need to be retested until an acceptable test result is attained.

H. Cost change for soil preparation work shall be in accordance with the provisions of the General Conditions. Refer to Part 1 Quality Assurance for additional requirements.

3.3 WEED CONTROL

A. Prior to commencement of the planting operations, remove all weeds including the roots, remove existing plant material including stumps designated not to remain, dispose of cleared and grubbed material at a legal refuse site.

B. Prior to using herbicides, review procedures with the Owner, and obtain written approval. Herbicide applications requiring government or agency approvals shall be performed by an operator licensed by the County. Protect existing plant material on site and on adjacent properties from exposure to herbicides and equipment.

3.4 PREPARATION AND LAYOUT

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. 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.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's Representative's acceptance of layout before excavating or planting. Make minor adjustments as required.

3.5 PROTECTION OF EXISTING PLANT MATERIAL

A. Erect the tree protection enclosures prior to commencing with site demolition work. Maintain fence during the entire construction period and remove when no longer needed, obtain approval from the Owner's Representative prior to removal.

B. Install the enclosure a minimum of 3' outside of the drip line of the tree or palm. Increase enclosure size for groupings of trees or in conditions where heavy equipment work may damage overhead branches. Set the posts a maximum of 10' on center, and stake to the ground. Perform work inside the enclosures by hand, where conditions

permit alternative methods, obtain approvals from the Owner's Representative for such work.

C. During the entire construction phase, provide ongoing maintenance of the existing plant materials, including watering, fertilizing, pest and disease control, and adjustments to the enclosures as directed by the Owner's Representative.

D. Trees damaged by construction shall be inspected by a certified arborist. Repair damaged trees as directed by the arborist. Replace trees damaged beyond repair as determined by the arborist, with the same species and of similar size or value. Repair, replacement, and inspections by the arborist, shall be at not additional expense to the Owner.

3.6 EROSION CONTROL

A. Install jute mesh on slopes over 3:1. After any grading, clearing and grubbing that is required, fine-grade the sloped planting areas to receive jute mesh, removing all surface rocks and debris greater than 2" in diameter.

B. Jute mesh shall be installed loosely on the slopes. Longitudinal seams of the jute mesh shall be at right angles to the slope contour lines. The installed mesh shall fit the soil surface contour and shall be held in place by 230 mm {9-inch} long, 3.05 mm (11-gage) (minimum) steel wire staples driven vertically into the soil at approximately 600-mm {24-inch} spacing. Jute mesh strips shall overlap the adjacent jute mesh a minimum of 150 mm {6 inches}. Ends of strips shall be buried into the soil a minimum of 150 mm {6 inches}.

3.7 SOIL PREPARATION

A. Proceed with this part of the work only after soil test analysis recommendations have been approved by the Owner's Representative.

B. Apply 50 lbs/1,000 SF of Gypsum to subgrade prior to tilling.

C. Rip or loosen native soil or subgrade for the entire extent of all planting areas except slope areas more than 3:1 to a minimum depth of **8 inches** without adding soil conditioner.

D. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter to a depth of ~~18"~~ 8" below finish grade and legally dispose of them off Owner's property.

E. Prepare areas within the driplines of existing trees by hand, do not use mechanical tillers.

F. Spread soil amendments, remaining gypsum and other amendments over all planting areas except slope areas more than 3:1 and mechanically till and blend to a depth of **8 inches.**

G. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

H. Use the soil amendments listed below for bidding purposes only. Materials and application rates may be modified after receipt of soils tests noted Part 3 Soils Tests.

Amendments	Rate or Quantity/1,000 SF.
Soil Amendment	4 cubic yards
Gypsum	100 lbs.
Pre-Plant Fertilizer	150 lbs.
Soil Sulfur	10 lbs.
Iron Sulfate	10 lbs
Mycorrhizal Soil Conditioner	20 lbs.
Humic Acid	50 lbs.
Soil Penetrating Agent	16 oz.

I. Float smooth and compact all soil preparation areas to 85% relative dry density, maintain positive drainage, flow lines, and swells to area drains, fine grade to within plus or minus 0.10 foot of the grades shown on the Drawings.

J. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

K. Before planting, obtain Owner's Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

L. Application of Mycorrhizal Fungi Soil Conditioner: Per the manufacturer's recommendations, broadcast dry product uniformly over prepared soil at application rates listed in the specifications.

M. Leaching process may be required to reduce the excess if the soils present high amounts of salinity or boron. The Owner's Representative will determine the leached process based on the test report.

