

SECTION 03 48 24

PRECAST CONCRETE COLUMBARIUM UNITS

PART 1 GENERAL

1.1 SUMMARY

- a. This section covers the manufacturer and installation of precast concrete columbarium units as shown on the drawings and specified herein, including but not limited to: the steel reinforcement, steel embedment plates, required sleeves, finished exposed surfaces, preparation of setting surface, adhesive, columbarium units fasteners, and niche cover anchor clip assemblies.
- b. Acceptable designs of the columbarium units components are provided as shown on the Drawings. The Contractor may use this design for this Work or may propose alternate designs of the corresponding components as follows:
  - (1) Design for alternate columbarium units shall comply with the design criteria as per Article 1.4 f. and further, if required by the Contractor, shall comply with the functional tests as per Article 1.4 g. of this Specification.
  - (2) Unless indicated otherwise, all provisions of this Specification shall apply to the Contractor proposed design.
- c. The Government may accept or reject part or all of any design proposed by the Contractor.
- d. This section includes finishing and staining/coating of exposed faces of the columbarium units as indicated on drawings or described herein.
- e. This section covers acceptance and installation of the Government provided niche covers, one for each niche of the new columbarium units.

1.2 RELATED DOCUMENTS

- a. Section 03 30 00 CAST-IN-PLACE CONCRETE, for concrete pilings, foundations, and formwork.
- b. Section 04 72 00 CAST STONE MASONRY VENEER for veneer on columbarium
- c. Section 04 72 10 CAST STONE CAPS FOR COLUMBARIUM MEMORIAL WALL AND COLUMNS
- d. Section 04 73 00 COLUMBARIUM NICHE COVERS for granite niche covers.
- e. Section 07 14 00 FLUID-APPLIED WATERPROOFING for waterproofing on walls
- f. Section 07 92 00 JOINT SEALANTS, Materials and Workmanship for sealant application.

- g. Section 32 93 00 EXTERIOR PLANTS, for decorative crushed stone.
- h. Section 31 00 00 EARTHWORK

### 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A615/A615M	(2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants

#### AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 533.3R	(1970) Fabrication, Handling and Erection of Precast Concrete
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#### **NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)**

<b><i>NPCA QC Manual</i></b>	<b><i>(2013) Quality Control Manual for Precast Plants (Amendment 2)</i></b>
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### 1.4 SUBMITTALS

Government approval by the SRE/CO is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval; the Government reserves the right to review and comment on submittals not having a "G" designation; and submittals with an "L" are for LEED review. LEED review shall be performed by the Contractor's LEED Coordinator and the LEED Administrator. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 01 33 29 LEED(TM) DOCUMENTATION as applicable:

SD-02 Shop Drawings

Precast Concrete Columbarium Units; G

Complete shop and erection drawings of all precast concrete columbarium units, showing all dimensions and details of construction, installation and relation to adjoining work, reinforcements, anchorage, attachments, inserts, location of all pre-drilled sleeves and other items to be installed in the work of other trades, joint treatment and sealant, water-proofing, joint alignment coordinated with columbarium pre-cast cap joints, and other work required for a complete installation. Provide evidence that the Contractor to be installing the cast in place concrete foundations for the columbarium and pier units has been contacted prior to any work relating to the footings for the columbarium construction, and that the construction of the concrete support (foundations) work has been coordinated with the precast columbarium unit manufacturer and installer.

SD-03 Product Data

Precast Concrete Columbarium Units

Manufacturer's Literature and Data for the following:

- a. Each type of Concrete Fastener, including adhesive and anchor devices.
- b. Instructions for final cleaning
- c. Concrete stain/coating, including color charts of manufacturers standard color palette (If applicable for this project.)

SD-04 Samples

Fastener System

Submit sample of all fastening systems, mounting hardware and exposed surface finishes including, but not limited to, the following:

- a. Stainless Steel Angle
- b. Stainless Steel Bolt, Nut and Washers
- c. Tamper Proof Stainless Steel Bolt
- d. Stainless Steel Expansion Anchors, Bolts and pins
- e. Stainless Steel Ferrule loop insert.
- f. Shims
- g. Exposed front of columbarium
- h. Adhesives, sealants, flashing, waterproofing and grouts.

Mock-Up of Double Columbarium; G  
Mock-Up of Single Columbarium; G

SD-07 Certificates

Manufacturer Qualifications; G

Manufacturers qualifications specifying precast concrete columbarium units meet the requirements of ACI 533.3R and as specified.

1.5 QUALITY ASSURANCE

- a. Manufacturer's Qualifications: Prior to commencement of work, Contractor shall submit documentation regarding the experience of his precast concrete supplier in the design and manufacture of Precast Concrete structures and custom units.
- b. Precast concrete manufacturer's qualified Registered Professional Structural Engineer to certify that precast reinforced concrete conforms to specified requirements.
- c. Codes and regulations of the Federal, State and County authorities shall apply.
- d. Fabricate to dimensions shown or approved. Replace or correct Columbarium Units that do not comply with the individual dimensions and tolerances.
- e. Construction Tolerances: Most stringent construction tolerances indicated anywhere in the contract documents will be applicable for columbarium construction regardless of any conflicting information.
- f. Design Criteria:
  - (1) The Columbarium Units shall be of the following type, style, and size:
    - (a) Type: Precast concrete, reinforced.
    - (b) Size: Interior and exterior dimensions as indicated on plans.
  - (2) Columbarium unit top shall be capable of structurally supporting imposed service live load of no less than 50 lb./ sq ft, and dead loads based on stone veneer thickness and heights, including material composition and element section properties, mortar and grout, and dead loads based on concrete top element sectional properties.
  - (3) The Contractor shall submit to the SRE/CO for review and approval 5 sets of design documentation showing structural design of the complete Columbarium unit. This documentation shall include dimensions, methods of construction, and calculations. All design calculations and drawings shall be signed and sealed by qualified Professional Structural Engineer.
- g. Functional Load Tests: If required by the SRE/CO, a functional load test will be made at the Contractor's expense to ensure that the columbarium proposed by the Contractor, as furnished, will be

capable of supporting loads stated in Article 1.4.f.(2). The functional test will consist of 2 loading conditions:

Unconfined Loading: The columbarium unit will be placed on a flat surface with no support against the sides. The entire top of the columbarium will be subjected to a simulated uniform load of live load of 50 lb./sq ft and required dead load simulating stone veneer, mortar, and grout as they will be installed. The load will be maintained for no less than 72 hours. At end of the loading period, the maximum deflection of the Columbarium top elements shall be no more than 1/8-inch. Upon removal of the load from the unit the residual deflection shall be no more than 1/16-inch and concrete elements shall be free of all structural distress.

h. Production Drawings:

- (1) Elevation view of each structural element.
- (2) Planametric view of unit.
- (3) Sections and details to show quantities and position of reinforcing steel, anchors, inserts, and essential embedded and non-embedded hardware for fabrication, handling, transportation and installation.
- (4) Lifting and erection inserts.
- (5) Dimensions and finishes.
- (6) Method of transportation.
- (7) Method of erection and handling.

i. Columbarium Manufacturer and/or Installer shall coordinate with Cast-in-Place Contractor to ensure that required clearance for all columbarium placement at courts has been provided including all connection weld plates as indicated on drawings prior to concrete pouring.

1.6 MOCK-UPS

1.6.1 Mock-Up of Double Columbarium

Construct mock up of double columbarium of length necessary to show a complete section including but not limited to:

- a. Double wide columbarium with all items as detailed including but not limited to: foundation, waterproofing system, sealant, cast stone cap, toe kick with cast stone veneer, decorative crushed stone floral strip with installed drainage.
- b. End column including but not limited to: cast-in-place column, foundation, moss rock stone veneer, and cast stone cap.
- c. Intermediate cast-in-place column with integral color and foundation.
- d. Granite niche cover and installation hardware.

- e. Signage including wall identification number with granite plaque, and columbarium niche row and column numbering.
- f. Reinforcing steel, anchors, inserts, and essential embedded and non-embedded hardware for fabrication, handling, transportation and installation.

Approved section shall become the standard of comparison and remain in place until completion of columbarium work. Sample may be incorporated into completed columbarium.

#### 1.6.2 Mock-Up of Single Columbarium

Construct mock up of single columbarium with retaining wall of length necessary to show a complete section including but not limited to:

- a. Double wide columbarium with all items as detailed including but not limited to: foundation, waterproofing system, sealant, cast stone cap, toe kick with cast stone veneer, decorative crushed stone floral strip with installed drainage.
- b. End column including but not limited to: cast-in-place column, foundation, moss rock stone veneer, and cast stone cap.
- c. Intermediate cast-in-place column with integral color and foundation.
- d. Granite niche covers installation.
- e. Signage including wall identification number with granite plaque, and columbarium niche row and column numbering.
- f. Reinforcing steel, anchors, inserts, and essential embedded and non-embedded hardware for fabrication, handling, transportation and installation.
- g. Retaining wall with all waterproofing.
- h. Moss rock veneer on back of free-standing single columbarium.

Approved section shall become the standard of comparison and remain in place until completion of columbarium work. Sample may be incorporated into completed columbarium.

#### 1.7 MANUFACTURER QUALIFICATIONS

- a. Precast concrete columbarium units shall be product of manufacturer who has a minimum of 3 years experience in fabrication of the precast concrete columbarium units similar in material design and extent to that indicated on the drawings and specified herein.
- b. Precast concrete columbarium units shall be installed by installer that has a minimum of 3 years experience in installation of the precast concrete columbarium units similar in material design and extent to that indicated on the drawings and specified herein.
- c. Supply and Installation of fastener system shall be by a product

manufacturer and installer, both whom have had a minimum of 3 years experience in installation of similar design as indicated on the drawing.

- d. Installation of columbarium granite niche covers will be performed by those companies who have had 3 years experience in installation of similar design as indicated in the drawings and specified herein.
- e. ***The precast manufacturer plant(s) used shall be National Precast Concrete Association (NPCA) certified in accordance with the NPCA QC Manual. (Amendment 2)***

1.8 ALLOWABLE TOLERANCES

In addition to tolerances of individual elements required by American Concrete Institute Publication 533.3R, erection tolerances shall be as follows:

- a. Variation of anchors and fasteners  
from dimensions specified ..... 1/8-inch
- b. Variation in overall dimensions of  
precast element (height and width) ..... 1/8-inch
- c. Maximum differential between adjacent  
units in erected position ..... 1/4-inch
- d. Variation in thickness of precast  
panels and elements ..... 1/8-inch
- e. Maximum vertical differential between  
adjacent columbarium units in installed  
position ..... 1/8-inch

1.9 DELIVERY AND STORAGE

Ship precast concrete columbarium units to site with adequate protection to prevent chipping, breaking and other damage. Materials shall be marked giving proper identifications and location. Store materials in protected areas to prevent damage, injurious effects of weather and inclusion of foreign matter.

