

# BN-1 - BENCH (CONCAVE)

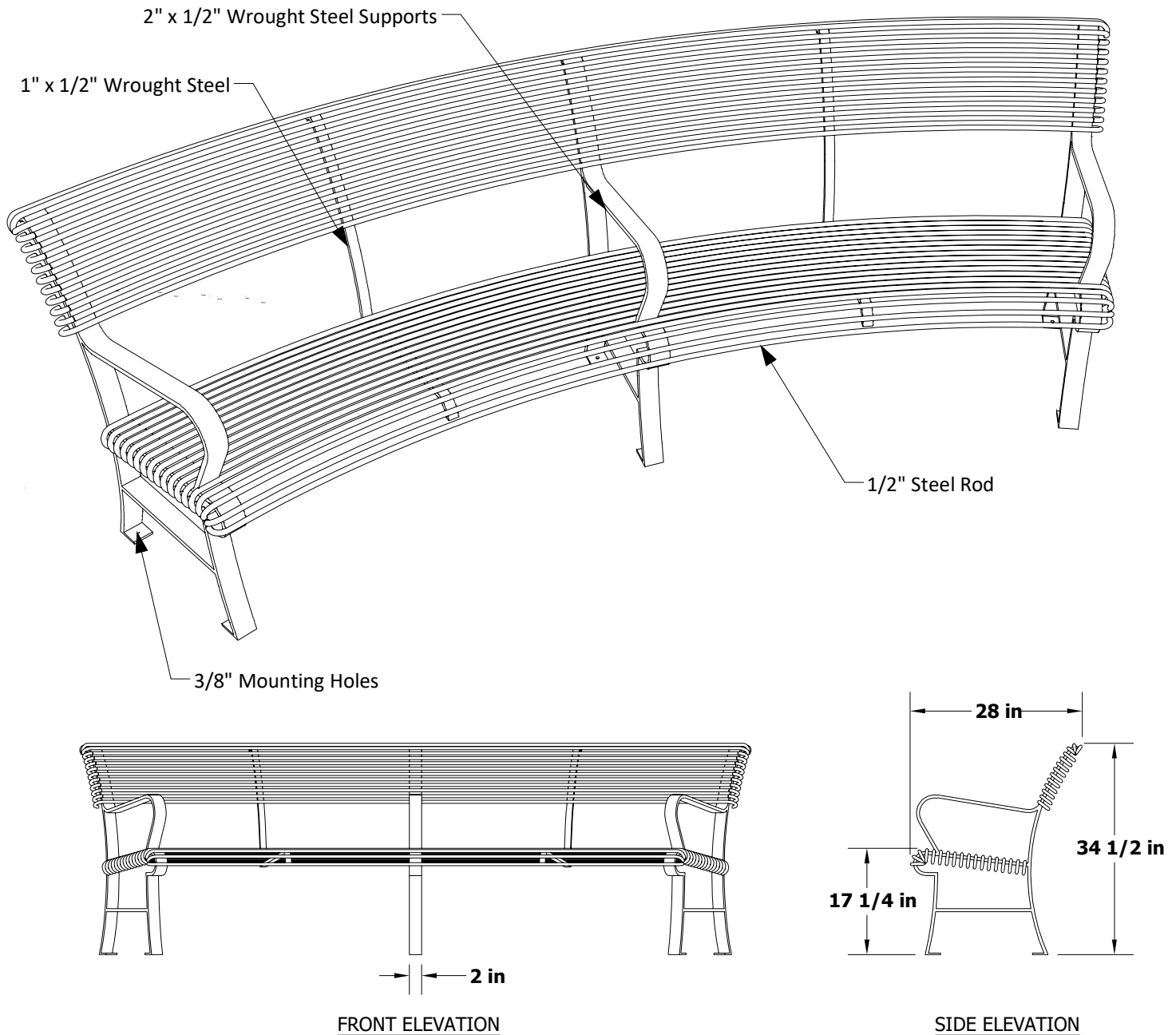
# BN-2 - BENCH (CONVEX)

## French Park Bench - Curved BNFRC-6-BR-M

CANTERBURY  DESIGNS

5632 W. Washington Blvd. | Los Angeles, CA 90016 | 323.936.7111

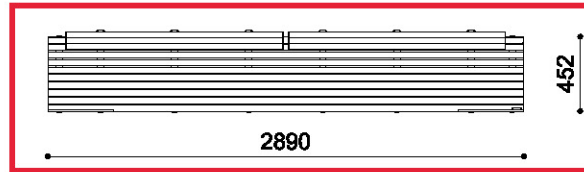
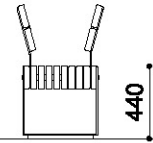
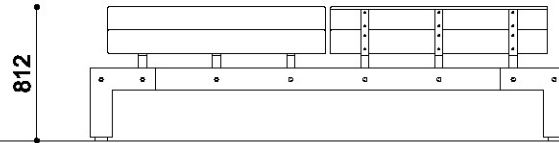
Website: [www.canterbury-designs.com](http://www.canterbury-designs.com) | Email: [info@canterbury-designs.com](mailto:info@canterbury-designs.com)



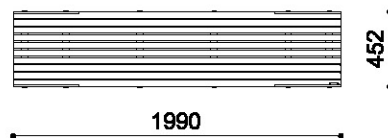
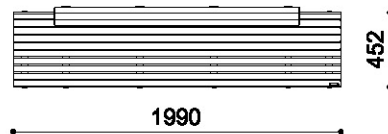
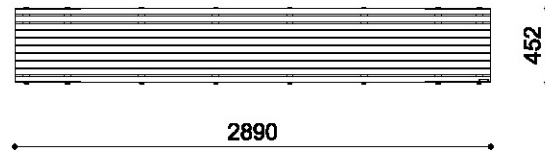
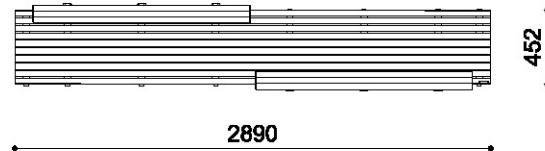
### NOTES:

1. All metal components are sandblasted, cleaned, and finished with zinc epoxy primer and polyester powder coat.
2. Mounting holes are 3/8" diameter; we do not recommend pre-drilling bolt hole locations (anchor bolts not provided).
3. Other bench lengths available upon request.

# BN-3 - BENCH (PLAZA)



SINGLE BACK OPTION

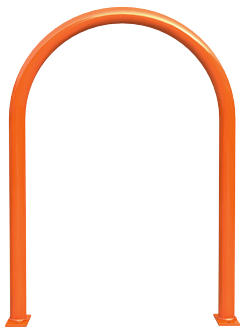


# BR-1 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOB RACK



## HOOP RACK



### Simple Security

The Hoop Rack is a proven design that provides high security and easy bike parking. The Hoop Rack uses thick pipe construction and the full radius of the bend makes the Hoop an attractive and functional bike rack. This bike rack can also be put on rails for mobility and is popular in bike corrals.



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# BR-1 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### YOUR LOGO HERE

Customize the Hoop Rack and brand your bike parking



### FINISH OPTIONS

Galvanized



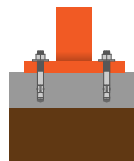
Stainless



PVC Dip



Surface

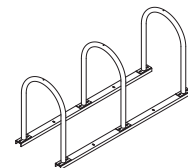


### MOUNT OPTIONS

In-Ground



Rail



### Powder Coat

White	Black	Light Gray RAL 7042	Deep Red RAL 3003	Yellow RAL 1023
CNH Bright Yellow	Orange RAL 2004	Blue RAL 5005	Sky Blue RAL 5015	Hunter Green RAL 6005
Light Green RAL 6018	Green RAL 6016	Sepia Brown RAL 8014	Bronze	Silver 9007
Dark Purple	Flat Black	Wine Red RAL 3005	Beige RAL 1001	Iron Gray 7011



Optional Lean Bar

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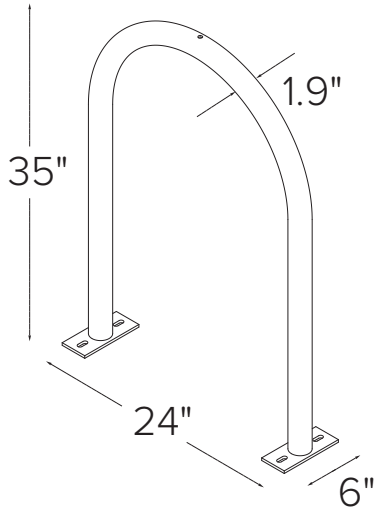
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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### Submittal Sheet

**CAPACITY** 2 Bikes



**MATERIALS**

- Standard**  
1.5" schedule 40 pipe (1.9" OD)
- Lightweight**  
1.5" schedule 10 pipe (1.9" OD)

**FINISHES**

- Galvanized**  
An after fabrication hot dipped galvanized finish is our standard option.

- Powder Coat**  
Our powder coat finish assures a high level of adhesion and durability by following these steps:  
1. Sandblast  
2. Epoxy primer electrostatically applied  
3. Final thick TGIC polyester powder coat

- PVC Dip** (plastisol)  
Other colors available by special order (minimum orders apply)

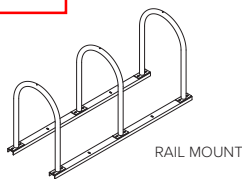
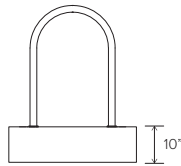
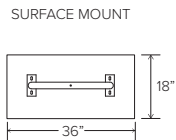
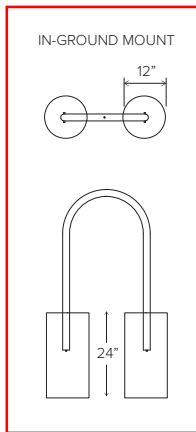
- Stainless**  
Stainless Steel: 304 grade stainless steel material finished in either a high polished shine or a satin finish.