3.8 PRE PLANT WEED CONTROL

A. Clear and remove existing weeds at least one-inch (1") below the soil surface.

B. Fertilize areas to receive planting with a 46-0-0 NPK commercial fertilizer at the rate of ½ lb. per 1,000 square feet.

C. After fertilization, irrigate the soil thoroughly and continuously at the equivalent of four inches (4") of water distributed over a fourteen (14) – day period. The application of water shall be applied to the soil as needed to gradually soak through the soil profile and not allowed to run-off the surface. Employ a specific watering duration and frequency program designed to germinate all residual weeds.

D. After sufficient weed germination is present, apply non-selective, post-emergent contact herbicide, in strict accordance to the Manufacturer's directions. Protect and buffer surrounding properties, buildings, and vegetation from overspray, as required.

E. Allow for a sufficient time period to ensure that the weeds are dead and the herbicide has dissipated, per the Manufacturer's recommendation.

F. Water planting areas thoroughly and continuously for a period of one (1) week after the application of the herbicide. Discontinue the watering process for one (1) day prior to the second application of the herbicide. Apply a second application of the herbicide. Avoid any irrigation for a minimum of four (4) days after the second application for effective weed kill.

G. After the second application and waiting period, water planting areas thoroughly and continuously for three (3) consecutive days to saturate upper layers of the soil prior to commencing planting operations.

H. Dead weeds shall be cleared and removed prior to planting.

I. Maintain a weed-free Project Site until final acceptance by the Diocese, utilizing mechanical, chemical or manual treatment.

3.9 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
   1. Excavate planting pits at least twice the diameter for container-grown stock rootball.
   2. Do not excavate deeper than depth of the root ball less one inch, measured from the root flare to the bottom of the root ball.
   3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
   4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
   5. Maintain supervision of excavations during working hours.
   6. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
   7. If subdrainage is shown on Drawings or required under planting areas, coordinate planting operations with installation of subdraiange.

B. Obstructions: Notify Owner’s Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

C. Drainage: Notify Owner’s Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

D. Subsoil and topsoil removed from excavations may be amended and used as planting backfill mix.

3.10 PERCOLATION TESTING

A. Locate and prepare five (5) minimum percolation test pits per the direction of the Owner's Representative. Refer to drawings for locations of percolation pits.

B. Excavate the pits as described under the Excavation for Trees and Shrubs section, remove all loose material, and fill the pits with six inches (6") of water. After 12 hours refill with the same amount of water. Six hours after the second filling, inspect the pits with the Owner's Representative and document locations where water remains in the pit.

C. If percolation problems occur, provide means and methods for correcting said problems. Planting operations at the locations identified shall be suspended as necessary or as directed by the Owner's Representative. Payment for corrective work shall be in accordance with the provisions of the General Conditions. Proceeding with the work without written approval, does not entitle the Contractor to additional compensation for corrective work.

D. If percolation problems occur, drill 8-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 5 feet below the bottom of rootball whichever is less, and backfill with drainage gravel and 4"diameter perforated PVC pipe open to below. Cap with appropriate grate, see AERATION TUBES Part 2.

3.11 TREE, SHRUB AND GROUNDCOVER PLANTING

A. To leach saline and sodic salts from the soil, fill all excavations with water and allow to percolate away before positioning trees and shrubs.

B. Notify the Owner's Representative of conditions where hardpan, adobe clay, or inadequate subgrade compaction are encountered. Planting operations at the locations identified shall be suspended pending corrective action.

C. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

D. Remove injured roots by cutting cleanly; do not break.

E. Use the soil amendments listed below for bidding purposes only. Materials and application rates may be modified after receipt of soils tests noted Part 3 Soils Tests.

1. Backfill mixture for all plants shall be thoroughly blended, consisting of the following:

Soil Amendment	1 part
Existing Soil	3 parts
Iron Sulfate	2 lb/cy of mix
Soil Sulfur	1 lb/cy of mix
Gypsum	25 lb/cy of mix
Pre-plant Fertilizer (5-3-1)	18 lb/cy of mix
Mycorrhizal Inoculum Soil Conditioner	10 lb/cy of mix

Humic Acid	3lb/cy of mix
Soil Penetrating Agent	1-2 oz./Gallon

F. Place planting tablets in the planting pits at the following rates:

Plant Size	Quantity	Tablet Size
liner and flat size plant	1	5 gram
1 gallon container	1	21 gram
5 gallon container	2	21 gram
15 gallon container	3	21 gram
box specimen	2	21 gram for each 12” of box size

G. Set container stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades or as indicated in the Drawings.
1. Use planting soil listed above for backfill.
2. Do not use planting stock if root ball is cracked or broken before or during planting operations.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts listed in the specifications. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole and do not place plant tablets in direct contact with the rootball.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.
6. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.12 AERATION TUBES

A. Wrap tubes with the fabric and set plumb in opposite corners of the planting pit. Place gravel and backfill mix as shown on the Drawings. Tubes to remain open to below. Knot filter fabric sock to prohibit sediment from getting into tubes. Cut tubes to 2” above finish grade and cap with a drain grate.