1.10 COORDINATION

Coordinate the manufacture and erection of precast concrete columbarium units with related work of other sections of the Specifications. Provide templates for inserts and other devices for anchoring precast concrete columbarium units to the work of other trades, in sufficient time to be built into adjoining construction. Perform cutting, fitting and other related work in connection with erection of precast concrete columbarium unit work. See Shop Drawing section for details regarding the coordination of work.

1.11 GUARANTEE

Guarantee precast concrete columbarium units work, including anchorage, joint treatment, water-proofing and related components to be free from all defects in materials and workmanship, including cracking and spalling, and

after erection, completed work will be subject to terms of "Guarantee" article in Division 1 Specification Sections except that guarantee period is one year.

PART 2 PRODUCTS

2.1 BUY AMERICAN ACT

This solicitation is subject to the Buy American Act requirements as defined in the Federal Acquisition Regulation (FAR) Clauses 52.225-9 and 52.225-10.

2.2 ACCEPTABLE MANUFACTURER/DESIGN

- a. Manufacturer's that have previously completed at least one successful NCA columbarium project are deemed to be acceptable for processing their units through the procedures according to these specifications and the drawings.
- b. Manufacturer's that do not have previous successful experience for a NCA columbarium project may be selected by the Contractor for the project. Contractor is hereby notified that the submittal process for a manufacturer with no previous NCA experience with a successful columbarium project, typically takes longer to process.

2.3 COARSE AGGREGATE

Hard durable aggregate carefully graded from coarse to fine in proportions required to match approved samples.

2.4 AGGREGATE FOR BACK-UP MIX (FINE AND COARSE AGGREGATE LIGHTWEIGHT)

ASTM C33/C33M. Limit gradation as required to produce the specified appearance and quality of concrete.

2.5 PORTLAND CEMENT FOR COLUMBARIUM UNITS

ASTM C150/C150M, Type I and Type II; Color as required.

2.6 STRUCTURAL STEEL

ASTM A36/A36M.

2.7 STEEL FABRIC REINFORCEMENT

ASTM A185/A185M, epoxy coated.

2.8 STEEL WIRE REINFORCEMENT

ASTM A82/A82M, cold drawn, epoxy coated.

2.9 REINFORCING STEEL

ASTM A615/A615M, deformed, Grade 60, epoxy coated.

2.10 MISCELLANEOUS GALVANIZED STEEL ITEMS

Bolts, nuts, washers, anchors, inserts, and the like for handling, erection, or use by other trades.

2.11 MASONRY ANCHOR DOVETAIL CHANNEL

Heckman #100 Standard dovetail Slot. See Plans for spacing and location.

2.12 GRANITE NICHE COVERS

Refer to Section 04 73 00 COLUMBARIUM NICHE COVERS (GRANITE).

2.13 NICHE COVER ATTACHMENT HARDWARE

Refer to Section 04 73 00 COLUMBARIUM NICHE COVERS (GRANITE).

2.14 BACK-UP MATERIAL

Closed cell neoprene, butyl, polyurethane, vinyl or polyethylene foam rod, diameter approximately 1-1/3 times the joint width.

2.15 BOND BREAKERS

Type and material recommended by sealant manufacturer.

2.16 SEALING COMPOUND

ASTM C920, Type S, Grade NS, Class 25.

2.17 WALL JOINT WEEPS

3/8-inch thick x 3-3/8 inches wide x 2-1/2 inches tall flexible 'cellvent' plastic weep insert with restrictive insect and debris ingress, similar to Blok-Lok Cellvent weep holes

2.18 COLD FLUID-APPLIED WATERPROOFING

Refer to Section 07 14 00 FLUID-APPLIED WATERPROOFING.

2.19 FABRICATION

Precast concrete columbarium units shall NOT be fabricated, delivered or incorporated in the work until samples have been approved. Precast concrete shall comply with ACI 533.3R, except as modified herein.

- a. Concrete for precast columbarium units shall have minimum compressive strength of 5,000 psi at 28 days.
- b. Provide additional steel reinforcing as required for casting, handling and erection loads.
- c. Back-up Mix: Porosity, strength, weight and gradation of coarse aggregate shall be as required to produce specified characteristics.
- d. Columbarium units shall be cast in steel forms designed to suit shape and finish required and to withstand high frequency vibration. Concrete shall be deposited in oiled forms. Form oil shall be non-staining type. Vibrations, where required, shall be continuous during process of casting to attain through compaction, complete embedment of reinforcement and to assure concrete of uniform and maximum density without segregation of mix and full

thickness of precast element is attained.

(1) Anchors, lifting devices, provisions for cutouts and openings, dovetail slots, notches, reglets, inserts and similar items required for the work of other trades shall be accurately positioned in forms before casting elements.

(2) All fastener location holes, including those for anchoring of units and attachment of niche covers, shall be cast into units. Drilling to precast concrete columbarium units, after fabrication, shall not be acceptable.

- e. Cement, aggregate and water shall be obtained from single sources for facing mix of precast concrete work in order to assure regularity of appearance and uniformity of color.
- f. Finish: Exposed faces shall have smooth finish, unless otherwise noted. The face of the units shall be processed by the manufacturer, following removal from the forms to ensure that the discoloration and blemishes on the niche faces are removed before shipping to the site.

Specified surface finish for the exposed back of the columbarium units shall be applied during the appropriate time of fabrication and curing. Seal coating of exposed back of units shall be applied as per manufacturer's recommendations.

- g. Curing: Precast concrete shall be cured as required to develop specified structural characteristics and shall be stored in a manner that will permit all surfaces to cure equally and minimize warping, without staining the exposed faces.
- h. Fluid-Applied Waterproofing: Apply waterproofing to back of precast units as shown on drawings. Apply as per manufacturer's instructions.

### PART 3 EXECUTION

#### 3.1 HANDLING AND INSTALLATION

Before beginning installation, inspect work of other trades in-so-far as it effects the work of this Section. Commencing installation of precast concrete columbarium units will be construed as acceptance, as suitable, of such work of other trades. Concrete base for the columbarium units shall be inspected and modified as required, grinding off high spots, to become an acceptable base upon which to install the units. Columbarium units shall be handled in a nearly vertical plane at all times and stacked vertically on wood supports of adequate strength, until erected. Cover and protect precast concrete columbarium units against staining and other damage. Reinstall, realign and otherwise correct improper installed units.

Accurately place and securely anchor precast concrete columbarium units to adjoining construction in accordance with approved shop and erection drawings.

#### 3.2 SETTING

- a. Concrete footings (pads) for columbaria shall be constructed to meet all structural requirements to meet local soil and climate

conditions and the weight and dimensions of the columbaria. The pad shall be set level and be long enough to carry the end panel stone work.

- b. Where shown, joints shall be filled with sealant. Surfaces and other joints for precast concrete columbarium units shall be cleaned of all dust, dirt and other foreign matter. Exposed surfaces of units shall be protected by anti-graffiti coating at the manufacturer. Units that have been damaged on exposed surfaces by graffiti, when not coated in advance shall be rejected and removed from the site. Each precast element shall be set level and true to line with uniform joints. Joints required to have sealants shall be kept free of dirt and other contaminants for their full depth. Precautions shall be taken to protect precast concrete work from being damaged and soiled during and after installation. Wedges, spacers or other appliances which are likely to cause staining shall be removed from joints.
- c. Precast Caps shall be installed on top of the columbarium. Specified sealant and flashing shall be in place prior to setting the capping. Four (4) anchor bolts (2 each side) shall be placed through top row of niche wall and into capping on each unit. The cap length shall extend beyond the face of the stone end panel as shown on drawings.

### 3.3 SEALING OF JOINTS

Where shown and/or where ever required to make the work watertight, joints between precast concrete columbarium units, and between other precast elements and adjoining masonry, concrete and other materials shall be filled with back-up material for depth extending as required to form joint of depth as shown or recommended by sealant manufacturer. Provide bond breakers, at base of sealant where space for back-up does not exist and to prevent sealant from bonding to material at base of joint.

Workmanship shall be in accordance with Division 1 Specification Sections.

### 3.4 CLEANING

After erection is complete, clean precast columbarium units using materials, equipment and methods recommended by manufacturer.

### 3.5 REPLACEMENT AND REPAIR

Precast concrete columbarium units which are damaged, cracked, stained, improperly fabricated or otherwise defective shall be removed and be replaced. Precast units having minor defects not affecting serviceability or appearance may be repaired when approved by the Owners Designated Representative. Repaired work shall be sound, permanent, flush with adjacent surfaces and of color and texture matching similar adjoining surfaces and shall show no line of demarcation between original and patched surfaces. Replacement and repairs shall be done at no additional cost to the Government.

### 3.6 FINISHING OF EXPOSED EDGES AND FACES

Apply coating to complete, cleaned exposed concrete edges as per manufacturers standard specifications and recommendations.

3.7 INSTALLATION OF NICHE COVERS

Install niche covers plumb and level as shown so that exposed faces of niche covers lie in the same plane and that rows of niche covers align both horizontally and vertically. Tighten fasteners to achieve snug fit but do not over tighten to the point where they may crack or break niche covers. Due to the manufacturing tolerances in the niche covers and the allowable deviations from the nominal dimensions, it will be impossible to install the niche covers perfectly. Coordinate the installation procedures with the SRE/CO and establish the critical visual line for which the best alignment is to be established.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D5851 (1995; R 2011) Planning and Implementing a Water Monitoring Program

ASTM D6155 (2006) Nontraditional Coarse Aggregate for Bituminous Paving Mixtures

TREE CARE INDUSTRY ASSOCIATION (TCIA)

TCIA Z133.1 (2006) American National Standard for Arboricultural Operations - Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush - Safety Requirements

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED GBDC (2009) LEED Reference Guide for Green Building Design and Construction

LEED NC (2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

- a. 100 percent establishment of Celebration Bermuda sod.
- b. 95 percent establishment of ground cover for other specified species.

### 1.2.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, annuals, perennials, ground cover, and a mulch topdressing excluding turf. Trees may also be found in planter beds.

### 1.3 RELATED REQUIREMENTS

Section 32 84 24 IRRIGATION SPRINKLER SYSTEM applies to this section for installation of irrigation equipment requirements, with additions and modifications herein.

Section 32 92 23 SODDING applies to this section for installation of sod requirements, with additions and modifications herein.

Section 32 92 19 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

Section 32 93 00 EXTERIOR PLANTS applies to this section for installation of trees, shrubs, and ground cover with additions and modifications herein.

### 1.4 SUBMITTALS

Government approval by the SRE/CO is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval; the Government reserves the right to review and comment on submittals not having a "G" designation; and submittals with an "L" are for LEED review. LEED review shall be performed by the Contractor's LEED Coordinator and the LEED Administrator. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 01 33 29 LEED(TM) DOCUMENTATION as applicable:

#### SD-01 Preconstruction Submittals

Integrated Pest Management Plan

#### SD-03 Product Data (LEED NC)

Fertilizer; L (LEED NC)  
Mulches Topdressing; L (LEED NC)  
Organic Mulch Materials; L (LEED NC)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate dollar value of product.

#### SD-07 Certificates

Maintenance Inspection Report

#### SD-10 Operation and Maintenance Data

Maintenance

#### SD-11 Closeout Submittals

Tree, Staking and Guying Removal

SD-11 Closeout Submittals (LEED NC)

Fertilizer; L (LEED NC)  
Mulches Topdressing; L (LEED NC)  
Organic Mulch Materials; L (LEED NC)

LEED documentation relative to recycled content credit in accordance with the LEED GBDC. Include in the LEED Documentation Notebook.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, and iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to State and Federal laws. Instead of containers, fertilizer, and gypsum may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, and Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.3 Handling

Do not drop or dump materials from vehicles.

1.6 MAINTENANCE

Submit Operation and Maintenance (O&M) Manuals for planting materials. Include instructions indicating procedures during one typical year including variations of maintenance for climatic conditions throughout the year. Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals shall include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

Develop a water monitoring program for surface and ground water on the project site in accordance with ASTM D5851 and consistent with the water management program utilized during construction operations.

PART 2 PRODUCTS

2.1 BUY AMERICAN ACT

This solicitation is subject to the Buy American Act requirements as defined in the Federal Acquisition Regulation (FAR) Clauses 52.225-9 and 52.225-10.

2.2 POST-PLANT FERTILIZER

Fertilizer for groundcover, wildflowers, and grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted.

Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content requirements. Fertilizer may contain post-industrial or post-consumer recycled content.

#### 2.2.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

**12 percent available nitrogen (Amendment 2)**  
**8 percent available phosphorus (Amendment 2)**  
**8 percent available potassium (Amendment 2)**

#### 2.3 WATER

Source of water shall be approved by the SRE/CO, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

#### 2.4 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content requirements. Mulches topdressing may contain post-industrial or post-consumer recycled content.

##### 2.4.1 Inert Mulch Materials

Recycled concrete, stone, or other recycled material complying with ASTM D6155, riverbank stone, crushed pit-run rock, volcanic rock and crushed coral chips ranging in size from 1/8 to 1/2 inch. Provide materials from site and construction waste to the greatest extent possible.

##### 2.4.2 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark, and shredded hardwood from site when available. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content requirements. Organic mulch materials may contain post-industrial or post-consumer recycled content.

##### 2.4.3 Recycled Organic Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 2-1/2 by 2-1/2 inch screen. It shall be cleaned of all sticks a minimum 1 inch in diameter and plastic materials a minimum 3 inch length. The material shall be treated to retard the growth of mold and fungi.

#### 2.5 PESTICIDES

Pesticides and herbicides are not permitted. Submit an Integrated Pest

Management Plan, including weed and pest management strategies and proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in the Plan.

### PART 3 EXECUTION

#### 3.1 EXTENT OF WORK

Provide landscape construction maintenance to include irrigation equipment cleaning and adjustments, mowing, edging, overseeding, aeration, fertilizing, watering, weeding, pruning, stake and guy adjusting for all newly installed landscape areas and existing plant material, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

##### 3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Policing shall extend to both sides of fencing or walls. Collected debris shall be promptly removed and disposed of at an approved disposal site.

##### 3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, catch basins, storm drain curb inlets, and yard drains. Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels shall be clear of any encroachment by vegetation.

#### 3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the SRE/CO shows that the new and repaired irrigation equipment furnished under this contract have been satisfactorily installed and is functional and shall continue for a period of 90 days.

##### 3.2.1 Maintenance During the Irrigation Establishment Period

Begin maintenance immediately after irrigation equipment has been installed and is functional. ***Inspect irrigation equipment at least once a week during the installation and establishment period and perform needed maintenance promptly. Irrigation controllers shall be inspected and reprogrammed after power outages. Sprinkler heads shall direct water away from buildings and hard surfaced areas. (Amendment 2)***

##### 3.2.2 Water Restrictions

The Contractor shall abide by State, local, or other water conservation regulations in force during the establishment period. Automatic controller shall be adjusted to comply with the water conservation regulations schedule.

##### 3.2.3 Fire Hydrants

To use a fire hydrant for irrigation, the Contractor shall obtain prior

clearance from the SRE/CO and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Contractor shall provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used shall be tested once per month by a certified backflow preventer tester.

#### 3.2.4 Final Acceptance

Upon completion of the irrigation establishment period and final acceptance of groundcover and exterior plants, temporary irrigation equipment shall be removed. Operation and coverage test is acceptable if system operates through at least one complete cycle for areas to be irrigated and all leaks or repairs have been completed.

#### 3.2.5 Controller Charts

Provide one chart for each controller supplied. Indicate in chart area controlled by the automatic controller. The chart is a reduction of the actual plans that will fit the maximum dimensions inside the controller housing. Use a black line print for the chart and a different pastel or transparent color to indicate each station zone of coverage. After chart is completed and approved for final acceptance, seal chart between two 20 mil pieces of clear plastic.

### 3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the SRE/CO shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 90 days.

#### 3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas at least twice a week during the installation and establishment period and perform needed maintenance promptly.

#### 3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color. Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, aerate, topdress and perform other operations necessary to promote growth, as approved by SRE/CO and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

#### 3.3.3 Mowing

##### 3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed areas to a minimum average height of 1/2 inch when average height of grass becomes 1-1/2 inches. The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be

picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

#### 3.3.3.2 Native Grasses

Native grass shall not be moved.

#### 3.3.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees, fences, poles, walls, irrigation valve boxes, and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

#### 3.3.5 Post-Fertilizer Application

Do not fertilize groundcover and grasses. Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the SRE/CO for approval prior to the use of a synthetic type of fertilizer. Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

#### 3.3.6 Turf Watering

The Contractor shall perform irrigation in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by State, local, or other water conservation regulations or restrictions in force during the establishment period. Irrigation controllers shall be adjusted to comply with the water conservation regulations schedule.

#### 3.3.7 Turf Aeration

Upon completion of weed eradication operations and SRE/CO's approval to proceed, aerate turf areas by approved device. Core, by pulling soil plugs, to a minimum depth of 12 inches. Leave all soil plugs that are produced in the turf area. After aeration operations are complete, topdress entire area 1/4 inch depth with the following mixture: 100 percent sand.

Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean all soil plugs off of other paving when work is complete. This work shall commence 20 days prior final acceptance of the maintenance establishment period.

#### 3.3.8 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of 18 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

#### 3.3.9 Replanting

Replant in accordance with Section 32 92 19 SEEDING and Section 32 92 23 SODDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

#### 3.3.10 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of wildflower and grass areas will be based upon a stand of 95 percent groundcover of established species.

#### 3.3.11 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by SRE/CO.

### 3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the SRE/CO shows that the new plants furnished under this contract have been satisfactorily installed and shall continue for a period of 90 days.

#### 3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least once a week during the installation and establishment period and perform needed maintenance promptly.

#### 3.4.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

#### 3.4.3 Planter Bed Maintenance

Planter beds shall be weeded, fertilized, irrigated, kept pest free, turf free, pruned, and mulch levels maintained. Planter beds will not be allowed to encroach into turf areas. A definite break shall be maintained between turf areas and planter beds. Fertilize exterior planting materials to promote healthy plant growth without encouraging excessive top foliar

growth. Remove noxious weeds common to the area from planting areas by mechanical means.

#### 3.4.3.1 Shrub Selective Maintenance

In addition to the above requirements, shrubs shall be selectively pruned, and shaped for health and safety when the following conditions exist: Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel; Remove dead, damaged or diseased branches or limbs; where shrub growth obstructs pedestrian walkways; where shrub growth is found growing against or over structures; where shrub growth permits concealment of unauthorized persons. All pruning debris shall be disposed of in a proper manner.

#### 3.4.3.2 Tree Maintenance

Tree maintenance shall include adjustment of stakes, ties, guy supports and turnbuckles, watering, fertilizing, pest control, mulching, pruning for health and safety. Fertilize exterior trees to promote healthy plant growth without encouraging excessive top foliar growth. Stakes, ties, guy supports and turnbuckles shall be inspected and adjusted to avoid girdling and promote natural development. All trees within the project boundaries, regardless of caliper, shall be selectively pruned for safety and health reasons. These include but are not limited to removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced. Pruning of all trees including palm trees shall be accomplished by or in the presence of a certified member of the International Society of Arboriculture and in accordance with TCIA Z133.1. All pruning debris generated shall be disposed of in a proper manner.

#### 3.4.4 Slope Erosion Control Maintenance

The Contractor shall provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped and natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear and graded berms to intercept and direct water flow to prevent development of large gullies and slope erosion and during periods of extended rainfall, irrigation systems shall be secured. Eroded areas shall be filled with amended topsoil and replanted with the same plant species. Erosion control blankets damaged due to slope erosion shall be reinstalled.

#### 3.4.5 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately and replace stakes, guys, mulch and eroded earth mound water basins. Additional plant establishment period will be required for replacement plants beyond the original warranty period. A tree shall be considered dying or dead when the main leader has died back, or a minimum of 20 percent of the crown has died. A shrub or ground cover shall be considered dying or dead when a minimum of 20 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine the cause for dying plant material and shall provide recommendations for replacement. The Contractor shall determine the cause for dying plant material and provide recommendations for replacement.

#### 3.4.6 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the SRE/CO, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 32 93 00 EXTERIOR PLANTS.

#### 3.4.7 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

##### 3.4.7.1 Total Plants on Site

Plants have been accepted and required number of replacements have been installed.

##### 3.4.7.2 Mulching and Weeding

Planter beds and earth mound water basins are properly mulched and free of weeds.

##### 3.4.7.3 Tree Supports

Stakes, guys, and turnbuckles are in good condition.

##### 3.4.7.4 Remedial Work

Remedial measures directed by the SRE/CO to ensure plant material survival and promote healthy growth have been completed.

#### 3.4.8 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by SRE/CO.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the SRE/CO within 7 calendar days of each site observation visit.

3.5.2 Tree Staking and Guying Removal

The Contractor shall provide a certified letter that all stakes and guys are removed from all project trees at the end of the establishment period.

-- End of Section --

SECTION 32 84 24

IRRIGATION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 598 (2009) Valve Inspecting and Testing

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C500 (2009) Metal-Seated Gate Valves for Water Supply Service

AWWA C651 (2005; Errata 2005) Standard for Disinfecting Water Mains

AWWA C901 (2008) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13mm) Through 3 In. (76 mm), for Water Service

ASME INTERNATIONAL (ASME)

ASME B1.2 (1983; Errata 1992; R 2007) Gages and Gaging for Unified Inch Screw Threads

ASME B16.15 (2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250

ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASTM INTERNATIONAL (ASTM)

ASTM B32 (2008) Standard Specification for Solder Metal

ASTM B43 (2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes

ASTM B88 (2009) Standard Specification for Seamless Copper Water Tube

ASTM D1785 (2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2564	(2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2774	(2008) Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3261	(2010a) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM F441/F441M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code
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NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2011a) Plastics Piping System Components
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and Related Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-51145

(Rev D; Notice 1) Flux, Soldering,  
Non-Electronic, Paste and Liquid

UNDERWRITERS LABORATORIES (UL)

UL 651

(2011) Standard for Schedule 40 and 80  
Rigid PVC Conduit and Fittings

1.2 SYSTEM DESCRIPTION

This system is designed with a water pressure minimum of 70 pounds per square inch (psi) maximum of 140 psi at connections as shown on the drawings and 40 psi at the last head in each zone. If pressure falls above or below indicated values, Contractor shall notify SRE/CO

1.3 SUBMITTALS

Government approval by the SRE/CO is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval; the Government reserves the right to review and comment on submittals not having a "G" designation; and submittals with an "L" are for LEED review. LEED review shall be performed by the Contractor's LEED Coordinator and the LEED Administrator. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 01 33 29 LEED(TM) DOCUMENTATION as applicable:

SD-03 Product Data

Piping Materials, Tubing, and Fittings  
Valves and Accessories  
Irrigation Control Valve Doubler  
Sprinkler Heads  
Automatic Controller  
Solvent Cement  
Control Wiring  
Drip Irrigation Equipment and Accessories  
Tapping Tee  
Valve Boxes and Lids  
Drip Head Accessories  
Weather Station  
Flower Watering Station Faucet and Assembly

SD-06 Test Reports

Valves and Accessories Tests  
Pressure Test  
Operation Test

Including verification of sprinkler head layout

Submit record of pressure tests conducted on recording gage.

SD-08 Manufacturer's Instructions

Automatic Controller  
Sprinkler Heads  
Piping Materials, Tubing, and Fittings  
Valves  
Irrigation Control Valve Doubler  
Solvent Cement  
Control Wiring  
Drip Irrigation and Accessories  
Weather Station

Submit mounting details for automatic controllers.

SD-10 Operation and Maintenance Data

Piping Materials and Fittings, Data Package 2  
Sprinkler Heads and Accessories, Data Package 2  
Valves, Data Package 2  
Automatic Controller, Data Package 2  
Drip Irrigation and accessories, Data Package 2

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Include troubleshooting procedures with respect to valve and controller problems.

SD-11 Closeout Submittals

Controller Charts

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in original rolls, packages, cartons, and containers with the name of manufacturer, brand, and model. Inspect materials delivered to the site for damage.

1.4.2 Storage

Store materials on site in enclosures or under protective covering. Store plastic piping and rubber gaskets under cover out of direct sunlight. Do not store materials directly on ground. Keep inside of pipes and fittings free from dirt and debris.

1.4.3 Handling

Handle and carry pipe, fittings, valves, and accessories in such a manner as to ensure delivery to trench in sound undamaged condition. Do not drag pipe.

1.5 EXTRA STOCK

- a. 2 quick coupler keys and hose swivels;
- b. 4 irrigation controller housing keys;
- c. 4 irrigation controller enclosure keys; and
- d. 2 hand-held remotes compatible with controller system.

1.6 QUALITY ASSURANCE

1.6.1 Required Test

Submit tests signed by an authorized official of a testing laboratory of sprinkler head, valve, automatic controller, and emitter heads.

PART 2 PRODUCTS

2.1 BUY AMERICAN ACT

This solicitation is subject to the Buy American Act requirements as defined in the Federal Acquisition Regulation (FAR) Clauses 52.225-9 and 52.225-10.

2.2 PIPING MATERIALS

2.2.1 Copper Tubing and Associated Fittings

2.2.1.1 Tubing

ASTM B88, Type K.

2.2.1.2 Fittings

ASME B16.22 and ASME B16.18, solder joint. Solder, ASTM B32 alloy Grade Sn95 or Sn94. Flux, CID A-A-51145, Type I.

2.2.2 Red Brass Pipe and Associated Fittings

2.2.2.1 Pipe

ASTM B43, regular.

2.2.2.2 Fittings

ASME B16.15, Class 250, cast bronze threaded.

2.2.3 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

NSF/ANSI 14, seal of approval for potable water.

2.2.3.1 Pipe

ASTM D1785, PVC 1120 Schedule 40 and 80; or ASTM D2241, PVC 1120 SDR 21, Class 200. Provide ultra-violet resistant piping for on-grade use.

2.2.3.2 Fittings

- a. Solvent Welded Socket Type: ASTM D2466, Schedule 40. Provide ultra-violet resistant fittings.
- b. Threaded Type: ASTM D2464, Schedule 80. Provide ultra-violet resistant fittings.

2.2.3.3 Solvent Cement

ASTM D2564.

#### 2.2.4 Polyethylene (PE) Plastic Piping

##### 2.2.4.1 Pipe

AWWA C901, outside diameter (od) base with dimension ratio (DR) of 9.3 to provide 150 psi minimum pressure rating.

##### 2.2.4.2 Fittings

ASTM D3261, DR of 9.3.

#### 2.2.5 Dielectric Fittings

ASTM F441/F441M, Schedule 80, CPVC threaded pipe nipples, 4 inch length.

#### 2.2.6 Drip Irrigation Tubing

ASTM D2287, maximum inside diameter (id) of 3/4 inch, vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serrations, blisters and other effects. Provide barbed fittings.

#### 2.2.7 Pipe Sleeving

- a. Provide PVC piping 2 times the diameter of main or lateral piping.
- b. Provide grey PVC electrical conduit sized according to number of control wires. Minimum 2 inch size.

### 2.3 IRRIGATION AND DRIP SPRINKLER HEADS

#### 2.3.1 Fixed Riser Irrigation Heads

##### 2.3.1.1 Stream Rotors, Full or Part Circle

Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Heavy duty, stainless steel internal construction with plastic body. Provide check valve below each sprinkler body on riser.

##### 2.3.1.2 Gear Rotor Irrigation Head, Full or Part Circle

Single-stream, water lubricated, gear drive type capable of covering 50 feet radius 50 psi with distribution rate of 8.0 gpm. Part circle sprinkler with an adjustable arc coverage of 30 to 360 degrees. Stainless steel internal construction with plastic body, with matched precipitation rate nozzles in standard /low/ flat angle trajectories, filter screen, reducible watering radius, and choice of nozzles.

##### 2.3.1.3 Spray Irrigation Heads, Full or Part Circle

Capable of covering 15 feet radius at 30 psi with a discharge rate of 4 gpm. Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Matched precipitation rate plastic nozzle with an adjustable screw capable of regulating the radius and the flow. Capable of housing under the nozzle; protective, non-clogging filter screen and/or pressure compensating devices. Screen used in conjunction with the adjusting screw from regulating. Provide check valve below each sprinkler body on riser.

2.3.1.4 Adjustable Flood Bubbler Head

Capable of providing a discharge rate of 1.7 gpm at psi, operating over a pressure range of 10 to 60 psi. Constructed of durable ultra-violet resistant plastic with a plastic inlet filter screen to protect the nozzle against clogging, and a stainless steel adjustable screw, capable of shutting off the bubbler and regulating the flow.

2.3.1.5 Pressure Compensating Flood Bubbler Head

Capable of providing a consistent discharge rate of 1.7 gpm at 30 psi. Plastic inlet filter screen bubbler assembly to protect the nozzle against clogging. Permanently assembled design constructed of durable, ultra-violet resistant plastic with a integral rubber flow washer for regulating the discharge rate at an operating pressure range of 20 to 90 psi.

2.3.2 Pop-Up Irrigation Head

2.3.2.1 Stream Rotor Irrigation Head, Full or Part Circle

Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Heavy duty, stainless steel internal construction with plastic body. Pop-up height of 4, 6, and 12 inches as measured from top of cap at normal installation to middle of nozzle orifice. Provide check valve in head.

2.3.2.2 Gear Rotor Irrigation Head, Full or Part Circle

Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Heavy duty, stainless steel internal construction with plastic body and match precipitation rates for standard low or flat angle trajectories. Single-stream, water lubricated, gear drive type capable of covering 50 feet radius 50 psi with distribution rate of 8.0 gpm. Part circle sprinkler with an adjustable arc coverage of 30 to 360 degrees. Pop-up height of 4, 6, and 12 inches as measured from top of cap at normal installation to middle of nozzle orifice. Provide wiper seal that positively seals against nozzle flange to keep debris out of rotor and cleans debris from pop-up steam as it retracts. Provide check valve in head.

2.3.2.3 Spray Irrigation Head, Full or Part Circle

Capable of covering 15 feet radius at 40 psi with a discharge rate of 4 gpm. Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic with wiper seal. Brass nozzle with matched precipitation rate and an adjustable screw capable of regulating the radius and flow. Capable of housing under the nozzle; protective, non-clogging filter screen and/or pressure compensating devices. Screen used in conjunction with the adjusting screw from regulating. Pop-up height of 4, 6, and 12 inches as measured from the top of cap at normal installation to middle of nozzle orifice. Provide check valve below each sprinkler body on riser.

2.3.3 Fixed Drip Head

2.3.3.1 In-Line Tubing Device

Factory installed, heavy-walled flexible polyethylene (PE) tubing, pressure compensating, self-cleaning emitters at spacings of 12 and 18 inches.

Emitter flow of 0.6 gph with inlet pressure of 14.7 psi. Tubing diameter of 3/4 inch.

## 2.4 VALVES

### 2.4.1 Isolation Valve

#### 2.4.1.1 Ball Valves, Less than 3 Inches

API Std 598, brass body, threaded ends.

#### 2.4.1.2 Gate Valves, 3 Inches and Larger

AWWA C500, bottom wedging double discs, parallel seats, non-rising stems, open by counterclockwise turning. Provide flanged end connections. Provide bronze interior construction of valves including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

### 2.4.2 Control Valves

#### 2.4.2.1 Pressure Regulating Master Control Valve

Automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current (ac) with 0.70 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position. Provide a manual flow stem to adjust closing speed and internal flushing. Provide an adjusting screw for setting pressure and schrader valve for monitoring pressure. Provide 2 inlet tappings capable of being installed as a straight pattern valve. Provide heavy duty brass valve body with brass seat that is removable and serviceable from top without removing valve body from system. Maximum working pressure of valve is 150 psi and pilot range from 10 to 125 psi.

#### 2.4.2.2 Remote Control Valve, Electrical

Solenoid actuated globe valves of 3/4 to 3 inch size. Provide bronze valve housing suitable for service at 150 psi operating pressure. Provide pressure regulating module capable of regulating outlet pressure between 15 to 25 psi (plus or minus) 5 psi and adjustable screw for setting pressure schrader valve connection for monitoring pressure.

### 2.4.3 Irrigation Control Valve Doubler

Irrigation control valve doubler, 2 valves on one wire, cylindrical, 4 inches long, 2-1/2 inch diameter, two outer seals and one inner seal, 14 inches long, 18 gauge solid copper wire, TSM Doubler or equal.

### 2.4.4 Quick Coupling Valves

Two piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutout of main. Provide brass parts. Provide yellow lockable lids with springs for positive closure on key removal.

### 2.4.5 Hose Bib

One piece consisting of all brass construction with full flow 1/2 inch hose connection outlet and removable key handle with gaskets and washers.

2.4.6 Drain Valves

2.4.6.1 Manual

MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 2-1/2 inches.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Tapping Tee

Bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.2 Drip Head Accessories

2.5.2.1 Strainer

Provide strainer at inlet to each drip control valve assembly. Provide polyester fabric screen attached to a PVC frame having the equivalent of 150 mesh filtration capacity. Compact "Y" body and cap configuration. Incorporate flush valves within strainer to clean screen without disassembling unit.

2.5.2.2 Tubing Stakes

Plastic, plastic coated steel, or other non-corrosive strong material to secure tubing.

2.5.2.3 Line Flushing Valve

Construct of PVC with maximum flow rate of 15 gpm with minimum flushing water volume of one gallon at a minimum 4 psi to a maximum 25 psi at a point of discharge.

2.5.2.4 Valve Boxes

Precast concrete valve box for each isolation valve, control valve, quick coupling valve, and drain valve. Provide box sizes that are suitable and adjustable for valve used.

- a. Cast the word "IRRIGATION" on cover.
- b. Stencil, engrave, or brand controller and valve sequence on remote control valve cover. Letters minimum 4 inches height.

2.5.3 Moisture Sensing Device

2.5.3.1 Weather Station

Replace the existing weather station with Rain Master Weather Center II or equal to match the existing central control system and to be compatible with the existing irrigation controllers.

2.5.4 Air/Vacuum Relief

Construct of PVC with a maximum operating pressure of 140 psi.

2.6 Automatic Controller, Electrical

Controller, NEMA ICS 2 with 120-volt single phase service, operating with

indicated station, and grounded chassis. Provide enclosure NEMA ICS 6 Type 3R, with locking hinge cover, pedestal mounted.

#### 2.6.1 Controller Features

Irrigation controller shall match the existing controllers and be compatible with the existing weather station and central control system.

### 2.7 ELECTRICAL CIRCUITS

#### 2.7.1 Control Wiring for Electrically Operated Valves

NFPA 70, copper conductor 14 gage wire, Type UF.

#### 2.7.2 Conduit

UL 651, rigid polyvinyl chloride conduit, Schedule 40.

### 2.8 CONCRETE MATERIALS

2500 psi compressive concrete strength at 28 days as specified under Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 2.9 FLOWER WATERING STATION FAUCET AND ASSEMBLY

- a. Faucet: Solid, lead-free brass, ADA accessible bib faucet with brass self-closing plain end lead-free faucet with an extended lever handle locked to valve, 1/2-inch IPS inlet connection. Model 6252EHLF as available from HAWS Corporation, (888) 640-4297 or equal.
- b. Flow Restrictor: Lead-free tellurium copper coupler with flow rate. Slip joint connection similar to Haws flow control assembly No. 6394 or equal.
- c. Pressure Reducing Valve: Single union, cast bronze body. Line size. Provide with standard valve box assembly.
- d. Ball Valve: Bronze valve body. Line size. Provide with standard valve box assembly. Provide adapter for connecting dissimilar pipe materials.
- e. Flange: 2-piece polished brass, with lacquer finish. Part Number 203884 as available from Signature Hardware (866) 855-2284, or equal. Provide rubber gasket 2.9 inch diameter x 1/16 inch thick. with two screw holes.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install sprinkler system after site grading has been completed.

#### 3.1.1 Trenching

Hand trench around roots to pipe grade when roots of 2 inches diameter or greater are encountered. Make width of trench 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill and hand tamp over excavation. When rock is encountered, excavate 4 inches deeper and

backfill with silty sand (SM) or well-graded sand (SW) to pipe grade. Keep trenches free of obstructions and debris that would damage pipe. Do not mix subsoil with topsoil. Bore under existing concrete walks, drives and other obstacles at a depth conforming to bottom of adjacent trenches. Install pipe sleeve, 2 pipe diameters larger than sprinkler pipe, to fill bore. Rock may be encountered. Excavate 4 inches deeper and backfill with silty sand (SM) or well graded sand (SW) to pipe grade. Prior to backfilling of trench, SRE/CO shall verify and approve location of all irrigation heads.

### 3.1.2 Piping System

#### 3.1.2.1 Clearances

- a. Minimum horizontal clearances between lines: 4 inches for 2 inch pipe and less; 12 inches for 2 inch pipe and more.
- b. Minimum vertical clearances between lines: One inch.

#### 3.1.2.2 Minimum Pitch

Down 6 inches per 100 feet in direction of drain valves.

#### 3.1.2.3 Thrust Blocks

Install thrust blocks at bends, tees, plugs and valves and mainline piping. Place concrete so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set.

#### 3.1.2.4 Minimum Backfill Cover

- a. 18 inches for pressure mainline pipe and valve control wire.
- b. 12 inches for non-pressure lateral pipe.
- c. 24 inches for all piping under paved or non-paved pedestrian paths.
- d. 36 inches for all piping under traffic loads.
- e. Install pipe sleeves at depths indicated in "c" and "d".

Rock may be encountered. Provide minimum 4 inches of silty sand (SM) or well graded sand (SW) cover on top of all piping. Fill remainder of trench or pipe cover to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

#### 3.1.2.5 Restoration

**Fill top 12 inches with topsoil and compact with same density as surrounding soil. (Amendment 2)** Restore turf and plants according to Section 32 92 23 SODDING and Section 32 93 00 EXTERIOR PLANTS.

#### 3.1.2.6 Sterilization

Sprinkler system fed from a potable water system sterilized upstream of backflow preventer in accordance with AWWA C651. Sterilize new water lines for a minimum of 24 hours to meet State and Federal health test

requirements before placing in service. Minimum retention period shall be 3 hours.

### 3.1.3 Piping Installation

#### 3.1.3.1 Polyvinyl Chloride (PVC) Pipe

- a. Solvent-Cemented Joints: ASTM D2855.
- b. Threaded Joints: full cut with a maximum of 3 threads remain exposed on pipe and nipples. Make threaded joints tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.
- c. Piping: ASTM D2774 or ASTM D2855, and pipe manufacturer's instructions. Install pipe in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Install pipes at temperatures over 40 degrees F.

#### 3.1.3.2 Soldered Copper Tubing

Ream pipe and remove burrs. Clean and polish contact surfaces of joint. Flux both male and female ends. Insert end of tube into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Remove excess acid flux from tubings and fittings.

#### 3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation ream pipe. Cut threads as specified in ASME B1.2. Make joints with pipe joint compound applied to male end only.

#### 3.1.3.4 Polyethylene (PE) Pipe and Drip Tubing

Bury drip tubing and PE pipe 12 inches deep. Compression connection in accordance with manufacturers recommendation. Install hose in serpentine manner. When cutting hose, use a shearing tool such as a pipe cutter, knife or shears. Use only manufacturer's recommended tool and procedure when installing drip heads.

#### 3.1.3.5 Dielectric Protection

Where pipes of dissimilar metal are joined, make connection with dielectric fitting.

#### 3.1.4 Irrigation Heads

Install plumb and level with terrain.

##### 3.1.4.1 Fixed Riser Irrigation Heads

Nozzle mounted on fixed riser minimum 6 inches above grade in mulched planter beds, 12 inches above grade in planter beds with groundcover. Provide swing joint assembly attachment between lateral lines and fixed risers.

##### 3.1.4.2 Pop-Up Irrigation Head

Install plumb and level with terrain. Provide swing joint assembly

attachment between lateral line and pop-up body. Top of irrigation head shall be flush with surrounding finish grade.

### 3.1.5 Valves

#### 3.1.5.1 Isolation Valves

Install in a valve box extending from grade to below valve body, with a minimum of 4 inches cover measured from finish grade to top of valve stem.

#### 3.1.5.2 Control Valves

Plumb valve in a valve box extending from grade to below valve body, with minimum of 4 inch cover measured from grade to top of valve. Install automatic valves beside sprinkler heads with a valve box.

#### 3.1.5.3 Irrigation Control Valve Doubler

Install per manufacturer's recommendation.

#### 3.1.5.4 Quick Coupling Valves

Install 2 inches above finish grade in planter bed, level with finish grade in turf areas.

#### 3.1.5.5 Hose Bibb

***Install above grade with support per details. (Amendment 2)***

#### 3.1.5.6 Drain Valves

Entire system shall be manually or automatically drainable. Equip low point of each underground line with drain valve draining into an excavation containing gravel. Cover gravel with building paper. Backfill with excavated material and 6 inches of topsoil.

### 3.1.6 Accessories

#### 3.1.6.1 Connection To Existing Water Supply Systems (Tapping Tee)

Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service. Notify SRE/CO in writing at least 15 days prior to the date the connections are required; receive approval before any service is interrupted. Provide materials required to make connections into the existing water supply systems and perform excavating, backfilling, and other incidental labor as required. Furnish the labor and the tapping or drilling machine for making the actual connections to the existing systems.

#### 3.1.6.2 Valve Boxes and Lids

- a. Install with one cu ft pea gravel sump below valve.
- b. Support valve box with concrete block.
- c. Provide wire screen between gravel sump and bottom of valve body

for rodent protection.

- d. For turf areas, install flush with finish grade.
- e. For planter beds, install 2 inches above finish grade.
- f. For sloped conditions, install valve box level with terrain.

#### 3.1.6.3 Weather Station

- a. Prepare and pour a concrete support slab per drawings and detail.
- b. Install per manufacturer's recommendation.

#### 3.1.6.4 Air/Vacuum Relief Valve

Locate at highest point in piping system.

#### 3.1.7 Electrical Circuits

Bury wires beside mainline pipe in same trench. Provide grey electrical conduit where wires run under paved or non-paved pedestrian paths and vehicular roads. Tag wires at controller and control valve location with plastic tie wrapped tags. Provide one control wire to each control valve location and one common wire looped from controller to each control valve. provide one separate control valve wire of a different color from controller to each control valve cluster.

##### 3.1.7.1 Loops

Provide a 12 inch loop of wire at each valve where controls are connected.

##### 3.1.7.2 Expansion and Contraction

Bundle multiple tubes or wires and tape together at 10 foot intervals with 12 inch loop for expansion and contraction.

##### 3.1.7.3 Splices

Make electrical splices waterproof. Locate all field electrical splices in valve boxes.

#### 3.1.8 Automatic Controller

Determine exact location of controllers in field and coordinate for approval with SRE/CO before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

#### 3.1.9 Flushing

After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads and valves, flush piping system under a full head of water. Maintain flushing for 3 minutes.

#### 3.1.10 Adjustment

After grading, plant installation, and rolling of planted areas, adjust sprinkler heads flush with finished grade. Make adjustments by providing

new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

### 3.1.11 Sterilization

Sprinkler system fed from a potable water system shall be sterilized upstream of backflow preventer in accordance with AWWA C651. Sterilize new waterlines for a minimum of 24-hours, to meet State and Federal health test requirements before placing in service. Minimum retention period shall be 3 hours.

### 3.2 FLOWER WATERING STATION FAUCET AND ASSEMBLY

Faucet Assembly, Pressure Reducing Valve, and Bronze Ball Valve: Install per manufacturer's recommendations and as detailed on the drawings. Install in standard valve box assembly.

### 3.3 FIELD QUALITY CONTROL

The Contractor will conduct and the SRE/CO and the QC representative will witness field inspections and field tests specified in this section. Perform field tests, and provide labor, equipment, and incidentals required for testing.

#### 3.3.1 Pressure Test

##### 3.3.1.1 Duration

During pressure test, maintain a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi before backfilling system.

##### 3.3.1.2 Leaks

Correct leaks. Make necessary corrections to stop leakage.

##### 3.3.1.3 Retest

Retest system twice until pressure can be maintained for duration of test.

#### 3.3.2 Operation Test

##### 3.3.2.1 Accessories

At conclusion of pressure test, install irrigation heads or drip heads, quick coupling assemblies, and hose bib, and test entire system for operation under normal operating pressure. Make necessary corrections or adjustments to raise or lower pressure for each system if tests results do not match pressure requirements.

##### 3.3.2.2 Acceptance

Operation test is acceptable if system operates through at least one complete cycle for areas to be irrigated.

#### 3.3.3 Controller Charts

Provide one chart for each controller supplied. Indicate in chart area

controlled by automatic controller. The chart is a reduction of the actual plans that will fit the maximum dimensions inside controller housing. Use black line print for chart and a different pastel or transparent color to indicate each station area of coverage. After chart is completed and approved for final acceptance, seal chart between two 20 mil pieces of clear plastic.

-- End of Section --

SECTION 32 93 00

EXTERIOR PLANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NURSERY & LANDSCAPE ASSOCIATION (ANLA)

ANSI/ANLA Z60.1 (1996; R 2004) American Standard for  
Nursery Stock

ASTM INTERNATIONAL (ASTM)

ASTM A580/A580M (2008) Standard Specification for  
Stainless Steel Wire

ASTM D4427 (2007) Peat Samples by Laboratory Testing

ASTM D4972 (2001; R 2007) pH of Soils

ASTM D5268 (2007) Topsoil Used for Landscaping  
Purposes

ASTM D5539 (1994; R 2008) Seed Starter Mix

ASTM D5852 (2000; R 2007) Standard Test Method for  
Erodibility Determination of Soil in the  
Field or in the Laboratory by the Jet  
Index Method

ASTM D6155 (2006) Nontraditional Coarse Aggregate for  
Bituminous Paving Mixtures

ASTM D6629 (2001; R 2007) Selection of Methods for  
Estimating Soil Loss by Erosion

ASTM F405 (2005) Corrugated Polyethylene (PE) Tubing  
and Fittings

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2000) Principles and Criteria for Forest  
Stewardship

L.H. BAILEY HORTORIUM (LHBH)

LHBH (1976) Hortus Third

TREE CARE INDUSTRY ASSOCIATION (TCIA)

TCIA A300P1 (2008) ANSI A300 Part1: Tree Care

Operations - Trees, Shrubs and Other Woody  
Plant Maintenance Standard Practices -  
Pruning

TCIA Z133.1

(2006) American National Standard for  
Arboricultural Operations - Pruning,  
Repairing, Maintaining, and Removing  
Trees, and Cutting Brush - Safety  
Requirements

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42

(1996) Soil Survey Investigation Report  
No. 42, Soil Survey Laboratory Methods  
Manual, Version 3.0

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED GBDC

(2009) LEED Reference Guide for Green  
Building Design and Construction

LEED NC

(2009) Leadership in Energy and  
Environmental Design(tm) New Construction  
Rating System

## 1.2 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 84 24 IRRIGATION SPRINKLER SYSTEMS,  
Section 32 92 23 SODDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT  
applies to this section for pesticide use and plant establishment  
requirements, with additions and modifications herein.

## 1.3 SUBMITTALS

Government approval by the SRE/CO is required for submittals with a "G"  
designation; submittals not having a "G" designation are for Contractor  
Quality Control approval; the Government reserves the right to review and  
comment on submittals not having a "G" designation; and submittals with an  
"L" are for LEED review. LEED review shall be performed by the  
Contractor's LEED Coordinator and the LEED Administrator. Submit the  
following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, Section  
01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 01 33 29  
LEED(TM) DOCUMENTATION as applicable:

### SD-01 Preconstruction Submittals

State Landscape Contractor's License  
International Society of Arboriculture, Arborist Certification  
Moss Rock Specimen

### SD-03 Product Data

Peat  
Composted Derivatives  
Mulch  
Fertilizer  
Weed Control Fabric  
Root Control Barrier  
Staking Material

SD-03 Product Data (LEED NC)

Gypsum; L (LEED NC)  
Fertilizer; L (LEED NC)  
Mulch; L (LEED NC)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate dollar value of product.

Staking Material; L (LEED NC)  
Aluminum Edging; L (LEED NC)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate dollar value of product.

If applicable, provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

SD-04 Samples

Decorative Crushed Stone; G

Submit one pint of river washed gravel for use at base of columbarium and base of memorial wall.

Lava Rock Groundcover; G

Submit several lava rocks ranging in sizes from 4 to 12 inches, dark brown color range, to be used for lava rock mosaic.

Lava Rock Groundcover Mock-up; G

SD-06 Test Reports

Topsoil composition tests; Soil Test of proposed area  
Percolation Test; Percolation Test of proposed area

SD-07 Certificates

Forest Stewardship Council (FSC) Certification; L (LEED NC)  
Nursery certifications

Indicate names of plants in accordance with the LHBH, including type, quality, and size.

SD-11 Closeout Submittals (LEED NC)

Gypsum; L (LEED NC)  
Fertilizer; L (LEED NC)  
Mulch; L (LEED NC)

LEED documentation relative to recycled content credit in accordance with the LEED GBDC. Include in the LEED Documentation

Notebook.

Staking Material; L (LEED NC)  
Aluminum Edging; L (LEED NC)

LEED documentation relative to recycled content credit in accordance with the LEED GBDC. Include in the LEED Documentation Notebook.

LEED documentation relative to certified wood credit in accordance with the LEED GBDC. Include in LEED Documentation Notebook.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

##### 1.4.2 Nursery Certifications

- a. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.
- b. Inspection certificate.
- c. Mycorrhizal fungi inoculum for plant material treated

##### 1.4.3 State Landscape Contractor's License

Construction company shall hold a landscape contractors license in the Sstate where the work is performed and have a minimum of 5 years landscape construction experience. Submit copy of license and 3 references for similar work completed in the last 5 years.

##### 1.4.4 Tree Tagging

The SRE/CO shall tag all trees proposed for the project at the nursery or place of growth. If proposed blocks of trees are not acceptable, in the opinion of the SRE/CO, the Contractor shall propose an alternate acceptable source of trees for review by the SRE/CO.

##### 1.4.5 Lava Rock Groundcover Mock-up

Construct one (1) of the five planter areas (excluding planting soil) in the entry plaza as the Lava Rock groundcover mock-up. The choice of which

planter area to use for the mock-up is up to the Contractor. The planter area mock-up shall include at least one Moss Rock specimen boulder and a minimum of 65 square feet of installed Lava Rock Groundcover complete with subgrade prep, crushed rock base, and mortar setting bed per drawings and as specified herein. Workmanship of the mock-up will be evaluated for compliance with the design intent and if approved will be used as the standard to evaluate subsequent Lava Rock Groundcover and overall plaza planter area construction quality and appearance. Approved mock-up assembly will be incorporated into the project. If the mock-up is not approved by the SRE/CO, then it shall be removed and/or reconstructed until approved by the SRE/CO. Note: prior to construction of mock-up Contractor shall have SRE/CO approval of all specimen Moss Rock boulders so that specific boulder for Contractor selected planter area mock-up can be tagged for placement within the selected mock-up area.

#### 1.4.6 Percolation Test

Immediately following rough grading operation, identify a typical location for one of the largest trees and or shrubs and excavate a pit per the project details. Fill the pit with water to a depth of 12 inches. The length of time required for the water to percolate into the soil, leaving the pit empty, shall be measured by the project Landscape Architect and verified by the SRE/CO. Within 6 hours of the time the water has drained from the pit, the Contractor, with the SRE/CO and project Landscape Architect present, shall again fill the pit with water to a depth of 12 inches. If the water does not completely percolate into the soil within 9 hours, a determination shall be made whether a drainage system or a soil penetrant will be required for each tree and or shrub being transplanted.

#### 1.4.7 Erosion Assessment

Assess potential effects of soil management practices on soil loss in accordance with ASTM D6629. Assess erodibility of soil with dominant soil structure less than 2.8 to 3.1 inches in accordance with ASTM D5852.

#### 1.4.8 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

- a. Tour, inspect, and discuss conditions of planting materials.
- b. Review planting schedule and maintenance.
- c. Review required inspections.
- d. Review environmental procedures.

#### 1.4.9 Arborist Certification

Construction company shall retain the services of an approved qualified certified arborist who has been certified with the International Society of Arboriculture (ISA) for at least 5 years, with experience in tree protection and preservation planning during construction, tree and root pruning, and transplanting of trees in the State of Hawaii. Submit copy of the current ISA Certification and 3 references for similar work completed

in Hawaii within the last 5 years.

1.4.10 Moss Rock Specimen

Contractor shall submit a source of Moss Rock Specimen boulders. The SRE/CO shall pick specimen moss rock boulders at the source, field or quarry, and the approved moss rock specimen boulders to be marked for the project use. If the adequate number of moss rock specimen boulders is not available at the field or quarry, the Contractor shall propose an alternative source for acceptable specimen moss rocks boulders.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

1.5.1.2 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to State and Federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.1.3 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.5.2 Storage

1.5.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

- a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.
- b. Heel-in bare root plants.
- c. Protect balled and burlapped plants from drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.
- d. Keep plants in a moist condition until planted by watering with a fine mist spray.

- e. Do not store plant material directly on concrete or bituminous surfaces.

#### 1.5.2.2 Fertilizer, Gypsum, pH Adjusters, and Mulch Storage

Store in dry locations away from contaminants.

#### 1.5.2.3 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation 3 to 4 weeks prior to stockpiling existing topsoil.

#### 1.5.2.4 Root Control Barrier and Weed Control Fabric

Store materials on site in enclosures or under protective covering in dry location. Store under cover out of direct sunlight. Do not store materials directly on ground.

#### 1.5.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped container plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Remove damaged plants from the site.

#### 1.5.4 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

#### 1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

##### 1.6.1 Restrictions

Do not plant when ground is muddy or when air temperature exceeds 90 degrees Fahrenheit.

#### 1.7 GUARANTEE

All plants shall be guaranteed for one year beginning on the date of inspection by the SRE/CO to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Government or by weather conditions unusual for the warranty period.

Remove and replace dead planting materials immediately. At end of warranty period, replace planting materials that die or have 25 percent or more of their branches that die during the construction operations or the guarantee period.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

1.8.1 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

PART 2 PRODUCTS

2.1 BUY AMERICAN ACT

This solicitation is subject to the Buy American Act requirements as defined in the Federal Acquisition Regulation (FAR) Clauses 52.225-9 and 52.225-10.

2.2 PLANTS

2.2.1 Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them. Furnish nursery stock in accordance with ANSI/ANLA Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Most plants specified shall be indigenous, low maintenance varieties, tolerant of site's existing soils and climate. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.

2.2.2 Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

2.2.2.1 Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.

2.2.2.2 Evergreen Trees and Shrubs

Well developed symmetrical tops with typical spread of branches for each particular species or variety.

2.2.2.3 Ground Covers and Vines

Number and length of runners and clump sizes indicated, and of the proper age for the grade of plants indicated, furnished in removable containers, integral containers, or formed homogeneous soil section.

### 2.2.3 Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI/ANLA Z60.1. Plants larger in size than specified may be provided with approval of the SRE/CO. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI/ANLA Z60.1.

### 2.2.4 Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI/ANLA Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

#### 2.2.4.1 Mycorrhizal fungi inoculum

Before shipment, root systems shall contain mycorrhizal fungi inoculum.

### 2.2.5 Growth of Trunk and Crown

#### 2.2.5.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

#### 2.2.5.2 Palms

Palms shall have the specified height as measured from the base of the trunk to the base of the fronds or foliage in accordance with ANSI/ANLA Z60.1. The palm shall have straight trunk and healthy fronds or foliage as typical for the variety grown in the region of the project. Palms trimmed or pruned for delivery shall retain a minimum of 6 inches of foliage at the crown as a means of determining plant health.

#### 2.2.5.3 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

#### 2.2.5.4 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANSI/ANLA Z60.1. The coniferous evergreen trees shall not

be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

#### 2.2.5.5 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

#### 2.2.5.6 Ground Cover and Vine Plant Material

Ground cover shall have the minimum number of runners and length of runner recommended by ANSI/ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

### 2.3 TOPSOIL

#### 2.3.1 Existing Soil

Modify to conform to requirements specified in paragraph entitled "Composition".

#### 2.3.2 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition". When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

#### 2.3.3 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition". Additional topsoil shall be furnished by the Contractor.

#### 2.3.4 Composition

Evaluate soil for use as topsoil in accordance with ASTM D5268. From 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, plants, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

### 2.4 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.

2.4.1 Iron

100 percent elemental

2.4.2 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427 and ASTM D5539 as modified herein. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation. Biobased content shall be a minimum of 100 percent. Peat shall not contain invasive species, including seeds.

2.4.3 Sand

Clean and free of materials harmful to plants.

2.4.4 Perlite

Horticultural grade.

2.4.5 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having the following properties:

2.4.5.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.4.5.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.4.5.3 Biobased Content

Minimum 100 percent.

2.4.6 Gypsum

Coarsely ground gypsum from recycled scrap gypsum board comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content materials requirements. Gypsum may contain post-industrial or post-consumer recycled content.

2.4.7 Vermiculite

Horticultural grade for planters.

#### 2.4.8 Rotted Manure

Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

#### 2.5 PLANTING SOIL MIXTURES

100 percent topsoil as specified herein. For native tree planting pits and bioretention soil at bio-sale area, provide planting soil mixture of screened amended topsoil, black cinder and organic mulch mix (50%-30%-20%).

#### 2.6 FERTILIZER

Fertilizer for groundcover and grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content requirements. Fertilizer may contain post-industrial or post-consumer recycled content.

##### 2.6.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

- 16 percent available nitrogen
- 16 percent available phosphorus
- 16 percent available potassium

##### 2.6.2 Fertilizer Tablets

Organic, plant tablets composed of tightly compressed fertilizer chips forming a tablet that is insoluble in water, is designed to provide a continuous release of nutrients for at least 24 months and contains the following minimum percentages, by weight, of plant food nutrients:

- 20 percent available nitrogen
- 20 percent available phosphorus
- 5 percent available potassium

#### 2.7 WEED CONTROL FABRIC

##### 2.7.1 Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.8 DRAINAGE PIPE FOR PLANT PITS AND BEDS

Corrugated plastic drainage tubing, 4 inches in diameter, perforated conforming to ASTM F405.

2.9 MULCH

Free from noxious weeds, mold, pesticides, or other deleterious materials.

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content requirements. Mulch may contain post-industrial or post-consumer recycled content.

2.9.1 Inert Mulch Materials

Recycled concrete, stone, or other recycled material complying with ASTM D6155, riverbank stone, crushed pit-run rock, and volcanic rock ranging in size from 1/8 to 1/2 inch. Provide materials from site and construction waste to the greatest extent possible.

2.9.2 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark, shredded hardwood from site when available. Biobased content shall be a minimum of 75 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application.

2.9.3 Recycled Organic Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 2-1/2 by 2-1/2 inch screen. It shall be cleaned of all sticks a minimum 1 inch in diameter and plastic materials a minimum 3 inches length. The material shall be treated to retard the growth of mold and fungi.

2.9.4 Decorative Crushed Stone

Hard, durable, washed ground gravel, 3/8 to one inch diameter in grey color range, submit sample for approval.

2.9.5 Lava Rock Groundcover

Moss rock lava rock groundcover as indicated in drawings. Match approved mock-up.

2.9.6 Black Cinder

3/4-inch to 3/8-inch pumice aggregate, screened and graded.

2.9.7 Crushed Rock

1/2 inch to 3/4 inch size, No 3B Fine Gravel.

2.10 STAKING AND GUYING MATERIAL

2.10.1 Staking Material

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative FSC certified wood requirements. Staking material may be FSC certified in accordance with LEED GBDC.

2.10.1.1 Tree Support Stakes

Rough sawn FSC-certified or salvaged hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Stakes shall be minimum 2 inches square or 2-1/2 inch diameter by 8 feet long, pointed at one end.

2.10.1.2 Ground Stakes

FSC-certified or salvaged wood or 100 percent post-consumer recycled content plastic, 2 inches square are by 3 feet long, pointed at one end.

2.10.2 Guying Material

2.10.2.1 Guying Wire

12 gauge annealed galvanized steel, ASTM A580/A580M.

2.10.2.2 Guying Cable

Minimum 5-strand, 3/16 inch diameter galvanized steel cable, plastic coated.

2.10.3 Hose Chafing Guards

New or used 2 ply 3/4 inch diameter reinforced rubber or plastic hose, black or dark green, all of same color.

2.10.4 Flags

White surveyor's plastic tape, 1/2 inch diameter PVC pipe, 12 inches long, fastened to guying wires or cables.

2.10.5 Turnbuckles

Galvanized or cadmium-plated steel with minimum 3 inch long openings fitted with screw eyes. Eye bolts shall be galvanized or cadmium-plated steel with one inch diameter eyes and screw length 1-1/2 inches, minimum.

2.10.6 Metal Anchors

2.10.6.1 Driven Anchors

Malleable iron, arrow shaped, galvanized, sized as follows:

<u>Tree Caliper</u>	<u>Anchor Size</u>
2 inches and under	3 inches
3 to 6 inches	4 inches
6 to 8 inches	6 inches
8 to 10 inches	8 inches
10 to 12 inches	10 inches

2.10.6.2 Screw Anchors

Steel, screw type with welded-on 3 inch round helical steel plate, minimum 3/8 inch diameter, 15 inches long.

2.11 EDGING MATERIAL

See Section 01 33 29 LEED(TM) DOCUMENTATION for cumulative total recycled content materials requirements. Aluminum edging may contain post-industrial or post-consumer recycled content.

2.11.1 Aluminum Edging (AE-1)

- a. Heavy Duty Straight Profile Edging: 3/16 inch x 4 inches high, extruded aluminum, 6063 alloy, T-6 hardness, landscape edging for straight-line and curvilinear applications in corrugated straight profile. Section shall have loops on side of section to receive stakes spaced approximately 2 to 3 feet apart along its length.
- b. Thickness: 1/8 inch gauge section at 0.072-inch minimum thick with 0.135 inch exposed top lip and 3/16 inch gauge section at 0.116 inch minimum thick with 0.187 inch exposed top lip.
- c. Length: 16 feet, selected products in 8 feet sections.
- d. Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design.
- e. Stake: 12 inch stake, 0.10 inch thick, with optional extruded aluminum, heavy duty 0.125 inch thick x 16 inch, 18 inch, or 24 inch long stakes. Stakes to interlock into section loops.
- f. Finish: Natural Mill Aluminum.

2.11.2 Aluminum Edging (AE-2)

- a. Heavy Duty L-shaped Profile Maintenance Strip Edging: 3/16 inch x 3-1/2 inches high, extruded aluminum, 6063 alloy, T-6 hardness, maintenance strip edging for straight-line applications in corrugated L-shaped profile having 1.2 inch horizontal base. Section shall have loops on side of section to receive stakes spaced approximately 2 feet apart along its length. Permaloc PermaStrip or equal.
- b. Thickness: 3/16 inch gage section at 0.076-inch minimum thick with 0.190 inch exposed top lip.
- c. Length: 8 or 16 foot sections.
- d. Connecion Method: Section ends shall splice together with a

horizontal aluminum sliding connector.

e. Stake: 12 inch stake. Stakes to interlock into section loops.

f. Finish: Natural Mill Aluminum.

## 2.12 EROSION CONTROL MATERIALS

As specified in Section 31 32 11 SOIL SURFACE EROSION CONTROL.

## 2.13 ROOT CONTROL BARRIER

Pre-formed, linear barrier with integral vertical root deflecting ribs constructed of ultraviolet resistant polypropylene material. Color to be black.

## 2.14 WATER

Source of water to be approved by SRE/CO and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

## 2.15 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

## 2.16 SOURCE QUALITY CONTROL

The SRE/CO and Landscape Architect of Record will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

# PART 3 EXECUTION

## 3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, tree, shrub, groundcover, and planting, edging, staking and guying, weed control fabric, and root control barrier installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

## 3.2 ALTERNATIVE HERBICIDE TREATMENT (SOLARIZING SOIL)

Within 48 hours of subsoil preparation, saturate soil with water to a depth of 3 feet. Immediately stake polyethylene sheeting over area to be planted. Stake tightly to surface of soil. Maintain sheeting in place for a minimum of 6 weeks. Immediately after removing sheeting, cover area to be planted with topsoil. Do not till soil prior to applying topsoil.

## 3.3 PREPARATION

### 3.3.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated

features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

### 3.3.2 Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The SRE/CO reserves the right to adjust plant material locations to meet field conditions. **Do not plant closer than half the specified plant spacing to any pavement edge, fence or wall edge, and other similar structures. (Amendment 2)** Provide on-site locations for excavated rock, soil, and vegetation.

### 3.3.3 Erosion Control

Coordinate erosion control and planting of native plant species to protect slopes with Section 31 32 11 SOIL SURFACE EROSION CONTROL.

### 3.3.4 Soil Preparation

#### 3.3.4.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

#### 3.3.4.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

#### 3.3.4.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

### 3.3.5 Root Control Barrier

Install linear polypropylene barrier a minimum 1/2 inch above finish grade to prevent root growth over the barrier. Backfill the outside of the barrier with 3/4 to one gravel a minimum width of 2 inches. For linear barrier application use appropriate device to connect 2 pieces.

### 3.3.6 Subsoil Drainage for Plant Pits and Beds

Provide as indicated. Lay perforated drain pipe with perforations down. Backfill trenches as specified in Section 31 00 00 EARTHWORK.

### 3.3.7 Installation of Lava Rock Groundcover

- a. Prepare the subgrade for planter areas to the proper compaction, grades and elevation. Remove and dispose of any excess subgrade material before installation of subbase materials.
- b. Ensure irrigation sleeving has been properly installed and ends staked. Care should be exercised to prevent damage to any utilities, including drainage and irrigation appurtenances during installation. Report any damage immediately to the SRE/CO.

- c. Place crushed rock base course per drawings to the proper horizontal alignment, depths and elevation over compacted subgrade, and compact to 95 percent relative compaction.
- d. At the direction of SRE/CO, place selected specimen Moss Rock Lava boulders on crushed rock base.
- e. Once specimen moss rock boulders are in final position, place minimum 3 inch compacted depth dry mix mortar setting bed over crushed rock base to horizontal alignment; grades and elevation as shown in drawings - a gently sloping convex profile.
- f. Hand set the 4 to 12 inch diameter moss rock lava rock groundcover rocks in natural interlocking stone pattern with maximum one inch wide joint per drawings. Set lava rock groundcover rocks securely into dry mix mortar setting bed with as tight joints as possible, with natural rock faces in continuous profile along the convex berm profile.
- g. Once lava rock groundcover rocks have been set into dry mix mortar setting bed, carefully fill joints with dry mix mortar to within maximum 3/4 inch from surface of lava rock groundcover surface. Pack and tool mortar joints. Avoid spilling dry mortar mix on exposed face of lava rock groundcover rocks to prevent cement staining of the natural rock face.
- h. Gently sprinkle mortar joints with water to allow dry set mortar mix joints and bed to saturate and set groundcover rock in place.
- i. Clean up finished rock surface and adjacent plaza areas including any dry set mortar mix in planting areas.
- j. Let lava rock groundcover set and dry. Inspect surface of rock groundcover for cement staining. Touch up cement stained areas with appropriate color stain(s) to match natural moss rock lava color.

### 3.4 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation". Do not install trees within 10 feet of any utility lines or building walls.

### 3.5 PLANT INSTALLATION

#### 3.5.1 Individual Plant Pit Excavation

Excavate pits per drawings and planting details.

#### 3.5.2 Plant Beds with Multiple Plants

Excavate plant beds continuously throughout entire bed as outlined to depth

shown.

### 3.5.3 Handling and Setting

Move plant materials only by supporting the root ball and container. Set plants on native soil and hold plumb in the center of the pit until soil has been tamped firmly around root ball. Set plant materials, in relation to surrounding finish grade, one to 2 inches above depth at which they were grown in the nursery, collecting field or container. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

#### 3.5.3.1 Balled and Burlapped Stock

Backfill with topsoil to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials from the top a minimum 1/3 depth from the top of the rootball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit prior to backfill operations.

#### 3.5.3.2 Container Grown Stock

Remove from container and prevent damage to plant or root system.

#### 3.5.3.3 Ground Covers and Vines

Plant after placing mulch topdressing. Do not remove plant materials from flats or containers until immediately before planting. Space at intervals indicated. Plant at a depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 6 inches without run off or puddling. Smooth planting areas after planting to provide even, smooth finish. Mulch as indicated.

### 3.5.4 Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

### 3.5.5 Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

### 3.5.6 Placement of Mulch Topdressing

Place specified mulch topdressing on top of weed control fabric covering total area enclosed by edging. **Place mulch topdressing to a depth of 2 inches. (Amendment 2)**

### 3.5.7 Mulch Topdressing

***Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 2 inches after completion of plant installation and before watering. (Amendment 2)*** Keep mulch out of the crowns of shrubs. Place mulch a minimum 2 to 3 inches away from trunk of shrub or tree. Place on top of any weed control fabric.

### 3.5.8 Installation of Edging

Uniformly edge beds of plants to provide a clear cut division line between planted area and adjacent lawn. Construct bed shapes as indicated. Install aluminum edging material as indicated.

### 3.5.9 Installation of Aluminum Edging

- a. Preparation: Ensure that all underground utility lines are located and will not interfere with the proposed edging installation before beginning work. Locate border line of edging with string or other means to assure border straightness and curves as designed. Dig trench 1 inch deeper than set of edging bottom.
- b. Set edging into trench with top at 1/2 inch above compacted finish grade on turf side with side having loops for stakes placed on opposite side of turf. Drive stakes through edging loops until locked in place. Requires 5 stakes evenly spaced for each 16 feet section, or 3 stakes evenly spaced for each 8 feet section with a total of 8 stake loops available in each 16 feet section if necessary. Provide additional stakes at approximately 24 inches apart, longer stakes, heavier gage stakes, or any combination of previously mentioned as necessary to firmly secure edging for permanent intended use.
- c. Where edging sections turn at corners and at angled runs, cut edging partially up through its height from bottom and turn back to desired angle to form rounded exposed radius.
- d. Backfilling and Cleanup: Backfill both sides of edging, confirm and adjust if necessary that sections are securely held together, and compact backfill material along edging to provide top of edging at 1/2 inch above turf finish grade. Cleanup and remove excess material from site.

### 3.5.10 Fertilization

#### 3.5.10.1 Fertilizer Tablets

Place fertilizer planting tablets evenly spaced around the plant pits to the manufacturer's recommended depth.

#### 3.5.10.2 Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

### 3.5.11 Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 12 inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

### 3.5.12 Staking and Guying

#### 3.5.12.1 Staking

Stake plants with the number of stakes indicated complete as detailed. Attach guy wire half the tree height but not more than 5 feet high. Drive stakes to a depth of 2-1/2 to 3 feet into the ground outside the plant pit. Do not injure the root ball. Use hose chaffer guards where guy wire comes in contact with tree trunk.

#### 3.5.12.2 Guying

Guy plants as indicated. Attach guying cable around the tree trunk at an angle of 45 degrees at approximately 1/2 of the trunk height. Protect tree trunks with chafing guards where guying cable contacts the tree trunk. Anchor guys to malleable iron anchors. Fasten flags to each guying cable approximately 2/3 of the distance up from ground level. Provide turnbuckles as indicated.

#### 3.5.12.3 Chafing Guards

Use hose chafing guards, as specified where guy cable will contact the plant.

#### 3.5.12.4 Iron Anchors

Drive malleable iron anchors into firm ground outside of plant pit a minimum 30 inches below finish grade. Place equal distance from tree trunk and around the plant pit.

#### 3.5.12.5 Flags

Securely fasten flags on each guy cable approximately two-thirds of the distance up from ground level.

### 3.5.13 Pruning

Prune in accordance with safety requirement of TCIA Z133.1.

#### 3.5.13.1 Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical. Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with TCIA A300P1.

#### 3.5.13.2 Wound Dressing

Do not apply tree wound dressing to cuts.

3.6 RESTORATION AND CLEAN UP

3.6.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.6.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center. Separate and recycle or reuse the following landscape waste materials: Wire. Adjacent paved areas shall be cleared.

-- End of Section --