**MOUNT OPTIONS**

- In-ground**  
In ground mount is embedded into concrete base. Specify in ground mount for this option.

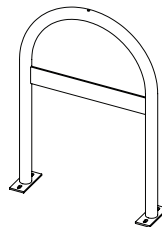
- Surface**  
Foot Mount has two 2.5"x6"x.25" feet with two anchors per foot. Specify foot mount for this option.

- Rail**  
Rail Mounted Racks are bolted to two parallel rails which can be left freestanding or anchored to the ground. Rails are heavy duty 3"x1.4"x3/16" thick galvanized mounting rails. Specify rail mount for this option.



**OPTIONAL LEAN BAR**

- Add Lean Bar**



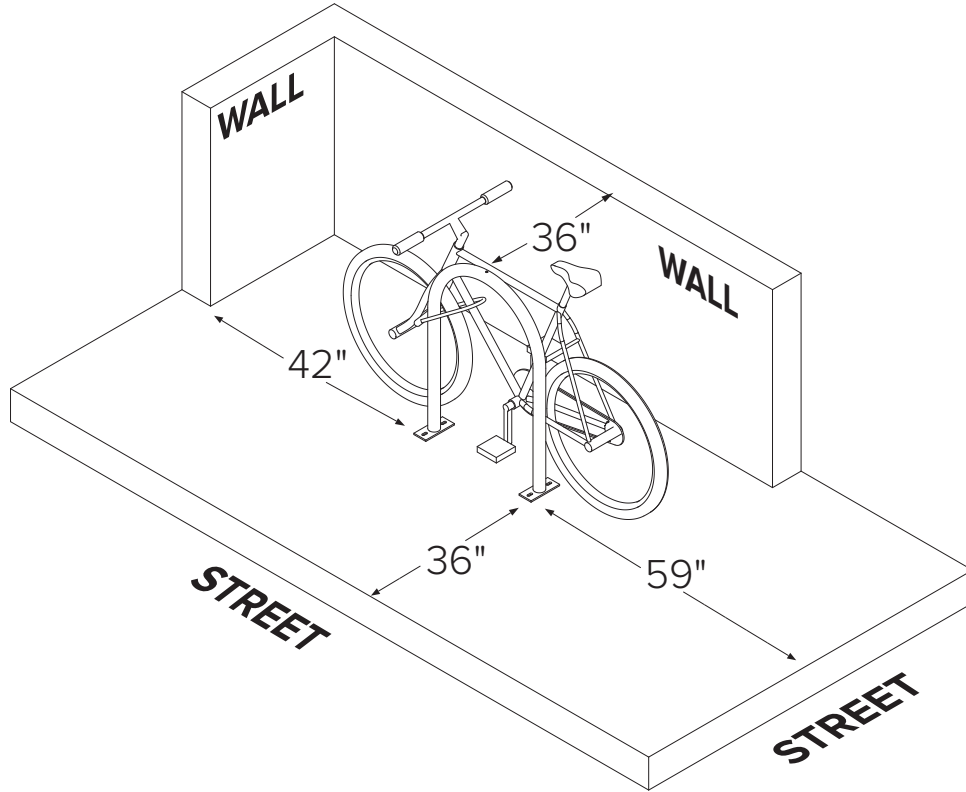
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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK Setbacks

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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### Installation Instructions – Surface Mount

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#### TOOLS NEEDED

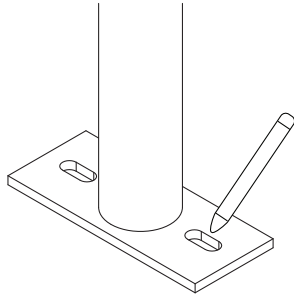
Tape Measure  
Marker or Pencil  
Masonry Drill Bit  
Drill (Hammer drill recommended)  
Hammer  
Wrench 9/16"  
Level

#### RECOMMENDED BASE MATERIAL

Solid concrete is the best base material for installation. To ensure the proper anchors are shipped with your rack, ask your Dero Rack representative which anchor is appropriate for your application. Be sure nothing is underneath the base material that could be damaged by drilling.

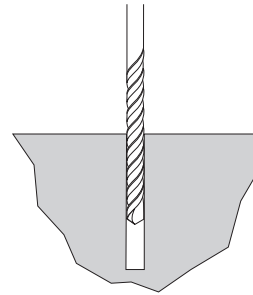
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**1**



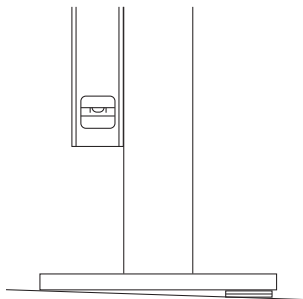
Place the rack in the desired location. Use a marker or pencil to outline the holes of the flange onto the base material.

**2**



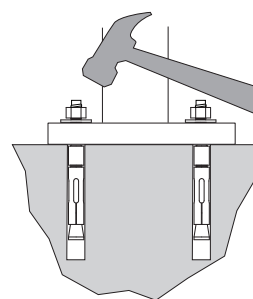
Drill 3/8" diameter holes 3" deep into surface. Make sure the holes are at least 3" away from any cracks in the base material.

**3**



Place rack (and washers to level rack if necessary) over holes.

**4**



Thread nuts onto anchors, leaving approximately 1/4" of the anchor protruding, and tap into surface. Tighten nuts down to secure rack.



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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### Installation Instructions – In Ground Mount

#### TOOLS NEEDED

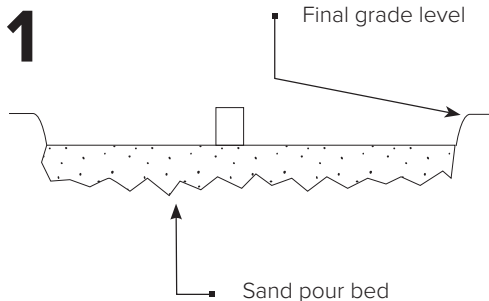
Level  
Cement mixing tub  
Shovel  
Trowel

Hole coring machine with 4" bit  
Access to water hose  
Materials to build brace (see "Install Tip" at bottom of page)

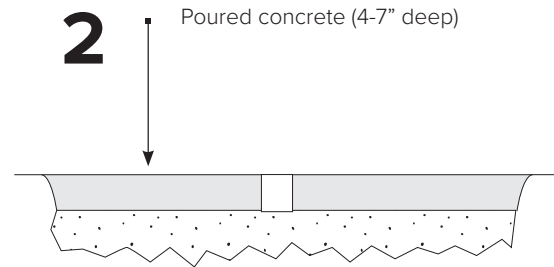
#### INSTALLING INTO EXISTING SIDEWALK

Core holes no less than 3" diameter (4" recommended) and 10" deep into sidewalk. Fill holes with Por-Rok or epoxy grout. Place rack into holes, making sure the rack is level. 33"-36" of the rack should remain above the surface. If the rack is less than 33" high, it will not support the bike adequately. Make sure the rack is level and held in place until the grout has set.

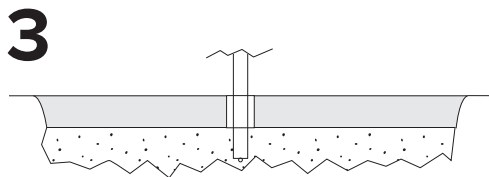
#### INSTALLING INTO A NEW SIDEWALK



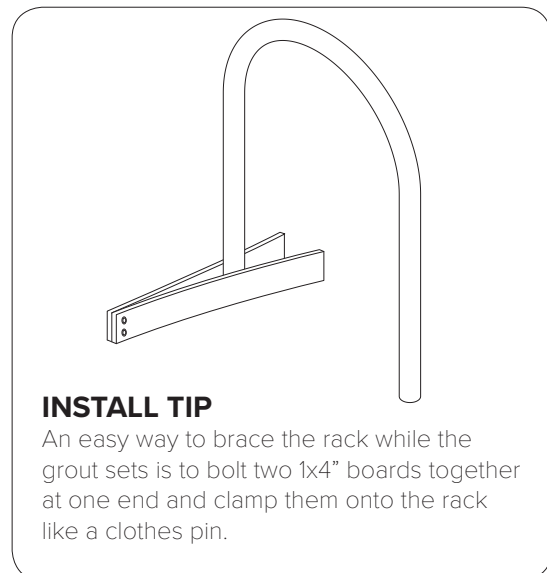
Place corrosion resistant sleeve (min. 3" inside diameter) in sand pour bed in exact location where rack will be installed. Make sure top of sleeve is at same level as desired finished concrete surface. Fill sleeve with sand to keep it in place and prevent it from filling with concrete.



Pour concrete and allow to cure.



After appropriate cure time, dig out sand from sleeves and insert racks, making sure they are level and at the appropriate height. Pour in Por-Rok or epoxy grout and allow to set.



#### INSTALL TIP

An easy way to brace the rack while the grout sets is to bolt two 1x4" boards together at one end and clamp them onto the rack like a clothes pin.



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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### Rail Mounted Options

#### RAIL MOUNTED HOOPS

Rail mounted Hoop Racks are standard foot mounted Hoop Racks attached with bolts to a rail as in the diagram at left. Rail mounted racks provide more flexibility than other mounting options while providing the same degree of security.