3.13 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.14 TREE STABILIZATION

A. Upright Staking and Tying: Per the Drawings.

B. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.15 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 120 inches (1500 mm)] in each direction from the tree trunk, for a total distance of 20 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
   1. Position top of root barrier at finished grade of soil unless otherwise directed. Adhere root barrier product in place using fabric pins or other measures. Secure fabric every two feet for entire length of installation. Adhere to edging or hardscape.
   2. Overlap root barrier a minimum of 12 inches (300 mm) at joints.
   3. Do not distort or bend root barrier during construction activities.
   4. Do not install root barrier surrounding the root ball of tree.

3.16 PLANTING AREA MULCHING

A. The entire limit of all planting areas shall receive landscape mulch unless otherwise specifically stated. Note that the drawings do not show mulch hatch patterns underneath plant symbols for graphic purposes only. The intention is that the entire planted area including the areas underneath the planting symbols shall receive organic mulch unless otherwise indicated as mineral mulch.

B. Organic Mulch: At the completion of the planting work, rake smooth the areas indicated on the Drawings, and spread a 3” layer of mulch over the areas. Within 3’ of flatwork, headers, curb, and mow edges, taper or reduce the depth to 2”. Keep mulch 2 feet away from tree trunks and 4-6” away from shrub stems.

C. Gravel/D.G. Mulch: At the completion of the planting work, rake smooth the areas indicated on the Drawings, and spread a 3” layer of gravel/DG. over the areas.

D. Stone Mulch: At the completion of the planting work, rake smooth the areas indicated on the Drawings. Depth of rock mulch shall be as indicated on the Drawings or 1 ½ times the size of the largest stone size. Keep mulch 2 feet away from tree trunks and 4-6” away from shrub stems.

3.17 TREE GRATE INSTALLATION

A. Tree Grates: Set grate segments flush with adjoining surfaces as shown on Drawings. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- (75-mm-)

minimum growth radius around base of tree; break away units of casting, if necessary, according to manufacturer's written instructions.

3.18 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.19 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Written permission is required.

C. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

3.20 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.21 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

SECTION 03 33 01

LANDSCAPE ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies cast-in-place Landscape Architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes for the following:

1. Exterior Site Concrete Walls shown on Landscape Plans (planting wall, seat wall, freestanding wall except retaining wall and exterior stair)
2. Exterior landscape concrete header and landscape concrete curb.
3. Miscellaneous Cast-In-Pace Concrete foundation/ footings for site furnishing and fence posts.
4. Expansion joints, Contraction joints, Isolation joint and Sawcut joints.
5. Steel dowel, sleeves and steel reinforcement.
6. Clear anti-graffiti coating for exterior concrete

B. Related Sections include the following:

1. Division 03 Section "Cast-In-Place Concrete" for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.

2. Division 05 Section “Decorative Railings” for fabrication and installation requirements for pipe and tube railings.

3. Division 31 Section "Earth Moving" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.

4. Division 32 Section "Decorative Concrete Paving" for Landscape Architectural concrete pavement and flatwork finishes.

5. Division 32 Section “Plants” and “Netlon Turf System” for coordination with adjacent planting areas.

6. Division 32 Section “Planting Irrigation” for coordination with adjacent irrigation systems.

1.2 DEFINITIONS

A. Identify cast-in-place Landscape Architectural concrete on Drawings and distinguish from structural concrete and other cast-in-place concrete not considered to be architectural.

B. Cast-in-Place Landscape Architectural Concrete: All exterior formed concrete shown on the Landscape Plans except for walkways requiring special concrete materials, formwork, placement, or finishes to obtain specified Landscape Architectural appearance.

C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

D. Design Reference Sample: Sample designated by Owner Representative in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place Landscape Architectural concrete.

E. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.3 SUBMITTALS

A. Comply with Submittal Procedures and Section 011813.13 - Sustainable Design Requirements.

B. Product Data: Furnish manufacturer's product specifications and installation instructions for the following and for each type of product indicated.
1. Integral color/ color admixture
2. Form release agent
3. Dowels
4. Curing agents
5. Clear sealer
6. Expansion joint filler material
7. Fiber reinforcement
8. Joint sealant
9. Finish retardant
10. Form materials
11. Anti-graffiti coating for exterior concrete

C. Product Samples: Submit one pound samples, clearly identified, for each component used to prepare each paving type, including but not limited to:
1. Coarse Aggregate

D. Design Mixtures: Furnish certified reports of proposed mix design for each type of concrete installation. For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.

E. Paving Mix Designs: Provide documentation for each paving type specified on Drawings that will enable Owner Representative's Authorized Representative's to better match replaced concrete:

F. Laboratory and Cement Test Reports: Submit six (6) copies of laboratory test reports for concrete materials and a certificate with each concrete mixer truck,

stating mix design, PSI, rating, slump, water and cement quantity, cement/water ration, fine and coarse aggregate and color additives.

1. Cement:
   a. Manufacturer and plant location.
   b. Cement type, i.e. Type I, II, III, or V.
2. Admixtures:
   a. Manufacturer and plant location.
3. Sand:
   a. Source and Type.
4. Aggregates:
   a. Source and Type.
5. Signed certification from a licensed structural engineer.

G. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place Landscape Architectural concrete.

H. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

I. Samples: For each of the following materials:

J. Expansion joint color samples

K. Samples in paragraph below may or may not be representative of a contractor's production on a project. Although the practice of manufacturing samples of plant-precast architectural concrete is widespread, samples of cast-in-place architectural concrete may be difficult to reproduce in the field.

L. Samples for Verification: Landscape Architectural concrete Samples, cast vertically, approximately 18 by 18 by 2 inches of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.

M. Coordinate paragraph below with qualification requirements in Division 01 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.

N. Qualification Data: For installer.

1. Installer Qualifications: Provide evidence to indicate successful experience in providing decorative concrete work similar to that specified herein and can demonstrate successful experience through past Project documentation and references. The bidder, or the bidder’s subcontractor shall sign and provide information herein attached as part of bidding requirement for installer qualification.

2. Experience: Minimum 5 years experience in the installation of specialty concrete paving.

3. Demonstration of Experience: 10 Projects which have been completed within the past 36 months utilizing similar products, scope and complexity.

4. Supervision: Perform placement and finishing of concrete work under supervision of a person having a minimum of 5 years of experience in placement and finishing of products specified herein.

5. Submit qualifications to Owner Representative's Authorized Representative for information purposes. Submit a resume of Project Manager and Superintendent who will be overseeing the Work.

O. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

P. Material Certificates: For each of the following, signed by manufacturer:

1. Cementitious materials.
2. Steel reinforcements and reinforcement accessories
3. Fiber reinforcement
4. Admixtures.
5. Curing Compounds
6. Applied finish materials
7. Joint materials
8. Form materials and form-release agents.
9. Repair materials.

Q. Certification that Owner's Representative Reference panels have been reviewed and that materials and processes provided will achieve intended effects indicated on Owner's Representative Reference panel.

R. Field quality-control test reports.

S. Minutes of pre-installation conference.

T. Delivery slips.

1.4 QUALITY ASSURANCE

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

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency acceptable to the Owner qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cast-in-Place Landscape Architectural Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from one manufacturer with resources to provide cast-in-place Landscape Architectural concrete of consistent quality in appearance and physical properties.

D. The total estimated requirement of architectural aggregate plus anticipated losses and waste shall be procured from one source of supply. The Contractor

will assure that the source of supply is adequate to provide, throughout the duration of the project, an aggregate which is uniform in size, color and shape. Should an aggregate be elected in which there is doubt about the quantity of a uniform supply, the Contractor shall require the supplier to remove the entire amount from the pit, mine or river and thoroughly mix and stockpile said aggregate for exclusive use of this project.

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Mix Designs: Mix Designs are required for all types and strengths of concrete. The Mix Designs are reviewed for contract conformance by the Owner's Materials Testing Company.

G. Continuous Inspection: Continuous Inspection of concrete work will be provided for all structural concrete.

H. Indicate location, size, and other details of mockups on Drawings or by inserts. Revise wording if only one mockup is required.

