SECTION NO. 17

SPECIAL PROVISIONS – LANDSCAPING AND IRRIGATION SPECIFICATIONS

NUMERICAL LISTING

SECTION NO. 17

SPECIAL PROVISIONS – LANDSCAPING AND IRRIGATION SPECIFICATIONS

17-01 DESCRIPTION OF WORK:

A. Provide all exterior planting as shown on the drawings or inferable there from and/or as specified in accordance with the requirements of the Contract Documents.

B. These specifications include standards necessary for and incidental to the execution and completion of planting, including hauling and spreading of topsoil, and finished grading as indicated on the prepared drawings and specified herein.

C. Protection of existing features. During construction, protect all existing trees, shrubs, and other specified vegetation, site features and improvements, structures, and utilities specified herein and/or on submitted drawings. Removal or destruction of existing plantings is prohibited unless specifically authorized by the owner.

17-02 APPLICABLE STANDARDS:

A. *American National Standards for Tree Care Operations, ANSI A300*. American National Standards Institute, 11 West 42nd Street, New York, N.Y. 10036.

B. *American Standard for Nursery Stock, ANSI Z60.1*. American Nursery and Landscape Association, 1250 Eye Street. NW, Suite 500, Washington, D.C. 20005.

C. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

17-03 QUALIFICATIONS: Landscape planting and related work shall be performed by a firm with a minimum of five years experience specializing in this type of work. All contractors and their sub-contractors who will be performing any landscape work included in this section of the specification shall be approved by the Urban Forestry and Land Manager.

17-04 SUBMITTALS:

A. Manufacturer's Data: Submit copies of the manufacturer's and/or source data for all materials specified, including soils.

B. Samples: Submit samples of all topsoil, soil mixes, mulches, and organic materials. Samples shall weigh 1 kg (2 lb) and be packaged in plastic bags. Samples shall be typical of the lot of material to be delivered to the site and provide an accurate indication of color, texture, and organic makeup of the material.

C. Plant Photographs: Submit color photographs of representative specimens of each type of tree and shrub on the plant list. Photos shall be 75 x 125 mm (3 x 5 in.) taken from angle that depicts the size and condition of the typical plant to be furnished. A scale rod or other measuring device shall be included in the photograph. For species where more than 20 plants are required, include a minimum of three photos that show the average plant, the

best quality plant, and the worst quality plant to be provided. Label each photograph with the plant name, plant size, and name of the growing nursery.

D. Nursery Sources: Submit a list of all nurseries that will supply plants, along with a list of the plants they will provide and the location of the nursery.

E. Soil Testing: Submit the manufacturers' particle size analysis and the pH analysis and provide a description and source location for the content material of all organic materials.

17-05 UTILITY VERIFICATION: The contractor shall contact the local utility companies for verification of the location of all underground utility lines in the area of the work. The contractor shall be responsible for all damage resulting from neglect or failure to comply with this requirement.

17-06 MATERIALS:

A. Topsoil

1. Imported Topsoil:
   a. Topsoil shall be a loam, sandy loam, clay loam, silt loam, sandy clay loam, and loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by City of Arlington Forestry and Beautification Department. Regardless, topsoil shall not be a mixture of contrasting textured sub-soils and shall contain less than 5 % by volume of cinders, stones, slag, coarse fragments, gravel, sticks, roots, trash, or other materials larger than 1 1/2 " in diameter.

   b. The subsoil shall be tilled to a minimum depth of 6-inches before placement of topsoil.

   c. Where the subsoil is either highly acidic or composed of heavy clays, ground limestone shall be spread at the rate of 4-8 tons/acre (200-400 lbs per 1000 sq ft) prior to the placement of topsoil. Lime shall be distributed uniformly over designated areas and worked into the soil.

   d. Topsoil shall be tested and amended as per soil test recommendations.

2. Existing Topsoil:
   a. Existing topsoil may be used if it meets the requirements for imported topsoil or if approved by the Urban Forest and Land Manger. Provide a minimum of one soil sample with accompanying soil test report for each topsoil type found at the site. Following the completion of the soil testing, the contractor and the Urban Forest and Land Manger shall meet at the site prior to beginning of topsoil stripping and establish the limitations of areas where existing topsoil may be used and the depth of topsoil stripping permitted. *(NOTE: The* Urban Forestry and Land Manager *may test the existing soil prior to bidding the project and include the areas and depths of topsoil availability in the bid documents along with the soil test results.)*

b. Topsoil shall not be stripped, transported, or graded if moisture content exceeds field capacity or if the soil is frozen.

c. Topsoil stockpiles shall be protected from erosion and contamination.

d. Amendments required to be added as indicated on the soil test report shall be added by the contractor at the time of spreading and/or grading.

B. Plants:

1. Plants shall be true to species and variety specified and nursery-grown in accordance with good horticultural practices under climatic conditions similar to those in the locality of the project for at least two years. They shall have been freshly dug (during the most recent favorable harvest season). Plants shall be native or adapted to this region and must be approved by the Urban Forestry and Land Manager.

   a. All plant names and descriptions shall be as defined in Hortus Third.

   b. All plants shall be grown and harvested in accordance with the American Standard for Nursery Stock.

   c. Unless approved by the Urban Forestry & Land Manager, plants shall have been grown at latitude not more than 325 km (200 miles) north or south of the latitude of the project unless the provenance of the plant can be documented to be compatible with the latitude and cold hardiness zone of the planting location.

2. Delivery and Inspection: All trees must be approved by the Forester or Urban Forestry & Land Manager prior to installation. The Forestry and Beautification Department may approve plants at the nursery, a designated holding area, or on site at the discretion of the Department. Contractors are responsible for notifying Forestry and Beautification prior to delivery of plant material. Plants shall be subject to inspection for conformity to specification requirements and approval by the Urban Forestry and Land Manager at their place of growth and upon delivery. Such approval shall not impair the right of inspection and rejection during progress of the work. (Rev. 6/2018)

   a. A written request for the inspection of plant material at their place of growth shall be submitted to the Urban Forestry and Land Manager at least ten calendar days prior to digging. This request shall state the place of growth and the quantity of plants to be inspected. The Urban Forestry and Land Manager may refuse inspection at this time if, in his or her judgment, sufficient quantities of plants are not available for inspection. (Rev. 6/2018)

   b. All plants shall be selected and tagged by the Urban Forest and Land Manager at their place of growth. For distant material, photographs may be submitted for pre-inspection review.

c. All field grown deciduous trees shall be marked to indicate the trees north orientation in the nursery. Place a 1-in. diameter spot of white paint onto the north side of the tree trunk within the bottom 12 inches of the trunk. (Rev. 6/2018)

3. Unless specifically noted, all plants shall be of specimen quality, exceptionally heavy, symmetrical, and so trained or favored in development and appearance as to be unquestionably and outstandingly superior in form, compactness, and symmetry. They shall be sound, healthy, vigorous, well branched, and densely foliated when in leaf; free of disease and insects, eggs, or larvae; and shall have healthy, well-developed root systems. They shall be free from physical damage or other conditions that would prevent vigorous growth.

   a. Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged or crooked leader, bark abrasions, sunscald, disfiguring knots, insect damage, or cuts of limbs over 3/4 in. in diameter that are not completely closed will be rejected.

   b. An inspection of the crown, trunk, and roots shall find the following characteristics:

4. Crown Form: The form or shape of the crown is typical for a young specimen of the species/cultivar. The crown is not significantly deformed by wind, pruning practices, pests or other factors.