Rail mounted Hoop Racks can be left freestanding, or they can be anchored to the ground using several anchors. This option allows for easier snow removal and sweeping. Installation of Rail mounted Hoops is also much less expensive than embedding the racks into the ground.

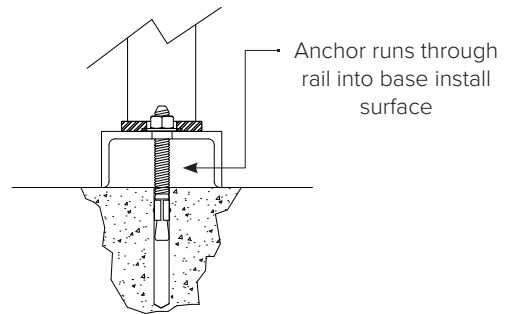
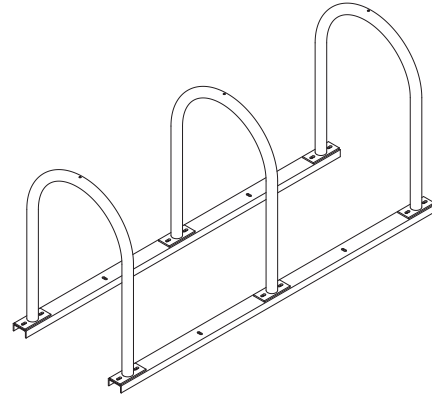
\* Note: Though racks may be painted, the rails will remain with only a galvanized finish

#### ADVANTAGES:

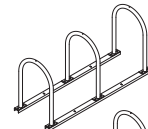
- Easier and inexpensive installation
- Can be left freestanding or anchored to the ground
- Easier to remove for sweeping and snow removal

#### APPLICATIONS:

- Installation to pavers
- Asphalt Installations
- Ground, dirt, or mulch
- Situations where the rack needs to be moved occasionally



3 Unit Rack  
69" Long  
Parks 6 Bikes



4 Unit Rack  
100.5" Long  
Parks 8 Bikes



5 Unit Rack  
132" Long  
Parks 10 Bikes



6 Unit Rack  
163.5" Long  
Parks 12 Bikes



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# BR-2 - BIKE RACK (TOWN OF BLUFFTON STANDARD)

## HOOP RACK

### Installation Instructions – Rail Mount

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#### TOOLS NEEDED

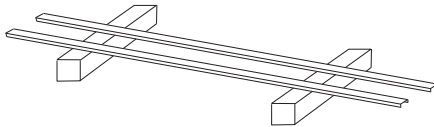
9/16" Socket set  
Two 4"x4"x28" (or larger) blocks  
4 bolts, nuts and washers for every Hoop (included with rack). If using a tamper resistant nuts, install two tamper resistant nuts with each Hoop.

#### ANCHORING THE RAILS

To anchor the rails to concrete, place 3.75" wedge anchor through holes in the rail into the concrete. Secure with nut.

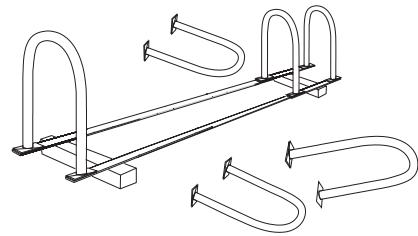
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**1**



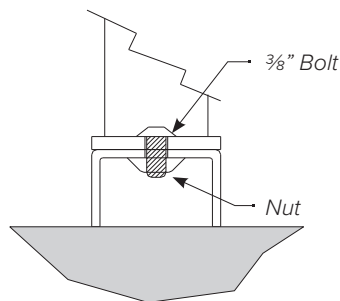
Lay out the two channel beams where the rack will be placed. Place the two beams on top of the two blocks of wood so that the open part of the channel faces the ground.

**2**



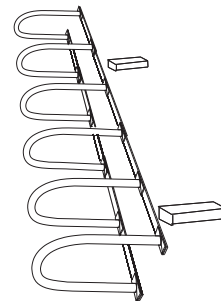
Place Hoop Racks on beams so holes in rack flanges line up with beam slots

**3**



Put bolts through Hoop Rack flange holes and beams so bolt head faces up. HAND tighten the nuts using new flange nuts.

**4**



Once nuts are on, tip assembled rack over and use a 9/16" socket to tighten nuts. Before fully tightening nuts, make sure the racks are straight on beams. If using tamper resistant nuts, use access tool to tighten nuts. Do not overtighten the tamper resistant nuts. Tip rack upright.



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## BL-1 - BOLLARD (WOODEN)



### NOTE:

1. ROUGH&READY BOLLARD FROM "STREETLIFE"  
<https://www.streetlife.nl/us/products/roughready-bollards>
2. ROBUST BEAMS IN WOOD WITH CORTEN STEEL FRAME
3. BEAMS ARE COVERED ON THE TOP AND ARE MOUNTED BY MEANS OF STAINLESS-STEEL THEFT-PROOF FLANGE NUTS

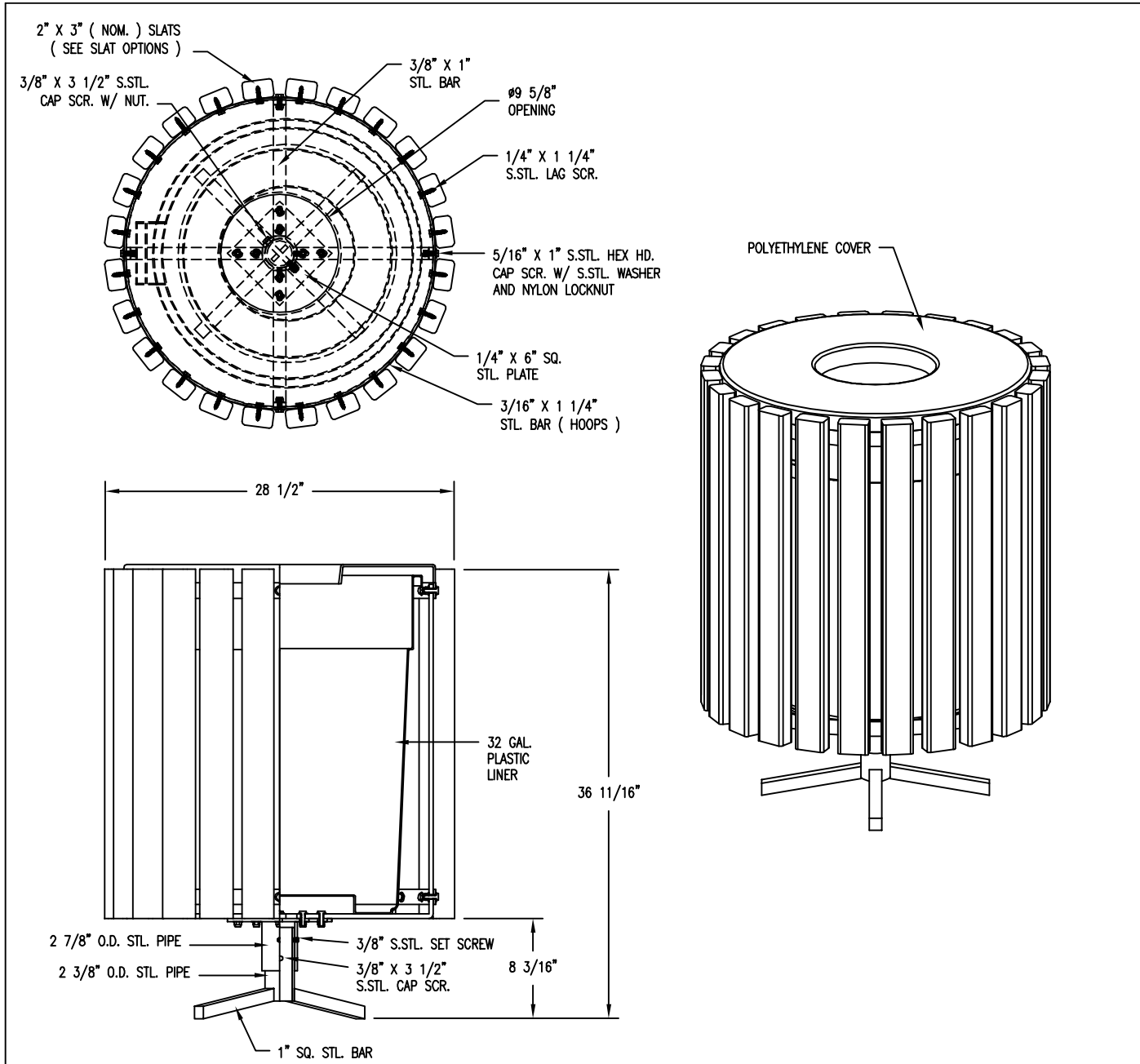
8

BL-1: WOOD BOLLARD

TYPICAL SECTION

N.T.S

# TR-1 - TRASH/RECYCLING RECEPTACLE



**NOTES**

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ BLACK POLYESTER POWDER COATING.