I. Field Mock-ups: Before casting Landscape Architectural site concrete wall, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Mock up: Prepare at the job site, 18" x 18" x 36" H cured sample panel of Each wall type and 48" long cured sample of landscape concrete header and landscape curb for each type, for color and texture approval. Sample panels shall be constructed using materials and methods to be used in the work. Sample panels shall be cured a minimum of 10 days prior to review by Owner's Representative. Construct the sample panels where directed at the job site.
   2. Include anti-grafitti coating and water repellant sealer on the full-length and height of mock-up. The application must use manufacturer-approved application methods, determining actual requirement for surface preparation, coverage rate, number of coats, and application procedures.
   3. Build mockups using identical materials, design mix and methods to be used in the work.
   4. Mix Design: The concrete mix design used to prepare the sample panels shall be identical to that used for the project's landscape architectural concrete
   5. Demonstrate curing, cleaning, and protecting of cast-in-place Landscape Architectural concrete, finishes, and contraction joints, as applicable.
   6. Mockups shall be cured a minimum of 10 days prior to review by the Owner's Representative.
   7. In presence of Owner's Representative, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
   8. Mock-up shall serve as the standard for quality and shall be located on project site. Mock-up shall be stand-alone and may not be part of the permanent installation.

9. Obtain Owner's Representative's approval of mockups before casting Landscape Architectural concrete.
10. The contractor shall be back charged for the costs of the Owner's Representative to review more than two (2) mock up attempts.
11. Remove mock ups from the job site when directed and dispose legally.

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place Landscape Architectural concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Cast-in-place Landscape Architectural concrete subcontractor.

2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place Landscape Architectural concrete.

K. Graffiti: Contractor shall provide, at Contractor's expense, security to ensure that the concrete surface shall remain free of graffiti until sufficiently hardened.

1.5 PROJECT CONDITIONS

A. Delete this Article if not required.

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

1.6 DELIVERY AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Water Stops: Store water stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.7 REGULATORY REQUIREMENTS

A. Testing: Slump tests shall be taken to certify compliance with mix design. Slump shall be in accordance

B. Mix design shall be in accordance with ACI 211-6.with ASTM C 143.

C. Conform to applicable laws, codes, and regulations required by authorities having jurisdiction over the work.

1.8 SITE CONDITIONS

A. Do not place concrete when subbase surface temperature is less than 40 degrees F, nor when surface is wet.

1.9 COORDINATION

A. Ensure that irrigation sleeves, electrical conduit, food cart outlets, and other utility elements are accommodated and as-built located prior to pouring concrete.

1.10 INSPECTION OF SITE

A. Verify conditions at site affect Work of this Section, and take field measurements as required. Report major discrepancies between Drawings and field dimensions to Owner Representative's Authorized Representative prior to commencing work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

A. Admixtures containing chlorides may not be used.

B. Hardener Treatment: All finished floors which will be left exposed shall be treated with a hardener to prevent cement dusting.

C. Non-Slip Surfacing: Ramps, treads and stair platforms shall have a non-slip aggregate surfacing when not covered with finish flooring materials.

D. For slabs on grade, maximum water cement ratio is 0.45.

2.3 FORMING MATERIALS

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork and other form-facing material requirements.

B. All forms shall be new; no reused or reconditioned forms will be permitted. Forms for landscape architectural concrete shall be built so that they are

completely rigid, strong enough to withstand without deflection, movement or leakage, the high hydraulic pressures which result from rapid filling and heavy frequency vibration. All materials shall be new at start of work.

C. Fasteners shall be formed galvanized steel or other approved non-corrosive steel materials.

D. Form-Facing Materials for Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlaid plyform, Class I or II. Use for surfaces to have a Plyformed finish.

E. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

F. Rustication Strips: Metal, rigid plastic, or dressed wood with sides beveled and back kerfed; nonstaining; in longest practicable lengths.

G. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.

H. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS, that adheres to form joint substrates.

I. Form Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
   1. Acceptable Manufacturers:
      a. W.R. Grace Company "Formfilm”
      b. Nox-Crete Chemicals, Inc. "Pre-Form”
      c. Hunt Process Co. "Seal Form-L”

J. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect Landscape Architectural concrete surfaces, that is compatible with the sealer and will not impair subsequent treatments of those surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Final acceptance of form release agent depends on proven performance on mock up panels.
3. Acceptable Manufacturers:
   a. Brickform Liquid Release, (909) 484-3399.

K. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
   1. Acceptable Manufacturers:
      a. Top Cast/ Top Face by Grace Products
      b. Rugasol

L. Form Ties: Factory-fabricated, As indicated on the Drawings or ¼" snap ties or for types requiring extra support 3/8" dia she bolts compatible with 1" dia cones. Ties shall be designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

M. Stripping Gaskets: Resilient rectangular material non-absorbent and non-staining at junctions of formwork and at junctions for forms with columns and beams as required to permit removal and reuse of formwork without damage.