5. Leaves: The size, color and appearance of leaves are typical for the time of year and stage of growth of the species/cultivar. Leaves are not stunted, misshapen, tattered, discolored (chlorotic or necrotic) or otherwise atypical.

6. Branches: Shoot growth (length and diameter) throughout the crown is typical for the age/size of the species/cultivar. Trees do not have dead, diseased, broken, distorted or other serious branch injuries.

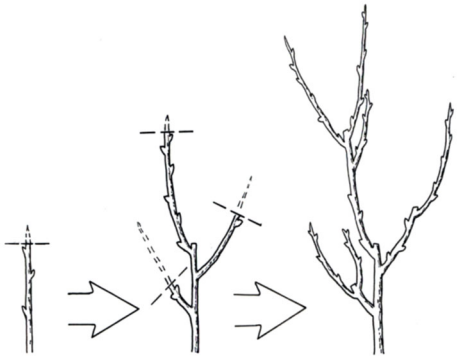
7. Trunk: The tree trunk should be straight, vertical and free of wounds (except properly–made pruning cuts), sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers/lesions and girdling ties.
8. Tree height and trunk diameter are typical for the age, species/cultivar and container size.

9. Roots: The root system is free of injury from biotic (insects, pathogens, etc.) and abiotic agents (herbicide toxicity, salt injury, excess irrigation, etc.). Root distribution is uniform throughout the soil mix or growth media and growth is typical for the species/cultivar.

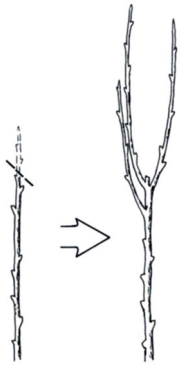
   a. Central Leader: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that

compete with the central leader. If the original leader has been headed, a new leader at least ½ (one–half) the diameter of the original leader shall be present.

Maintaining a single, central leader is preferable.



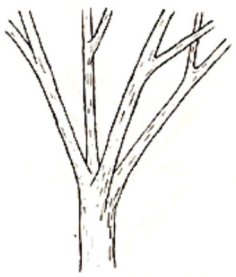
Heading and retaining a leader is acceptable.



Heading without retaining a leader is unacceptable.

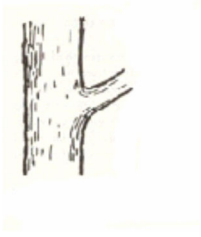
b. Main Branches (scaffolds): Branches should be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species.

1. Main branches, for the most part, shall be well spaced.

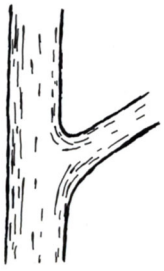
preferable unacceptable preferable unacceptable

2. Branch diameter shall be no greater than 2/3 (two thirds) the diameter of the trunk, measured 1" (one inch) above the branch.




preferable unacceptable preferable unacceptable

3. The attachment of scaffold branches shall be free of included bark.



preferable

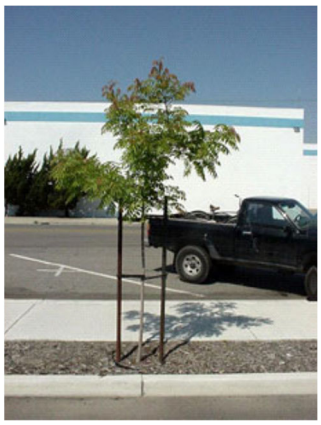
unacceptable

preferable

unacceptable

c. Temporary branches: Temporary branches should be present along the lower trunk, particularly for trees less than 1–1/2" (one and one–half inches) in trunk diameter. They should be no greater than 3/8" (three–eighths inch) in diameter. Heading of temporary branches is often necessary to limit their growth.

Good



Not as Good

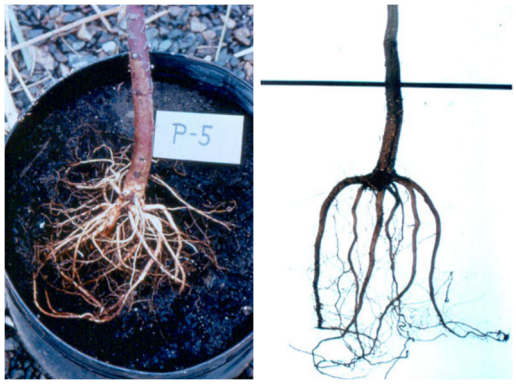
d. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.

e. The trunk shall be free of wounds (except properly–made pruning cuts), sunburned areas, conks (fungal fruiting–bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.

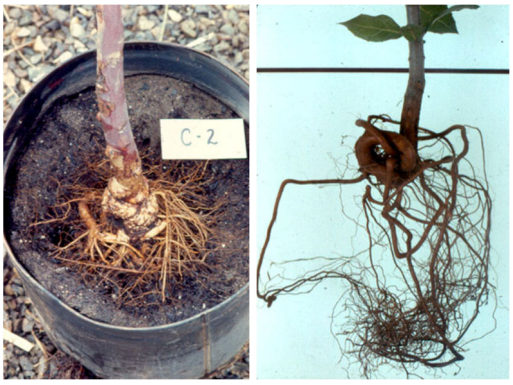
f. Trunk diameter at 6" (six inches) above the soil surface shall be within the diameter range shown for each container size below:

Container Size	Trunk Diameter (*inches*)
# 5 (gallon)	0.5" to 0.75"
# 15 (gallon)	0.75" to 1.5"
24 inch box	1.5" to 2.5"

g. The trunk, root collar (root crown) and large roots shall be free of circling and/or kinked roots. Soil removal near the root collar may be necessary to inspect for circling and/or kinked roots.



preferable



unacceptable

h. The tree shall be well rooted in the soil mix. When the container is removed, the root ball shall remain intact. When the trunk is carefully lifted both the trunk and root system shall move as one.

preferable

unacceptable

i. The upper–most roots or root collar shall be within 1" (one inch) above or below the soil surface.


preferable


unacceptable

j. The rootball periphery should be free of large circling and bottom–matted roots. The acceptable diameter of circling peripheral roots depends on species and size of rootball. The maximum acceptable size should be indicated for the species (if necessary).


preferable


unacceptable

k. At time of inspection and delivery, the root ball shall be moist throughout. The crown shall show no signs of moisture stress as indicated by wilted, shriveled or dead leaves or branch dieback. The roots shall show no signs of excess soil moisture conditions as indicated by poor root growth, root discoloration, distortion, death or foul odor.

10. The owner reserves the right to reject trees that do not meet specifications as set forth in these guidelines or as specified by the owner. If a particular defect or substandard element or characteristic can be easily corrected, appropriate remedies shall be required. If destructive inspection of a root ball(s) is to be done, the owner and contractor should have a prior agreement as to the time and place of inspection, minimum number of trees or percentage of a species or cultivar to be inspected and financial responsibility for the inspected trees.

11. Plants shall conform to the measurements specified, except that plants larger than those specified may be used if approved by the Urban Forestry and Land Manager.

Use of larger plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant.

a. Caliper measurements shall be taken on the trunk 6 in. above the natural ground line for trees up to and including 4 in. in caliper, and 12 in. above the natural ground line for trees over 4 in. in caliper. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to branch tip. Plants shall be measured when branches are in their normal position. If a range of sizes is given, no plant shall be less than the minimum size, and no less than 50 percent of the plants shall be as large as the maximum size specified. Measurements specified are minimum sizes acceptable after pruning, where pruning is required. Plants that meet measurements but do not possess a standard relationship between height and spread, according to the American Standards for Nursery Stock, shall be rejected.

