

Bakersfield National Cemetery
Arvin, California

Landscape Rehabilitation Project
Project 929-MM-18-006

ATTACHMENT B — SPECIFICATIONS

SECTION	DIVISION 32 – EXTERIOR IMPROVEMENTS
32 84 00	PLANTING IRRIGATION
32 90 00	PLANTING
32 96 00	TRANSPLANTING

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Section 32 90 00, PLANTING
B. Section 32 96 00, TRANSPLANTING

1.3 DEFINITIONS

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

1.4 ABBREVIATIONS

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

1.5 PERFORMANCE REQUIREMENTS

- A. Drip irrigation zone modifications when completed shall be under automatic operation of the existing controllers and automatic control valves.
B. Location of sprinklers and specialties on Drawings is approximate.
Contractor to make minor adjustments necessary to avoid obstructions such as utilities. Provide full irrigation of new and existing landscaped areas indicated.
C. Minimum Working Pressures: The following are maximum pressure requirements for piping, valves and specialties unless otherwise indicated.

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 QUALITY ASSURANCE:

A. Products Criteria:

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

B. Installer Certification:

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

C. System Requirements:

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

1.8 SUBMITTALS

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

1.9 EXTRA MATERIALS

- A. Furnish extra materials, as called out below, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Drip-line system tubing: 20 percent of total length installed for each type and size indicated, but not less than 50 feet (15 m).
 - 2. Plug in pressure compensating drip emitters: 5 percent of amount installed for each type and flow, but no fewer than 30 units of each type, and 30 units of compatible emitter diffuser bug caps.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
- C. American Society for Testing and Materials (ASTM):

B61-08.....Steam or Valve Bronze Castings

B62-09.....Composition Bronze or Ounce Metal Castings

D1785-06.....Poly Vinyl Chloride) (PVC) Plastic Pipe,
Schedule 40, 80, and 120

D2241-09.....Poly Vinyl Chloride) (PVC) Pressure Rated Pipe
(SDR Series)

D2464-06.....Threaded Poly (Vinyl Chloride) (PVC) Plastic
Pipe Fittings, Schedule 80

D2466-06.....Poly Vinyl Chloride) (PVC) Plastic Pipe
Fittings, Schedule 40

D2467-06.....Poly Vinyl Chloride) (PVC) Plastic Pipe
Fittings, Schedule 80

D2564-04(2009)e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)
Plastic Piping Systems

D2609-02(2008).....Plastic Insert Fittings for Polyethylene (PE)
Plastic Pipe

D2683-10.....Socket-Type Polyethylene Fittings for Outside
Diameter-Controlled Polyethylene Pipe and
Tubing

D2855-96(2010).....Making Solvent Cemented Joints with Poly (Vinyl
Chloride) (PVC) Pipe and Fittings

F656-10.....Primers for Use in Solvent Cement Joints of
Poly Vinyl Chloride (PVC) Plastic Pipe and
Fittings

C906-07.....Polyethylene (PE) Pressure Pipe and Fittings, 4
in. (100 mm) Through 63 in. (1600 mm), for
Water Distribution and Transmission

D. National Fire Protection Association (NFPA):

70 2011 Edition.....National Electrical Code

1.11 SUBSTITUTIONS

A. Unless otherwise noted, use specified equipment to match existing equipment. COR must approve equipment prior to construction. Changes and associated design costs to accommodate alternative equipment are Contractor's responsibility. "As-Built" information shall show the sizes installed.

B. Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at Contractor's option.

1.12 CONSTRUCTION REVIEWS

A. The purpose of on-site reviews by the Contracting Officer's Representative (COR) is to periodically observe the work in progress, the Contractor's interpretation of the construction documents, and to address questions with regard to the installation.

1. Schedule reviews for irrigation system layout or testing with the COR as required by these specifications.
2. Impromptu reviews may occur at any time during the project.
3. A Final Inspection will occur at the completion of the irrigation Acceptance Test. The intent of the Final Inspection is to verify that

all installation; testing; maintenance and operation submittals; and project record drawing submittals are completed prior to the start of the Maintenance and Warranty periods.

1.13 WARRANTY

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

PART 2 - PRODUCTS

2.1 PIPES, TUBES AND FITTINGS

- A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. PVC Mainline Pipe: ASTM D1785, PVC 1120 compound, Schedules 40 and 80.
1. PVC socket fittings: ASTM D2467, Schedule 80.
 2. PVC threaded fittings: ASTM D2464, Schedule 80.
 3. PVC socket unions: Both headpiece and tailpiece shall be Schedule 80 PVC with threaded ends.
- C. PVC Lateral Pipe: ASTM D2241, PVC 1120 compound, SDR 21.
1. Solvent weld pipe Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe.
 2. PVC socket fittings shall be ASTM D2466, Schedule 40.
 3. PVC socket unions: Both headpiece and tailpiece shall be Schedule 40 PVC with socket or threaded ends.
- D. Threaded Pipe:
1. Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- E. Swing joints:
1. Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 200 psi (1375 kPa) working pressure, may be used in lieu of standard threaded fittings.

2.2 PIPE JOINING MATERIALS

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

2.3 VALVES

A. Underground Shut-Off Valves:

1. Ball valves, isolation valves, 1-1/2 inch (38 mm) and smaller: Full-port ball valves with bronze body, PTFE seats, and 90 degree on/off handle. Ball valves to have NPT female end connections.
2. Valve ends shall accommodate the type of main pipe adjacent to valve.

B. Remote Control Valves:

1. Valves shall be globe type of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation.
2. Brass Valves: Straight valve body shall be cast iron with brass bonnet, trim and renewable seat.
 - a. Install valves with unions on each side to allow for easy removal.
 - b. Valves shall have a minimum of 150 psi (1025 kPa) working pressure.
 - c. Each irrigated area shall be automatically operated by a remote control valve installed underground and operated by a 24 volt AC electric solenoid.
 - d. Each valve shall be in the specified valve box.