N. Form Gaskets: 1/8" x ½" adhesive backed foam tape.
   1. Acceptable Manufacturers:
      a. Burke Company
      b. Norton Sealants
      c. Arlon Co.

O. Chairs and spacers: Solid plastic of color matching landscape architectural concrete

2.4 STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."

   1. Where legs of wire bar supports contact forms, use gray, all-plastic, CRSI Class 1, gray, plastic-protected, or CRSI Class 2, stainless-steel bar supports.

2.5 ABRASIVE STAIR NOSINGS

A. Provide in contrasting colors, install at all treads and top landing of exterior stairs in compliance with California Building Code requirements.

B. Acceptable Manufacturer:
      a. Refer to architect detail and specification.

2.6 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type II, gray or white as needed to achieve desired color effect.

    a. Fly Ash: ASTM C 618, Class F.
    b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
    c. Silica Fume: ASTM C 1240, amorphous silica.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse Aggregate Size: 3/4 inch nominal. Cleanliness value shall not be less than 75 when tested in accordance with California Test 227.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement. Sand Equivalent shall not be less than 75 when tested in accordance with California Test 217.
3. Gradation: Uniformly graded.

C. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

2.7 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Color: As indicated on the Drawings or as selected by Owner Representative from manufacturer's full range.

2.8 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. For integrally colored concrete, curing compound shall be pigmented type approved by color pigment manufacturer.
2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.9 REPAIR MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

1. Types I and II, non-load bearing; IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of cast-in-place Landscape Architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Mix design shall be the responsibility of the Contractor.
2. Contractor shall employ a Testing Laboratory approved by the Owner Representative under the active direction of the Civil Engineer, who shall determine mix designs to fulfill the specified requirements for strength, aggregate size and workability of concrete, and such designs shall be used in proportioning all structural concrete.
3. Mix designs shall be submitted to the Owner Representative for review at

least 10 days prior to scheduled concrete pour.
4. Review by the Owner Representative shall not be considered unqualified approval, and shall not relieve the Contractor of his responsibility to furnish concrete of proper consistency and specified strengths.
5. Provide concrete of the strengths indicated in the structural general notes

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

C. Proportion concrete mixtures as follows:

1. Compressive Strength (28 Days): As indicated on the Drawings or 3000 psi (20.7 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.46.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

D. Cementitious Materials: For cast-in-place Landscape Architectural concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.

E. Limit water-soluble, chloride-ion content in hardened concrete to [**0.06**] [**0.15**] [**0.30**] [**1.00**] percent by weight of cement.

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

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

2.11 CONCRETE MIXING

A. Ready-Mixed Landscape Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

1. Clean equipment used to mix and deliver cast-in-place Landscape Architectural concrete to prevent contamination from other concrete.
2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.12 ANTI-GRAFFITI COATING:

A. Anti-Graffiti Coating: Non-Sacrificial anti-graffiti coating, a single part system that provides a tough and durable graffiti resistant finish. A cross-linking co-polymer material coating that dries clear, non-yellowing.
1. Acceptable Manufacturer:
Rainguard International Inc.; 1079 Culpepper Dr. Conyers GA. 30094

Ph. 949-675-2811 Fax 949-675-3450

2. Product:
   VandIguard TEN System non-sacrificial anti-graffiti coating with a one coat of “Micro-seal” water repellant and three-coats system of VandIguard anti-graffiti coating.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork, embedded items, and shoring and reshoring.

B. The design, engineering and construction of forms shall be the Contractor’s responsibility.

C. Construct forms to shape, lines and dimensions of architectural concrete members. Spacing of studs, ties and other supporting members shall be such to support maximum pressures imposed by the wet concrete (mix). Final concrete surfaces shall conform to tolerances as specified.

D. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

E. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place Landscape Architectural concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

   1. Class A, 1/8 inch (3.2 mm)

F. Fabricate forms to result in cast-in-place Landscape Architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Tolerances: In addition to ACI 117, comply with the following tolerances:
   1. Tolerances shall not be cumulative.
   2. Variation from plumb for lines and surface of columns, walls, beams and arises:
      a. In any 10' length: 1/8".
      b. Maximum for entire length: 1/2".
   3. Variation from the level or from the indicated elevations of tops of slabs, beams, and arises:
      a. Across Top: 1/8".
      b. In any 10' length: 3/16".
      c. In any bay or in any 20' length: 1/4".
      d. Maximum for entire length: 1/2".
   4. Deviation from Round:
      a. Out of round, 1/4".