SLAT OPTIONS

- "CEDAR" RECYCLED PLASTIC
- "GREY" RECYCLED PLASTIC
- "REDWOOD" RECYCLED PLASTIC
- "WALNUT" RECYCLED PLASTIC
- OTHER \_\_\_\_\_

# TR-1 - TRASH/RECYCLING RECEPTACLE

## NOTES:

- 1.) DURING ASSEMBLY PROCEDURE;  
DO NOT COMPLETELY TIGHTEN HARDWARE.
- 2.) THE ACTUAL PARTS WILL NOT BE NUMBERED.  
NUMBERS ONLY APPLY TO DRAWING.
- 3.) UPON COMPLETION OF ASSEMBLY SQUARE  
ALL COMPONENTS THEN TIGHTEN ALL HARDWARE.
- 4.) MOUNT AND ANCHOR AS SPECIFIED.

## TOOLS REQ'D

- 9/16" WRENCH
- 1/2" WRENCH
- 7/16" WRENCH
- 1/4" ALLEN WRENCH
- PLIERS ( FOR ATTACHING COVER )

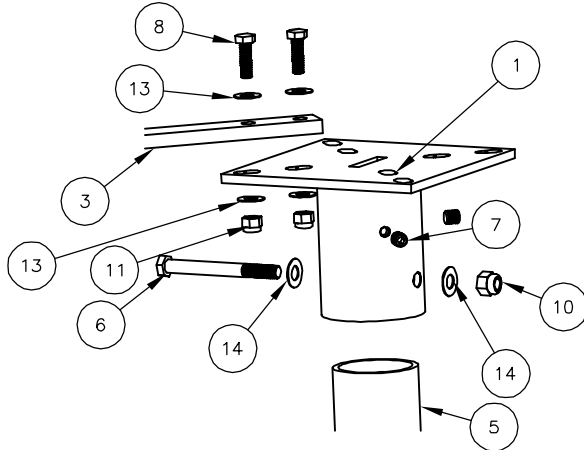
## PARTS LIST

ITEM	QTY	PART NO	DESCRIPTION
1	1	0-41-00-04	CENTER BRACKET
2	2	0-41-30-01	HOOP FOR 30 GAL
3	4	0-41-30-07	"L" SUPPORT STRAP FOR 30 GAL
4	24	0-41-30PL-06	2" X 3" X 28 1/2" SLAT, PLASTIC
5	1	0-43-00-01	FREE STANDING BASE
6	1	1-12-034	3/8" X 3 1/2" SS HEX HD CAP SCR
7	2	1-12-054	3/8" X 3/8" SS SKT SET SCR
8	16	1-12-061	5/16" X 1" SS HEX HD CAP SCR
9	48	1-13-004	1/4" X 1 1/4" SS HEX HD LAG SCR
10	1	1-20-007	3/8" SS NYLON LOCKNUT
11	16	1-20-016	5/16" SS NYLON LOCKNUT
12	48	1-22-006	1/4" SS FLAT WASHER
13	32	1-22-017	5/16" SS FLAT WASHER
14	2	1-22-024	3/8" SS FLAT WASHER
15	1	49-32	32 GAL PL LINER W/ HANDLE, BLK

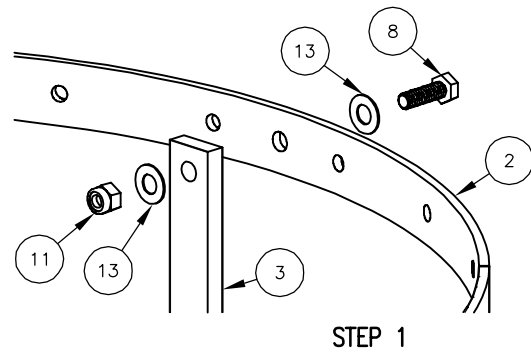
## KITS PROVIDED

ITEM	QTY	PART NO	DESCRIPTION
16	1	K-41	41 SER HARDWARE KIT

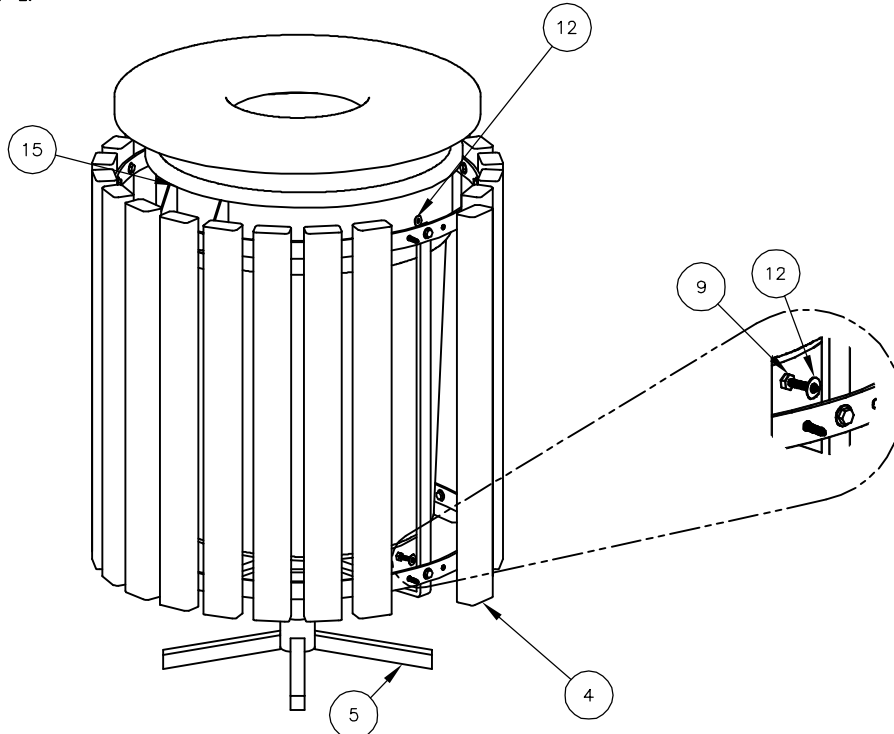
① ATTACH SUPPORT, CENTER BRACKET & "L" SUPPORT STRAPS TOGETHER.



② ATTACH HOOPS TO STEP 1.



③ ATTACH SLATS TO STEP 2.



# DB-1 - DOG BAG DISPENSER

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## DOG WASTE STATION with ROLL BAG SYSTEM - DEPOT-006-B

(5 of 5 bones)

Our CHEAP PRICE: **\$199.99**

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- 50 Can Liners
- [Installation Instructions](#)
- Hardware

100% Commercial Grade Aluminum/Metal (not poly-plastic like our competitor's)

Choose **GREEN** or **BLACK**, Screen-Printed and Powder Coated to last! This Station comes with the **ROUND MESH WASTE CAN**. If you prefer the **SQUARE, Solid Waste Can**, choose **Item #: DEPOT-006**.

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It's **NOT FAIR!** Why do Dogipot<sup>®</sup>, HD Supply and Peachtree/FIDO charge **\$150 MORE** for their stations?

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SECTION 321316 - DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes Tabby/Oyster Shell concrete paving.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
    - a. Concrete mixture design.
    - b. Quality control of concrete materials and decorative concrete paving construction practices.
    - c. .
  - 2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
    - a. Contractor's superintendent.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.



- C. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Applied finish materials.
- C. Material Test Reports: For each of the following:
  - 1. Aggregates.
- D. Field quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
  - 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 8 linear feet of sidewalk.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on decorative concrete paving mixtures.

#### 1.9 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

### 2.2 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, gray portland cement Type I.
  2. Fly Ash: ASTM C618, Class C or F.
  3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 4M, uniformly graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Water: Potable and complying with ASTM C94/C94M.

2.3 RELATED MATERIALS

- A. Joint Fillers: ASTM D1752, cork or self-expanding cork in preformed strips.

2.4 CONCRETE MIXTURES

- A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.
- B. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. nominal maximum aggregate size.
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- E. Concrete Mixtures: Normal-weight concrete.
1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).
- F. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- G. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below decorative concrete paving and site furnishing base to identify soft pockets and areas of excess yielding.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 25 feet (7.62 m unless otherwise indicated).
  - 2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### 3.5 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- H. Screed paving surface with a straightedge and strike off.

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

### 3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

### 3.8 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:
  1. Elevation: 3/4 inch (19 mm).
  2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  3. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/2 inch (13 mm).
  4. Joint Spacing: 3 inches (75 mm).
  5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
  6. Joint Width: Plus 1/8 inch (3 mm), no minus.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
  1. Testing Frequency: Obtain at least one composite sample for each 1000 sq. ft. (92.9 sq. m) or fraction thereof of each concrete mixture placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
  - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.10 REPAIR AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316



SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Brick pavers set in mortar setting beds.
  - 2. Steel Aluminum edge restraints.
- B. Related Requirements:
  - 1. Section 321316 "Decorative Concrete Paving".

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
  - 1. Pavers.
  - 2. Mortar and grout materials.
  - 3. Edge restraints.
- C. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.
- D. Samples for Initial Selection: For each type of unit paver indicated and the following:
  - 1. Joint materials involving color selection.
  - 2. Exposed edge restraints involving color selection.
- E. Samples for Verification: For full-size units of each type of unit paver indicated. Include Samples of the following:
  - 1. Joint materials.
  - 2. Exposed edge restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.
- B. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, Samples of flooring materials that will contact or affect mortar and grout that contain latex additives.
  - 1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimal adhesion with, and will be nonstaining to, installed brick and other materials constituting brick flooring installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers 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.
- 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. Store liquids in tightly closed containers protected from freezing.
- E. Store asphalt cement and other bituminous materials in tightly closed containers.