12. Substitutions of plant materials will not be permitted unless authorized in writing by the Urban Forestry and Land Manager. If proof is submitted in writing that a plant specified is not obtainable, consideration will be given to the nearest available size or similar variety, with a corresponding adjustment of the contract price.

13. The plant list at the end of this section, or in the plans, is for the contractor's information only, and no guarantee is expressed or implied that quantities therein are correct or that the list is complete. The contractor shall ensure that all plant materials shown in the plans are included in his or her bid.

14. All plants shall be labeled by plant name. Labels shall be attached securely to all plants, bundles, and containers of plant materials when delivered. Plant labels shall be durable and legible, with information given in weather-resistant ink or embossed process lettering.

15. Anti-Desiccants: Anti-desiccants, if specified, are to be applied to plants in full leaf immediately before digging or as required by the Urban Forestry and Land Manager. Anti-desiccants are to be sprayed so that all leaves and branches are covered with a continuous protective film.

16. Balled and Burlapped (B&B) Plant Materials: Trees designated B&B shall not be used unless specifically approved by the Urban Forestry and Land Manager.

17. Container Plants:
    a. Plants grown in containers shall be of appropriate size for the container as specified in the most recent edition of the American Standard for Nursery Stock and be free of circling roots on the exterior and interior of the root ball.

    b. Container plants shall have been grown in the container long enough to have established roots throughout the growing medium.

18. Bareroot and Collected Plants:
    a. Plants designated as bareroot or collected plants shall conform to the American Standard for Nursery Stock.

    b. Bareroot material shall not be dug or installed after bud break or before dormancy.

19. Immediately after harvesting plants, protect from drying and damage until shipped and delivered to the planting site. Rootballs shall be checked regularly and watered sufficiently to maintain root viability.

20. Transportation and Storage of Plant Material:
    a. Branches shall be tied with rope or twine only, and in such a manner that no damage will occur to the bark or branches.

    b. During transportation of plant material, the contractor shall exercise care to prevent injury and drying out of the trees. Should the roots be dried out, large branches broken, balls of earth broken or loosened, or areas of bark torn, the Urban Forestry and Land Manager may reject the injured tree(s) and order them replaced at no additional cost to the owner. All loads of plants shall be covered at all times with tarpaulin or canvas. Loads that are not protected will be rejected.
    c. All bareroot stock sent from the storage facility shall be adequately covered with wet soil, sawdust, woodchips, moss, peat, straw, hay, or other acceptable moisture-holding medium, and shall be covered with a tarpaulin or canvas. Loads that are not protected in the above manner may be rejected.

    d. Plants must be protected at all times from sun or drying winds. Those that cannot be planted immediately on delivery shall be kept in the shade, well protected with soil, wet mulch, or other acceptable material, and kept well watered. Plants shall not remain unplanted any longer than three days after delivery. Plants shall not be bound with wire or rope at any time so as to damage the bark or break branches. Plants shall be lifted and handled with suitable support of the soil ball to avoid damaging it.

21. Mechanized Tree Spade Requirements: Trees may be moved and planted with an approved mechanical tree spade. The tree spade shall move trees limited to the maximum size allowed for a similar B&B root-ball diameter according to the American Standard for Nursery Stock or the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller. The machine shall be approved by the Urban Forestry and Land Manager prior to use. Trees shall be planted at the designated locations in the manner shown in the plans and in accordance with applicable sections of the specifications.

C. Materials for Planting:

1. Mulch: shall be finely shredded native hardwood. Material shall be mulching grade, uniform in size, and free of foreign matter. Submit sample for approval.

2. Anti-desiccant: shall be an emulsion specifically manufactured for agricultural use, which provides a protective film over plant surfaces. Anti-desiccants shall be delivered in containers of the manufacturer and shall be mixed according to the manufacturer's directions. Submit manufacturer literature for approval.

3. Tree Shelter: shall be extruded, twin-walled polypropylene tubes, 80 mm to 105 mm (3-1/4 to 4-1/4 in.) in diameter; 600 mm (2 ft) tall, with manufacturer-supplied oak stakes and bird screen. Submit manufacturer literature for approval.

4. Tree Wrap:
   a. Option 1 Extruded, translucent, twin-walled polypropylene protection board sheets; 3 mm thick. 1800mm (6 ft) long tree shelters may be utilized for short trunk trees 75 mm (3 in.) caliper or less. Submit manufacturer literature for approval.

   b. Option 2 Breathable synthetic fabric tree wrap. White in color, delivered in 75 mm (3 in.) wide rolls, specifically manufactured for tree wrapping. Tree wrap shall be "Breathable Fabric Tree Wrap" as manufactured by the Dewitt Company, Inc., Sikeston, MO, or approved equal. Submit manufacturer literature for approval.
   c. 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 two years after installation.

5. Biostimulants: Biostimulants shall contain soil conditioners, VAM, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions. Submit manufacturer literature for approval.

D. Materials for Soil Amendment:

Planting Mix

Contents:

Hammermilled, screened and aerobically composted organics including compost (approx. 35%), decomposed pine bark (approx. 35%), screened fine sand (approx. 10%), Expanded Shale (approx.10%), and Texas Green Sand (approx 10%).

17-07 EXECUTION:

A. Excavation of Planted Areas:

1. Locations for plants and/or outlines of areas to be planted are to be staked out at the site. Locate and mark all subsurface utility lines. Approval of the stakeout by the Urban Forestry and Land Manager is required before excavation begins.

2. Tree, shrub, and groundcover beds are to be excavated to the depth and widths indicated on the drawings. If the planting area under any tree is initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.

    a. The sides of the excavation of all planting areas shall be sloped at 45 degrees. The bottom of all beds shall slope parallel to the proposed grades or toward any subsurface drain lines within the planting bed. The bottom of the planting bed directly under any tree shall be horizontal such that the tree sits plumb.

    b. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not excavate compacted subgrades of adjacent pavement or structures.

    c. Subgrade soils shall be separated from the topsoil, removed from the area, and not used as backfill in any planted or lawn area. Excavations shall not be left uncovered or unprotected overnight.

3. For trees and shrubs planted in individual holes in areas of good soil that is to remain in place and/or to receive amendment in the top 150-mm (6 in.) layer, excavate the hole to the depth of the root ball and to widths shown on the drawing. Slope the sides of the excavation at a 45 degree angle up and away from the bottom of the excavation.
    a. In areas of slowly draining soils, the root ball may be set up to 75 mm (3 in.) or 1/8 of the depth of the root ball above the adjacent soil level.

    b. Save the existing soil to be used as backfill around the tree.

    c. On steep slopes, the depth of the excavation shall be measured at the center of the hole and the excavation dug as shown on the drawings.

4. Detrimental soil conditions: The Urban Forestry and Land Manager is to be notified, in writing, of soil conditions encountered, including poor drainage, that the contractor considers detrimental to the growth of plant material. When detrimental conditions are uncovered, planting shall be discontinued until instructions to resolve the conditions are received from the Urban Forestry and Land Manager.

5. Obstructions: If rock, underground construction work, utilities, tree roots, or other obstructions are encountered in the excavation of planting areas, alternate locations for any planting shall be determined by the Urban Forestry and Land Manager.