H. Failure to comply with these limits will result in the Contractor, at his expense, filling and/or grinding the sub-standard surfaces, or if this is deemed impossible by the Owner Representative's Representative, then the concrete section shall be removed and reconstructed at no expense to the Owner Representative.

I. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.

1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
2. Do not use rust-stained steel form-facing material.

J. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

K. Do not chamfer exterior corners and edges of cast-in-place Landscape Architectural concrete.

L. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.

M. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Forms shall be tight to prevent concrete loss. Corner chamfer strips are not allowed, making mandatory especially tight well designed corners of the forms. Continuous girts and blocking shall be provided behind all plywood butt joints not backed.

Q. All forms shall be cleaned of extraneous loose material with compressed air, and thoroughly inspected before use. Forms with clips, dents, damaged corners or edges, scratches, gouges or other defects that will transfer to the concrete surface will be discarded. Forms shall be thoroughly wetted just before concrete placement. Have sufficient equipment available to allow for these procedures.

R. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

S. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

T. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 REINFORCEMENT AND INSERTS

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Schedule form removal to maintain surface appearance that matches approved mockups.

B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place Landscape Architectural concrete surfaces.

3.4 JOINTS

A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place Landscape Architectural site concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner’s Representative.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
3. Space vertical joints in walls as indicated on the Drawings or 16'-0" max. on center as approved by the Owner's Representative. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

B. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place Landscape Architectural concrete so strength and appearance of concrete are not impaired, at locations indicated on the Drawings or 8'-0" on center as approved by Owner's Representative.

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 concrete develops random contraction cracks.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

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

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Owner's Representative.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.

E. 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 average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 FINISHES, GENERAL

A. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

B. Maintain uniformity of special finishes over construction joints, unless otherwise indicated.

3.7 AS-CAST FORMED FINISHES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.

B. Rubbed Finish: Apply the following to smooth-form-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

3.8 EXPOSED-AGGREGATE FINISHES

A. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed. Rinse scrubbed surfaces with clean water. Maintain continuity of finish on each surface or area of Work. Remove only enough concrete mortar from surfaces to match design reference sample or mockup.

B. High-Pressure Water-Jet Finish: Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa). Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.

1. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in reveal projection to match design reference sample or mockup.

C. Sandblast Finish: Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa). Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform

results. Surfaces shall be free of ruts, grooves, dimples, or swirl marks resulting from the sandblast operations. Edges shall be crisp and true to lines, and have finishes consistent with the field.

1. Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample provided by Owner's Representative.
2. Abrasive Blasting: Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge finish as well as prevent blast damage to adjacent surfaces and landscaping. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
3. Use same nozzle, nozzle pressure and blasting technique as used to prepare initial mock-ups. Exercise care to provide even and consistent strokes with air nozzle to minimize pockmarking of paving surface.
4. Cleanup and remove expended sand particles, concrete dust, loose aggregate, and other work-related debris at end of each day's blasting operations.
5. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match design reference sample or mockup, as follows:
    a. Light: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; with maximum reveal of 1/16 inch (1.5 mm).
    b. Medium: Generally expose coarse aggregate; with slight reveal, a maximum of 1/4 inch (6 mm).
    c. Heavy: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter; with reveal range of 1/4 to 1/2 inch (6 to 13 mm).
6. Cleanup and remove expended sand particles, concrete dust, loose aggregate, and other work-related debris at end of each day's blasting operations.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to exterior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Site Furnishing Concrete Foundations and Post Foundations: Provide foundations as shown on Drawings.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Coordinate curing methods with form removal, especially for as-cast finishes. Concrete in beams, columns, and undersides of slabs may be cured with forms left in place if intended surface appearance and color remain uniform as verified on sample panels or mockups.

C. Begin curing cast-in-place Landscape Architectural concrete immediately after removing forms from concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:

1. Moisture Curing: Keep exposed surfaces of cast-in-place Landscape Architectural concrete continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 ANTI GRAFFITI COATING

A. Apply materials in strict accordance with manufacturer's recommendations and when substrate surface temperature is above 45 degrees F.
    1. Follow instructions in manufacturer's current technical data sheet for general information and coverage rates.

B. Mix materials in strict accordance with manufacturer's instructions; do not dilute unless permitted by manufacturer.

C. Airless spray brush to be used for non-smooth surfaces. Test a small area before applying to the entire surface.

D. Clean all drips, runs, and overspray residue while still wet.

E. Allow coating to dry and become clear before applying subsequent coats. Achieve a uniform pinhole free, continuous film.