## 1.9 FIELD 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. Weather Limitations for Bituminous Setting Bed:
  - 1. Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.
  - 2. Apply asphalt adhesive only when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.
- C. Weather Limitations for Mortar and Grout:
  - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
  - 2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.
    - a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

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

### 2.2 BRICK PAVERS

- A. Brick Pavers: Light-traffic paving brick; ASTM C902. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
  - 1. Thickness: As indicated.
  - 2. Face Size: As indicated.
  - 3. Color: As selected by Architect from manufacturer's full range.
- B. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C67.
- C. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and

can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

### 2.3 CURBS AND EDGE RESTRAINTS

- A. Steel Edge Restraints: Manufacturer's standard painted steel edging **1/4 inch (6.4 mm)** thick by **5 inches (125 mm)** high with loops pressed from or welded to face to receive stakes at **36 inches (900 mm)** o.c. and steel stakes **15 inches (380 mm)** long for each loop.
  - 1. Color: As selected by Architect from manufacturer's full range.
- B. Job-Built Concrete Edge Restraints: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of **3000 psi (20 MPa)**.

### 2.4 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D1056, Grade 2A1.

### 2.5 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Sand: ASTM C144.
- D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
- E. Thin-Set Mortar for Bond Coat: Latex-portland cement mortar complying with ANSI A118.4.
- F. Water: Potable.
- G. Reinforcing Wire Fabric: Galvanized, welded wire fabric, **2 by 2 inches (50.8 by 50.8 mm)** by **0.062 inch (1.57 mm)** in diameter; comply with ASTM A185/A185M and ASTM A82/A82M except for minimum wire size.

### 2.6 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, made of white or gray cement and white or colored aggregate as required to produce color indicated.

1. Colored Mortar 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.
- B. Standard Cement Grout: ANSI A118.6, sanded.
- C. High-Performance Cement Grout: ANSI A118.7, sanded.
- D. Grout Colors: As selected by Architect from manufacturer's full range.
- E. Water: Potable.

## 2.7 BITUMINOUS SETTING-BED MIX

- A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F (149 deg C).

## 2.8 MORTAR AND GROUT MIXES

- 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 optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix neat cement and latex additive water to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C270, Proportion Specification.
- D. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions 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 Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.
- F. Thinset Mortar Bond Coat: Proportion and mix according to manufacturer's written instructions.
- G. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.
  1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.
  2. Colored-Aggregate Grout: Produce color required by combining colored aggregates with portland cement of selected color.

- H. Packaged Grout: Proportion and mix according to grout manufacturer's written instructions.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.
- C. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.

#### 3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. 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. For concrete pavers, a block splitter may be used.
- D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: As indicated.

- F. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.
  - 1. Provide joint filler at waterproofing that is turned up on vertical surfaces.
- G. Tolerances: Do not exceed **1/32-inch (0.8-mm)** unit-to-unit offset from flush (lippage) or **1/8 inch in 10 feet (3 mm in 3 m)** from level, or indicated slope, for finished surface of paving.
- H. 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.
- I. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 079200 "Joint Sealants."
- J. Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
- K. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
  - 1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
  - 2. For metal edge restraints with top edge exposed, drive stakes at least **1 inch (25 mm)** below top edge.
  - 3. Install job-built concrete edge restraints to comply with requirements in Section 033000 "Cast-in-Place Concrete."
  - 4. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.
  - 5. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.
- L. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
  - 1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

### 3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D698 laboratory density.

- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place separation geotextile over prepared subgrade, overlapping ends and edges at least **12 inches (300 mm)**.
- D. Place aggregate subbase and base, compact by tamping with plate vibrator, and screed to depth indicated.
- E. Place aggregate subbase and base, compact to 100 percent of ASTM D1557 maximum laboratory density, and screed to depth indicated.
- F. Place drainage geotextile over compacted base course, overlapping ends and edges at least **12 inches (300 mm)**.
- G. Place leveling course and screed to a thickness of **1 to 1-1/2 inches (25 to 38 mm)**, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- H. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- I. Set pavers with a minimum joint width of **1/16 inch (1.5 mm)** and a maximum of **1/8 inch (3 mm)**, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed **3/8 inch (10 mm)** with pieces cut to fit from full-size unit pavers.
  - 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- J. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a **3500- to 5000-lbf (16- to 22-kN)** compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
  - 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least **36 inches (900 mm)** of uncompacted pavers adjacent to temporary edges.
  - 2. Before ending each day's work, compact installed concrete pavers except for **36-inch (900-mm)** width of uncompacted pavers adjacent to temporary edges (laying faces).
  - 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within **36 inches (90 mm)** of laying face.
  - 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- K. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- L. Do not allow traffic on installed pavers until sand has been vibrated into joints.



- M. Repeat joint-filling process 30 days later.

### 3.5 BITUMINOUS SETTING-BED APPLICATIONS

- A. Apply primer to concrete slab or binder course immediately before placing setting bed.
- B. Prepare for setting-bed placement by locating **3/4-inch- (19-mm-)** deep control bars approximately **11 feet (3.3 m)** apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.
- C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of **250 deg F (121 deg C)**. Strike setting bed smooth, firm, even, and not less than **3/4 inch (19 mm)** thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.
  - 1. Roll setting bed with power roller to a nominal depth of **3/4 inch (19 mm)**. Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to **185 deg F (85 deg C)**.
- D. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling to a uniform thickness of **1/16 inch (1.6 mm)**. Proceed with setting of paving units only after adhesive is tacky and surface is dry to touch.
- E. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
- F. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

### 3.6 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 mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed **1/16-inch (1.6-mm)** thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.
- C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

- D. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of mortar bed. Hold edges back from vertical surfaces approximately **1/2 inch (13 mm)**.
- E. Place mortar bed with reinforcing wire fully embedded in middle of mortar bed. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- F. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
- G. Wet brick pavers before laying if the initial rate of absorption exceeds **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.
- H. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform **1/16-inch- (1.5-mm-)** thick bond coat to mortar bed or to back of each paver with a flat trowel.
- I. 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 or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- J. Spaced Joint Widths: Provide **1/2-inch (13-mm)** nominal joint width with variations not exceeding plus or minus **1/8 inch (3 mm)**.
- K. Grouted Joints: Grout paver joints complying with ANSI A108.10.
- L. Grout joints as soon as possible after initial set of setting bed.
  - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
  - 2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
  - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
  - 4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
- M. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

### 3.7 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. 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 grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
  - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
  - 2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 321400

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seating.
2. Tables.
3. Bicycle racks.
4. Trash receptacles.
5. Drinking Fountains.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves cast installing anchor bolts cast formed voids in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.
- E. Product Schedule: For site furnishings. See Material & Furnishing Schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For site furnishings manufactured with preservative-treated wood.
  1. Indicate type of preservative used and net amount of preservative retained.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SEATING: See Material & Furnishing Schedule

2.2 TABLES: See Material & Furnishing Schedule

2.3 BICYCLE RACKS: See Material & Furnishing Schedule

2.4 TRASH RECEPTACLES: See Material & Furnishing Schedule

2.5 DRINKING FOUNTAIN: See Material & Furnishing Schedule

2.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:

1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B211 (ASTM B211M).
2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B221 (ASTM B221M).
3. Structural Pipe and Tube: ASTM B429/B429M.
4. Sheet and Plate: ASTM B209 (ASTM B209M).
5. Castings: ASTM B26/B26M.

- B. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
6. Perforated Metal: From steel sheet not less than 0.090-inch (2.3-mm) nominal thickness; manufacturer's standard perforation pattern.
7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F1267.
8. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended by fabricator for type of use intended.
9. Gray-Iron Castings: ASTM A48/A48M, Class 200.

- C. Stainless Steel: Free of surface blemishes and complying with the following:
  - 1. Sheet, Strip, Plate, and Flat Bars: ASTM A666.
  - 2. Pipe: Schedule 40 steel pipe complying with ASTM A312/A312M.
  - 3. Tubing: ASTM A554.
  
- D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
  - 1. Wood Species: Manufacturer's standard.
    - a. Douglas Fir: Clear Grade, vertical grain.
    - b. Pine: Southern pine; No. 2 or better.
    - c. Eastern White Cedar: Select Grade or better.
    - d. Redwood: Clear all heart, free-of-heart center.
    - e. Teak (*Tectona Grandis*): Clear Grade.
  
- E. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
  
- F. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
  - 1. Polyethylene: Fabricated from virgin plastic HDPE resin.
  
- G. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant.
  
- H. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.
  
- I. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
  
- J. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
  - 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil (0.0076 mm) thick.
  - 2. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

## 2.7 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment: Pressure-treat wood according to AWWA U1, Use Category UC3b, and the following:
  - 1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  - 2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

## 2.8 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWWA M4 to cut surfaces.
- E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

## 2.9 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.10 ALUMINUM FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.12 IRON FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.13 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run directional finishes with long dimension of each piece.
  - 2. Directional Satin Finish: No 4.
  - 3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.



- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 323300

## SECTION 328400 - PLANTING IRRIGATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Piping.
  - 2. Manual valves.
  - 3. Automatic control valves.
  - 4. Automatic drain valves.
  - 5. Sprinklers.
  - 6. Quick couplers.
  - 7. Drip irrigation specialties.
  - 8. Controllers.
  - 9. Boxes for automatic control valves.

#### 1.3 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers which use some method of weather based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET; broadcasting of ET measurements; or use of on-site sensors to track ET.
- D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Detailed layout design of lateral piping, heads, zoning, and accessories is NOT provided. See submittals below. Design to be furnished by the contractor shall provide layout as needed to obtain required and complete coverage with manufacturer's standard heads as specified.

Provide all labor, materials and equipment required by or inferred from the Drawings and Specifications to complete the Work of this Section.

1. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Irrigation zone control shall be automatic operation with controller and automatic control valves.

C. valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 60 PSI.

2. Circuit Piping: 40 PSI.

#### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.

B. Qualification Data: For qualified Installer.

C. Zoning Chart: Show each irrigation zone and its control valve.

D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

E. Field quality-control reports.

#### 1.7 RECORD AS-BUILT DRAWINGS:

A. Indicate exact location of check valves, gate valves, wire locations, head layout, automatic valves, quick couplers, all irrigation and drainage piping, etc.

B. Five sets of a site map showing the individual zones using numbers and color code of the installed irrigation system. One of the site maps is to be laminated and placed in the door of the irrigation control clock for onsite reference.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinklers controllers and automatic control valves to include in operation and maintenance manuals.
- B. Provide schedule indicating length of time each valve is required to be run to provide a determined amount of water.
- C. Provide a complete parts list with manufacturer's designations for each component.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers that include a certified irrigation designer qualified by The Irrigation Association.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 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 to prevent sagging and bending.

1.11 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 IRRIGATION SYSTEM MANUFACTURERS:

- A. All irrigation system components shall be supplied by regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all aspects. The manufacturer Hunter Industries shall be the Basis of Design.

## 2.3 MATERIALS

### A. General:

1. Substitutions: If sprinkler heads or remote valves are requested to be substituted each zone affected by such substitution shall be recalculated for pressure loss, GPM, and shall be submitted to the Architect for review and approval.
2. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of this system.

### B. Plastic Pipe

1. All piping shall be from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. All pipe shall be National Sanitation Foundation (NSF) approved.
2. For irrigation mainline, use polyvinyl chloride (PVC) with a minimum rating of Class 200 unless otherwise shown on the drawings, sized to maintain a maximum flow velocity of less than 5 ft. per second (FPS). For laterals, use PVC class 200 sized to maintain a maximum flow velocity of less than 5 ft. per second.
3. Pipe shall be marked at intervals (not to exceed 5 ft.) with the following information: Manufacturer's name or trademark, nominal pipe size, schedule, PVC type and grade ( i.e. PVC 1120), SDR rating class, working pressure at 73 degrees F. and NSF approval.
4. Avoid dropping and carefully handle pipe to prevent cracking or splitting.
5. Comply with pipe sizes and types indicated on Shop Drawings. No substitution of smaller pipe will be permitted. Larger sizes may be used subject to acceptance of the Architect. Remove damaged and defective pipe from site.
6. When connection is plastic to metal, Sch 80 TOE (Threaded One End) nipples shall be used. The nipple shall have two turns of Teflon tape, be hand tightened, plus one turn with a strap wrench. The connection to PVC shall be solvent welded.
7. Minimum pipe size for laterals is 3/4".

### C. Piping for Sleeving

1. For sleeves under 6 inches in size, high impact type, polyvinyl chloride (PVC) 1120, minimum Schedule 40.
  2. Coordinate sleeve installation for all piping passing under paved areas, through concrete or masonry walls and slabs while the same are under construction.
  3. Sleeving shall always be twice the diameter of pressure pipe running thru it.
1. Provide purple Primer for solvent weld pipe bells and schedule 40 fittings.
  2. Provide Clear PVC cement for solvent weld pipe bells and schedule 40 fittings. Use Purple primer and Heavy duty Gray PVC Cement for any schedule 80 fittings.

### E. Fittings

1. Fittings for Solvent -weld PVC Pipe

- a. Schedule 40 or 80, polyvinyl chloride (PVC), Type 1 injection molded fittings
  - b. suitable for solvent weld or threaded connections, to meet ASTM D-2466-73 and D-2467-73 NSF approved. Fittings made of other materials are not permitted.
2. Threaded PVC nipples shall be Schedule 80. Use high quality grade of teflon tape for threaded fittings.
    - a. Saddle fittings are not permitted.
    - b. Use high quality grade of Teflon tape for sprinkler head and electric remote control valve connections.
  3. Any 'T' intersections or 90 degree bends in pipe located under paved areas shall be made of ductile iron with positive restraints.
- F. Isolation Valves on the mainline
1. Gate valves shall be 200 psi rated W.O.G. 200 with brass bodies. Valves shall be equipped with tee handles. As manufactured by Watts Regulator, West Andover, MA or acceptable Substitute. Space at a maximum of 200' along mainline.
- G. Valve Boxes
1. In grass, groundcover, and shrub areas, tapered rib reinforcement enclosure of rigid tensile strength plastic material components chemically inert and unaffected by moisture, ultra violet light, corrosion and temperature changes. Lid and base shall withstand normal loads exerted by turf equipment without collapsing. Lid to be green or black
  2. Acceptable Manufacturers:
    - a. Armor Access Boxes, Sheboygan, WI 1-800-348-7558
    - b. Carson Brooks, La Verne, CA (818) 332-6225
  3. For remote control valves and quick coupler valves use rectangular standard turf box, 16 inches x 11 inches.
  4. For individual isolation valves use 9 inch circular turf box.
- H. Spray or stream heads for shrub and groundcover areas
1. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultra-violet resistant plastic.
  2. The sprinkler shall have a matched precipitation rate (MPR) plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall incorporate a pressure regulating device that will regulate nozzle pressure to approximately 30 psi.
  3. A built-in check valve shall prevent low-head drainage of up to 8 feet of head.
- I. Rotor heads for med-to large turf areas

1. The rotor heads shall incorporate a stainless steel riser sleeve and a built in check valve.
  2. Although not mandatory, it is desired that rotor heads have rubber covers and an easy mechanism to stop flow to an individual head while the rest of the zone is running.
  3. A wide assortment of nozzles must be available, including Low Angle trajectories to effectively irrigate the many areas with trees.
  4. Acceptable Products:
    - a. Hunter I-25 heads with stainless steel risers or equal primarily for large turf areas.
- J. Electric Control Valve:
1. The valve bodies shall be constructed from glass-filled nylon and have a minimum pressure rating of 200 psi.
  2. All metal parts shall be stainless steel or brass (bronze)
  3. Solenoid parts shall be captive. Holding amperage to be no more than .22 amps.
  4. The diaphragm shall be fabric reinforced.
  5. Acceptable Products:
    - a. Hunter ICV Series or equal
- K. Quick Coupler valves:
1. Valves shall be located along the mainline at a spacing of approx. 200' whether or not if shown in the drawings. Locate one within 5' of where the pressure pipe exits the building.
  2. Valves to be standard brass construction.
- L. Irrigation Controller:
1. Acceptable Products:
    - a. Hunter – ACC controller or equal able to control up to 50 stations, controllable in the field with hand-held remote. The remote is to be included as a part of the irrigation package.
- M. Rain Detection:
1. Detection device to be located near the controller and wired to it for emergency system shut off in the event of a rain storm while system is running.
  2. Acceptable products: Hunter Rain-Click or equal. Must be compatible with 'smart' controller for LEED Credit WE 1.
- N. PVC Solvent Cement:
1. Provide professional grade cement, Whitlam #PR32 or approved Substitute for PVC pipe and fittings.
- O. PVC Primer/Cleaner

1. Provide professional grade primer/cleaner, Whitlam #PP32 or approved Substitute (purple) primer.
- O. Remote Controller – Hunter ICR hand-held remote control. Installer to verify remote operates controller within the project limits.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Carefully schedule irrigation work with landscaping work and all other site developments.
- D. Full and completed coverage is required per 1.2 above. Contractor shall make any necessary minor adjustments to layout as required to achieve full coverage of irrigated areas at no additional cost to the Owner.
- E. It shall be the Contractor's responsibility to establish the location of all sprinkler heads in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on drawings. No substitution of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.
- F. The irrigation system shall be installed and completely operational prior to the installation of any planting operations.

#### 3.2 POINT OF CONNECTION

- A. Provide irrigation system complete from point of connection outside of building. See drawings for Point of Connection (POC).
- B. Irrigation contractor shall be responsible for making the full connection and providing all piping and equipment downstream from a point 5' outside the building. Sleeving thru the exterior wall or bldg. grade beam if present for site access will be coordinated by the General Contractor.

#### 3.3 EXCAVATING AND BACKFILLING

- A. All piping is to be trenched. Pipe pulling method is not to be used.
- B. Comply with requirements for utilities in Earthmoving or Earthwork specifications in other contracts except as otherwise noted herein.
- C. Excavate to depths required to provide 2 inches depth of sand bedding material for piping when unsuitable bearing materials are encountered.



- D. Install lateral irrigation lines with a minimum cover of 12 inches and a maximum cover of 18-inches based on finished grades.
- E. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.
- F. When two pipes are to be placed in the same trench, a 6 inch space is to be maintained between the pipes. Do not install two pipes with one directly above the other.
- G. The Contractor shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts.

### 3.4 PIPE LINE ASSEMBLY

#### A. General

- 1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
- 2. Clean all pipes and fittings of dirt, scales and moistures before assembly.
- 3. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when laying is not in progress, open ends of pipe shall be closed by approved means.

#### B. Solvent-Welded Joints for PVC Pipe

- 4. Use solvents and methods approved by solvent and pipe manufacturers.
  - 5. Cure joints a minimum of one hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure, unless otherwise specified by the manufacturer.
  - 6. Cut all pipe with square ends and remove burrs, ridges and dirt. Check dry fit pipe and fitting. Clean pipe and fitting with purple primer and apply thin coat of cement to fitting with a liberal coat to pipe. Quickly push pipe fully into fitting using a 1/4 turning motion. Hold pipe and fitting together a minimum of 30 seconds, wipe off excess with cloth.
- 
- 1. Pipes shall be bedded in at least 2 inches of finely divided material with no rocks or clods over 1 inch diameter to provide a uniform bearing.
  - 2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
  - 3. Do not lay PVC pipe when there is water in the trench.
  - 4. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner so as to ensure a square cut. Burrs at end cuts shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
  - 5. All plastic to plastic joints will be solvent-weld joints. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer

for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

### 3.5 PVC SLEEVES

- A. It is the responsibility of the General Contractor to install sleeves for the successful completion of the irrigation system. Coordinate sleeving efforts with other Site Contractors and/or Construction Manager and Irrigation Contractor.
- B. All PVC sleeves shall be a minimum of twice (2x) the diameter of pipe to be sleeved.
- C. All PVC control wire conduit shall be of sufficient size to hold the required quantity of control and common wires.

### 3.6 ISOLATION VALVES

- A. Provide isolation valve within 10' of the point of connection and at 200' maximum spacing along the mainline.

### 3.7 VALVE BOXES

- A. Set valve boxes flush with grade or even with the crowns of grass roots. Boxes set too high or too low will be adjusted prior to project acceptance.
- B. Provide valve access boxes set on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the valve box. See irrigation details.

### 3.8 SPRAY HEADS

- A. All sprinkler heads within a zone shall have matched precipitation rates.
- B. Install plumb to within 1/16 inch, unless otherwise noted (see detail for heads on sloped areas on detail sheet). Top of collar (not nozzle) should be flush with finish grade.
- C. Place spray heads 2 inches from edge of adjacent walks, curbs and mowing bands, or paved areas at time of installation, rotor heads 6 inches, root watering canisters 3 feet from center of tree trunks.
- D. All sprinkler nozzles shall be adjusted for the proper radius and direction of spray pattern. Make adjustments where possible to prevent overspraying onto walks, pavement or buildings.
- E. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw as required for proper radius.
- G. Do not use polyethylene swing joints to extend head more than eighteen inches (18") from lateral.

3.9 FLUSHING, TESTING AND ADJUSTMENTS

- A. After piping is installed and before sprinklers and spray heads are installed, open control valves and flush out the system with full head of water.
- C. Testing of the system shall be performed after completion of each section or completion of the entire installation; and any necessary repairs shall be made, at the Contractor's expense, to put the system in good working order before final project close-out.
- D. Adjust all electric automatic valve control stems for system balance and optimum performance.
- E. Adjust all spray heads and risers for proper distribution of water over the pattern coverage. Adjust for the proper arc of coverage.
- F. After the system has been installed, test the entire system and demonstrate to the project team that the entire system meets coverage requirements and automatic controls function properly.
- G. Notify the Architect 24 hours prior to testing.

3.10 CLEANING AND DISPOSAL OF WASTE MATERIAL

- A. Perform clean-up during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment as fast as it accumulates.
- B. Restore and repair all disturbed or damaged areas resulting from irrigation installation operations to original condition in a manner acceptable to the Associate.
- C. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

END OF SECTION 328400

## SECTION 32 91 00 - PLANTING SOIL PREPARATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Correction of subsoil conditions.
  - 2. Site amended topsoil.
  - 3. Planting Soil Mix for tree pits and plant beds.
- B. Related Sections:
  - 1. Section 32 92 00 "Turf and Grasses" for turf (lawn).
  - 2. Section 32 93 00 "Plants" for plants.

#### 1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of topsoil.
- C. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before topsoil is placed.
- D. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms
- E. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
  - 1. Preconstruction Testing: Site-salvaged topsoil, surface soil & organic compost amendment

- a. For site-salvaged topsoil and surface soil, submit material test reports for the following:
  - 1) Texture analysis (% Sand, Silt and Clay)
  - 2) USDA texture class
  - 3) pH
  - 4) Soluble salts content
  - 5) Organic matter content (ASTM D2974-87 Method C)
  - 6) Nutrient analysis (plant available phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper and boron)
- b. For organic compost amendment, submit material test reports for the following (in conformance with *US Compost Council's Test Methods for the Examination of Composting and Compost* TMECC unless otherwise indicated):
  - 1) pH
  - 2) Soluble salts content
  - 3) Organic matter content (ASTM D2974-87 Method C)
  - 4) Carbon to Nitrogen ratio
  - 5) Solvita Maturity Index
  - 6) Moisture content
  - 7) Nutrient Analysis (nitrate-nitrogen, phosphorous, potassium, calcium, magnesium, iron, manganese, zinc, copper, boron and sodium (extracted per NER493 or NCR-221 for soil-less media)
  - 8) Heavy metal content / OEPA Compost Quality Table 1 (TMECC 04.06)
- c. Product certificates for each chemical soil amendment and fertilizer material
- d. Provide topsoil and subsoil amending recommendations by Soil-Testing Laboratory.

- B. Qualification Data: 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.

#### 1.5 QUALITY ASSURANCE

- A. Lime stabilization application to stabilize wet soils during construction is prohibited on all future plant bed and lawn areas. Use protection mats, plywood and wood-chip blankets in these areas if needed to enable circulation over wet soils.
- B. Soil-Testing Laboratory Qualifications: 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.
- C. Preinstallation Conference: Conduct conference at Project site prior to installation of soil.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Bulk Materials:

1. Handle soil only when soil moisture is such that the soil is friable. Soil should hold together in clods as it is being handled and should cause hands to be dirty but not muddy when squeezed in a fist.
  - a. Do not store topsoil or compost material in stockpiles greater than four feet in height.
  - b. Do not cover topsoil stockpiles with an impervious cover.
2. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
3. 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.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, and dimensions of contiguous construction by field measurements before proceeding with work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
  1. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Weather Limitations: Proceed with soil operations only when existing and forecasted weather conditions permit operations 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. Existing Trees: Do not machine excavate or amend under critical root zones. Do not sever or damage existing tree root systems. Hand fracture and amend within critical root zone.

PART 2 - PRODUCTS

1.8 TOPSOIL

1. Topsoil
  - a. Existing topsoil available on site that generally conforms to the following description shall be stockpiled for re-use.
  - b. A loamy, friable mineral soil essentially free from heavy or stiff clay lumps, stones, cinders, concrete, brick, roots, sticks brush, litter, plastics, metals, refuse or other deleterious materials in accordance with ASTM D 5286-92. The soil shall be free

of herbicides, petroleum-based materials or other substances of a hazardous or toxic nature which may inhibit plant growth. The soil shall be free of noxious weeds, seeds or vegetative parts of weedy plants that cannot be selectively controlled in the planting.

2. Organic Compost Amendment

The organic compost amendment shall be a stable, mature aerobically composted, a compost derived from mixed green waste/yard waste feedstocks.

- a. The organic compost material shall meet the U.S. Composting Council ([www.compostingcouncil.org](http://www.compostingcouncil.org)) Seal of Testing Approval (STA).
- b. The compost shall be a homogeneous material essentially free of soil clods, lumps, roots and stones; dark brown to black in color with no anaerobic odor.
- c. The compost shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5% for material retained on a U.S. Std.No.5 (4 mm) sieve (TMECC 03.06)
- d. The compost shall be screened such that a minimum of 90% passes a U.S.Std. 3/4" sieve and that no more than 20% passes a U.S. Std. No.10 sieve on a dry weight basis.
- e. The compost shall have a pH of 7.0 to 8.3 when determined on a 1:5 compost/water slurry
- f. The compost shall have a soluble salts content less than 6.0 milliohms per cm. when determined on a 1:5 compost/water slurry
- g. The compost shall have an organic matter content of not less than 35% by weight determined by ASTM D2974-87 Method C on material passing a U.S. Std.1/4" sieve
- h. The compost shall have a carbon to nitrogen (C:N) ratio less than 25:1.
- i. The compost shall have a Solvita<sup>®</sup> Maturity Index of 6 or higher.
- j. The compost shall have a moisture content in the range of 35% to 65%.
- k. The heavy metal content as determined by TMECC 04.06 shall not exceed the following USEPA 40 CFR 503 (2010) limits:

Concentration	
<u>Element</u>	<u>Limits (mg/Kg d.w.)</u>
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

3. Stockpiling

- a. General: Stockpiles of compost or topsoil should be no more than 4 feet in height to prevent anaerobic conditions within the pile. Stockpiled composts should be turned every other week (unless otherwise instructed by the Landscape Architect) to prevent anaerobic conditions or excessive water absorption.

### PART 3 - EXECUTION

#### 1.9 EXAMINATION

- A. Examine subsoil areas to receive topsoil 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. Work only during periods when soil and subgrade are friable.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- 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 Landscape Architect and replace with new planting soil.

#### 1.10 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.

#### 1.11 Preparation of Subsoils

- A. Prior to placing topsoil, prepare subsoil areas to receive topsoil on the same day topsoil is placed.
- B. Subsoil shall be mechanically disrupted by either the Backhoe Turning or Ripping methods described below.
- C. Backhoe Turning Method
  - 1. Spread two inches of organic compost material over area to be turned.
  - 2. Use backhoe bucket to lift subsoil twice to depth as indicated below in all areas to be seeded/sodded with standard or low-mow turf grass and break the subsoil into large peds. Lift subsoil twice to depth as indicated below in all plant beds and tree pits, unless indicated otherwise.
    - a. Lawn subsoil depth = **0" (Zero)**
    - b. Plant bed depth = **12" (Twelve)**



3. Perform lifting operation in two directions at approximately 90 degrees.
4. Surface will be very rough, drag backhoe teeth across soil surface and/or lightly till surface to create texture suitable to fine grade.
5. Do not perform lifting closer than 24 inches to installed underground utility lines, structures or dripline of existing trees and shrubs to remain; or within 12 inches of pavements to remain.

D. Subgrade Ripping Method

1. Rip subgrade twice to depth as indicated below in all areas to be seeded with standard or low-mow turf grass. Rip subgrade twice to depth as indicated below in all plant beds and tree pits, unless indicated otherwise.
  - a. Lawn subsoil depth = **0" (Zero)**
  - b. Plant bed depth = **12" (Twelve)**
2. Space ripping tines at 24 inches on center.
3. Make second ripping pass in a direction 90 degrees to the direction of the first ripping pass.
4. Do not rip closer than 24 inches to installed underground utility lines, structures or dripline of existing trees and shrubs to remain; or within 12 inches of pavements to remain.

1.12 PREPARATION OF SITE-SALVAGED SURFACE SOIL BEFORE AMENDING

- A. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- B. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- C. Screening: Pass unamended soil through a 1-inch screen to remove large materials.

1.13 PLACING TOPSOIL OVER PREPARED SUBSOIL

- A. Subsoil Preparation: Prepare subsoil as described above for all lawn areas, plant beds and tree pits.
- B. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Application: Spread stockpiled topsoil to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
- D. Spread organic compost material to a consistent depth of three inches over surface of in-place topsoil and work into the top six inches of the topsoil. Do not apply materials or disc if existing soil or subgrade is frozen, muddy, or excessively wet.
  1. Lawn: Disc organic amendment into topsoil to a minimum depth as indicated below.
    - a. Lawn subsoil depth = **6" (Six)**

2. Planting Beds: Disc organic amendments into 2-lifts into topsoil to a minimum depth as indicated below.
    - a. Plant bed depth = **12" (Twelve)**
  3. Organic compost material will shrink after applications. Establish finish grades of prepared planting soil areas high enough to compensate for expected shrinkage.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

1.14 CLEANUP AND PROTECTION

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

1.15 DISPOSAL

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

END OF SECTION 32 91 00

## SECTION 329200 - TURF AND GRASSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sodding.
- B. Related Requirements:
  - 1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

#### 1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For fertilizers, from manufacturer.
- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
  - 1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
  - 2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 4. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in one of the following categories from the National Association of Landscape Professionals:
    - a. Landscape Industry Certified Technician - Exterior.
    - b. Landscape Industry Certified Lawn Care Manager.
    - c. Landscape Industry Certified Lawn Care Technician.
  - 5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 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 materials with appropriate certificates.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.1 TURFGRASS SOD

- A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Bermudagrass (*Cynodon dactylon*).

#### 2.2 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

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

## 2.3 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.
- C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- G. Asphalt Emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

## 2.4 PESTICIDES

- A. General: Pesticide, registered and approved by the 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 Nonselective): 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 Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
  - 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. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- 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 Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  - 2. Protect grade stakes set by others until directed to remove them.
- 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.

3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
  - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moistening prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.
- B. 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 soil or sod during installation. Tamp and roll lightly to ensure contact with soil, 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.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.5 TURF MAINTENANCE

- A. General: 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 integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: 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 one-third of grass height. Remove no more than one-third 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 bermudagrass to a height of 1/2 to 1 inch (13 to 25 mm).
- D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.
  - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.



3.6 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 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.

3.7 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.8 CLEANUP AND PROTECTION

- A. 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.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. 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.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.9 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
  - 1. Sodded Turf: 30 days from date of planting completion.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings.

B. Related Requirements:

1. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a 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 as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: 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. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. 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.
- F. 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.

- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. 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.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 COORDINATION

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

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to 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 three 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. Samples for Verification: For each of the following:
1. Organic Mulch: 1-quart (1-L) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
  2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
  3. Proprietary Root-Ball-Stabilization Device: One unit.
  4. Slow-Release, Tree-Watering Device: One unit of each size required.
  5. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
  6. Root Barrier: Width of panel by 12 inches (300 mm).

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For 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.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
  2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

#### 1.9 QUALITY ASSURANCE

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

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
  3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  4. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in one of the following categories from the Professional Landcare Network:
    - a. Landscape Industry Certified Technician - Exterior.
    - b. Landscape Industry Certified Interior.
    - c. Landscape Industry Certified Horticultural Technician.
  5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure 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. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Architect 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. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials seven days in advance of delivery to site.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
  - B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  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 materials with appropriate certificates.
- C. Deliver bare-root stock plants within 36 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- 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. 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.
- G. 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.
- H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
  2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  3. Do not remove container-grown stock from containers before time of planting.
  4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

#### 1.11 FIELD CONDITIONS

- A. Field Measurements: 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. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

#### 1.12 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    - b. Structural failures including plantings falling or blowing over.
    - c. Faulty performance of tree stabilization.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Periods: From date of Acceptance.
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
    - c. Annuals: Three months.
  - 3. Include the following remedial actions as a minimum:
    - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
    - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

### PART 2 - PRODUCTS

#### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots are unacceptable.
  2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

## 2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Size: 10-gram tablets.
  2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## 2.3 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Ground or shredded bark.
  2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
  3. Color: Dark Brown.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch (25-mm)



sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

#### 2.4 WEED-CONTROL BARRIERS

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

#### 2.5 PESTICIDES

- A. General: Pesticide registered and approved by the 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 Nonselective): 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 Nonselective): Effective for controlling weed growth that has already germinated.

#### 2.6 TREE-STABILIZATION MATERIALS

- A. Trunk-Stabilization Materials:
  1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
  2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.

#### 2.7 LANDSCAPE EDGINGS

- A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Border Concepts, Inc.
  - b. J. D. Russell Company (The).
2. Edging Size: 1/4 inch (6.4 mm) thick by 5 inches (125 mm) deep.
  3. Stakes: Tapered steel, a minimum of 12 inches (300 mm) long.
  4. Accessories: Standard tapered ends, corners, and splicers.
  5. Finish: Zinc coated.

## 2.8 TREE-WATERING DEVICES

- A. Watering Pipe: PVC pipe 4 inches (100 mm) in diameter, site-cut to length as required, and with snug-fitting removable cap.
- B. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BIO-PLEX.
    - b. Engineered Watering Solutions; PQ Partners, LLC.
    - c. Spectrum Products, Inc.
  2. Color: As selected by Architect from manufacturer's full range.

## 2.9 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.
- B. Root Barrier: Black, molded, modular panels 24 inches (610 mm) high (deep), 85 mils (2.2 mm) thick, and with vertical root deflecting ribs protruding 3/4 inch (19 mm) out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. DeepRoot Green Infrastructure, LLC.
    - b. NDS Inc.
- C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- D. Burlap: Non-synthetic, biodegradable.
- E. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8.

- F. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.
- G. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
  - 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. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
  - 3. Suspend planting 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 or which is dusty.
- B. 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 Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 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 Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
  - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. 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.
  - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped container-grown stock.
  - 3. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  - 5. 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.
  - 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  - 7. Maintain supervision of excavations during working hours.
  - 8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
  - 9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
  - 1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.

- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### 3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of 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. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
  - 1. Backfill: Planting soil LST-1.
  - 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 filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
    - a. Quantity: Three for each caliper inch of plant.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
  - 1. Backfill: Planting soil LST-1.
  - 2. Carefully remove root ball from container without damaging root ball or plant.
  - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
    - a. Quantity: Three for each caliper inch of plant.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.

- E. Fabric Bag-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
  - 1. Backfill: Planting soil LST-1.
  - 2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
    - a. Quantity: Three for each caliper inch of plant.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grade.
  - 1. Backfill: Planting soil LST-1.
  - 2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.
  - 3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.
  - 4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. 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.
    - a. Quantity: Three for each caliper inch of plant.
  - 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. Watering Pipe: During backfilling, install watering pipe 4 feet (1.25 m) deep into the planting pit outside the root ball with top of pipe 1 inch (25 mm) above the mulched surface.
- H. Slopes: 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 MECHANIZED TREE-SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

- B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.
- C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- D. Cut exposed roots cleanly during transplanting operations.
- E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.
- F. Where possible, orient the tree in the same direction as in its original location.

### 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 as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

### 3.8 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
  - 1. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
  - 2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; three stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.
  - 3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
  - 4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

### 3.9 ROOT-BARRIER INSTALLATION

- A. Install root barrier where trees are planted within 60 inches (1500 mm) of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

- B. Align root barrier vertically, and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of 60 inches (1500 mm) in each direction from the tree trunk, for a total distance of 10 feet (3 m) per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  - 1. Position top of root barrier according to manufacturer's written recommendations.
  - 2. Overlap root barrier a minimum of 12 inches (300 mm) at joints.
  - 3. Do not distort or bend root barrier during construction activities.
  - 4. Do not install root barrier surrounding the root ball of tree.

### 3.10 PLACING SOIL IN PLANTERS

### 3.11 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil LST-1 for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.12 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches (300mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 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 3 inches (75 mm) of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and 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.



3.13 EDGING INSTALLATION

- A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.

3.14 INSTALLING SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree.
- B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.15 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.16 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.17 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
  1. Provide new trees of same size as those being replaced for each tree of 6 inches (150 mm) or smaller in caliper size.
  2. Provide two new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measures more than 6 inches (150 mm) in caliper size.
  3. Species of Replacement Trees: Species selected by Architect.

### 3.18 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. 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.
- D. 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.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

### 3.19 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. 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: Three months from date of Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. 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: Three months from date of Substantial Completion.

END OF SECTION 329300