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

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

E. Valves shall be equipped with manufacturer's pressure regulation module.

F. Available Manufacturer/Model: 'Griswold'/2000H to match existing. No approved equal.

2.4 VALVE BOX

A. Remote Control Valve Assemblies: Super Jumbo rectangular valve boxes for remote control valves in landscape areas, shall be HDPE structural foam Type A, Class III, tan in color. Box shall be minimum 640 mm (25-1/4 inches) long by 400 mm (15-3/4 inches) wide by 387 mm (15-1/4 inches) deep with tan "T"-style lid.

1. After installation hot brand into lid of valve boxes in 75 mm (3-inch) high, 1 mm (3/16") deep stencils designating the controller letter and valve station numbers. Numbers shall be placed at center of valve cover and shall face nearest main road or service road.
 2. Available Product: 'Carson-Brooks' Model 1324; or approved equal.
- B. Drip Air-Vacuum Release Valve and Flush Valve Boxes in landscape areas shall be heavy-duty, high-density polyethylene valve box and cover. Box shall be minimum of 6 inches (150mm) diameter by 12 inches (305mm) deep and have a black color "T"-cover marked with "Irrigation". Available Product: 'Rain Bird' Subterranean Drip Emitter Box, Model SWB7XB, or equal.
- C. Valve Box Accessories:
1. Galvanized steel wire mesh fabric; 16 gauge with 1/2-inch openings.
 2. Filter Fabric: Spunbond polyester 3.5 oz. per square yard landscape fabric.
 3. Support Blocks: precast concrete pavers, or bricks.
 4. Drainage Backfill: Clean gravel or crushed stone, graded from 1/4 inch (6 mm) inch minimum to 3/4 inch (19 mm) maximum.
 5. Valve I.D. Tags: Standard I.D. tags with hot-stamped black letters on a yellow background designating controller letter and valve station number in 1-inch minimum tall letters; 'Christy' or equal.

2.5 IN-LINE DRIP EMITTER TUBING:

- A. Drip tubing shall be dual layered, extra-flexible and kink resistant and constructed of UV resistant vinyl material with a 16.1 mm (0.634") O.D. and a 13.6 mm (0.536") I.D.
- B. Tubing shall offer in-line emitters spaced at 30.5 cm, 45.7 cm, or 61.0 cm (12", 18" or 24") on center with a flow rate of 0.6 gph or 0.9 gph while operating at a pressure range of 8.5 to 60 psig.
- C. Tubing shall be installed on grade.
- D. Tubing shall be designed to accept 17mm barbed fittings.
- E. Tubing shall also be available in a blank form of identical diameter and from same manufacturer as inline emitter tubing.
- F. Drip tubing emitters shall provide a wide flow path to resist clogging and have a self-flushing action.
- G. Emitters shall have a pressure-regulating diaphragm with a spring action allowing it to self-rinse. The inline emitter shall be raised off the inside tub wall to minimize dirt intrusion.

H. Available Product: 'Rain Bird' XFD Dripline. Emitter spacing and flow rate to match existing drip tubing.

2.6 PRESSURE COMPENSATING DRIP EMITTERS

A. Barbed pressure compensating drip emitters to supplement in-line drip tubing for establishment of new trees on existing drip irrigation zones.

B. Flow Rates: 0.5, 1.0, and 2.0 gph.

C. Available Product: 'Rain Bird' Xeri-bug Emitters.

2.7 DRIP ZONE PRESSURE REGULATOR/FILTER ASSEMBLY

A. The assembly shall consist of a PVC ball valve, and combination basket filter with pre-set pressure regulator. The pressure regulator setting shall provide sufficient pressure at the furthest downstream outlet. The filter screen shall be 120 mesh.

2.8 GALVANIZED STAKES

A. 12-gauge wire pre-bent with notched sides to secure drip tubing to grade. Minimum 10 inches long.

2.9 DRIP TUBING INSERT FITTINGS

A. Compatible with existing drip irrigation tubing.

B. 17mm break-resistant plastic insert fitting.

C. Operating pressure 0 to 50 psi.

D. Available Product: 'Rain Bird' Insert Fittings.

E. Install with 'Rain Bird' Insertion Tool for secure fit.

2.10 DRIP ZONE AIR/VACUUM RELIEF VALVE

A. Plastic corrosion-proof device used to allow air to escape the pipeline and air to enter the lines as water evacuates the lines at shutdown, preventing vacuum of dirty water into the system; ½-inch MPT for installation onto barb x barb x FPT fitting.

B. Install below grade in valve box.

C. Available Product: 'Rain Bird' ARV050, or approved equal.

2.11 DRIP ZONE FLUSH CAP

A. Drip End Closure or compression fitting with removable flush cap.

B. Available Products: 'Rain Bird' EC50, or MDCFCAP; approved equal.

2.12 LOW VOLTAGE CONTROL VALVE WIRE

A. Wire shall be solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, never less than No. 14 AWG.

B. Colors: Use color scheme currently employed for the control system. Provide easily distinguished colors for other control wires. Spare

control wires will be of a color different from that of the active control wire.

2.13 SPLICING MATERIALS:

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

2.14 WARNING TAPE

1. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type purple with black letters, and imprinted with "CAUTION BURIED IRRIGATION WATER LINE BELOW".

2.15 SLEEVE MATERIAL

A. ASTM D2241, Schedule 40 PVC.

2.16 OTHER COMPONENTS

- A. Tools and Spare Parts: Provide operating keys, servicing tools, spare parts and other items indicated in the General Notes of the drawings.
- B. Pipe Bedding and Initial Backfill: Clean plaster sand, ASTM C-33.
- C. Other Materials: Provide other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.