F. During process of work, remove discarded coating materials, rubbish, cans, and rags at end of each workday.

3.12 FIELD QUALITY CONTROL

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for field quality-control requirements.

3.13 REPAIRS, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of cast-in-place Landscape Architectural concrete when approved by Owner's Representative. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

1. Remove and replace cast-in-place Landscape Architectural concrete that cannot be repaired and cured to Owner's Representative approval.

B. Protect corners, edges, and surfaces of cast-in-place Landscape Architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place Landscape Architectural concrete from staining, laitance, and contamination during remainder of construction period.

D. Clean cast-in-place Landscape Architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

E. Wash and rinse surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.

1. Do not use cleaning materials or processes that could change the appearance of cast-in-place Landscape Architectural concrete finishes.

END OF SECTION 033301

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Include all services, labor, materials, transportation, tools and equipment necessary to perform the work indicated on the Drawings and specified herein as required to properly complete the work in this contract.

B. This Section includes the following:

1. Bike Racks
2. Trash Receptacles
3. Recycling Receptacles
4. Benches
5. Bollards

1.2 RELATED SECTIONS

A. Division 03 Section "Landscape Architectural Concrete" for installation of pipe sleeves cast], installation of anchor bolts cast, and formed voids in concrete footings.

B. Division 31 Section "Earth Moving" for excavation for installation of concrete footings

C. Division 32 Section "Decorative Concrete Paving"

1.3 SUBMITTALS

A. Comply with Submittal Procedures and Section 011813.13 - Sustainable Design Requirements.

B. All submittals shall comply with Division 1 submittal procedures. Submit the following:

1. Product Data: Include product data sheets, and shop drawings for each type of product indicated.
2. Representative samples of factory-applied colors and finish for each product.
3. Manufacturer’s instructions, maintenance recommendations, and warranty
4. Samples:

a. Samples for Initial Selection: For units with factory-applied color finishes.

b. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Size: Not less than 6-inch- long linear components and 4-inch-square sheet components.

1.5 SITE CONDITIONS

A. Prior to commencing with work, review on site grading conditions, including sub grade conditions, verify the elevations, and dimensions, and notify the Owner's Representative of unsatisfactory conditions. Proceeding with the work constitutes acceptance of existing or corrected conditions.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishings through one source from a single manufacturer.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Trash or Recycling Receptacle Inner Containers: Full-size units equal to 5 percent of amount installed for each size indicated, but no fewer than 2 units.

2. Anchors: For each product specified.

PART 2 - PRODUCTS

2.1 FURNISHINGS

A. Bike Rack: See Landscape Drawings for type.

B. Trash Receptacles: See Landscape Drawings for type.

C. Recycling Receptacles: see Landscape Drawings for type.

D. Benches Type 1: see Landscape Drawings for types.

E. Bollards Type 1: see Landscape Drawings for types.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify exact locations for all furnishings coordinate installation and equipment with the Owner's Representative.

1. Bicycle Racks: Embedded mount per manufacturer's specifications at location

indicated.

2. Trash Receptacles: surface mount per Manufacturer's Recommendations.

3. Recycling Receptacles: surface mount per Manufacturer's Recommendations.

4. Benches: Install per the Drawings and per Manufacturer's Recommendations

B. Exercise care so as not to damage finishes. Repair all damaged surfaces, or replace as directed by the Owner's Representative.

3.2 ACCEPTANCE

A. Review and acceptance of the placement and installation shall be performed by the Owner's Representative. Provide notification at least forty-eight (48) hours prior requested inspection time and date.

3.3 CLEAN-UP

A. Perform cleaning during installation of the work and upon completion of the work. Remove from the site all excess materials, debris, and equipment.

END OF SECTION 12 93 00

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 32 Section "Decorative Concrete Paving" for constructing joints in concrete pavement.

2. Division 33 Section “Landscape Architectural Concrete” for constructing joints at concrete walls and other appurtenances.

1.3 SUBMITTALS

A. Comply with Section 13 33 00 Submittal Procedures and Section 01 10 10 - Sustainable Design Requirements.

B. Product Data: For each joint-sealant product indicated.

C. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. Qualification Data: For Contractor.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

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

4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the [commencement of] the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg.

3. When joint substrates are wet or covered with frost.

4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Design Consultant from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

B. One part moisture curing polyurethane sealant designed for caulking applications of exterior horizontal joints. Self-leveling and compatible for uses with the expansion material.

1. Products:

a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.

b. Polytite

c. Tremco

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Contractor present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION