

DEPARTMENT OF VETERANS AFFAIRS, NATIONAL CEMETERY ADMINISTRATION  
Oakland, California

**Project Title:**

**Eagle Point National Cemetery –Remove Non-Compliant Stairs and Re-Landscape Project**

**Attachment B – Specifications (10 Sections)**

- Section 03 30 53 – Cast-in-Place Concrete
- Section 04 22 00 – Unit Masonry Assemblies
- Section 04 40 00 – Stone Masonry
- Section 26 56 00 – Exterior Lighting
- Section 31 10 00 – Site Clearing
- Section 31 20 11 – Earthwork
- Section 32 14 40 – Exterior Stone Paving
- Section 32 84 00 – Planting Irrigation
- Section 32 90 00 – Planting
- Section 32 96 00 – Transplanting

**SECTION 03 30 53**

**(SHORT-FORM) CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and material and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Division 04 "Unit Masonry" for CMU block walls.
- B. Division 04 Section "Stone Masonry" for stone veneer over concrete substrates.
- C. Division 32 Section "Exterior Stone Paving" for unit paving over concrete bases.

**1.3 TOLERANCES:**

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

**1.4 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

**1.5 SUBMITTALS:**

- A. Concrete Mix Design.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings.
- C. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. Standard Specifications of Oregon Department of Transportation (ODOT), latest revision.
- C. American Concrete Institute (ACI):
  - 117-10.....Specification for Tolerances for Concrete Construction, Materials and Commentary
  - 211.1-91(R2009).....Standard Practice for Proportions for Normal, Heavyweight, and Mass Concrete
  - 301-10.....Specifications for Structural Concrete
  - 305.1-06.....Specification for Hot Weather Concreting
  - 306.1-90(R2002).....Standard Specification for Cold Weather Concreting

- SP-66-04 .....ACI Detailing Manual
- 318-11.....Building Code Requirements for Structural  
Concrete and Commentary
- 347-04.....Guide to Formwork for Concrete
- D. American Society for Testing and Materials (ASTM):
- A185/A185M-07.....Standard Specification for Steel Welded Wire  
Reinforcement, Plain, for Concrete Reinforcement
- A615/A615M-09.....Standard Specification for Deformed and Plain  
Carbon Steel Bars for Concrete Reinforcement
- C31/C31M-10.....Standard Practice for Making and Curing Concrete  
Test Specimens in the Field
- C33/C33M-11a.....Standard Specification for Concrete Aggregates
- C39/C39M-12.....Standard Test Method for Compressive Strength of  
Cylindrical Concrete Specimens
- C94/C94M-12.....Standard Specification for Ready Mixed Concrete
- C143/C143M-10.....Standard Test Method for Slump of Hydraulic  
Cement Concrete
- C150-11.....Standard Specification for Portland Cement
- C171-07.....Standard Specification for Sheet Material for  
Curing Concrete
- C172-10.....Standard Practice for Sampling Freshly Mixed  
Concrete
- C173-10.....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Volumetric Method
- C192/C192M-07.....Standard Practice for Making and Curing Concrete  
Test Specimens in the Laboratory
- C231-10.....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Pressure Method
- C260-10.....Standard Specification for Air-Entraining  
Admixtures for Concrete
- C330-09.....Standard Specification for Lightweight  
Aggregates for Structural Concrete
- C494/C494M-11.....Standard Specification for Chemical Admixtures  
for Concrete
- C618-12.....Standard Specification for Coal Fly Ash and Raw  
or Calcined Natural Pozzolan for Use in Concrete
- D1751-04(R2008) .....Standard Specification for Preformed Expansion  
Joint Fillers for Concrete Paving and Structural  
Construction (Non-extruding and Resilient  
Bituminous Types)

D4397-10.....Standard Specification for Polyethylene Sheeting  
for Construction, Industrial and Agricultural  
Applications

E1155-96(2008).....Standard Test Method for Determining  $F_F$  Floor  
Flatness and  $F_L$  Floor Levelness Numbers

## **PART 2 - PRODUCTS**

### **2.1 FORMS:**

Wood, plywood, metal, or other materials, approved by COR, of grade or type suitable to obtain type of finish specified.

### **2.2 MATERIALS:**

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67.
- D. Fine Aggregate: ASTM C33.
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).
- J. Reinforcing Steel: ASTM A615, deformed.
- K. Welded Wire Fabric: ASTM A185.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Grout, Non-Shrinking: Premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout shall show no settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement, and produce a compressive strength of at least 18mpa (2500 psi) at 3 days and 35mpa (5000 psi) at 28 days.

### **2.3 CONCRETE MIXES:**

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 25mpa (3000 psi) for wall footings and concrete bases; and 30 Mpa (4000 psi) for wall caps.

- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- E. Cement and water factor (See Table I):

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete: Strength Min. 28 Day Comp. Str. MPa (psi)	Non-Air-Entrained		Air-Entrained	
	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) <sup>1,3</sup>	375 (630)	0.45	385 (650)	0.40
30 (4000) <sup>1,3</sup>	325 (550)	0.55	340 (570)	0.50
25 (3000) <sup>1,3</sup>	280 (470)	0.65	290 (490)	0.55
25 (3000) <sup>1,2</sup>	300 (500)	*	310 (520)	*

- If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
  - For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
  - Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- F. Air-entrainment is required for all exterior concrete. Air content shall conform with the following table:

**TABLE I - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
10 mm (3/8 in)	6 to 10
13 mm (1/2 in)	5 to 9
19 mm (3/4 in)	4 to 8
25 mm (1 in)	3 1/2 to 6 1/2
40 mm (1 1/2 in)	3 to 6

**2.4 BATCHING & MIXING:**

- A. Store, batch, and mix materials as specified in ASTM C94.
  - 1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
  - 2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

**PART 3 - EXECUTION****3.1 FORMWORK:**

- A. Installation conforms to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  - 1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
  - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather cool metal forms by thoroughly wetting with water just before placing concrete.
  - 3. Use sealer on reused plywood forms as specified for new material.
- C. Inserts, sleeves, and similar items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned and built into construction, and maintained securely in place.
- D. Construction Tolerances:
  - 1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
  - 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering

individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

### **3.2 REINFORCEMENT:**

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
  - 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.

### **3.3 EXPANSION JOINTS AND CONTRACTION JOINTS:**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints to form a complete, uniform separation between the structure and the site work concrete item.
- C. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished surface where shown to allow for backer rod and sealant.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Provide contraction (control) joints in cast-in-place concrete wall caps at 15-feet on centers. Joints shall be troweled to 1/4 wall cap depth after the surface has been finished. Protect joints from intrusion of foreign matter.

### **3.17 CONSTRUCTION JOINTS**

- A. Locate transverse construction joints between in concrete footing for stone veneer wall.
- B. Place transverse construction joints whenever the placing of concrete is suspended for more than 30 minutes.

D. Use keyed joints with tiebars.

#### **3.4 PLACING CONCRETE:**

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of COR before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.
- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from COR.

#### **3.5 PROTECTION AND CURING:**

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by COR.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m<sup>2</sup>/L (400 square feet per gallon) on steel troweled surfaces and 7.5m<sup>2</sup>/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

### **3.6 FORM REMOVAL:**

Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

### **3.7 SURFACE PREPARATION:**

Immediately after forms have been removed and work has been examined and approved by COR, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

### **3.8 FINISHES:**

#### **A. Vertical and Overhead Surface Finishes:**

1. Exterior Exposed Areas (to be painted): Fins, burrs and similar projections on surface shall be knocked off flush by mechanical means approved by COR and rubbed lightly with a fine abrasive stone or hone. Use an ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
2. Exterior Exposed Areas (finished): Finished areas, unless otherwise shown, shall be given a grout finish of uniform color and shall have a smooth finish treated as follows:
  - a. After concrete has hardened and laitance, fins and burrs have been removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone or stone.
  - b. Apply grout composed of 1 part portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until all pits and honeycomb are filled.

- c. After grout has hardened, but still plastic, remove surplus grout with a sponge rubber float and by rubbing with clean burlap.
- d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish for any area in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
2. Float Finish: Concrete wall caps and slabs to receive flagstone paving, except as specified, shall be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces shall be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
3. Steel Trowel Finish: Cast wall caps shall be steel troweled. Final steel troweling to secure a smooth, dense surface shall be delayed as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface shall be free of trowel marks, uniform in texture and appearance.
4. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application shall all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to roughen surface to insure a permanent bond between base slab and applied cementitious materials.
5. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:

Slab on grade & Shored suspended slabs	Unshored suspended slabs
Specified overall value $F_F$ 25/ $F_L$ 20	Specified overall value $F_F$ 25
Minimum local value $F_F$ 17/ $F_L$ 15	Minimum local value $F_F$ 17

**3.21 CLEANING**

- A. After completion of the curing period:
1. Remove the curing material (other than liquid membrane).
  2. Sweep the concrete clean.
  3. After removal of all foreign matter from the joints, seal joints as specified.
  4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

**3.22 PROTECTION**

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

**3.23 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.

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**SECTION 04 22 00**

**UNIT MASONRY ASSEMBLIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes unit masonry assemblies as concrete substrates for stone veneer walls consisting of the following:
1. Concrete masonry units (CMU).
  2. Mortar and grout.
  3. Reinforcing steel.
  4. Masonry joint reinforcement.
  5. Ties and anchors.
- B. Related Sections include the following:
1. Division 3 Section "Cast-in-Place Concrete" for concrete footings for CMU walls.
  2. Division 4 Section "Stone Masonry" for stone veneer over concrete substrates.
- C. Products installed, but not furnished, under this Section include the following:
1. Masonry anchors, furnished under Division 4 Section "Stone Masonry."

**1.2 DEFINITIONS**

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

**1.3 SUBMITTALS**

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.

- a. Include material test reports substantiating compliance with requirements.
  2. Cementitious materials. Include brand, type, and name of manufacturer.
  3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  4. Grout mixes. Include description of type and proportions of ingredients.
  5. Reinforcing bars.
  6. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, UBC Standard 21-16, for mortar mixes required to comply with property specification.
  2. Include test reports, per ASTM C 1019, UBC Standard 21-18, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations for Masonry Units: Obtain masonry units of a uniform texture through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- C. Mockups: Build sample panels in conjunction with Division 4 Section "Stone Masonry" for mockups of stone veneer walls.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602, Section 2104.3 in the Uniform Building Code.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

### PART 2 - PRODUCTS

#### 2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

## **2.2 CONCRETE MASONRY UNITS (CMU)**

- A. Concrete Masonry Units: ASTM C 55, Grade S, type 1.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.
  - 2. Weight Classification: Normal weight.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
  - 4. Size (Width): As indicated on Drawings.

## **2.3 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, UBC Standard 21-13, Type S.
- C. Masonry Cement: ASTM C 91, UBC Standard 21-11.
- D. Mortar Cement: ASTM C 1329, UBC Standard 21-14.
- E. Aggregate for Mortar: ASTM C 144.
- F. Aggregate for Grout: ASTM C 404.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- H. Water: Potable.

## **2.4 REINFORCEMENT**

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

## **2.5 TIES AND ANCHORS**

- A. Materials: As specified in Division 4 Section "Stone Masonry."

## **2.6 MORTAR AND GROUT MIXES**

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, UBC Standard 21-15, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type S.
  2. For reinforced masonry, use Type S.
- C. Grout for Unit Masonry: Comply with ASTM C 476, UBC Standard 21-19.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602, Table 21-C in the Uniform Building Code for dimensions of grout spaces and pour height.
  2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
- D. Use mortar and grout within 90 minutes of addition of water to portland cement.

## **2.7 DAMPPROOFING**

- A. Bitumastic waterproofing for CMU exposed to soil: Complies with ASTM D 412, Comply with Federal Specification TT-C-555B, Type II. VOC compliant.
1. Silicone modified acrylate resin system producing a weatherproof coating capable of being applied at 7 to 13 mils dry film thickness by spray, roller, or brush.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Verify that foundations are within tolerances specified.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. For conspicuous vertical lines, such as corners, expansion and control joints do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
  - 3. For conspicuous horizontal lines, such as sills, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

### 3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

### **3.4 MORTAR BEDDING AND JOINTING**

- A. Lay hollow concrete masonry units as follows:
  - 1. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

### **3.5 ANCHORING MASONRY VENEERS**

- A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
  - 1. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

### **3.6 CONTROL AND EXPANSION JOINTS**

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall movement.
- B. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod but not less than 3/8 inch.

### **3.7 REPAIRING, POINTING, AND CLEANING**

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

**3.8 DAMPPROOFING**

- A. Cure masonry and mortar for at least 28 days; apply waterproofing coating only to dry masonry and mortar, surfaces clean and free of dirt, oil or grease.
- B. Remove loose particles, laitance, fins and mortar droppings and other foreign material; ensure mortar joints free of voids and cracks.
- C. Prime clean, unpainted surfaces in accordance with manufacturer's written instructions, filling porous, lightweight, or split faced block to achieve pinhole-free surface. Apply by brush, roller, or spray; when spray applied, back-roll split faced, lightweight, or porous block to eliminate pinholes.
- D. Finish Coat: Apply pinhole-free finish coat of waterproofing coating 80 to 100 square feet per to achieve a minimum 21 wet, 9 to 10 dry mils.
- E. Provide drainage rock as indicated in the Drawings..

**3.9 MASONRY WASTE DISPOSAL**

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

**SECTION 04 43 00**

**STONE MASONRY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Furnish labor, material and equipment necessary and required to install stone masonry over substrates of concrete.
- B. Related Sections include the following:
  - 1. Division 04 Section "Concrete Unit Masonry" for concrete substrates.

**1.2 SAMPLES**

- A. Provide five (5) stone samples illustrating range of product size and color.

**1.3 QUALIFICATIONS**

- A. Provide stone mason who is familiar with materials and methods of installation, 12 years minimum experience with similar projects and workmanship previously performed on similar projects.
- B. Stone masons shall specialize in stone masonry only. Brick and concrete block masons are not acceptable for this work.
- C. Provide listing of at least 3 projects in the last 3 years with similar products with a stone masonry construction cost of at least \$150,000 each.

**PART 2 - PRODUCTS**

**2.1 STONE**

- A. Natural stone, free of cracks, seams, or imperfections which would impair the structural integrity of the material.
  - 1. Match existing stone used on cemetery stone walls.

**2.2 MORTAR AND GROUT**

- A. Type M mortar mixed mechanically on site in the following proportions or approved: One part Portland Cement Type I & II, one quarter part "Easy Spread," "Hydratite" water repellent per manufacturer's recommended application, and three parts masonry sand ASTM C-144, 4-6 percent air-entraining add-mixture, and clean water free from debris, oil, or other substances that may degrade finished product. "Easy Spread" and "Hydratite" are available from Masons Supply Company (MASCO), Medford, OR (541) 772-4752 and 1-800-537-6216.
- B. Bonding agent shall meet the following proportions or approved: One 90-pound bag of Portland Cement, one pint "Mascobond SBR", "Hydratite Plus" water repellent per manufacturers recommended application. "Mascobond" and "Hydratite Plus" are available from Masons Supply Company (MASCO), Medford, OR (541) 772-4752 and 1-800-537-6216.
- C. Pigmented Grout, use a colored cement formulation as required to produce color to match existing grout on stone walls.
  - 1. Pigments shall be composed of natural or synthetic iron oxides, compounded for use in mortar mixes, and with a record of satisfactory performance in stone masonry mortars.
  - 2. Pigments shall not exceed 10 percent of portland cement by weight.
  - 3. Submit manufacturer's product information and dosage rate for specified color.
  - 4. Submit manufacturer's full range of color samples for approval by COR.
- D. Latex additive (water emulsion) described below, serving as replacement for part of or all gauging water, of type specifically recommended by latex-additive manufacturer for use with job-mixed portland cement mortar and not containing a retarder.
- E. Latex Additive: acrylic resin.

### **2.3 METAL ACCESORIES**

- A. Corrugated-Metal Masonry Anchors: Not less than 0.030-inch thick by 7/8-inch wide stainless steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch and amplitude of 0.06 to 0.10 inch

## **PART 3 - EXECUTION**

### **3.1 COLD AND RAINY WEATHER CONDITIONS**

- A. Perform no work when temperatures are below 40 degrees Fahrenheit or above 90 degrees Fahrenheit, prior to, during, and within 48 hours of temperatures indicated. Protect work from freezing for four days after laying. Perform no work in the rain. Use no admixtures, antifreeze or calcium chloride in mortars. Cover top of wall when work is interrupted by weather or other adverse conditions.

### **3.2 PROTECTION OF WORK**

- A. Protect face materials from staining. Remove misplaced or splattered mortar or grout from masonry and adjacent surfaces. Protect sills, ledges, offsets and similar items from mortar dripping or other damage.

### **3.3 CONDITION OF SURFACES**

- A. Concrete surfaces which will receive masonry shall have been roughened to expose aggregate and cleaned of laitance, dirt, oil or other bond-reducing coatings. Check alignment of supporting structure. Do not start unless horizontal and vertical surfaces are within 1/4 inch of dimensions indicated on the Drawings. Examine supporting structure and conditions under which masonry work is to be installed. Do not proceed until unsatisfactory conditions have been corrected. Dampen concrete surfaces which will receive masonry.
- B. Direct placing of dowels and inserts before concrete is poured; be responsible for their accuracy. Coordinate location of piping, conduit and other work in masonry. Notify other trades in ample time for delivery and setting of their work.
- C. Install all bolts, anchors, sleeves, pipes, and other built-in items as masonry progresses. Device location, spacing and loading subject to approval. Size and locations of openings not detailed subject to approval. Openings up to 6 inches in diameter may be drilled. No chipping of finished masonry permitted except as approved. Provide masonry ties per Uniform Building Code at all veneer.

### **3.4 SETTING STONE**

- A. Grout color as selected by COR.
- B. Brush stone free of dust, or foreign matter and thoroughly wash with clean water.
- C. Install stone anchoring system.
- D. Accurately set stone true to line level as shown on the Drawings. Lay stone in a pattern per the Drawings. Exposed face of stones shall have 3/4 inch maximum depth of surface irregularity.
- E. Lay stone to true vertical face in sizes selected to minimize joints. Keep exposed faces clear of mortar.
- F. Finish mortar joints to match existing stone walls.

### **3.5 CLEANING**

- A. Brush or wash exposed rock surfaces clean of any mortar or spall after mortar has set.

**END OF SECTION**

**SECTION 26 56 00  
EXTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of exterior light fixtures and supports. The terms "lighting fixtures", "fixture" and "luminaire" are used interchangeably.

**1.2 RELATED WORK**

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit product data sheets for exterior sign light luminaries and all specified accessories in electronic Adobe PDF format for review and approval of COR.
  - 1. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
  - 2. Manuals:
    - a. Submit complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
  - 3. Certifications: Two weeks prior to final inspection, submit the following.
    - a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Aluminum Association Inc. (AA):
  - AAH35.1-06.....Alloy and Temper Designation Systems for Aluminum

- E. American National Standards Institute (ANSI):
  - C81.61-09 .....Electrical Lamp Bases - Specifications for  
Bases (Caps) for Electric Lamps
- F. American Society for Testing and Materials (ASTM):
  - B108-03a-08 .....Aluminum-Alloy Permanent Mold Castings
- H. Illuminating Engineering Society of North America (IESNA):
  - HB-9-00.....Lighting Handbook
  - LM-72-10.....Directional Positioning of Photometric Data
  - LM-79-08.....Approved Method for the Electrical and  
Photometric Measurements of Solid-State Lighting  
Products
  - LM-80-08.....Approved Method for Measuring Lumen Maintenance  
of LED Light Sources
  - TM-15-07.....Backlight, Uplight and Glare (BUG) Ratings
- I. National Electrical Manufacturers Association (NEMA):
  - C136.3-05 .....For Roadway and Area Lighting Equipment -  
Luminaire Attachments
  - ICS 2-00 (R2005) .....Controllers, Contactors and Overload Relays  
Rated 600 Volts
  - ICS 6-93 (R2006) .....Enclosures
- J. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
- K. Underwriters Laboratories, Inc. (UL):
  - 496-08 .....Lampholders
  - 773-95.....Plug-In, Locking Type Photocontrols for Use  
with Area Lighting
  - 773A-06 .....Nonindustrial Photoelectric Switches for  
Lighting Control
  - 1598-08 .....Luminaires
  - 8750-09.....Light Emitting Diode (LED) Equipment for Use in  
Lighting Products

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

Luminaires, materials and equipment shall be in accordance with NEC,  
UL, ANSI, and as shown on the drawings and specified.

### **2.3 FOUNDATIONS FOR STANCHIONS**

- A. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
- B. Foundations shall support the effective projected area of the specified support stanchion.
- C. Place concrete in spirally-wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Smooth trowel finish and round all above-grade concrete edges to approximately 13 mm (0.5-inch) radius.

### **2.4 LUMINAIRES**

- A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and driver heat, and safe cleaning and relamping.
- C. Incorporate drivers in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, clear tempered glass, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by captive torque screws. Use heat and aging-resistant, resilient silicone gaskets to seal and cushion lenses and refractors in luminaire doors.
- G. Stanchion-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of support materials.
- J. Luminaires shall carry factory labels, showing complete, specific lamp and driver information.

### **2.5 LAMPS**

- A. Install the proper lamps in every luminaire installed.
- B. Lamps shall be general-service, outdoor lighting types.
- F. LED sources shall meet the following requirements:
  - 1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 40 degrees C (104 degrees F).
  - 2. Correlated Color Temperature (CCT): 4000K.
  - 3. Color Rendering Index (CRI): ≥ 85.

4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life (60,000 to 100,000 hours).

## **2.9 LED DRIVERS**

- A. LED drivers shall meet the following requirements:
  1. Drivers shall have a minimum efficiency of 85%.
  2. Starting Temperature: -40 degrees C (-40 degrees F).
  3. Input Voltage: 120 to 480 ( $\pm 10\%$ ) volt.
  4. Power Supplies: Class I or II output.
  5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50  $\mu$ s, 10kA/8 x 20  $\mu$ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
  6. Power Factor (PF):  $\geq 0.90$ .
  7. Total Harmonic Distortion (THD):  $\leq 20\%$ .
  8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
  9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

## **2.10 EXISTING LIGHTING SYSTEMS**

- A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
- B. New luminaires shall have approximately the same configurations, dimensions, lamping and reflector type as the existing luminaires, except where otherwise shown on the drawings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Stanchion Foundations:
  1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.

2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
  3. Install stanchion as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
- C. Install wire connections in waterproof, subterranean, GFCI-protected junction boxes.
  - D. Install lamps in each luminaire.
  - E. Install photocell on one luminaire for each electrical circuit.
  - F. Install barn doors on each luminaire.
  - G. Adjust luminaires that require field adjustment or aiming.