2.17 CONTROL SYSTEM COMPONENTS

A. Exiting automatic central control equipment with field satellites.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 PIPE INSTALLATION - GENERAL

- A. Layout work as closely as possible to drawings. Swing joints, offsets and all fittings are not shown. Lines are to be installed in a common trench wherever possible.
- B. Install sprinkler lines to avoid other utility lines; all of which have the right of way.
- C. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any cracked concrete, due to settling, during the warranty period.

- D. Do not lay pipe on unstable material, in wet trenches or, in the opinion of Contracting Officer's Representative, when trench or weather conditions are unsuitable for work.
- E. Allow a minimum of 3 inches (80 mm) between parallel pipes in the same trench.
- F. Clean the interior portion of pipe and fittings of foreign matter before installation. Securely close open ends of pipe and fittings with caps or plugs to protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- G. The full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- H. Hold pipe securely in place while joint is being made.
- I. Do not work over, or walk on, pipe in trenches until covered by layers of earth, well tamped, in place to a depth of 12 inches (300 mm) over pipe.
- J. Irrigation lines in cemetery applications shall run at boundaries of graves, through designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.
- K. Minimum cover over water mains shall be 24 inches (610 mm). Cover laterals shall be 18 inches (460 mm).
- L. Warning tape shall be continuously placed 12 inches (300 mm) above sprinkler system laterals.

3.3 PLASTIC PIPE INSTALLATION

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

3.4 EMITTER HOSE INSTALLATION

- A. Joint: Solvent weld connection.
- B. Bushing: Adaptation from PVC Schedule 40 fittings to drip tubing shall be by threaded barbed adapter with twist lock feature.

- C. Available Product: 'Rain Bird' TLF-MPT (size as required), or approved equal.

3.5 DRIP EMITTER INSTALLATION

- A. Use manufacturer's proprietary hole punch to insert barbed emitters into drip tubing.
- B. Repair mistakes and plug unused holes with 'Rain Bird' EMAGPX Drip Goof Plug.

3.6 SLEEVE INSTALLATION

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

3.7 VALVE INSTALLATION

- A. Locations of remote control valves are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.
- B. Clean interior of valves of foreign matter before installation.
- C. Set valve box cover flush with finished grade unless otherwise indicated.
- D. Control valves shall never be less than 3 inches (80 mm) below the bottom of the valve box cover.
- E. Remote Control Valve Assembly:
1. Locations of remote control valves are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads, and aligned with existing valves.
 2. Mainline Flushing:
 - a. Thoroughly flush mainline before installation of Remote Control Valve Assemblies.
 - b. Identify remote control valve service tee(s) to be used for mainline flushing. Plug service tees not being used for flushing.
 - c. Connect 50 mm (2-inch) pipe to flushing service tee(s). Use pipe to direct water away from trench and into drainage swale, curb section or storm sewer, i.e. to an area that will direct the water away from the work area. Direct water so that it does not disrupt the cemetery operations.

- d. Use a volume of water such that the velocity in the largest pipe flushing to this point is 0.9 m/s (3 FPS).
 - e. Multiple points may be flushed simultaneously.
 - f. Flush for a minimum of 20 minutes. Continue flushing until the water is clear of any and all debris.
 - g. The COR will review the flushing operation and clarity of water before stopping the flushing operation.
 - h. Disconnect pipe from service tee(s) and install remote control valve(s).
3. Install per manufacturer's printed instructions and where indicated on the drawings.
 4. Adjust valve to regulate the downstream operating pressure to 240 kPa (35 psi) for drip irrigation.
 5. Wire connectors and waterproof sealant will be used to connect control wires to solenoid wires. Install connectors and sealant per the manufacturer's recommendations.
 6. Install only one remote control valve to a valve box. Locate valve box 1.5m (5-feet) from and align square with nearby edges of paved areas.
 7. Valve box shall be sized large enough to house all equipment within including ball valve and unions with sufficient clearances to allow removal of the valve
 8. Attach ID tag with controller station number to control wiring at solenoid.
 9. Brand controller and station number in 50 mm (2-inch) high by 5 mm (3/16-inch) deep letters on valve box lid.

3.8 VALVE BOX INSTALLATION

1. As presented in the installation details, per manufacturer's instructions.
2. Install 1 inch above finish grade in mulched areas and landscape beds.

3.9 CONTROL WIRE INSTALLATION

- A. Provide 12 inch (300 mm) expansion coils in wiring at each wire connection or change in wire direction. Provide 24 inch (600 mm) loop at remote control valves. Create coil by wrapping 24 inch (600 mm) length of wire around 1-inch (25 mm) diameter pipe.
- B. Run spare control wires into each valve box along mainline. Provide 24 inches (600 mm) coil of wire inside each valve box.
- C. Use water-proof wire connectors for wire connections.

3.10 DRIP IRRIGATION INSTALLATION

- A. Remove and re-install in-line drip tubing as required for soil preparation and planting. If removing drip tubing, disconnect from PVC pipe headers wherever possible.
- B. Reinstall drip tubing as shown on the Drawings. Install drip tubing in parallel rows perpendicular to slopes with tubing spaced at 18 inches on centers. Locate top row of tubing uphill of rows of plants.
- C. Replace drip tubing damaged by soil preparation and planting activities to the satisfaction of the COR.
- D. Install drip tubing flush with finish grade. Stake drip tubing to grade with galvanized stakes at minimum 3 feet on centers and at all corners and changes in direction.
- E. Install air-vacuum release valves at all high points in the system.
- F. Install flush caps at all dead ends in drip tubing.

3.11 TREE DRIP IRRIGATION RINGS

- A. Install tree drip irrigation rings at all new trees. Incorporate drip rings into existing in-line drip tubing, providing two connections to the existing tubing.
- B. Extend PVC headers/lateral lines to new tree locations. Bury lateral lines minimum 18 inches deep. Run lateral lines inside PVC sleeves in decomposed granite burial sections
- C. Replace existing tree drip irrigation rings on all existing trees on the same zone as new trees receiving new tree drip irrigation rings. Locate outer ring at edge of the tree dripline and locate inner ring midway between the outer ring and the tree trunk.

3.12 FIELD TEST AND QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Pressure test lines before pipe joints backfilled. Backfill a minimum of 12 inches (300 mm) over the pipe to maintain pipe stability during test period. Test piping at system static pressure for two hours. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
 - 2. After testing, flush lines before installing drip emission devices.
 - 3. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- B. Any irrigation product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.13 ADJUSTMENTS

- A. Coordinate with COR to request adjustments to settings of controllers for plant establishment. Provide a written irrigation schedule for approval of the District Agronomist.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust drip tubing to be flush with finish grade.

3.14 CLEANUP

- A. Upon completion of work, remove from site all machinery, tools, excess materials, and rubbish. Restore site to normal or original condition.

----- E N D ----

SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work in this section consists of furnishing and installing plants, soil amendments, tree stakes, root barriers, mulches and other landscape materials required as specified in locations shown.

1.2 RELATED WORK

- A. Section 32 84 00, PLANTING IRRIGATION.
- B. Section 32 96 00, TRANSPLANTING.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace earth in an excavation.
- B. Balled and Burlapped Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball.
- C. Balled and Potted Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- F. Finish Grade: Elevation of finished surface of planting soil.
- G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments, soil enhancers and fertilizers to produce a soil mixture best for plant growth.
- J. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, and grasses, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- L. Tree Drip Line: The area defined by the outermost circumference of a tree canopy where water drips from and onto the ground.
- M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- N. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 ABBREVIATIONS

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

1.5 DELIVERY, STORAGE AND HANDLING

- A. Notify the Contracting Officer's Representative (COR) of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant and landscape materials from the job site immediately.
- B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.
- C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, burial sections, walkways and pavements, or on existing mulch areas or plants. Keep bulk materials in dry storage away from contaminants.
 2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers, lime, gypsum, and soil amendments with appropriate certificates.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than 6 hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet, condition.
- H. Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding". Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage, seed contamination and drying.
- I. All pesticides and herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Deliver materials in original, unopened containers showing, certified analysis, name and address of

manufacturer, product label, manufacturer's application instructions specific to the project and indication of conformance with state and federal laws, as applicable.

1.6 PROJECT CONDITIONS

- A. Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. Plant during one of the following periods:
 - 1. Spring Planting: April 1 to June 1.
 - 2. Fall Planting: September 1 to November 1.
- C. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Plant trees, shrubs, and other plants after finish grades are established.
- E. Plant trees, shrubs, and other plants after finish grades established and irrigation system components are ready to be put back into position.
 - 1. When planting trees, shrubs, and other plants, protect irrigation system components and promptly repair damage caused by planting operations.

1.7 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association with 5 years experience in landscape installation.
2. Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
3. Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network and submit one copy of certificate to the Contracting Officer's Representative:
 - a. Certified Landscape Technician (CLT) - Exterior, with installation, maintenance, irrigation, designated CLT-Exterior.
 - b. Certified Ornamental Landscape Professional, designated COLP.
4. Pesticide Applicator: Licensed in state of project, commercial.
- C. A qualified Arborist shall be licensed and required to submit one copy of license to the Contracting Officer's Representative.
- D. Include an independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- E. Provide quality, size, genus, species, variety and sources of plants indicated, complying with applicable requirements in ANSI Z60.1.
- F. Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 1. Measure trees and shrubs with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4 inch (100 mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
 2. Measure other plants with stems, petioles, and foliage in their normal position.
- G. Contracting Officer's Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Contracting Officer's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject

unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Contracting Officer's Representative of plant material sources 14 days in advance of delivery to site.

H. Include product label and manufacturer's literature and data for pesticides and herbicides.

I. Conduct a pre-installation conference at Project site.

1.8 SUBMITTALS

A. Submit manufacturer's literature and data for each product:

1. Include quantities, sizes, quality, and sources for plant materials.
2. Include EPA approved product label, SDS (Safety Data Sheet) and manufacturer's application instructions specific to the Project.
3. Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of 3 photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Submit samples and manufacturer's literature for each of the following for approval before work is started.

1. Soil Treatment: (1) sack of manufacturer's product in commercially produced packaging.
2. Pea Gravel: 1 quart (1-liter) volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
3. Drainage Backfill: 1 quart (1-liter) volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of aggregate.
4. Organic and Compost Mulch: 1 quart (1-liter) volume of each organic and compost 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.

- 5. Mineral Mulch: 1 quart (1-liter) volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of aggregate.
- 6. Tree Wrap: Width of panel by 12 inches (300 mm).
- C. Qualification data for qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Prior to delivery, provide notarized certificates attesting that each type of manufactured product, from the manufacturer, meet the requirements specified and shall be submitted to the Contracting Officer's Representative for approval:
 - 1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).
 - 2. Manufacturer's certified analysis of standard products.
 - 3. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Material Test Reports: For existing native surface topsoil.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

1.9 PLANT ESTABLISHMENT PERIOD

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

1.10 PLANT MAINTENANCE SERVICE

- A. Provide initial maintenance service for trees, shrubs, ground cover and other plants by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: 12 months from date of Substantial Completion.

1.11 APPLICABLE PUBLICATIONS

- A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American National Standards Institute (ANSI):
 - Z60.1-04.....Nursery Stock
- C. Association of Official Seed Analysts (AOSA): Rules for Testing Seed.
- D. American Society for Testing And Materials (ASTM):
 - C136-06.....Sieve Analysis of Fine and Coarse Aggregates
 - C602-07.....Agricultural Liming Materials
 - D5268-07.....Topsoil Used for Landscaping Purposes
- E. Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.
- F. Turfgrass Producers International (TPI): Guideline Specifications to Turfgrass Sodding.
- G. United States Department of Agriculture (USDA): Handbook No. 60
Diagnosis and Improvement of Saline and Alkali Soils; Federal Seed Act Regulations.
- H. National Cemetery Administration (NCA):
 - Handbook 3420-08.....Turfgrass Maintenance
 - Appendix TL-08.....Cemetery Construction Requirements for
Turfgrass and Landscape Plant Material
Installation

1.12 WARRANTY

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance, unless noted otherwise below. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.
 - 1. Plant Warranty Periods will begin from the date of Government acceptance of the project or phase for beneficial use and occupancy.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - c. Annuals: 3 months.

2. The Contractor shall have completed, located, and installed all plants according to the plans and specifications. All plants are expected to be living and in a healthy condition at the time of final inspection.
3. The Contractor will replace any dead plant material immediately, unless required to plant in the succeeding planting season. Provide extended warranty for period equal to original warranty period for replacement plant materials. Replacement plant warranty will begin on the day the work is completed.
4. Replacement of relocated plants, that the Contractor did not supply, is not required unless plant failure is due to improper handling and care during transplanting. Loss through Contractor negligence requires replacement in plant type and size.
5. The Government will reinspect all plants at the end of the Warranty Period. The Contractor will replace any dead, missing, or defective plant material immediately. The Warranty Period will end on the date of this inspection provided the Contractor has complied with the warranty work required by this specification. The Contractor shall also comply with the following requirements:
 - a. Replace plants that are more than 25 percent dead, missing or defective plant material prior to final inspection.
 - b. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - c. Mulch and weed plant beds and saucers. Just prior to final inspection, treat these areas to a second application of approved pre-emergent herbicide.
 - d. Complete remedial measures directed by the Contracting Officer's Representative to ensure plant survival.
 - e. Repair damage caused while making plant replacements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. Plant materials: ANSI Z60.1; will conform to the varieties specified and be true to botanical name as listed in Hortus Third; nursery-grown plants material true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings; healthy, normal and unbroken root systems developed by transplanting or root pruning; well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf; free of disease, pests, eggs, larvae, and defects such as knots, sun scald, windburn, injuries, abrasions, and disfigurement.

1. Trees-deciduous and evergreen: Single trunked with a single leader, unless otherwise indicated; symmetrically developed deciduous trees and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
2. Ground cover and vine plants: Provide the number and length of runners for the size specified on the Drawings, together with the proper age for the grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Spray all plants budding into leaf or having soft growth with an anti desiccant at the nursery before digging.
3. The minimum acceptable sizes of all plants, measured before pruning with branches in normal position, shall conform to the measurements designated. Plants larger in size than specified may be used with the approval of the Contracting Officer's Representative, with no change in the contract price. When larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

4. Provide nursery grown plant material conforming to the requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in a manner that will not cause damage to branches, shape, and future development after planting.
 5. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
 6. Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers, but shall not be root bound.
 7. Make substitutions only when a plant (or alternates as specified) is not obtainable and the Contracting Officer's Representative authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant with the same essential characteristics and an equitable adjustment of the contract price.
 8. Existing plants to be relocated, ball sizes shall conform to requirements for collected plants in ANSI Z60.1, and plants shall be dug, handled, and replanted in accordance with applicable sections of these specifications.
 - a. Trenches around the rootballs of plants to be relocated are to be cut 4 weeks minimum prior to removing the plant from the ground to allow the root cuts to harden off.
 - b. Cut trenches around rootballs in accordance with ANSI Z60.1 requirements for sizes of plants being transplanted.
 - c. Cut roots with clean sharp tools under the direction of a licensed arborist.
 9. Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Label at least one plant of each variety, size, and caliper with a securely attached, waterproof and weather-resistant label bearing legible the correct designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as indicated in the Plant Schedule or Plant Legend shown on the Drawings. Labels shall be securely attached and not be removed.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36 mm) sieve and a minimum of 75 percent passing through No. 60 (0.25 mm) sieve.
 2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36 mm) sieve and a minimum of 55 percent passing through No. 60 (0.25 mm) sieve.
 3. Provide lime in form of ground calcitic limestone.
- B. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30 mm) sieve.
- C. Soil Amendment Aggregate: ASTM #8 Washed Crushed Pea Gravel; or 1/4"-#10 chip rock, no fines. Gradation: 90-100 percent passing 1/2" sieve; minimum 70 percent retained on the #4 sieve; and no more than 5 percent passing the #8 sieve.

2.3 ORGANIC SOIL AMENDMENTS

- A. Organic matter: Commercially prepared compost. Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2 inch (13 mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
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 DRAINAGE BACKFILL

- A. Drainage Aggregates: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-inch sieve and 0 to 4 percent passing a No. 4 sieve.

2.5 PLANT FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.
- B. Plant Fertilizer Pack: Long-lasting, slow-release, commercial-grade planting fertilizer in packet form.

1. Size: 2 ounce packets.
2. Nutrient Composition shall be 16 percent nitrogen, 8 percent phosphorous, and 8 percent potassium, by weight plus micronutrients.

C. Available Product: 'Nutri-Pak' 16-8-8 (3-Year)

2.6 PLANTING SOILS

- A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D5268 topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 1. Supplement with planting soil when quantities are insufficient.
 2. Mix existing, native surface topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources can be used if sufficient topsoil is not available on site to meet the depth as specified herein. The Contractor shall furnish imported topsoil. At least 10 days prior to topsoil delivery, notify the Contracting Officer's Representative of the source(s) from which topsoil is to be furnished. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs, or marshes.

2.7 BACKFILL MIX

- A. A mixture of 50 percent planting soil; 45 percent soil amendment aggregates; and 5 percent compost by weight.

2.8 SOIL TREATMENT

- A. A mixture of controlled release fertilizer, organic fertilizers(i.e., fish meal), trace elements, calcium, iron, pH corrector, 10 varieties of mycorrhizae, 10 varieties of beneficial bacteria, microbe food, organic matter, soil penetrant, wetting agent.
- B. Available Product: 'Green As It Gets' GardenMAX Soil Treatment, or approved equal.

2.9 MULCH

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood; Ground or shredded bark; or Wood and bark chips to match existing.
 2. Size Range shall be 1 inch (25 mm) maximum, 1/2 inch (13 mm) minimum.
 3. Color shall be natural to match existing.
- B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
1. Gravel Mulch: 3/4 inch (19 mm) maximum, 1/4 inch (6.4 mm) minimum; Crushed rock from granitic sources; Color: gold. Mulch shall match existing and used to repair landscape.
 - a. 'Sonoma Gold' as available from Maranatha Landscape Supplies (Tel.: (661)363-9638); or approved equal.

2.10 COMPOST

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 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.

2.11 ROOT BARRIER

- A. Root intrusion prevention panels for linear applications. Each panel includes joining mechanism for easy assembly; raised 90 degree molded root deflecting ribs; 1/2 inch (1.2 cm) ground lock tabs to prevent lifting by tree; and double top edge for strength, safety, straight edge appearance, and root overgrowth protection. Panel dimensions shall be 24 inches height x 24 inches width (61 cm x 61 cm).
- B. Materials and Manufacturing Process: Copolymer Polypropylene of 0.080 inch (2.032 mm) thickness; 75 percent reprocessed polypropylene; Injection molded; ISO 9002 certified; Tensile stress @ yield ASTM D638 3800 PSI (26,200 kPa or kN/m²); Elongation @ yield ASTM D638 6.3%; Flexural Modulus ASTM D790B 155,000 PSI (1,068,687 kPa or kN/m²).
- C. Available Product: 'DeepRoot' Root Barrier, Model UB 24-2; or approved equal.

2.12 TREE STAKES AND GUYING MATERIALS

A. Staking Material:

1. Tree Support Stakes: Rough sawn hardwood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 57 mm (2 1/4 inches) diameter by 2.4 m (8 feet) long, pointed at one end.
2. Tree Ties: Vinyl rubber strap, 1-inch wide, with UV-inhibitors.
3. Tack Nail: Galvanized steel roofing nail.

B. Guying Material:

1. Guying Wire: ASTM A580/A580M, galvanized steel wire.
2. Guying Cable: Minimum five strand, 5 mm (3/16 inch) galvanized steel cable.
3. Hose Chafing Guards: New or used 2 ply 19 mm (3/4 inch) reinforced rubber or plastic hose, black or dark green, all of same color.
4. Flags: White surveyor's plastic tape 150 mm (6 inches) long, fastened to guying wires or cables.
5. Turnbuckles: Galvanized or cadmium plated steel with minimum 75 mm (3 inch) long openings fitted with screw eyes and galvanized or cadmium plated steel eye bolts with 25 mm (1 inch) diameter eyes and 38 mm (1 1/2 inches) minimum screw length.
6. Ground Stakes: 50 mm (2 inches) square by 0.91 m (3 feet) long wood or plastic, pointed at one end.

C. Proprietary Tree Staking Devices:

1. Proprietary stabilization system to secure each new planting by the trunk; sized as indicated and per manufacturer's written recommendations.
2. Products: Subject to compliance with requirements, provide the following: an attachable-type steel stake with an adjustable height strap-bar, UV-resistant adjustable vinyl strap with 2 bolts/washers/nuts, and powder-coated black.
3. Stake Size: 8 foot, 1-1/4 inch diameter, Schedule 40, for trees (taller than 7 feet).
4. Strap Bar: 3/8 inch by 12 inches and 18-inch flat bar with flexible PVC strap and hardware.
5. Available Products: 'Grate Stake'; and 'Mega Grate Stake' System, as manufactured by J.R. Partners, (888) 333-3090; no known equal.

2.13 TREE WRAP

- A. Crinkle paper tree wrap: Two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches (100 mm) in width and have a stretch factor of 33 1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.
- B. Extruded, translucent, twin walled polypropylene protection board sheets: 1/8 inch (3 mm) thick, 6 ft (1800 mm) long tree shelters may be utilized for short trunk trees 3 inch (75 mm) caliper or less.
- C. Breathable synthetic fabric tree wrap: White in color, delivered in 3 inch (75 mm) wide rolls. Material shall be specifically manufactured for tree wrapping.
- D. Tree wrap shall be secured to the trunk using bio-degradable tape suitable for nursery use and which is expected to degrade in sunlight in less than 2 years after installation.

2.14 WATER

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

2.15 ANTIDESICCANT

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

2.16 PESTICIDES

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

- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.17 TREE AERATION TUBES

- A. 18" long x 3" diameter porous HDPE tube with 1,500 + sidewall openings. The top is engineered to allow continuous air convection (exchange) and water transfer from the surface to the tube to hydrate and aerate the plant. The tubes are able to accommodate third-party irrigation connections. The sidewall openings are engineered to minimize any soil entry.
- B. Acceptable Product: 'ROOTWELL' PRO-318; or approved equal. No known equal.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and existing plants from damage 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. Protect and/or remove and reinstall existing drip irrigation lines after soil preparation.
- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- F. For New Drip Irrigation Area:
 - 1. Spray area with non-selective herbicide (Round-up Pro, or glyphosate-equivalent) per manufacturer's printed instructions to remove all vegetation within the indicated area.
 - 2. Proceed by providing "Planting Area Soil Preparation" as indicated in article below.

3.3 PLANTING AREA SOIL PREPARATION

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches (300 mm). Remove stones larger than 3 inches (75 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
 - 1. Apply gypsum at 50 pounds per 1000 square feet.
 - 2. Apply Dolomitic Lime at a rate of 20 pounds per 1000 square feet.
 - 3. Apply compost at rate of 1 cubic yard per 1000 square feet.
- B. Thoroughly incorporate soil amendments into the soil to a depth of 8-inches by tilling in two directions perpendicular to each other.
- C. Compact amended soil to 80 to 85 percent relative density. (The finished surface shall be firm enough to show a light shoe print when walked upon, but should not be soft enough that a shoe would sink into the soil more than 1/4-inch.)

- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions with clean topsoil to meet finish grades.
- E. Before planting, obtain Contracting Officer's Representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 LAYOUT OF TREES AND SHRUBS

- A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain approval by the Contracting Officer's Representative of layout before excavating or planting. The Contracting Officer's Representative may approve adjustments to plant material locations to meet field conditions.
- B. Layout plants to fill voids in existing planting to remain wherever possible. Obtain COR's approval for adjustments to locations shown on drawings.
- C. Rotate plants so that the side with largest mass of vegetation faces into the strong westerly winds.
- D. Plants shall be set plumb to slightly leaning (2 degrees from plumb) into the westerly winds. In no case shall plants lean in the downwind direction.

3.5 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45 degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit glazed or smoothed during excavation.
 - 1. Excavate approximately 2 times as wide as root ball diameter.
 - 2. Excavate approximately 2 times deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 3. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 4. Maintain supervision of excavations during working hours.
 - 5. Keep excavations covered or otherwise protected after working hours and when unattended by Installer's personnel.

6. Use topsoil to form earth saucers or water basins for watering around plants. Basins to be 2 inches (50 mm) high for shrubs and 4 inches (100 mm) high for trees.

- B. Subsoil removed from excavations may not be used as planting soil.
- C. Notify Contracting Officer's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Notify Contracting Officer's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow water to percolate away before positioning trees and shrubs.

3.6 TREE, SHRUB, AND VINE PLANTING

- A. Prior to planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
 - 1. Carefully remove root ball from container without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
- C. Remove bottom of boxes, before setting boxed trees. Do not use planting stock if root ball is cracked or broken before or during planting operation. Cut metal bands and remove remainder of box material completely from the planting pit
- D. Set plants plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
- E. Backfill:
 - 1. Trees: Backfill top 2/3 of planting pit with planting soil mixed with soil treatment. Compact in 8-inch lifts to 90% relative density. Backfill the remaining 1/3 of the planting pit with amended backfill mix (mixture of coarse aggregates, native soil and compost. Compact in 8-inch lifts to 90% relative density.
 - 2. Shrubs: Backfill the entire planting pit with amended backfill mix. Compact in 8-inch lifts to 90% relative density.
- F. Use backfill mix described above.

1. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 2. Place fertilizer packs in each planting pit when pit is approximately one-half filled; in quantities recommended by fertilizer manufacturer. Place packets 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.
 3. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. 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.

3.7 SOIL TREATMENT

- A. After planting, apply minimum 3/4-inch deep layer of soil treatment extending outward from the base of each plant, making sure the material does not touch the plant stem/trunk. Provide: 6 pounds per 1 gallon plant; 10 pounds per 5 gallon plant; and 40 pounds per 24" box tree.
- B. Hand-water 3 extra times in the first week to fully dissolve and activate the soil treatment. Keep soil moist throughout growing season.

3.8 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 the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- C. Cut exposed roots cleanly during transplanting operations.
- D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.
- E. Where possible, orient the tree in the same direction as in its original location.

3.9 TREE, SHRUB, AND VINE PRUNING

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

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

3.10 TREE WRAP

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

3.11 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 shown on Drawings.
- B. Align root barrier vertically with bottom edge angled at 20 degrees away from the paving or other hardscape element and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
 - 1. Position top of root barrier 1/2 inch (13 mm) above finish grade per manufacturer's printed instructions.
 - 2. Use interlocking slots to join root barrier panels.
 - 3. Do not distort or bend root barrier during construction activities.
 - 4. Do not install root barrier closely surrounding the root ball of tree. Backfill with 6 inches (150mm) width of drainage rock between the root barrier and the edge of paving as indicated.

3.12 DRAINAGE SUMP

- A. Install drainage sumps in tree wells as indicated in the Drawings.
- B. Install Two 8-inch diameter perforated pipe sumps in each tree well to depths indicated. Cut top of pipe flush with finish grades.
- C. Backfill the pipes with 3/4-inch drainage backfill.
- D. Cover pipe opening with removable black plastic drain grate.

3.13 STAKING AND GUYING

- A. 'Grate Stake': Install tree staking system by fastening metal tree stake to existing cast-iron tree grates in accordance with installation details and manufacturer's printed instructions.

- B. Staking: Stake plants with number of stakes indicated on drawings with double strand of guy wire. Attach guy wire at half tree trunk height but maximum 1.5 m (5 feet) high. Drive stakes to depth of 0.80 to 0.91 m (2-1/2 to 3 feet) into the ground outside plant pit. Do not injure root ball. Install hose chafer guards where wire is in contact with tree trunk.
- C. Guying: Guy 4-inch caliper and larger transplanted trees. Attach guying cable around tree trunk at 0.785 rad (45 degrees) at half tree trunk height. Install hose chafer guards where cable is in contact with tree trunk. Anchor guys to ground stakes. Fasten flags to each guying cable at 2/3 of the distance above ground level. Provide turnbuckles as indicated on drawings.

3.14 MULCH INSTALLATION

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

3.15 IRRIGATION

- A. Tree Drip Irrigation Ring:
1. Run new non-pressure lateral PVC irrigation line to the new tree location from the nearest tree drip irrigation PVC service line; or tie into existing adjacent shrub drip lines, and install tree drip irrigation ring.
 2. Inner ring shall be located at the edge of the rootball; and outer ring shall be located at the drip line of the tree.
 3. Tie into adjacent existing drip irrigation lines in two locations to avoid creating a dead-end pipe run wherever possible.
 4. Install drip air release valve and drip flush valve at dead-end runs of lateral line.
 5. Provide irrigation as indicated on the Drawings and as specified under Division 32 Section "Planting Irrigation."

B. Shrub Drip Irrigation:

1. Restore existing drip irrigation to new plantings as indicated in the Drawings and as specified under Division 32 Section "Planting Irrigation."

3.16 TREE AERATION TUBE INSTALLATION

- A. Install 4 tree aeration tubes per tree. Install at the edge of the tree pit with the top of the tube 1/2 inch above finish grade per manufacturer's printed instructions.

3.17 PLANT MAINTENANCE

- A. Frequency: Begin maintenance immediately after plants have been installed. Inspect plants at least once week and perform required maintenance promptly.
- B. Promotion of Plant Growth and Vigor: Water, prune, fertilize, mulch, eradicate weeds, and perform other operations necessary to promote plant growth and vigor.
- C. Planter Beds: Weed, fertilize, and irrigate planter beds and keep pest free, pruned, and mulch levels maintained. Do not permit planter beds encroach into turf areas. Maintain edging breaks between turf areas and planter beds. Fertilize plant materials to promote healthy growth without encouraging excessive top foliar growth. Remove noxious weeds common to area from planter beds by mechanical means.
- D. Shrubs: In addition to planter bed maintenance requirements, selectively prune and shape shrubs for health and safety when following conditions exist:
1. Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel.
 2. Remove dead, damaged, or diseased branches or limbs where shrub growth obstructs pedestrian walkways, where shrub growth is growing against or over structures, and where shrub growth permits concealment of unauthorized persons.
 3. Properly dispose of all pruning debris.
- E. Trees: Adjust stakes, ties, guy supports and turnbuckles and water, fertilize, control pests, mulch, and prune for health and safety.
1. Fertilize trees to promote healthy plant growth without encouraging excessive top foliar growth. Inspect and adjust stakes, ties, guy supports and turnbuckles to avoid girdling and promote natural development.

2. Selectively prune all trees within project boundaries, regardless of caliper, for safety and health reasons, including, but not limited to, removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced.
3. All pruning, including palm tree pruning, must be by or in presence of certified member of International Society of Arboriculture and according to TCIA Z133.1.
4. Properly dispose of all pruning debris.

3.18 SLOPE EROSION CONTROL MAINTENANCE

A. Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped areas. Maintenance tasks include immediate repairs to weak spots in sloped areas and maintaining erosion control devices to intercept and direct water flow to prevent development of large gullies and slope erosion and securing irrigation systems during periods of extended rainfall.

1. Fill eroded areas with amended topsoil and replant with same plant species.
2. Reinstall erosion control materials damaged due to slope erosion.

3.19 REMOVAL OF DYING OR DEAD PLANTS

A. Remove dead and dying plants and provide new plants immediately upon commencement of specified planting season and replace stakes, guys, mulch, and eroded earth mound water basins. No additional correction period will be required for replacement plants beyond original warranty period. Plants will be considered dead or dying as follows:

1. Tree: Main leader died back or minimum 20 percent of crown died.
2. Shrub and Ground Cover: Minimum 20 percent of plant died.
3. Determination: Scrape on maximum 2 mm (1/16 inch) square branch area to determine dying plant material cause and provide recommendations for replacement.

3.20 PESTICIDE APPLICATION

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

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

3.21 CLEANUP AND PROTECTION

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

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SECTION 32 96 00

TRANSPLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Division 32 Section "PLANTING."
- B. Division 32 Section "PLANTING IRRIGATION."

1.3 REFERENCES

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

1.4 SUBMITTALS

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

1.5 QUALIFICATIONS

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

1.6 SITE CONDITIONS

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

1.7 WARRANTY AND REPLACEMENT OF TRANSPLANTED TREES

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

PART 2 - PRODUCTS

2.1 ANTI-DESICCANT

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

2.2 MULCH

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

2.3 TREE STAKING

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

2.4 TREE WRAP

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

2.5 FERTILIZER TABLETS

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Four (4) weeks minimum prior to the intended transplanting date, cut a 6-inch wide trench around the rootball of the tree or shrub equal to the diameter and depth of the proposed transplant rootball. The dimensions of the transplant rootball are to be determined by the "Tree and Shrub Transplanting Manual" for the size, species, and habit of plant being transplanted.
- B. Cut the lateral roots with clean, sharp root pruning equipment.
- C. Fill the trench with mulch material and compact to provide a stable walking surface.

3.2 ANTI-DESICCANT

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

3.3 EXCAVATION

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

3.4 TRANSPORTING

- A. Coordinate route for transporting the tree with the COR.
- B. Transport tree to location as indicated on the drawings.

3.5 PLANTING

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

3.6 IRRIGATION

- A. Tree Drip Irrigation Ring:

1. Run new non-pressure lateral PVC irrigation line to the transplanted tree location from the nearest tree drip irrigation PVC service line and install tree drip irrigation ring.
2. Install drip air release valve and drip flush valve at dead-end runs of lateral line.
3. Provide irrigation as indicated on the Drawings and as specified under Division 32 Section "Planting Irrigation."

3.7 MAINTENANCE

- A. Water transplanted tree immediately after transplanting, insuring adequate moisture to the root zone.
- B. Form an earthen watering basin as specified under Division 32 Section "Planting."
- C. If directed by the Arborist, prune off broken or badly bruised branches.
- D. Maintain the replanted tree for a period of 90-days after Final Acceptance by the Government as specified under Division 32 Section "Planting."

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