### **3.2 GROUNDING**

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

### **3.3 ACCEPTANCE CHECKS AND TESTS**

Verify operation after installing luminaires and energizing circuits.

- - - E N D - - -

**SECTION 31 10 00**

**SITE CLEARING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Protecting existing trees shrubs groundcovers plants and grass to remain.
  - 2. Removing existing shrubs and groundcovers plants.
  - 3. Removing above- and below-grade site improvements including but not limited to pavements, structures and other appurtenances.
  - 4. Disconnecting, capping or sealing, and abandoning site utilities in place and removing site utilities where indicated.
  - 5. Temporary erosion and sedimentation control measures.
  - 6. Alleviation or prevention of dust nuisance.
  
- B. Related Sections include the following:
  - 1. Division 31 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
  - 2. Division 32 Sections "Planting" for planting requirements, finish grading including preparing and placing topsoils, planting soil mixes and testing of topsoil material.

**1.02 DEFINITION**

- A. Clearing is defined as removal of debris, trees, brush, vines, sod, and other vegetative growth at or above the ground surface.
  
- B. Grubbing is defined as removal of vegetative growth or natural wooden items at or below ground surface, which remain after clearing work.
  
- C. Demolition is defined as removal of fences, portion of structures, pavements, stairs, utilities, and other such manmade items at or below the ground surface. Salvage and deliver to Government items noted in plans or as directed by Contracting Officer's Representative (COR).
  
- D. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
  
- E. Remove and Salvage: Detach items from existing construction and deliver them to the Government ready for reuse.
  
- F. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

- G. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- H. Disposal is defined as removal of refuse resulting from clearing, grubbing, and demolition work.
- I. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- J. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

#### **1.03 OWNERSHIP OF MATERIALS**

- A. Unless otherwise shown, specified, indicated to remain or designated for salvage, all materials resulting from the grubbing, clearing and demolition Work shall become the property of the Contractor and shall be disposed of off-site in a lawful manner. All topsoil material is to remain on the site and be stockpiled at approved location during grading. Care shall be taken not to contaminate existing topsoil.

#### **1.04 SUBMITTALS**

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings: Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### **1.05 QUALITY ASSURANCE**

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

#### **1.06 PROJECT CONDITIONS**

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3. Provide flaggers as needed to ensure public safety.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and transport items to location(s) on the Governments premises as directed by the COR.
- C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- D. Protection: Protect burial areas and turf from damage from site clearing operations. Restore damaged areas to original condition to the satisfaction of the COR at no additional cost to the Government.

#### **1.07 EXISTING UTILITIES**

- A. Contractor shall be responsible for determining which utility agencies, public or private, have underground or surface facilities. Contact COR to obtain copies of Record Documents for existing on-site utilities.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Call Oregon Utility Notification Center (OUNC). 1-800-332-2344. (or 811).
- C. Locate and identify, with visible marking, existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during excavation operations.
- D. Should uncharted piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the Government and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner. The cost of repairing charted utilities shall be paid by the Contractor.
- E. Do not interrupt existing utilities service facilities occupied and used by the Government or others, except when permitted in writing by the COR and then only after acceptable temporary utility services have been provided.

### **PART 2 - PRODUCTS**

#### **2.01 SOIL MATERIALS**

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthwork."
- B. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

#### **2.02 WATER**

- A. Contractor may use water source located on site if approved by and coordinated with the COR.

- B. Water used in dust control shall be free of silts and other materials deleterious to the quality of the material to which it is applied or with which it is mixed.

**PART 3 - EXECUTION**

**3.01 INSPECTION OF SITE**

- A. Prior to commencement of Work under this section, inspect the site in the company of the COR to fully determine the extent of work requirements and limitations.
- B. Mark or flag improvements to be removed prior to the inspection.

**3.02 PREPARATION**

- A. Protect and maintain benchmarks, burial section control markers, and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated. Do not use paint to mark trees to remain.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to the Government or Owner's Representative at no additional cost to the Government.

**3.03 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.04 PLANT PROTECTION**

- A. Protect all trees, shrubbery, and grass areas not designated for removal under this Contract. Temporary, continuous barriers shall be erected where necessary to assure their safety. Repair any trees, vegetation or grass areas damaged as a result of Work under this section in an approved manner.
- B. Erect and maintain temporary fencing around plant protection zones before starting site clearing. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within fenced area.

2. Do not permit vehicles, equipment, or foot traffic within fenced area.
  3. Maintain fenced area free of weeds and trash.
- C. Do not excavate within tree protection zones, unless otherwise indicated.
- D. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
  2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  4. Backfill with soil as soon as possible.
- E. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by COR.
1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
  2. Replace trees that cannot be repaired and restored to full-growth status, as determined by COR.

### 3.05 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government, lessors or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify COR not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without written permission of the COR.
- C. Excavate and remove underground utilities indicated to be removed on the Drawings. Disconnect existing service lines to be abandoned and cap exposed service lines to be maintained.

### 3.06 DUST CONTROL

- A. Contractor shall provide a dust control media, such as water, to control on-site dust and to prevent dust from leaving the site. Failure may result in Government providing dust control measures at Contractor's expense.
- B. The watering Work shall be subject to the control of the COR. Watering shall be done only when and where directed by the COR.

The rates of application shall be as directed, and the manner of application shall be as approved by the COR.

- C. Watering shall be performed at any hour of the day and on any day of the week that the COR may determine necessary for adequate alleviation of dust nuisance. Wastage of water or watering which is detrimental to other Work shall be avoided and such operations ceased until the COR determines what corrective measures shall be taken.
- D. Watering shall be by means of tank trucks equipped with spray bars, by hose and nozzle or by other means, any and all of which shall insure uniform and controlled application.

### **3.07 CLEARING AND GRUBBING**

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  - 3. Grind stumps and remove roots larger than one inch in diameter, obstructions, and debris extending to a depth of 24 inches below exposed subgrade.
  - 4. Use only hand methods for grubbing within tree protection zone.
  - 5. Chip removed tree branches and stockpile or spread onto areas approved by COR.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

### **3.08 MULCH REMOVAL**

- A. Remove volcanic rock mulch to full depths encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. Transport rock and stockpile or spread in a location as directed by the COR.
  - 1. Remove weed barrier fabric and staples.
- B. Remove bark mulch and stockpile or spread in a location as directed by the COR.
- C. Remove subsoil and nonsoil materials from mulches, including trash, debris, weeds, roots, and other waste materials.

### **3.09 TOPSOIL REMOVAL**

- A. Stockpile topsoil materials from excavations away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.
4. Dispose of excess topsoil and unsuitable topsoil by transporting material to cemetery spoils area as directed by the COR.

### **3.10 SITE IMPROVEMENTS DEMOLITION**

- A. Remove existing above- and below-grade improvements as indicated on the Drawings and as necessary to facilitate new construction.
- B. Remove slabs, paving, steps, stairways, handrails, concrete blocks, railroad ties, aggregate base, and electrical components as indicated on the Drawings.
  1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain at the nearest control joint before removing existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.
- C. Remove all structures or portions of structures shown, specified, or required to be removed in areas of Work. For salvage items, transports and deliver to Government's materials storage area. Remove all debris from the demolition work from the site as specified in this section.
  1. The removal of debris, construction materials, loose rocks and other materials at or below grade encountered while grading is considered incidental to the site preparation work.

### **3.11 DISPOSAL OF WASTE MATERIAL**

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, cleared vegetation, and waste materials including trash and debris, and legally dispose of them off Government's property.
  1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

### **3.12 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by site clearing operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

**SECTION 31 20 11**

**EARTHWORK**

**PART 1 - GENERAL**

**1.1:DESCRIPTION:**

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and imported topsoil.

**1.2 DEFINITIONS:**

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698 and D1557.

D. The term fill means fill or backfill as appropriate.

E. Base Course: Course placed between the subgrade and a pavement, a cement concrete walk, or concrete footing.

F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

**1.3 RELATED WORK:**

- A. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and

stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

- B. Division 03 Section "Cast-in-Place Concrete" for, concrete bases, walls and footings.
- C. Division 26 Section for installing underground electrical utilities.
- D. Division 32 Section "Planting" for amendment of imported topsoil

#### **1.4 CLASSIFICATION OF EXCAVATION:**

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Classified Excavation: Removal and disposal of all material not defined as rock.
- C. Rock Excavation:
  - 1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
  - 2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m<sup>3</sup> (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
  - 3. Boulders or other detached stones each having a volume of 0.4 m<sup>3</sup> (1/2 cubic yard) or more.

#### **1.7 SUBMITTALS:**

- A. Furnish to COR, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.
- B. Qualifications of the commercial testing laboratory or Contractor's Testing facility shall be submitted.
- C. Imported Topsoil Testing: For each imported topsoil, furnish soil analysis and a written report by an independent, qualified agricultural soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; mineral and plant-macro and micro nutrient content of the soil. Test results shall indicate that the topsoil meets the requirements for imported topsoil as defined in these specifications.

**1.8 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Nursery and Landscape Association (ANLA):  
2004.....American Standard for Nursery Stock
- C. American Association of State Highway and Transportation Officials (AASHTO):  
T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop  
T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop
- D. American Society for Testing and Materials (ASTM):  
C33-03.....Concrete Aggregate  
D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort  
D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve  
D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method  
D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort  
D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method  
D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)  
D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- E. Standard Specifications of Oregon Department of Transportation (ODOT), latest revision.

**PART 2 - PRODUCTS****2.1 MATERIALS:**

- A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m<sup>3</sup> (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.
- B. Imported Topsoil: ASTM D 5268; natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles, conforming to USDA classification for Loam or Sandy Loam; friable, pervious, and

black or a darker shade of brown, gray or red than underlying subsoil; minimum of 6 percent organic material content; pH range between 6 and 8; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inches in any dimension; and free of weeds, roots, and other deleterious materials.

- C. Buried Warning and Identification Tape: Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red:	Electric
Blue:	Water Systems

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION:**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during earthwork operations.
- D. Protect and maintain tree protection, which is specified in Division 31 Section "Site Clearing" during earthwork operations.
- E. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COR. Eliminate foreign material, such as weeds, roots, stones, subsoil,

frozen clods, and similar foreign materials, larger than 0.014 m<sup>3</sup> (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

- F. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

### **3.2 DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### **3.3 EXPLOSIVES**

- A. Explosives: Do not use explosives.

### **3.4 EXCAVATION, GENERAL:**

- A. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the COR as unsuitable, and replace with acceptable material.
- B. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 6 inches outside of minimum required dimensions of concrete cast against grade.

- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- e. 6 inches beneath bottom of concrete slabs on grade.
- f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

### **3.5 EXCAVATION FOR STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Comply with Geotechnical Report and Structural Engineer's requirements, if engineered fill is required.

### **3.6 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Finished elevation of subgrade shall be as follows:
  - 1. Pavement Areas - bottom of the pavement or base course as applicable.

### **3.7 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
  - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

### **3.8 EXCAVATION FOR LANDSCAPE AREAS**

- A. Lawn Areas - Establish subgrades for lawn areas 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.
- B. Planting Areas - Establish subgrades for planting areas 300 mm (12 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

**3.9 SUBGRADE INSPECTION**

- A. Notify COR and Soils Engineer when excavations have reached required subgrade.
- B. If COR and/or Soils Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by COR, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by COR and/or Soils Engineer, without additional compensation.

**3.10 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by COR.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by COR.

**3.11 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials, topsoil, and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

**3.12 FILLING AND BACKFILLING:**

- A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until walls have been completed and adequately cured, waterproofing or damp-proofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COR.

- B. Proof-rolling Existing Subgrade: - Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade with 8 to 12 passes of a steel drum roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the COR a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the COR. Rutting or pumping of material shall be undercut as directed by the COR to a depth of 305 mm (12 inches) and replaced with fill and backfill.
- C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.
- D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing walls without the prior approval of the COR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer until there is no evidence of further compaction // to not less than 95 percent of the maximum density determined in accordance with the following test method D698. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.
- E. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from the cemetery spoils yard. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.
- F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the COR sufficiently in advance of the opening of any excavation

or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

### **3.13 GRADING:**

- A. General: Uniformly grade the areas within the limits of work, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.
- C. Slope grades to direct water away from structures and to prevent ponding.
- D. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus 0 or minus 1 inch.
  - 2. Pedestrian pavements: Plus 0 or minus 1/2 inch.

### **3.14 LAWN AREAS:**

- A. Existing Lawns: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before imported topsoil placement begins.
- B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply imported topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of imported topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with

undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

### **3.14 PLANTING AREAS:**

- A. Existing Planting Areas: Harrow and till to a depth of 100 mm (4 inches), new or existing planting areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out planting areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before imported topsoil placement begins.
- B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in planting areas to a depth of 100 mm (4 inches). Apply imported topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 300 mm (12 inches) of imported topsoil over all planting areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

### **3.15 SUBSURFACE DRAINAGE**

- A. Complete all excavation carrying the grade of the trench bottom to the lines and grades shown on the plan or as established by the COR, with adequate allowance for pipe bedding.
- B. Do not deviate from line or grade by more than 1/2 inch for line and 1/4 inch for grade provided that such variation does not result in a level or reverse sloping invert.
- C. Inspect all pipe and fittings prior to installation to ensure that no broken, cracked, or otherwise defective materials are used.
- D. Clean ends of pipe prior to joining and ensure that no soil or other foreign matter is in the pipe when laid. When work stops for any reason, cap or plug the end of the pipe.
- E. Make joints in a manner recommended by the pipe manufacturer.
- F. After the joint is made, check pipe for alignment and grade. Place sufficient pipe bedding and backfill material to secure the pipe from movement before the next section of pipe is installed.
- G. Connect perforated drain lines to site drainage lines. Provide solid drain line under paving and to connect to drainage structures where

shown on the Drawings. Cap all blind ends of perforated drain lines with solid cap.

- H. Install cleanouts at changes in direction in drain lines and as shown on Drawings.
- I. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- J. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

### **3.16 SUBBASE AND BASE COURSES**

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under slabs, pavements and walks as follows:
  - 1. Shape subbase and base course to required elevations and cross-slope grades.
  - 2. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 3. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### **3.17 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be

based on a visual comparison of subgrade with tested subgrade when approved by COR.

- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Retaining Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 4 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### **3.18 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by COR; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.19 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

- A. Disposal: Transport surplus soil to designated storage areas on Cemetery property. Stockpile or spread soil as directed by COR.
  - 1. Remove waste material, trash, and debris, and legally dispose of it off Cemetery property.
- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

**3.20 CLEAN-UP:**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Cemetery Property.

- - - E N D - - -

**SECTION 32 14 40**

**STONE PAVING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Stone pavers set in mortar setting bed.
- B. Related Sections include the following:
  - 1. Division 32 Section "Concrete Paving" for expansion joint filler, backer rod and joint sealant.
  - 2. Division 03 Section "Cast in Place Concrete" for concrete slabs under stone pavers.

**1.2 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Stone pavers.
  - 2. Mortar materials.
  - 3. Grout materials.
  - 4. Expansion Joint Material including backer rod and sealant.
- B. Paver Samples for Verification: The following type quantity and size for each unit paver and slab shall be submitted to show the color, texture, and pattern specified, showing the full range of variations expected in the completed work.
  - 1. Five - full size stone paver showing extreme variations in color and texture.
- C. Grout Samples for Initial Selection: Submit manufacturer's color bar samples showing the full range of colors.
- D. Grout Samples for Verification: Provide the colored grout selected by COR installed between stone pavers or as required to show the full range of colors to be expected in the finish work.
- E. Compatibility and Adhesion Test Reports: From latex-additive manufacturer indicating the following:
  - 1. Mortar and grout containing latex additives have been tested with pavers and slabs for compatibility and adhesion.
  - 2. Interpretation of test results relative to mortar and grout performance and written recommendations for installation practices needed for adhesion.

### **1.3 QUALITY ASSURANCE**

- A. **Installer Qualifications:** An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Source Limitations:** Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- C. **Mockups:** Before installing unit pavers, build mockups for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated:
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by COR.
  - 2. Notify COR seven days in advance of dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain COR's approval of mockups before starting unit paver installation.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 6. Demolish and remove mockups when directed.
  - 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.
  - 1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store liquids in tightly closed containers protected from freezing.

### **1.5 PROJECT CONDITIONS**

- A. **Cold-Weather Protection:** Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or

setting beds. Remove and replace unit paver work damaged by frost or freezing.

- B. Hot Weather Protection: In hot weather, masonry shall be protected to prevent excessive evaporation of setting beds and grout. Artificial shade, wind breaks and cooled materials shall be used as required.
- C. Weather Limitations for Mortar and Grout: Comply with the following requirements:
  - 1. Maintain ambient temperatures between 50-100 deg. F. (10-38 deg. C) during installation and for minimum 7 days after completion. Verify substrate, ambient and material at least 37 deg. F (3 deg. C) for installation of Latex-modified mortars. Maintain surface between 60 to 90 deg. F (16 to 32 deg. C) during installation of epoxy grouts. Protect mortars and grouts until cured to prevent premature evaporation of moisture.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS:**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Stone Pavers:
    - a. Quarzitic Sandstone flagstone
    - b. Available from: Fill in supplier name, Tel.: phone number
    - c. Style: Pattern Cut with Natural cleft on top with fractured edges.
    - d. Finish: Natural.
    - e. Size: 12, 18 and 24 inch widths by random lengths.
    - f. Thickness: 1 inch minimum.
    - g. Color: Golden tan with red tints to match existing stone walls.
    - h. Pattern: Random
  - 2. Latex-Modified Portland Cement Mortars and Grouts:
    - a. Laticrete International, Inc.
  - 3. Stone Floor and Grout Sealers:
    - a. Masco, Masco-Seal, Silane/Siloxane Sealer, 6% VOC.

### **2.2 GROUT COLORS AND TEXTURES**

- A. Colors and Textures: As selected by COR from manufacturer's full range.

### **2.3 ACCESSORIES**

- A. Floor Sealer: Colorless, slip- and stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
- B. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50 by 50 mm) by 0.108-inch (2.75-mm) (12 gauge) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

#### 2.4 SETTING and GROUT MATERIALS

- A. Cementitious Material:
  - 1. Portland cement shall be ASTM-C 150, Type I of natural color or white, as required to produce the required color of mortar or grout.
  - 2. Latex additives shall be Laticrete as follows:
    - a. Slurry Bond Coat: Laticrete 211 Crete Filler Powder gauged with Laticrete 3701 Mortar Admix.
    - b. Thick-set Mortar Leveling Bed: Weather, frost, shock resistant complying with ANSI A118.4 test and equal to Laticrete 226 Thick Bed Mortar Mix gauged with Laticrete 3701 Mortar Admixture.
    - c. Thin-set (Paver Bond Coat) Mortar Bed: Laticrete 211 Crete Filler Powder gauged with Laticrete 4237 Latex Thin Set Mortar Additive.
  - 3. For approval of other Manufacturers and Products, a substitution request shall be submitted prior to the Bid date.
  - 4. Mortar and Grout additives shall be compatible and from one manufacturer.
- B. Aggregate for Mortar and Grout: ASTM C 144, graded to comply with latex-additive manufacturer's requirements.
- C. Grout Materials:
  - 1. Grout: Laticrete 500 series sanded floor grout and joint filler gauged with Laticrete 3701 Mortar and Grout Admixture. Color to be selected by COR from Traditional Group I.
- D. Colored Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in Portland cement grout. Pigment to cement ratios, by weight of 1 to 7 shall not be exceeded.
- E. The mortar and grout shall be weather, frost, shock and chemical resistant and meet the following requirements:
  - 1. Thick-set mortar bed compressive strength, 3000 psi.
  - 2. Thin-set paver bed bond strength, 500 psi.
  - 3. Water absorption, 4% minimum.

- F. All materials shall be delivered to the job site in the original containers with the manufacture's identification on each package. The addition of water or other materials to dilute mortar and grout additives on the job site shall not be permitted.

## **2.5 MORTAR AND GROUT MIXES (with Latex Admixture)**

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout when they have reached their initial set.
- B. Slurry Bond Coat: Mix bond coat to a consistency similar to that of thick cream and consisting of material indicated in article 2.5, A, 2, a. Substitute latex admixture for part or all of water per directions of latex-additive manufacturer.
- C. Thick-set Mortar Leveling Bed: Type M complying with ASTM C 270, Proportion Specification with materials indicated in article 2.5, A, 2, b.
- D. Thin-set (Paver Bond Coat) Mortar Bed: Proportion and mix Portland cement, aggregate, and latex additive for setting bed to comply with directions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- E. Latex-Modified Portland Cement Grout: Add latex additive to dry grout mix in proportion and concentration recommended by latex-additive manufacturer. Proportion cement and aggregate to comply with directions of latex-additive manufacturer.
  - 1. Job-Mixed, Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 7, by weight.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

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

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

### **3.3 INSTALLATION, GENERAL**

- A. Do not use unit pavers with cracks, large voids, discolorations, and other defects that might be visible or cause staining in finished work.
- B. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
  - 1. Thickness of Stone Paving: As indicated on Drawings.
  - 2. Stone Edges: Eased.
  - 3. Cut stone to produce random joints, 1/2 inch (13mm) minimum and 1 inch (25mm) maximum wide, in locations indicated.
  - 4. Clean sawed backs of stones to remove rust stains and iron particles.
- C. Joint Pattern: Random, rectangular pattern composed of units not less than 12 inches (300 mm) nor more than 24 inches (610 mm) in nominal dimension.
- D. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- E. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide joint filler and backer rod for sealant-filled joints where indicated. Install joint filler before setting pavers.
  - 1. Install expansion joints at all vertical surfaces including building walls and foundations, site walls and curbs.

### **3.4 MORTAR SETTING-BED APPLICATIONS**

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply cement-paste bond coat over surface of concrete subbase about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.
  - 1. Place reinforcing wire fabric over concrete, lapped at joints by at least one full mesh and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces approximately 1/2 inch (13 mm).

- C. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Cut back, bevel edge, remove, and discard setting-bed material that have reached initial set before placing pavers.
- E. Wet stone pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow pavers to absorb water so they are damp but not wet at the time of laying.
- F. Place pavers before initial set of cement occurs. Immediately before placing pavers on setting bed, apply uniform 1/16-inch- (1.5-mm-) thick, slurry bond coat to bed or to back of each paver with a flat trowel.
- G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set and disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- H. Rake out joints to depth required to receive grout as units are set.
- I. Spaced Joint Widths: Provide 3/4 inch nominal joint width with variations not exceeding plus or minus 1/4 inch

### **3.5 GROUTING OF STONE PAVING**

- A. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions.
- B. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free of drying cracks.
- C. Cure grout by maintaining in a damp condition for seven days except as otherwise recommended by latex-additive manufacturer.

### **3.6 ADJUSTING AND CLEANING**

- A. Remove and replace stone paving of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by COR.
  - 2. Defective joints.

3. Stone paving and joints not matching approved samples and mockups.
4. Stone paving not complying with other requirements indicated.

- B. Replace in a manner that results in stone paving matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone paving as work progresses. Remove mortar fins and smears before tooling joints.
- D. Clean stone paving after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application.

### **3.7 PROTECTION**

- A. Prohibit traffic from installed stone for a minimum of 72 hours.
- B. Protect stone paving during construction with nonstaining kraft paper. Where adjoining areas require construction work access, cover stone paving with a minimum of 3/4-inch (20-mm) untreated plywood over nonstaining kraft paper.

### **3.8 REPAIR, POINTING, CLEANING, AND PROTECTION**

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with mortar or grout. Point up joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess mortar from exposed paver surfaces; wash and scrub clean.

### **3.9 PAVER AND GROUT SEALER**

- A. After pavers are thoroughly cleaned and joint sealant has been installed apply sealer to the tops of pavers and grout joints.
  1. Apply sealer according to manufacturer's written instructions.
  2. After sealer is applied, protect area from traffic for six hours.

END OF SECTION

**SECTION 32 84 00**

**PLANTING IRRIGATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies materials and procedures for furnishing and installing modifications to an existing automatically-controlled irrigation system, and all other appurtenances necessary to irrigate landscape areas indicated on the drawings.

**1.2 RELATED WORK**

A. Plant materials: Section 32 90 00, PLANTING

**1.3 DEFINITIONS**

- A. Lateral Line Piping: Downstream from control valves to sprinklers, drip tubing and specialties. Piping is under pressure during flow.
- B. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under constant system pressure.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control, signaling power-limited circuits.

**1.4 ABBREVIATIONS**

- A. FPT: Female pipe thread
- B. HDPE: High-density polyethylene plastic
- C. NPT: National pipe thread
- D. PTFE: Polytetrafluoroethylene
- E. PVC: Polyvinyl chloride plastic
- F. WOG: Water, oil and gas

**1.5 PERFORMANCE REQUIREMENTS**

- A. Irrigation zone control shall be under automatic operation with controller and automatic control valves.
- B. Location of sprinklers and specialties on Drawings is approximate. Contractor to make minor adjustments necessary to avoid plantings and obstructions such as signs, utilities and light standards. Provide 100 percent irrigation coverage of areas indicated.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves and specialties unless otherwise indicated.

1. Irrigation Main Piping: 100 psi (640 kPa).
2. Circuit Piping: 80 psi (520 kPa).

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support pipe to prevent sagging and bending.

**1.7 QUALITY ASSURANCE:**

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Certification:

1. Installer should be an employer of workers that include a certified irrigation designer qualified by The Irrigation Association Professional Class member of the American Society of Irrigation Consultants; Professional Technical Class member of the American Society of Irrigation Consultants to perform specified work, and have provided irrigation installations for 5 years.
2. Service provider qualifications shall be maintained and/or trained by the manufacturer to render satisfactory service within 8 hours of service request notification.

C. System Requirements:

1. 100 percent irrigation coverage of specified areas is required. The Contractor shall, at no additional cost to the Government, make minor adjustments necessary to avoid plantings and obstructions such as signs, utilities and light standards and achieve full and complete coverage of irrigated areas without overspray on roadways, sidewalks, window wells, or buildings and to protect trees from close high spray velocity.

**1.8 SUBMITTALS**

- A. Submit product data as one package for each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Highlight items being supplied on the catalog cut sheets
- B. Provide qualification data for:
  - 1. A qualified irrigation Installer.

**1.9 EXTRA MATERIALS**

- A. Furnish extra materials, as called out below, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Rotary Head Sprinklers: 5 percent of amount installed for each type and size indicated, but no fewer than 6 units of each type.

**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society Of Mechanical Engineers (ASME):
- C. American Society For Testing And Materials (ASTM):
  - B61-08.....Steam or Valve Bronze Castings
  - B62-09.....Composition Bronze or Ounce Metal Castings
  - D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe,  
Schedule 40, 80, and 120
  - D2241-09.....Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe  
(SDR Series)
  - D2464-06.....Threaded Poly (Vinyl Chloride) (PVC) Plastic  
Pipe Fittings, Schedule 80
  - D2466-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe  
Fittings, Schedule 40
  - D2467-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe  
Fittings, Schedule 80
  - D2564-04(2009)e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)  
Plastic Piping Systems
  - D2609-02(2008).....Plastic Insert Fittings for Polyethylene (PE)  
Plastic Pipe

Eagle Point National Cemetery Eagle Point, Oregon	Remove Non-Complaint Stairway and Repair Landscape Project 906-MM-FY16-003
D2683-10.....	Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
D2855-96(2010).....	Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
F656-10.....	Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
C906-07.....	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1600 mm), for Water Distribution and Transmission

D. National Fire Protection Association (NFPA):

70 2011 Edition.....National Electrical Code

**1.11 WARRANTY**

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from date of final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

**PART 2 - PRODUCTS**

**2.1 PIPES, TUBES AND FITTINGS**

- A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. PVC Mainline Pipe: ASTM D1785, PVC 1120 compound, Schedules 40 and 80.
  - 1. PVC socket fittings: ASTM D2467, Schedule 80.
  - 2. PVC threaded fittings: ASTM D2464, Schedule 80.
  - 3. PVC socket unions: Both headpiece and tailpiece shall be Schedule 80 PVC with threaded ends.
- C. PVC Lateral Pipe: ASTM D2241, PVC 1120 compound, SDR 21.
  - 1. Solvent weld pipe Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe.
  - 2. PVC socket fittings shall be ASTM D2466, Schedule 40.

Eagle Point National Cemetery  
Eagle Point, Oregon

Remove Non-Complaint Stairway  
and Repair Landscape  
Project 906-MM-FY16-003

3. PVC socket unions: Both headpiece and tailpiece shall be Schedule 40 PVC with socket or threaded ends.

D. Threaded Pipe:

1. Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.

E. Swing joints:

1. Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 200 psi (1375 kPa) working pressure, may be used in lieu of standard threaded fittings.

## 2.2 PIPE JOINING MATERIALS

- A. Solvent cements for joining PVC piping: ASTM D2564. Include primer according to ASTM F656.

## 2.3 VALVES

A. Underground Shut-Off Valves:

1. Ball Valves: 64 mm (2-1/2 inches) and smaller: ASTM B584 bronze cast body, with ASTM B16 brass stem, gland, and chrome-plated ball, full-port, solid ball, blow-out proof stem, adjustable packing, with stainless steel handle and nut; threaded ends; PTFE seats, line size or as shown on drawings. Available manufacturer/model: Apollo 77C-10 or equal.
2. Valve ends shall accommodate the type of main pipe adjacent to valve.

B. Quick Coupling Valve Assembly:

1. As presented in the installation details.
2. Brass construction, 1-inch nominal size, two-piece, operating pressure 35-860 kPa(5-125 psig) with locking non-potable purple, rubber or vinyl cover. Acceptable manufacturer and model is Rain Bird 44NP, to match existing equipment or approved equal.
3. Swing Joint: Use pre-manufactured triple swing joint with integral check valve. Quality of manufactured product shall meet or exceed that of products manufactured by Rain Bird, Spears, Lasco, or approved equal.
4. Quick Coupler Valve Stabilizer: Use pre-manufactured bolt-on anchor. Approved manufacturer and model is LEEMCO LS-120 or approved equal.
5. Valve Box: Use plastic (ABS) 10-inch round valve box with black lid or larger as needed to fit all components including quick coupling

valve stabilizer. Acceptable manufacturer is Carson, Pentek, Rain Bird, Brooks Products, or approved equal.

6. Filter Fabric: Use a spunbond polyester 3.5 oz. per square yard landscape fabric.
7. Quick Coupler Key and Hose Swivel: Provide manufacturer's matching brass quick coupler key with hose swivel, and key for locking cap. (Provide 1 for each quick coupler on the project.)

C. Remote Control Valves:

1. Valves shall be globe type of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation.
2. Plastic Valves: Straight valve body shall be glass-filled nylon construction, with fabric reinforced rubber diaphragm and renewable seat.
  - a. Install valves with unions on each side to allow for easy removal.
  - b. Valves shall have a minimum of 150 psi (1025 kPa) working pressure.
  - c. Each sprinkler section shall be automatically operated by a remote control valve installed underground and operated by a 24 volt AC electric solenoid.
  - d. Each valve shall be in the specified valve box.

D. Valves shall be completely serviceable from the top without removing valve body from the system. Valves to operate at no more than 7 psi (50 kPa) pressure loss at manufacturers maximum recommended flow rate.

E. Valves shall be diaphragm type designed to operate in water containing sand and debris and shall have a self-cleaning type contamination filter to filter all water leading to the solenoid actuator and the diaphragm chamber. Valve shall incorporate a non-adjustable type opening and closing speed control for protection against surge pressures, or valves shall operate by means of a slow acting direct drive thermal hydraulic motor without ports, screens or diaphragms.

F. Available Manufacturer/Model: Rain Bird Model PESB. No approved equal.

**2.4 VALVE BOX**

A. Remote control valve boxes in landscape areas, shall be HDPE structural foam Type A, Class III, black in color. Box shall be minimum 475 mm (19 inches) long by 350 mm (14 inches) deep with lockable "T"-style lid. Acceptable manufacturers are Carson, Pentek, Rain Bird or approved equal.

1. After installation hot brand into lid of valve boxes 75 mm (3-inch) high, 1 mm (3/16") deep labels designating the controller and circuit numbers with permanent white epoxy paint. Numbers shall be placed at center of valve cover and shall face nearest main road or service road.

## **2.5 SPRINKLER HEADS**

A. Pop-Up Gear-Driven Rotary Sprinkler Assembly: Heads to be as indicated on Drawings.

1. Full Circle Sprinklers: To be a dual or tri-nozzle combination type with positive drive by means of a gear assembly. Sprinkler head to rotate uniformly and to be driven by means of a train of gears. Sprinklers to be equipped with an integral anti-drain valve to be self-closing at pressures of 3.0 m (10 feet) of head or less. Gears and pinions shall be assembled on stainless steel spindles in a water-lubricated sand-proof gear case. An inlet screen shall prevent debris from entering the sprinkler and shall be removable with the internal assembly. Sprinklers outer case shall be constructed of corrosion resistant, impact resistant, heavy-duty ABS.
2. Part circle sprinklers to be variable arc type as required with same type drive used for full circle heads.
3. Swing Joint: Use pre-manufactured triple swing joint with integral check valve. Quality of manufactured product shall meet or exceed that of products manufactured by Rain Bird, Spears, Lasco, or approved equal.

B. Pop-up Sprinkler heads: Heads to be as indicated on Drawings. The entire internal assembly including filter screen, to be capable of removal from the top without removing the sprinkler case from the riser. Body shall have internal pressure regulation of 40 to 45 PSI.

1. Sprinkler head body shall be pop-up spray type of standard, undersize or oversize configuration as noted on plans. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated co-molded wiper seal for cleaning debris from the pop-up stem. The sprinkler shall have a plastic multi-stream rotary nozzle with an adjusting screw capable of regulating the radius and flow.

The sprinkler shall be capable of housing protective, non-clogging filter screens under the nozzle.

C. Multi-Stream Rotary Nozzles

1. Radius and arc as noted on plans. Manufacturer and models: Hunter MP Rotator; No known equal.

**2.6 LOW VOLTAGE CONTROL VALVE WIRE**

A. Two-Wire Decoder Cable:

1. 2-conductor control cable design consisting of tin coated copper conductors, insulated with PVC and having a high density polyethylene direct burial jacket. Conductors are listed as Type UF by UL or ETL or CSA.
2. Conductor: Minimum conductor size 14 AWG; soft annealed tin coated solid copper conforming to ASTM B-33.
3. Insulation: Polyvinyl Chloride conforming to UL Standard 493 for TYPE UF rated 60°C.
4. Cable Assembly: Insulated conductors are laid parallel.
5. Outer Jacket: Pressure Extruded High Density PE conforming to ICEA S-61-402, and NEMA WC5 Jacket Thickness 3/64" minimum jacket material to completely fill interstices between the two insulated conductors.
6. Color Coding: Black, Red.
7. Jacket Color: Blue, or match existing.
8. Acceptable Manufacturer and Model: Rain Bird Maxi-Cable, Size 600V sunlight-resistant direct-burial for Rain Bird two-wire control systems; as indicated in the irrigation controller manufacturer's printed instructions, or approved equal.

- B. Decoder-to-Solenoid (DTS) Cables 14 AWG, solid copper; 2-conductor; Use jacketed wire pairs with colors matching jacketed wires on decoders for connecting decoders to control valves. Acceptable Manufacturer and Model: Paige Electric P7351D, or approved equal.

**2.7 SPLICING MATERIALS:**

- A. Waterproof Wire Connectors. '3M' DBY or DBR

**2.8 SLEEVE MATERIAL**

- A. ASTM D2241, Schedule 40 PVC.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Examine proposed irrigation areas for compliance with requirements and conditions affecting installation and performance.
- B. Set stakes to identify locations of proposed irrigation system. Obtain Contracting Officer's Representative's approval before excavation.

**3.2 PIPE INSTALLATION - GENERAL**

- A. Layout work as closely as possible to drawings. Swing joints, offsets and all fittings are not shown. Lines are to be installed in a common trench wherever possible.
- B. Install sprinkler lines to avoid other utility lines; all of which have the right of way.
- C. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any cracked concrete, due to settling, during the warranty period.
- D. Do not lay pipe on unstable material, in wet trenches or, in the opinion of Contracting Officer's Representative, when trench or weather conditions are unsuitable for work.
- E. Allow a minimum of 3 inches (80 mm) between parallel pipes in the same trench.
- F. Clean the interior portion of pipe and fittings of foreign matter before installation. Securely close open ends of pipe and fittings with caps or plugs to protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- G. The full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- H. Hold pipe securely in place while joint is being made.
- I. Do not work over, or walk on, pipe in trenches until covered by layers of earth, well tamped, in place to a depth of 12 inches (300 mm) over pipe.
- J. Irrigation lines and control wire in cemetery applications shall run at boundaries of graves, through designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.

- K. Irrigation lines and control wire shall run through designated utility lanes or beside roadways where possible.
- L. Connect new system to existing mains. Disconnect and abandon existing irrigation zones as indicated.
- M. Concrete thrust blocks shall be installed where the irrigation main changes direction at "L" and "T" locations and where the irrigation main terminates. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.
- N. Minimum cover over water mains shall be 24 inches (610 mm). Cover laterals to minimum depth of 18 inches (460 mm).
- O. Warning tape shall be continuously placed 12 inches (300 mm) above sprinkler system water mains and laterals.

### **3.3 PLASTIC PIPE INSTALLATION**

- A. Plastic pipe shall be snaked in trench at least 1 foot per 100 feet (1 meter to 100 meters) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints
  - 1. Solvent Welded Socket Type: ASTM D2855.
  - 2. Threaded Type: Apply liquid Teflon thread lubricant of Teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to two additional full turns.

### **3.4 SLEEVE INSTALLATION**

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeves to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 12 inches (300 mm) beyond edges of paving or construction.
- C. Bed sleeves with a minimum of 4 inches (100 mm) of sand backfill above top of pipe in areas where pipe is placed prior to hardscape is installed.

### **3.5 VALVE INSTALLATION**

- A. Locations of remote control valves are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.

- B. Clean interior of valves of foreign matter before installation.
- C. Set valve box cover flush with finished grade unless otherwise indicated.
- D. Control valves shall never be less than 3 inches (80 mm) below the bottom of the valve box cover.

### **3.6 SPRINKLER INSTALLATION**

- A. Place part circle rotary sprinkler heads no more than 6 inches (150 mm) from edge, of and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation.
- B. Install all sprinklers on swing joints, as detailed on plans.

### **3.7 CONTROL WIRE INSTALLATION**

#### **A. Two-Wire Decoder Cables:**

1. Install two-wire decoder cable in a loop wiring configuration from the irrigation controller to all decoders in the field per the manufacturer's approved routing method.
2. Provide two-wire cable for decoder based controller in trench with new mains or in a separate trench at back of curb. Locate in trench with mains when possible. Install line surge protection per manufacturer's printed instructions. Locate all splices in valve boxes with valves or in separate splice boxes with black covers branded with "WS" and painted with permanent white epoxy paint.
3. All wire splicing shall occur only at the valves, at the controller, or at splits in the two-wire cable path. Install Decoder Cable Fuse Devices at each split in the two-wire cable path and along long runs of cable greater than 600-feet as show in the Drawings and per the manufacturer's printed instructions.
4. Provide lighting/surge protection consisting of a lightning arrestor and copper clad grounding rod in decoder cable at 600-foot intervals or less along the two-wire path and as recommended by irrigation equipment manufacturer.

#### **B. Decoder-to-Solenoid Cables:**

1. Provide decoder-to-solenoid (DTS) cable from decoders to solenoids on remote control valves.
2. Two-conductor DTS control cable from decoders to each solenoid shall have a colored jacket matching the wire jacket color on the decoder for ease of installation and repair. Wire the cables from the decoders to the solenoids per manufacturer's printed instructions and as indicated in the Drawings.

3. Install DTS cable in sleeves under paving.
4. Provide 1 spare wire, 2-conductor decoder-to-solenoid (DTS) cable, yellow in color, making a circuit from each decoder to all valves served by that decoder. Coil 24 inches length neatly in each box.

C. Decoders:

1. Program decoder two-wire interface modules per manufacturer's printed instructions using the decoder field programmer. Assign unique station numbers to each decoder before installing decoders in the field at the valve locations.
2. Test the decoders by validating that the station numbers have been correctly accepted into the decoder.
3. Write down the decoder number and the station(s) assigned to it onto the irrigation as-built drawing in the blank chart provided with the irrigation plans.
4. Secure decoders to interior of valve boxes with self-taping stainless steel screws.
5. The distance from the furthest valve to the controller shall not exceed 5000 feet.
6. The distance from a valve to its decoder shall not exceed 100 feet.

D. Control Wire:

1. Install two-wire decoder cable in the same trench as mainline, preferably to the side of mainline below top of pipe in a consistent fashion. Do not wrap wire around mainline or fittings. Separate wire from mainline into separate sleeves one for pipe, one for wire when crossing under hard surfaces.
2. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 3 m (10-foot) intervals.
3. Control wiring may be chiseled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling and wire installation. Appropriate chisel shall be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth shall equal minimum cover previously listed.
4. Provide a 600 mm (24-inch) excess length of wire in a 200mm (8-inch) diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 30 m (100-foot) intervals along continuous runs of wiring. Do not tie wiring loop. Coil 600mm (24-inch) length of wire within each remote control valve box.

5. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
    - a. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in turf areas using a valve box that contains an irrigation valve assembly, or in a separate valve box. Use same procedure for connection to valves as for in-line splices. If a separate valve box is used for wire splices, brand "WS" in 50 mm (2-inch) high by 5 mm (3/16-inch) deep letters on valve box lid and painted with permanent white epoxy paint.
  6. Install control wire not installed with PVC mainline inside of Schedule 40 PVC electrical conduit. Protect conduit with a continuous run of low-voltage electrical warning tape placed in the backfill 150 mm (6-inches) above the conduit.
  7. Cap all exposed wire ends with waterproof wire connectors.
  8. Wiring bundles located with piping and shall be set below and to one side of the pipe. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals.
  9. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.
- E. Use water-proof wire connectors for wire connections.

### **3.8 FIELD TEST AND QUALITY CONTROL**

#### **A. Tests and Inspections:**

1. Pressure test lines before joint areas are backfilled. Backfill a minimum of 12 inches (300 mm) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 150 psi (1025 kPa) for two hours. Maximum loss shall be 0.8 gallons/inch pipe diameter/1,000-feet (3 L/25 mm pipe diameter/300 m). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
2. After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.

3. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  4. After electrical circuitry has been energized and final adjustment of the sprinkler heads to permanent level at ground surface is complete, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate controllers and automatic control valves to demonstrate the complete and successful installation and operation of all equipment.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Any irrigation product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.9 ADJUSTMENTS**

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers and devices, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.
- D. Adjust sprinkler radius and arcs to minimize overspray onto structures and pavement.

---- E N D ---

**SECTION 32 90 00**

**PLANTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The work in this section consists of furnishing and installing plants, soils, turf edging, sod, grasses and landscape materials required as specified in locations shown.

**1.2 RELATED WORK**

- A. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
- B. Division 31 Section "Earthwork" for rough grading, and imported topsoils for turf and planting areas.
- C. Division 32 Section "Planting Irrigation" for automatic irrigation of turf and planting areas.
- D. Division 32 Section "Transplanting" for transplanting of existing shrubs impacted by demolition work.

**1.3 DEFINITIONS**

- A. Backfill: The earth used to replace earth in an excavation.
- B. Balled and Burlapped Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball.
- C. Balled and Potted Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

- E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- F. Finish Grade: Elevation of finished surface of planting soil.
- G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- J. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, turf and grasses, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- L. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- M. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

#### **1.4 ABBREVIATIONS**

- A. TYP.: Typical.
- B. MIN.: Minimum
- C. MAX.: Maximum

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Notify the Contracting Officer's Representative (COR) of the delivery schedule in advance so the plant material may be inspected upon arrival

at the job site. Remove unacceptable plant and landscape materials from the job site immediately.

- B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants. Keep bulk materials in dry storage away from contaminants.
  - 2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than 6 hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  - 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  - 2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet, condition.
- H. Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding". Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage, seed contamination and drying.
- I. All pesticides and herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Deliver materials in original, unopened containers showing, certified analysis, name and address of manufacturer, product label, manufacturer's application instructions specific to the project and indication of conformance with state and federal laws, as applicable.

#### **1.6 PROJECT CONDITIONS**

- A. Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. Plant during the following periods:
  1. April 1 to October 1.
- C. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
- E. Plant trees, shrubs, and other plants after finish grades and irrigation system components are established, but not before irrigation system components are installed, tested and approved.

1. When planting trees, shrubs, and other plants, protect irrigation system components and promptly repair damage caused by planting operations.

**1.7 QUALITY ASSURANCE:**

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association with 5 years experience in landscape installation.
2. Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
3. Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network and submit one copy of certificate to the Contracting Officer's Representative (COR):

- a. Certified Landscape Technician (CLT) - Exterior, with installation, maintenance, irrigation, designated CLT-Exterior.
- b. Certified Ornamental Landscape Professional, designated COLP.

4. Pesticide Applicator: Licensed in state of project, commercial.

C. A qualified Arborist shall be licensed and required to submit one copy of license to the Contracting Officer's Representative.

D. Include an independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

E. Soil Testing: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay

content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60, "Diagnosis and Improvement of Saline and Alkali Soils".
  2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer's Representative. A minimum of 3 representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
  3. Report suitability of tested soil for plant growth.
    - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    - b. Based upon the test results, state recommendations for compost to be incorporated into the soil to provide minimum of 6 percent and a maximum of 8 percent organic matter.
    - c. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- F. Compost Testing: Provide documentation from supplier that compost meets specifications. Engage an independent soil testing laboratory to test representative sample(s) of compost and furnish compost analysis report to the COR for review and approval.
- G. Provide quality, size, genus, species, variety and sources of plants indicated, complying with applicable requirements in ANSI Z60.1.
- H. Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Measure trees and shrubs with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150

- mm) above the root flare for trees up to 4 inch (100 mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
2. Measure other plants with stems, petioles, and foliage in their normal position.
- I. Contracting Officer's Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Contracting Officer's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Contracting Officer's Representative of plant material sources 14 days in advance of delivery to site.
- J. Include product label and manufacturer's literature and data for pesticides and herbicides.
- K. Conduct a pre-installation conference at Project site.

#### **1.8 SUBMITTALS**

- A. Submit product data for each type of product indicated, including soils:
1. Include quantities, sizes, quality, and sources for plant materials.
  2. Include EPA approved product label, MSDS (Material Safety Data Sheet) and manufacturer's application instructions specific to the Project.
  3. Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of 3 photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Submit samples and manufacturer's literature for each of the following for approval before work is started.
1. Compost and Organic Mulch: 1 quart (1-liter) volume each of compost organic and mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished;

provide an accurate representation of color, texture, and organic makeup.

- a. Provide testing certificates with compost samples.
2. Inorganic Mulch: Submit minimum 4 stones showing full variation in color and size of rock to COR for approval.
- C. Qualification data for qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Prior to delivery, provide notarized certificates attesting that each type of manufactured product, from the manufacturer, meet the requirements specified and shall be submitted to the Contracting Officer's Representative for approval:
  1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).
  2. Manufacturer's certified analysis of standard products.
  3. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Material Test Reports: For existing native surface topsoil.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

#### **1.9 PLANT AND TURF ESTABLISHMENT PERIOD**

- A. The establishment period for plants and turf shall begin immediately after installation, with the approval of the Contracting Officer's Representative, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Establishment Period the Contractor shall maintain the plants and turf as required in Part 3.

#### **1.10 PLANT AND TURF MAINTENANCE SERVICE**

- A. Provide initial maintenance service for trees, shrubs, ground cover and other plants by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 3 months from date of Substantial Completion.

**1.11 APPLICABLE PUBLICATIONS**

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

B. American National Standards Institute (ANSI):

Z60.1-04.....Nursery Stock

C. Association of Official Seed Analysts (AOSA): Rules for Testing Seed.

D. American Society For Testing And Materials (ASTM):

C136-06.....Sieve Analysis of Fine and Coarse Aggregates

C602-07.....Agricultural Liming Materials

D5268-07.....Topsoil Used for Landscaping Purposes

E. Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.

F. Turfgrass Producers International (TPI): Guideline Specifications to Turfgrass Sodding.

G. United States Department of Agriculture (USDA): Handbook No. 60  
Diagnosis and Improvement of Saline and Alkali Soils; Federal Seed Act  
Regulations.

H. National Cemetery Administration (NCA):

Handbook 3420-08.....Turfgrass Maintenance

Appendix TL-08.....Cemetery Construction Requirements for  
Turfgrass and Landscape Plant Material  
Installation

**1.12 WARRANTY**

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance, unless noted otherwise below. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

1. Plant and Turf Warranty Periods will begin from the date of Government acceptance of the project or phase for beneficial use and occupancy.

- a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
  - b. Ground Covers, Biennials, Perennials, Turf, and Other Plants: 12 months.
  - c. Annuals: 3 months.
2. The Contractor shall have completed, located, and installed all plants and turf according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.
  3. The Contractor will replace any dead plant material and any areas void of turf immediately, unless required to plant in the succeeding planting season. Provide extended warranty for period equal to original warranty period for replacement plant materials. Replacement plant and turf warranty will begin on the day the work is completed.
  4. Replacement of relocated plants, that the Contractor did not supply, is not required unless plant failure is due to improper handling and care during transplanting. Loss through Contractor negligence requires replacement in plant type and size.
  5. The Government will reinspect all plants and turf at the end of the Warranty Period. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty Period will end on the date of this inspection provided the Contractor has complied with the warranty work required by this specification. The Contractor shall also comply with the following requirements:
    - a. Replace plants that are more than 25 percent dead, missing or defective plant material prior to final inspection.
    - b. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
    - c. Mulch and weed plant beds and saucers. Just prior to final inspection, treat these areas to a second application of approved pre-emergent herbicide.
    - d. Complete remedial measures directed by the Contracting Officer's Representative to ensure plant and turf survival.
    - e. Repair damage caused while making plant or turf replacements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
  - b. Structural failures including plantings falling or blowing over.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

## **PART 2 - PRODUCTS**

### **2.1 PLANT MATERIAL**

- A. Plant and turf materials: ANSI Z60.1; will conform to the varieties specified and be true to botanical name as listed in Hortus Third; nursery-grown plants and turf material true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings; healthy, normal and unbroken root systems developed by transplanting or root pruning; well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf; free of disease, pests, eggs, larvae, and defects such as knots, sun scald, windburn, injuries, abrasions, and disfigurement.
1. Trees-deciduous and evergreen: Single trunked with a single leader, unless otherwise indicated; symmetrically developed deciduous trees and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well-developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
  2. Ground cover and shrub plants: Provide the proper age for the grade of plants specified. Provide shrubs and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Spray all plants budding into leaf or having soft growth with an anti-desiccant at the nursery before digging.

3. The minimum acceptable sizes of all plants, measured before pruning with branches in normal position, shall conform to the measurements designated. Plants larger in size than specified may be used with the approval of the Contracting Officer's Representative, with no change in the contract price. When larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.
  4. Provide nursery grown plant material conforming to the requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in a manner that will not cause damage to branches, shape, and future development after planting.
  5. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
  6. Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers, but shall not be root bound.
  7. Make substitutions only when a plant (or alternates as specified) is not obtainable and the Contracting Officer's Representative authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant with the same essential characteristics and an equitable adjustment of the contract price.
  8. Existing plants to be relocated, ball sizes shall conform to requirements for collected plants in ANSI Z60.1, and plants shall be dug, handled, and replanted in accordance with applicable sections of these specifications.
    - a. Trenches around the rootballs of plants to be relocated are to be cut 4 weeks minimum prior to removing the plant from the ground to allow the root cuts to harden off.
    - b. Cut trenches around rootballs in accordance with ANSI Z60.1 requirements for sizes of plants being transplanted.
    - c. Cut roots with clean sharp tools under the direction of a licensed arborist.
  9. Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Label at least one plant of each variety, size, and caliper with a securely attached, waterproof and weather-resistant label bearing

legible the correct designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as indicated in the Plant Schedule or Plant Legend shown on the Drawings. Labels shall be securely attached and not be removed.

## **2.2 INORGANIC SOIL AMENDMENTS**

- A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36 mm) sieve and a minimum of 75 percent passing through No. 60 (0.25 mm) sieve.
  2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36 mm) sieve and a minimum of 55 percent passing through No. 60 (0.25 mm) sieve.
  3. Provide lime in form of ground calcitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35 mm) sieve and a maximum of 10 percent passing through No. 40 (0.425 mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30 mm) sieve.
- F. Coarse Sand shall be concrete sand, ASTM C33 Fine Aggregate, clean, sharp free of limestone, shale and slate particles, and toxic materials.

## **2.3 ORGANIC SOIL AMENDMENTS**

- A. Compost: Well-decomposed, commercially manufactured, stable, and weed-free organic matter from agricultural, food, biosolids, or yard debris sources; free of refuse (less than 1 percent by dry weight), plastics, contaminants or any material toxic to plant growth; composted for a minimum of 9 months and reached a monitored temperature of 140 degrees F for at least one week; tested, at minimum, every six months for noxious weeds; and conforming to the following:
1. Organic Matter Content: 60 to 80 percent of dry weight as determined by ash method.
  2. Moisture Content: 35 to 55 percent by weight

3. Inerts: less than 0.5% by dry weight
4. pH range of 6.0 to 8.0
5. Soluble salts: less than 2 decisiemens (dS)/m
6. Particle size: 100 percent passing through 1/2-inch (13-mm) sieve
7. Nutrient Content: sum of N, P, K percent of wet weight, less than 5%
8. Trace Metals: Pass per US EPA Class A Standard, 40 CFR 503.32 (a)
9. Maturity Indicator (bio-assay): Greater than 80% seedling emergence maximum dry to positive control.
10. Stability Indicator: Carbon dioxide evolution rate is less than 8 mg CO<sub>2</sub>-C per g OM per day - "Stable"
11. Tested, at minimum, every six months for noxious weeds.
12. Organic matter source (feedstock): Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
13. Organic Matter Content: 30 to 65 percent of dry weight as determined by ash method.
14. Processed to meet U.S. Composting Council's Seal of Testing Assurance Program, or equivalent.

#### **2.4 PLANTING SOILS**

- A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D5268 topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
  1. Supplement with planting soil when quantities are insufficient.
  2. Mix existing, native surface topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources can be used if sufficient topsoil is not available on site to meet the depth as specified herein. The Contractor shall furnish imported topsoil. At least 10 days prior to topsoil delivery, notify the Contracting Officer's Representative of the source(s) from which topsoil

is to be furnished. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs, or marshes.

## **2.5 PLANT AND TURF FERTILIZERS**

- A. Soil Test: Evaluate existing soil conditions and requirements prior to fertilizer selection and application to minimize the use of all fertilizers and chemical products. Obtain approval of Contracting Officer's Representative for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Fertilizers to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- C. Slow-Release Fertilizer: Granular or pellet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- D. Plant Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Size: 21-gram tablets.
  2. Nutrient Composition shall be 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## **2.6 BIOSTIMULANTS**

- A. Mycorrhizae: Endo mycorrhizal granules inoculum consisting of the following 4 species blend of propagules of arbuscular mycorrhizal fungi: Glomus intraradices, Glomus mosseae, Glomus aggregatum, and Glomus etunicatum. Minimum 100,000 spores/propagules per pound.
- B. Available Products: 'MycoApply Endo' by Mycorrhizal Applications, Inc.; 'Endo Granular' by Mycorrhizal Products.com; or equal.

## **2.7 LANDSCAPE MEMBRANES**

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101 g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.
- B. Composite Fabric shall be woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

## **2.8 MULCH**

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood; Ground or shredded bark; or Wood and bark chips.
  2. Size Range shall be 1 inch (25 mm) maximum, 1/2 inch (13 mm) minimum.
  3. Color shall be natural.
- B. Inorganic Mulch: rounded 4 to 6 inch diameter dark grey/black river rock mulch; or 4 to 6 inch diameter dark grey/black basalt fractured rock.

## **2.9 EDGE TREATMENT**

- A. Shovel Cut: As shown on the installation details.

## **2.10 WATER**

- A. Water shall not contain elements toxic to plant life. Water to be obtained from Government at no cost to the Contractor.

## **2.11 ANTIDESICCANT**

- A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide a protective film over plant surfaces permeable enough to permit transpiration.

## **2.12 TURF SELECTIONS**

- A. Grasses for Cool Regions shall be:

1. Bluegrasses: Kentucky (*Poa pratensis*).
  2. Ryegrasses: Perennial (*Lolium perenne*)
- B. All cemetery turf sod compositions shall conform to the species and cultivar requirements detailed in the "Appendix T/L for NCA Cemetery Construction Requirements". Any deviation from the turf species requirements must receive written approval by the NCA Chief Agronomist and appropriate MSN Agronomist in coordination with the Contracting Officer's Representative.

#### **2.13 SOD**

- A. Sod: Sod shall be produced from Blue Tag certified seed and State of California certified, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding". Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Sod Species: The composition of the grass species in the sod shall be a mix of 80% Ryegrass and 20% Kentucky Bluegrass. The ryegrass shall be a blend of at least 3 regionally adapted cultivars.
1. Available Supplier: JB Instant Lawn.

#### **2.14 PESTICIDES**

- A. Consider IPM (Integrated Pest Management) practices to minimize the use of all pesticides and chemical products. Obtain approval of Chief Engineer for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Pesticides to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
  - 5. Special conditions may exist that warrant a variance in the specified planting dates or conditions. Submit a written request to the Contracting Officer's Representative stating the special conditions and proposal variance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Contracting Officer's Representative and replace with new planting soil.

#### **3.2 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain approval by the Contracting Officer's

Representative of layout before excavating or planting. The Contracting Officer's Representative may approve adjustments to plant material locations to meet field conditions.

- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

### **3.3 PLANTING AREA ESTABLISHMENT**

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches (300 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
  - 1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  - 2. Spread planting soil to a depth of 12 inches (300 mm) but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Contracting Officer's Representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### **3.4 EXCAVATION FOR TREES AND SHRUBS**

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45 degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately 2 times as wide as ball diameter for balled and burlapped, balled and potted, container-grown, fabric bag-grown stock.
2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
5. Maintain supervision of excavations during working hours.
6. Keep excavations covered or otherwise protected after working hours and when unattended by Installer's personnel.
7. Use topsoil to form earth saucers or water basins for watering around plants. Basins to be 2 inches (50 mm) high for shrubs and 4 inches (100 mm) high for trees.

B. Subsoil removed from excavations may not be used as planting soil.

C. Notify Contracting Officer's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Notify Contracting Officer's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow water to percolate away before positioning trees and shrubs.

### **3.5 TREE, SHRUB, AND VINE PLANTING**

A. Prior to planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a

level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
  - 1. Use planting soil for backfill.
  - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Place plant tablets in each planting pit when pit is approximately one-half filled; in quantities recommended by fertilizer manufacturer. Place tablets beside soil-covered roots about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole or touching the roots.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### **3.6 BIOSTIMULANT APPLICATION**

- A. Apply mycorrhizal inoculum to all turf areas and backfill mix for plants.
- B. For turf areas: Uniformly broadcast using calibrated equipment, granular endo mycorrhizal product at a rate 0.5 pound per 1000 square-feet and roto-till into the top 4 inches of soil.
- C. For trees and shrubs: Add 5 pounds of granular endo mycorrhizal product to 1 cubic yard of plant backfill mix. Thoroughly incorporate the product into the backfill mix.

### **3.7 TREE, SHRUB, AND VINE PRUNING**

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Contracting Officer's Representative, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- C. Do not apply pruning paint to wounds.

### **3.8 TREE WRAP**

- A. Wrap the trunks of deciduous trees immediately after planting. Wrap the trunks of deciduous trees, 1-1/2 inches (40 mm) or greater in caliber with the specified material beginning at the base and extending to the first branches. Remove wrapping after one year. When using crinkled paper wrap, securely tie wrapping at the top and bottom and at 18 inch (450 mm) maximum intervals with twine.

### **3.9 GROUND COVER AND PLANT INSTALLATION**

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### **3.10 MULCH INSTALLATION**

- A. Mulch backfilled surfaces of planting areas and other areas indicated. Keep mulch out of plant crowns and off buildings, pavements, utility standards, pedestals, and other structures.
  - 1. Trees in Turf Areas: Apply organic mulch ring of 3 inch (75 mm) average thickness, with 36 inch (900 mm) radius around trunks or stems. Do not place mulch within 6 inches (150 mm) of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 3 inch (75 mm) average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm) of trunks or stems.

### **3.11 EDGING INSTALLATION**

- A. Install shovel cut edge treatment where indicated as shown on the drawings.

### **3.12 PLANT MAINTENANCE**

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring plant saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

### **3.13 TURF AREA PREPARATION AND GRADING**

- A. For newly graded subgrades loosen subgrade to a minimum depth of 8 inches (200 mm). Remove stones larger than 1/2 inch (13 mm) in any dimension, dead turf, sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
  1. Apply fertilizer, lime and soil amendments directly to subgrade before loosening, at rates recommended by the soils analysis.
  2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
  3. Spread planting soil to a depth of 4 inches (100 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is muddy, or excessively wet.
    - a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
    - b. Reduce elevation of planting soil to allow for soil thickness of sod.

- B. Fine grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

### **3.14 SODDING**

- A. Prior to delivery of sod, the COR(s) shall inspect the work area. Any discrepancies in the ground preparation shall be corrected prior to the laying of sod in the work area.
- B. Prior to installation of the sod, the COR shall have the right to inspect and to assess the acceptability and quality of the proposed sod. The COR shall have the right to reject poor quality sod before installation. The contractor shall warranty the sod for one (1) year from the date of Final Acceptance.
- C. The sod shall be cut as thinly as possible (1.25 to 1.5 inch) to allow for faster rooting and shall be cut and delivered to the work site the same day of installation. Contractor shall make all necessary arrangements to protect delivered sod from excessive drying and wind damage.
- D. Moisten prepared sod beds before planting if soil is dry. Water thoroughly and allow surface moisture to dry before sodding. Do not create a muddy soil condition.
- E. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- F. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation.
- G. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  - 1. Lay sod across angle of slopes exceeding 3:1.
- H. Sod shall be cut and fitted around sprinkler heads, valve boxes, edges of pavement/curb lines, edging, and other objects.
- I. Sod shall be kept moist until it is well rooted and able to survive with standard watering. Saturate sod with fine water spray within two hours

of planting. During first week after planting, water daily or more frequently until sod is established.

### **3.15 TURF RENOVATION**

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  - 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before preparing soil. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off the Government's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
- I. Install sod as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

### **3.16 TURF MAINTENANCE**

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow to a height of 2-1/2 to 3 inches (50 to 75 mm).

### **3.17 SATISFACTORY TURF**

- A. Turf installations shall meet the following criteria as determined by Contracting Officer's Representative:
1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

### **3.18 PESTICIDE APPLICATION**

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

- B. Pre-Emergent Herbicides (Selective and Non-Selective): Applied to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Applied only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

### **3.19 CLEANUP AND PROTECTION**

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- D. Erect temporary fencing or barricades and warning signs, as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- E. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- F. Remove non-degradable erosion control measures after grass establishment period.
- G. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Government's property.

--- END ---

**SECTION 32 96 00**

**TRANSPLANTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Furnish labor, material and equipment necessary for relocating plants as indicated on the drawings.

**1.2 RELATED WORK**

- A. Division 31 Section "SITE CLEARING."
- B. Division 32 Section "PLANTING."

**1.3 REFERENCES**

- A. Tree and Shrub Transplanting Manual, EB. Himelick, 1981 Ed., International Society of Arboriculture.

**1.4 SUBMITTALS**

- A. Schedule and Work Plan: Within 7 days after award of contract, submit coordination schedules and methods of work for transplanting to the Contracting Officer's Representative (COR).

**1.5 QUALIFICATIONS**

- A. Contractor must be knowledgeable of standards and have at least five years of experience involving this work.

**1.6 SITE CONDITIONS**

- A. Review locations of above and underground utilities. Avoid conflicts that may arise by digging near utilities.
- B. Coordinate necessary shut-offs and re-routing prior to excavation.
- C. Verify the location where the plants will be directly transplanted with the COR.
- D. Prepare planting pits to accept plants prior to transplanting.
- E. Proceed and coordinate with the work as the site becomes available, consistent with seasonal limitations for transplanting, only when trees are dormant.

**1.7 WARRANTY AND REPLACEMENT OF TRANSPLANTED TREES**

- A. As specified under Division 32 Section "Planting". Transplanted shrubs shall be warranted and replaced the same as new shrubs.

**PART 2 - PRODUCTS**

**2.1 ANTI-DESICCANT**

- A. Emulsion-type film-forming agent, "Dowax" by Dow Chemical Co., "Wilt-Pruf" by United Specialty Products, Inc., "D-Wax" by Plant Products Inc. or approved.

**2.2 MULCH**

- A. As specified under Division 32 Section "Planting."

**2.3 TREE WRAP**

- A. As specified under Division 32 Section "Planting."

**2.4 FERTILIZER TABLETS**

- A. As specified under Division 32 Section "Planting."

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Cut a 6-inch wide trench around the rootball of the shrub equal to the diameter and depth of the proposed transplant rootball. The dimensions of the transplant rootball are to be determined by the "Tree and Shrub Transplanting Manual" for the size, species, and habit of plant being transplanted.
- B. Cut the lateral roots with clean, sharp root pruning equipment.

**3.2 ANTI-DESICCANT**

- A. Spray shrub prior to transplanting with two separate applications allowing 48 hours between them. Use a power sprayer to provide an adequate film over trunk, branches, stems, twigs and foliage. Anti-desiccant must be dry prior to transplanting.

**3.3 EXCAVATION**

- A. Prepare plant pits to accept transplanted plants prior to transplanting.

- B. Shrubs: Excavate a pit 12 inches wider than the rootball diameter and to the same depth to receive transplanted shrub.
- C. Use excavated soil at new plant location to backfill pit created by removing plant from existing location.
- D. Place a 1 inch x 2 inch mark with non-toxic white paint on the true north side of the plant at its base prior to transplanting.
- E. Excavate shrubs with 12 inches diameter of rootball for each caliper-inch of trunk measured 4 inches above rootball crown, minimum 24 inches diameter. Wrap rootballs with burlap, sisal twine and wire basket.

### 3.4 PLANTING

- A. Placing:
  - 1. Set top of root ball to match finish grade. If pit is too deep, fill pit with soil to correct level.
  - 2. Place plants in the same true north orientation as originally grown, unless directed otherwise by the COR to attain best possible profile for the plant, or to best fit the new location.
  - 3. Clip wire basket but do not remove it from rootball. Remove burlap and twine from the crowns after they have been settled completely in the planting pit.
- B. Backfilling: As specified under Division 32 Section "Planting."
- C. Wrapping: As specified under Division 32 Section "Planting."
- D. Mulching
  - 1. Remove grass and other vegetation brought with rootball from original location.
  - 2. Establish a three-foot radius circle from center of plant and fill with 3-inch depth of mulch.

### 3.5 MAINTENANCE

- A. Water transplanted plants immediately after transplanting, insuring adequate moisture to the root zone.
- B. Prune off broken or badly bruised branches.

--- END ---