B. <u>Installation of Topsoil and Planting Mix:</u>
1. Prior to the installation or modification of topsoil and planting mix, install subsurface drains, irrigation main lines, lateral lines, and irrigation risers shown on the drawings.

2. The Urban Forestry and Land Manager shall review the preparation of subgrades prior to the installation or modification of topsoil or planting mix.

3. Do not proceed with the installation of topsoil and planting mix until all utility work in the area has been installed.

4. Protect adjacent walls, walks, and utilities from damage or staining by the soil. Use 12-mm (1/2 in.) plywood and/or plastic sheeting as directed to cover existing concrete, metal, masonry work, and other items as directed during the progress of the work.
   a. Clean up any soil or dirt spilled on any paved surface at the end of each working day.

   b. Any damage to the paving or architectural work caused by the soils installation contractor shall be repaired by the general contractor at the soils installation contractors' expense.

5. Till the subsoil into the bottom layer of topsoil or planting mix.
   a. Loosen the soil of the subgrade to a depth of 50 to 75 mm (2 to 3 in.), unless more extensive depth is specified in plans, with a rototiller or other suitable device.

   b. Spread a layer of the specified topsoil or planting mix 50 mm (2 in.) deep over the subgrade. Thoroughly till the planting mix and the subgrade together.
   c. Immediately install the remaining topsoil or planting mix in accordance with the following specifications. Protect the tilled area from traffic. DO NOT allow the tilled subgrade to become compacted.

   d. In the event that the tilled area becomes compacted, till the area again prior to installing the planting mix.

6. Subsoiling: When subsoiling is indicated on the drawings, use a chisel plow subsoil ripping tool mounted on a machine of sufficient power to make vertical trenches 500 mm (18 in.) deep into the subsoil 600 mm (24 in.) apart. Run the ripping tool over each area in opposite directions so that each area is ripped twice to thoroughly break up the compacted subgrade material prior to the installation of topsoil and planting mix.

7. Install the remaining topsoil or planting mix in 200- to 250-mm (8- to 10-in.) lifts to the depths and grades shown on the drawing. The depths and grades shown on the drawings are the final grades after soil settlement and shrinkage of the organic material. The contractor shall install the soil at a higher level to anticipate this reduction of soil volume, depending on predicted settling properties for each type of soil.
   a. Phase the installation of the soil such that equipment does not have to travel over already-installed topsoil or planting mixes.

   b. Compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The soil in each lift should

feel firm to the foot in all areas and make only slight heel prints. Over compaction shall be determined by the following field percolation test.

1. Dig a hole 250 mm (10 in.) in diameter and 250 mm (10 in.) deep.

2. Fill the hole with water and let it drain completely. Immediately refill the hole with water, and measure the rate of fall in the water level.

3. In the event that the water drains at a rate less than 25 mm (1 in.) per hour, till the soil to a depth required to break the over compaction.

4. The Urban Forestry and Land Manager shall determine the need for, and the number and location of percolation tests based on observed field conditions of the soil.

c. Maintain moisture conditions within the soils during installation to allow for satisfactory compaction. Suspend installation operations if the soil becomes wet. Do not place soils on wet or frozen subgrade.

d. Provide adequate equipment to achieve consistent and uniform compaction of the soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction.

e. Add lime, sulfur, fertilizer, and other amendments during soil installation. Spread the amendments over the top layer of soil and till into the top 100 mm (4 in.) of soil. Soil amendments may be added at the same time that organic matter, when required, is added to the top layer of soil.

f. Protect soil from over compaction after placement. An area that becomes over compacted shall be tilled to a depth of 125 mm (6 in.). Uneven or settled areas shall be filled and regraded.

C. Installation of Organic Matter Layer:

1. After the specified topsoil or planting mix is installed and just prior to fine grading and the installation of tree, shrub, or flower plantings, spread 100 mm (4 in.) of organic matter over all bed areas designated on the drawings and rototill into the top 100 mm (4 in.) of the planting mix or topsoil.

2. Allow the finished grades to remain 50 to 75 mm (2-3 in.) higher than the grades on the grading plan to anticipate settlement over the first year. At the end of the planting guarantee period, reset the grades in this area, if required, to the final grades shown on the grading plan.

D. Fine Grading:

1. Grade the surface of all planted or lawn areas to meet the grades shown on the drawings after the 12-month settling period. Set grades at time of installation high enough relative to the type of soil mix and settlement anticipated so that the soil will be at the correct grades after the settlement period. Adjust the finish grades to meet field conditions as directed.

a. Provide for positive drainage from all areas toward the existing inlets and drainage structures.

b. Provide smooth transitions between slopes of different gradients and direction. Modify the grade so that the finish grade is flush with all paving surfaces or as directed by the drawings.

2. Fill all dips and remove any bumps in the overall plane of the slope.
   a. The tolerance for dips and bumps in lawn areas shall be a 12-mm (1/2 in.) deviation from the plane in 3,000 mm (10 ft).

   b. The tolerance for dips and bumps in shrub planting areas shall be a 25-mm (1 in.) deviation from the plane in 3,000 mm (10 ft).

   c. All fine grading shall be inspected and approved by the Urban Forestry and Land Manager prior to planting, mulching, sodding, or seeding.

E. Planting Operations: see http://bit.ly/UrbanTreePlanting for detailed drawings (Rev. 6/2018)

1. Plants shall be set on flat-tamped or unexcavated pads at the same relationship to finished grade as they were to the ground from which they were dug, unless otherwise noted on the drawings. Plants must be set plumb and braced in position until topsoil or planting mix has been placed and tamped around the base of the root ball. Improper compacting of the soil around the root ball may result in the tree settling or leaning. Plants shall be set so that they will be at the same depth and so that the root ball does not shift or move laterally one year later.

   a. Determine the elevation of the root flare and ensure that it is planted at grade. This may require that the tree be set higher than the grade in the nursery.

   b. If the root flare is less than 50 mm (2 in.) below the soil level of the root ball, plant at the tree the appropriate level above the grade to set the flare even with the grade. If the flare is more than 50 mm (2 in) above the soil level at the center of the root ball/trunk the tree shall be rejected.

2. Lift plants only from the bottom of the root balls or with belts or lifting harnesses of sufficient width not to damage the root balls. Do not lift trees by their trunk or use the trunk as a lever in positioning or moving the tree in the planting area.

3. Remove plastic, paper, or fiber pots from containerized plant material. Pull roots out of the root mat and cut circling roots with a sharp knife. Loosen the potting medium and shake away from the root mat. Immediately after removing the container, install the plant such that the roots do not dry out. Pack planting mix around the exposed roots while planting.

4. The roots of bare-root trees shall be pruned at the time of planting to remove damaged or undesirable roots (those likely to become a detriment to future growth of the root system). Bare-root trees shall have the roots spread to approximate the natural position of the roots and shall be centered in the planting pit. The planting-soil

backfill shall be worked firmly into and around the roots, with care taken to fill in completely with no air pockets.

5. Cut ropes or strings from the top of shrub root balls and trees smaller than 3 in. caliper after plant has been set. Remove burlap or cloth wrapping and any wire baskets from around top half of balls. Do not turn under and bury portions of burlap at top of ball.
   a. Do not immediately remove the ropes and burlap from trees larger than 3 in. caliper. Return to each tree three months after planting (six months for fall-planted material), and cut all ropes around the trunks and tops of the root balls of these trees.

   b. Completely remove any waterproof or water-repellant strings or wrappings from the root ball and trunk before backfilling.

6. Set balled and burlapped trees in the hole with the north marker facing north unless otherwise approved by the Urban Forestry and Land Manager.

7. Place native soil, topsoil, or planting mix into the area around the tree, tamping lightly to reduce settlement.
   a. For plants planted in individual holes in existing soil, add any required soil amendments to the soils, as the material is being backfilled around the plant. Ensure that the amendments are thoroughly mixed into the backfill.

   b. For plants planted in large beds of prepared soil, add soil amendments during the soil installation process.

   c. When required by the Urban Forestry and Land Manager, add biostimulants at the time of planting in the area directly around the plant root ball.

   d. Ensure that the backfill immediately around the base of the root ball is tamped with foot pressure sufficient to prevent the root ball from shifting or leaning.

8. Thoroughly water all plants immediately after planting. Apply water by hose directly to the root ball and the adjacent soil.

9. Remove all tags, labels, strings, etc. from all plants.

10. Remove any excess soil, debris, and planting material from the job site at the end of each workday.

11. Form watering saucers 100 mm (4 in.) high immediately outside the area of the root ball of each tree as indicated on the drawings.

F. Staking and Guying:
   1. Staking and guying methods shall be approved by the Urban Forestry & Land Manager. All below-ground staking material shall be capable of decomposing through biological

activity in the soil. Belowground staking methods that consist primarily of metals or other non-biodegradable material are not permitted. Below-ground staking methods shall not encircle the tree and shall not restrict the future growth of stem. (Rev 6/2018)

2. Below-ground Staking: see https://goo.gl/S0zxft for detailed drawings (Rev. 6/2018)
   a. Materials
      i. Root ball stakes
         1. Stake length will be no less than 40 inches.
         2. Stake diameter will be no less than 0.75 inches.
         3. Minimum 3 stakes per tree.
         4. For trees larger than 3 caliper inches, an additional stake will be required for each caliper inch.
      ii. Lock
         1. Trees will be secured by placing a lock on each stake which prevents the lifting of the tree from the stakes.
         2. The lock must be less than 1 inch in height.
   b. Planting
      i. The planting well shall be excavated no deeper than the height of the root ball to minimize disturbance of underlying soil.
      ii. Install root ball into planting pit per drawings / details.
      iii. Backfill with placement of specified topsoil mixture and compact to firmly hold root ball against surrounding soil.
   c. Adjustment
      i. Verify placement, direction and verticality.
      ii. Adjust as necessary.
      iii. Re-compact surrounding soil.
   d. Prepare Root Ball
      i. Remove loose and extra soil, mulch, etc. from top of root ball to a point where density is consistent or coarse roots (greater than 0.25 inches diameter) are encountered.
      ii. Ensure root ball is free of burlap, wire, plastic, nylon, or any other foreign material.
   e. Stake Installation
      i. Install the specified quantity of stakes based on caliper inches of the tree.
      ii. Stakes shall be placed equally proportionate around the trunk and no more than 120 degrees apart.
      iii. Stakes shall be placed approximately 6 inches from the trunk or root flare laterally and not less than 6 inches from the outer edge of the root ball.
      iv. Stakes shall be driven a minimum of 6 inches into undisturbed soil while also leaving 1-2 inches above the root ball for installation of the lock.
   f. Lock installation
      i. Each stake must have a lock to secure the root ball.
      ii. The lock should be oriented perpendicular to the trunk and should be no less than 4 inches from the trunk or root flare.
      iii. Locks should be secured evenly with the top of the root ball to minimize gaps.

iv. Locks shall not bind irrigation lines or prevent proper operation of emitters.

3. Above-ground Staking: see https://bit.ly/2I9UOaR for detailed drawings (Rev. 6/2018)
   a. Where guys are attached around the tree, the trunk shall be protected with 20-mm (3/4 in.) diameter rubber hose, black in color, and of sufficient length to extend past the trunk by more than 105 mm (6 in.). The guy must be placed around the stem with sufficient space for trunk growth during tree establishment.

4. Stakes and guys shall be installed immediately upon approval or planting, and shall be removed at the end of the first growing season except in the case of biodegradable below-ground staking methods. Any tree that is not stable at the end of this time shall be rejected. (Rev. 6/2018)

G. Wrapping:

1. Wrap the trunk of any tree only when necessary for the specific conditions encountered and with the approval of the Urban Forestry and Land Manager. Wrapping may be required for thin-barked species in unusual circumstances such as trees planted adjacent to South- or West-facing reflective surfaces, or when it is impossible to plant the tree with the trunk oriented to the same north orientation that it held in the growing nursery.

2. When required, wrapping methods shall be approved by the Urban Forestry and Land Manager. If no wrapping requirements appear on the drawings, submit for approval a drawing of the wrapping method to be used. Wrapping material shall be as specified in this specification. Wrapping material shall be fastened using a biodegradable tape. All tape shall be loosely wrapped around the wrapping material in single layer to permit its breakdown in sunlight and permit a minimum of 25 mm (1 in.) of unrestricted trunk growth. Stapling or tying the wrap with non- or slowly biodegradable tape or any synthetic or natural fiber string shall be prohibited.

3. Wrapping material shall be applied from the base of the tree to the first branch.

4. All wrapping material shall be removed no later than at the end of the year after planting or as specified by the Urban Forestry and Land Manager.

H. Pruning:

1. Plants shall not be heavily pruned at the time of planting. Pruning is required at planting time to correct defects in the tree structure, including removal of injured branches, double leaders, waterspouts, suckers, and interfering branches. Healthy lower branches and interior small twigs should not be removed except as necessary to clear walks and roads. In no case should more than one-quarter of the branching structure be removed. Retain the normal or natural shape of the plant.

2. All pruning shall be completed using clean, sharp tools. All cuts shall be clean and smooth, with the bark intact with no rough edges or tears.

3. Except in circumstances dictated by the needs of specific pruning practices, tree paint shall not be used. The use of tree paint shall be only upon approval of the Urban Forestry and Land Manager. Tree paint, when required, shall be paint specifically formulated and manufacturing for horticultural use.

4. Pruning of large trees shall be done from a hydraulic man-lift such that it is not necessary to climb the tree.

I. Mulching:

1. All trees, shrubs, and other plantings will be mulched with mulch previously approved by the Urban Forestry and Land Manager. The mulch on trees and shrubs shall be to the depths shown on the drawing. Mulch must not be placed within 8 cm (3 in.) of the trunks of trees or shrubs.

2. Mulch will be 3" thick and in a 7' diameter circle around the base of the tree.

J. Turfgrass Planting:

1. This work includes labor, material, and equipment for soil preparation, fertilization, planting, and other requirements regarding turfgrass planting areas shown on the plan.

2. Delivery Receipts and Invoices: All delivery receipts and copies of invoices for materials used for this work shall be subject to checking by the Urban Forestry & Land Manager and shall be subsequently delivered to the office of the Urban Forestry & Land Manager.

3. Samples and Producers' Specifications: Various samples, certificates, and specifications of seed, fertilizer, sand, compost, other soil amendments and other materials shall be submitted for approval as required by subsequent sections of this specification.

4. Buffalograss Sod or Bermuda Grass Sod: Turfgrass sod shall be "Buchloe dactyloides" (Buffalograss) 'Prairie Grass' variety or "Cynodon dactylon" Common Bermuda Grass. Sod shall consist of stolons, leaf blades, rhizomes, and roots with a healthy, virile system of dense, thickly matted roots throughout the soil of the sod for a thickness not less than three-quarters inch (3/4″). Sod shall be alive, healthy, vigorous, free of insects, disease, stones, and undesirable foreign materials and grasses. The grass shall have been mowed prior to sod cutting so that the height of the grass shall not exceed two inches (2″). Sod shall have been produced on growing beds of clay or clay-loam topsoil. Sod shall not be harvested or planted when its moisture condition is so excessively wet or dry that its survival will be affected. All sod is to be harvested, delivered, and planted within a thirty-six (36) hour period of time. Sod shall be protected from exposure to wind, sun and freezing. If sod is stacked, it shall be kept moist and shall be stacked roots-to-roots and grass-to-grass. If the work is completed in portion of an area where existing grass will remain around the work area; match the new sod to the existing sod species. (Rev. 6/2016)

5. Dimensions: All sod shall be machine cut to uniform soil thickness of one inch (1″) plus or minus one-quarter inch (1/4″). All sod shall be of the same thickness. Rectangular sections of sod may vary in length, but all shall be of equal width and of a size that permits the sod to be lifted, handled, and rolled without breaking. Broken pads and torn, uneven ends will be unacceptable.

6. Solid Sodding: Prior to laying the sod, the planting beds shall be raked smooth to true grade and moistened to a depth of four inches (4″), but not to the extent causing puddling. The sod shall be laid smoothly, tightly butted edge to edge, and with staggered joints. The sod shall be pressed firmly into contact with the sod bed by rolling or by hand tamping with an approved tamper so as to eliminate all air pockets, provide a true and even surface, and insure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Following compaction, fine screened soil of good quality shall be used to fill all cracks between sods. Excess soil shall be worked into the grass with suitable equipment and shall be well watered. The quantity of fill soil shall be such that it will cause no smothering of the grass.

7. If sod is placed after September 15, final acceptance on the grass will not occur until after April 15. The grass shall not be over seeded with rye. The Contractor shall water the grass until the grass is accepted.

K. Maintenance of Trees, Shrubs, and Vines:

1. Maintenance shall begin immediately after each plant is planted and continue until its acceptance has been confirmed by the Urban Forestry and Land Manager.

2. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, tightening and repairing guys and stakes, resetting plants to proper grades or upright position, restoring of the planting saucer, and furnishing and applying such sprays or other materials as necessary to keep plantings free of insects and diseases and in vigorous condition.

3. Planting areas and plants shall be protected at all times against trespassing and damage of all kinds for the duration of the maintenance period. If a plant becomes damaged or injured, it shall be treated or replaced as directed by the Urban Forestry and Land Manager at no additional cost.

4. Watering: Contractor shall irrigate as required to maintain vigorous and healthy tree growth. Overwatering or flooding shall not be allowed. The contractor shall monitor, adjust, and use existing irrigation facilities, if available, and furnish any additional material, equipment, or water to ensure adequate irrigation. Root balls of all trees and large shrubs shall be spot watered using handheld hoses during the first four months after planting, as required to ensure adequate water within the root ball.

5. During periods of restricted water usage, all governmental regulations (permanent and temporary) shall be followed. The contractor may have to transport water from

ponds or other sources, at no additional expense to the owner when irrigation systems are unavailable.

6. Vegetation planted in floodplains, streams, streambanks, ditches, or runoff flow paths shall be secured to ensure that they are protected from high velocities and flood inundation until they are fully established and accepted by the City. Vegetation lost to rain events prior to establishment shall be replaced at no cost to the City."

(Rev. 6/2020)

L. Acceptance:

1. The Urban Forestry and Land Manager shall inspect all work for acceptance upon written request of the contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

2. Acceptance of plant material shall be for general conformance to specified size, character, and quality and shall not relieve the contractor of responsibility for full conformance to the contract documents, including correct species.

3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Urban Forestry and Land Manager, the Urban Forestry and Land Manager shall certify in writing that the work has been accepted.

M. Acceptance in Part: Work may be accepted in parts when the Urban Forestry and Land Manager and contractor deem that practice to be in their mutual interest. Approval must be given in writing by the Urban Forestry and Land Manager to the contractor verifying that the work is to be completed in parts. Acceptance of work in parts shall not waive any other provision of this contract.

17-08 GUARANTEE PERIOD AND REPLACEMENTS:

A. The guarantee period for trees and shrubs shall begin at the date of acceptance.

B. The contractor shall guarantee all plant material to be in healthy and flourishing condition for a period of two year from the date of acceptance.

C. When work is accepted in parts, the guarantee periods extend from each of the partial acceptances to the terminal date of the guarantee of the last acceptance. Thus, all guarantee periods terminate at one time.

D. The contractor shall replace, without cost, as soon as weather conditions permit, and within a specified planting period, all plants determined by the Urban Forestry and Land Manager to be dead or in an unacceptable condition during and at the end of the guarantee period. To be considered acceptable, plants shall be free of dead or dying branches and branch tips and shall bear foliage of normal density, size, and color. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification.

E. The guarantee of all replacement plants shall extend for an additional period of one year

from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of said extended guarantee period, the Urban Forest and Land Manger may elect subsequent replacement or credit for that item.

F. At the end of the guarantee, the contractor shall reset grades that have settled below the proposed grades on the drawings.

G. The contractor shall make periodic inspections, at no extra cost, during the guarantee period to determine what changes, if any, should be made in the maintenance program. If changes are recommended, they shall be submitted in writing to the Urban Forestry and Land Manager. Claims by the contractor that the owner's maintenance practices or lack of maintenance resulted in dead or dying plants will not be considered if such claims have not been documented by the contractor during the guarantee period.

17-09 FINAL INSPECTION AND FINAL ACCEPTANCE: At the end of the guarantee period and upon written request of the contractor, the Urban Forestry and Land Manager will inspect all guaranteed work for final acceptance. The request shall be received at least ten calendar days before the anticipated date for final inspection. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Urban Forestry & Land Manager at that time, the Urban Forestry & Land Manager shall certify, in writing, that the project has received final acceptance.

17-10 TURF MAINTENANCE SPECIFICATIONS:

A. Description: Upon beginning a public works construction project, the General Contractor shall initiate and sustain turf maintenance requirements in inaccessible areas until receiving official acceptance at the final inspection. These minimum requirements are stated to insure that the City of Arlington receives a quality end product and an aesthetically acceptable construction area

B. Maintenance Schedules: For the duration of the construction project, the General Contractor will be required to provide lawn maintenance services to the surrounding area. These areas of maintenance are not limited to the project footprint, but also include adjacent medians, rights-of-way and other properties that are difficult to access during construction. Turf areas are to be mowed, trimmed, edged and blown bi-weekly. Regular and consistent maintenance should be provided as described below.

C. Turf Watering:

1. Upon completion of turf installations, the General Contractor should utilize watering trucks to provide a minimum of one inch of precipitation weekly. Environmental changes will dictate how often truck watering is required, but a minimum standard of one inch per week must be maintained. Within the construction area, if previously existing grass, trees, plant material, flower beds etc. are present, the General Contractor is responsible for watering if these areas were currently being watered. These watering expectations will be consistent with newly installed turf areas (1" per week) to ensure proper establishment and healthy turf.

2. Performance measure: **Maintain a consistent and acceptable precipitation rate to sustain healthy turf and plant material.**

D. Mowing and Trimming:

1. Turf areas are to be mowed, trimmed, edged and blown to keep the area in code compliance. Maintenance should be regular and consistent on a fourteen day schedule.

2. Mowing times shall be between the hours of 7:30am and 8:00pm central standard time for each calendar week day.

3. Contractor shall remove all trash and litter from the entire Project Area prior to initiating any mowing of the turf areas.

4. Turf shall be cut at a height of two inches (2") in a professional manner as not to scalp turf or leave areas of uncut grass. Equipment must be operated at a speed to provide the optimal desired "manicured" cut designated by the Urban Forestry & Land Manager.

5. Use of chemicals for trimming and edging is not acceptable.

6. Performance measure: **Mowed area shall be FREE of clumped grass, trash, grass over-hanging the curb, grass in the gutter and along the curb, and tire tracks or ruts from the mowing equipment repaired.**

E. Removal of Grass Clippings:

1. Removal of cut grass from the turf area where growth occurred will not be required unless grass is clumped. Cut grass and debris which falls or is thrown upon the pavement, streets, sidewalks, driveways, adjacent properties, or other hard surface through the action of the work crew shall be removed from the Project Area prior to the exit of the work crew from the work site.

2. The City of Arlington has the authority to issue citations and impose fines beginning at $250 per offense, per Article 2 of the "Industrial Waste and Water Pollution Control" Chapter of the Code of the City of Arlington, as amended.

3. Performance measure: **No visibly cut vegetation on pavement, streets, sidewalks, driveways, adjacent properties, or any other hard surfaces shall be present when the work crew exits the work site.**

F. Trimming:

1. Contractor shall cut and remove of all plant material immediately adjacent to or under Project Area structures, poles, trees (not within 2" of tree trunks), signs, fences, planting beds, etc. This shall also include the removal of all plant material from expansion joints and any other cracks in curbs, sidewalks (both sides), driveways and any other hard surface.

2. Special care shall be given to trimming around small trees as not to inflict damage to the bark of the trees.

3. All trimming shall be accomplished maintaining the required 2" cutting height.

4. All trimming must be accomplished concurrently with mowing operations.

5. Use of chemicals for trimming and edging is not acceptable.

6. Performance measure: **No vegetation taller than existing turf around structures and obstacles.**

G. Edging:

1. All sidewalks, curbs, and steps must be mechanically edged to a one-inch (1") depth and one-quarter-inch inch (1/4") width where they exist exposing the concrete surface. This must be completed before final acceptance will be given by the Urban Forestry & Land Manager.

2. Performance measure: **Visible separation of turf from concrete and no vegetation overhanging onto sidewalks, curbs, steps, drives or other concrete surfaces.**

H. Litter/Debris Removal:

1. Litter pick up is required prior to each mowing.

2. Contractor shall on each visit to a site clean and sweep all paved areas, remove all clippings, bottles, cans, paper, fallen limbs, rocks, and other debris from all site grounds which is not intended to be present as part of the landscape.

3. All trash and litter, including debris in the parking lots, shall be removed by the Contractor and disposed of through their waste disposal provider at an off-site location. Contractor is not allowed to utilize City dumpsters to dispose of collected litter and trash bags, and is therefore solely responsible for pick up and disposal of said litter.

4. Miscellaneous items: Should unique items be found in Project Areas, such as abandoned barrels, roofing materials, appliances, etc., it will be necessary for Contractor to notify city's representative. It will be the responsibility of the Contractor to notify the City of any potential hazardous materials found on site, as well as report any branding on container if possible.

5. Performance measure: **Zero visible litter and debris on finished maintenance areas.**

I. Weed and Pest Control and Chemical Application: In the event of excessive weed growth or pest infestation, the City of Arlington (at its discretion), may require a professional

chemical application. The applicator must be accredited with appropriate licensing and all chemical applications must be approved by the Urban Forestry & Land Manager.

17-11 IRRIGATION EQUIPMENT AND MATERIALS:

A. General:

1. All materials shall be new and without flaws or defects of any type and shall be the best of their class and kind. All materials shall have a minimum guarantee of two year against material defects or defective workmanship.

2. All materials shall be of the brands and types noted on the drawings or as specified herein, or approved by the Urban Forestry & Land Manager as equal. (Rev. 3/09)

3. The irrigation system was designed around equipment manufactured by specific companies as a standard. Approved as equal equipment by other manufacturers may be used only with the approval of the Urban Forestry & Land Manager five days prior to the opening of bids.

4. Submittal of approved equal shall be per the following: If the approved equal deals with any portion of the irrigation system that can affect or alter the hydraulics of said system, the submittal for approved equal shall list the equipment along with the manufacturer's technical design data along with a 24" X 36" plan showing the substitution as well as complete hydraulic calculations. All design work must be prepared by a current State of Texas Licensed Irrigator. Drawings/plans must be signed and sealed and in accordance with current City Ordinances. (Rev. 3/09)

B. Cements, Cleaners/Primers, and Joint Compounds:

1. Cement shall be No. 2200 series Uni-Weld or Rectorseal Gold low temperature plastic pipe cement for use on all sizes and schedules of PVC pipe and fittings. Cement must be NSF approved and meet ASTM D 2564 specifications.

2. Cleaner/primer shall be No. 8700 United Elchem hi-etch cleaner/primer. Cleaner/primer must be any color other than clear.

3. All threaded connections between PVC and metal pipe shall be made using Rectorseal No. 100 virgin heavy duty sealing paste of plasto-joint stick as manufactured by Lake Chemical Company or Teflon tape.

4. All metal to metal connections shall be made using Rectorseal No. 5, slow dry, and soft set pipe thread compound. All PVC-to-PVC threaded connections shall use Teflon tape.

5. "O"-ring gasket and pipe spigot ends shall be lubricated using the lubricant recommended or supplied by the pipe manufacturer. If the pipe manufacturer does not provide a lubricant for the pipe, use IPS Weld-On No. 787 gasket lube as manufactured by Industrial Polychemical Service.

C. Polyvinyl Chloride Pipe (PVC Pipe):

1. Applicable Standards.
   a. ASTM - D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)

   b. ASTM - D2464 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Threaded, Schedule 40

   c. ASTM - D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Socket Type, Schedule 40

   d. ASTM - D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

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

2. Marking and identification of PVC pipe shall be continuously and permanently marked with following information:
   a. Manufacturers' name, size, type of pipe and materials, SDR number, Product Standard number and the NSF (National Sanitation Foundation) Seal.

3. PVC pipefittings shall be of the same material as the PVC pipe specified and compatible with PVC pipe furnished. Solvent weld type shall be Schedule 40.

4. PVC pipe shall be Schedule 40 solvent weld, SDR-PR, PS22-70 for all sizes 1/2″ - 2″.

D. 4″ Pop-Up Bubbler Heads: Bubbler heads shall have a minimum four-inch (4″) pop-up. The sprinkler body on all related parts shall be plaster, cycolac or polycarbonate. They shall have a spring retraction for positive return action of the pop-up nozzle. The spring for retraction and the fixed flow nozzle shall be made of corrosion resistant materials. Four inch (4″) pop-up bubbler heads shall be Rain Bird 1404, 2 - 50 (.5 gal) each side of tree or 1 - 10 (1 gal) on up side of tree. (Rev 6/2016)

E. Drip Irrigation Tubing: Drip tubing shall be used for all landscape beds and the tubing shall be Netafim .9 tubing with 12” spacing. No other tubing or spacing shall be used without the written approval of the Urban Forestry and Land Manager.

F. Wire And Splices: All wire shall be single strand solid copper, minimum 14 gauge with type UF insulation which is Underwriters Laboratory approved for direct underground burial when used in a National Electrical Code Class II Circuit (30 volts AC or less) as per Articles 725 and 300. Voltage drop shall be taken into consideration. All wire shall be color coded so that the common wire shall have white insulation and the signal wires shall have red insulation. All wire connectors shall have a pre-filled insulator tube with a Scotchlok Y or R connector, which, when pressed together, forms a permanent, one-piece, moisture-proof wire splice. All connectors shall be U.L. listed and rated 600 volts

maximum as a wire connector system for use with underground conductors. All direct bury wire splice kits shall be DBY-6 or DBR-6 as manufactured by the Electrical Products Division of 3M Corporation.

G. Swing Joints: Swing joints for quick coupling valves shall be Lasco Model G17B-212 with one-half inch (½″) brass insert stabilizer elbow or approved equal.

H. Ball Valves: Ball valves two inch (2″) and smaller shall be made of PVC, shall have a non-shock rating of 200 psi, shall have ball seals made of teflon, shall have Viton O-rings and threaded end connectors. Ball valves shall be Spears "Safe-T-Shear" compact or approved equal.

I. Flexible PVC Risers (Nipples): All flexible PVC nipples shall be made from virgin PVC material, shall comply with ASTM D2287, and shall be tested at 200 P.S.I. Flexible PVC pipe nipples shall be "Excalibur" or approved equal.

J. Valve Boxes:

1. A box shall be provided for all backflow preventers, electric valves, quick coupling valves, and wire splices. Valve boxes for quick coupling valves and wire splices shall be made of high strength plastic, shall have covers with bolt down or locking mechanisms and shall be colored green or black. Valve boxes for electric remote control valves and backflow preventers or any box located within 10' of any traffic flow shall be made of concrete with a concrete cover and cast iron hinged lid. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve. Extension sections will be used as appropriate to the depth of piping. All boxes shall be set with bricks or extensions under the base of the box. (Rev. 3/09)

2. Electric Valves: Boxes for remote control electric valves two inch (2″) and smaller shall be 65 Series or approved equal as manufactured by Brooks Products, Inc.

3. Quick Coupling Valves: Boxes for quick coupling valves shall be Model 910 or approved equal as manufactured by Carson-Brooks Plastics, Inc. (800) 255-6340.

4. Backflow Preventers: Boxes for backflow preventers two inches (2″) or smaller shall be 65 Series or approved equal as manufacture by Brooks Products, Inc. (817) 465-0080.

5. Wire Splices: Boxes for wire splices shall be Model 910 or approved equal as manufactured by Carson-Brooks Plastics, Inc.

K. Quick Coupling Valves: Quick coupling valves shall be heavy-duty brass construction with a locking purple thermoplastic rubber cover and shall be marked with special "Do Not Drink!" warnings in English and Spanish for use on non-potable systems. Quick coupling valves shall be Rain Bird Model 44 NP or approved equal. They need to be housed in a plastic coupler valve box with a purple lid. Provide two (2) 44k keys and two (2) SH-2

swivel hose ells. Each quick coupler must have a ball valve in front of it to allow quick shut off for leak emergencies.

L. Backflow Preventer: The backflow preventer shall be a double gate valve, double check assembly, shall have all bronze construction, shall be located and sized as shown on the plans, shall be installed in a box and shall conform to City of Arlington's plumbing codes. The backflow preventer shall be Fabio Model 805Y or approved equal.

M. Irrigation Controller; Remote Control Compatible:

1. Electrical Controller: In parks or municipal property where 120 volt, 60 cycle AC is available the controller shall be a Rain Bird ESP – LXME Controller. (Rev. 3/09)

2. Solar Battery Powered Controllers: Use the Hunter XCH battery powered controller with the Hunter solar panel for SC hybrid battery operated controller model SPXCH, on all tree areas. (Rev. 6/2016)

3. All landscape beds use Motorola/Irrinet controls. (Rev. 6/2016)

N. Electric Remote Control Valves:

1. Electric Remote Control Valves shall have plastic bodies and covers and shall be globe-type diaphragm valves. Operation shall be accomplished by means of an integrally mounted heavy-duty 24 VAC or 24 VDC solenoid complying with National Electrical Code, Class II Circuit. A flow stem adjustment shall be included for each valve.

2. 24 VAC: MCplus-B electric remote control valves used with the Irri-Trol MCplus-B controller shall be Rain Bird PGA Series with 24 VAC solenoid as manufactured by the Rain Bird Company.

3. 24 VDC: Valves used with the Hunter XCH battery powered controller are the Rain Bird Valve model DVF. These valves should be coupled with the Rain Bird TBOS potted latching Solenoid model K80920.

4. Drip Irrigation Valves and Pressure Reducers: Drip irrigation valves with pressure reducers and filters shall be Rain Bird XCZ 100 PRS.

17-12 IRRIGATION SYSTEM SPECIFICATIONS:

A. Design Pressure: Irrigation systems shall be designed to operate with a minimum static inlet water pressure at the point of connection to the city water supply as shown on the drawings. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is less than shown on the drawings, the Contractor shall notify the Urban Forestry & Land Manager for instructions as to further action.

B. Contractor Responsibility: The contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or static water pressure exist that

might not have been considered in the design. Such obstructions or differences shall be brought to the attention of the Urban Forestry & Land Manager. In the event this notification is not performed, the contractor shall assume full responsibility for any revision necessary at no additional cost to the Owner.

C. Staking: Before installation begins, the Contractor shall place a stake or flag where each bubbler shall be located in accordance with drawing. Staking shall be approved by the Urban Forestry & Land Manager before proceeding.

D. Piping Layout: Piping layout is diagrammatic. The Contractor shall route piping around existing trees, shrubs and any existing utilities or other underground improvements in such manner as to avoid damage to plantings. The Contractor shall not dig within the ball of newly planted trees or shrubs or in the drip line of mature trees without written approval from the Urban Forestry & Land Manager In areas where trees are present, trenches will be adjusted on site to provide a minimum clearance of ten times the trunk diameter of the tree (at its base) between any tree and any trench. If spacing is limited boring under 24" under the root zone is preferred. (Rev. 3/09)

E. Submittals: The contractor shall submit to the Urban Forestry & Land Manager two (2) copies of shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit, fittings and all other types of fixtures and equipment which will be installed on the job. The submittal shall include the manufacturer's name, model number, equipment capacity and manufacturer's installation recommendation, if applicable, for each proposed item. No partial submittal will be accepted and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Urban Forestry & Land Manager. Shop drawings shall include dimensions, elevation, construction detail, arrangements and capacity of equipment, as well as manufacturer's installation recommendations.

F. Codes/Permits:

1. All work under this contract shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Urban Forestry & Land Manager and shall satisfy all applicable City of Arlington codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this project. Installation of equipment and material shall be done in accordance with the requirements of the National Electric Code, City of Arlington Plumbing codes and standard plumbing procedures. The drawings and these specifications are intended to comply with all the necessary rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Urban Forestry & Land Manager in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these contract documents.

2. The Contractor shall give all necessary notices, obtain all permits and pay all costs (including all costs for water meters and impact fees) and fees in connection with his or her work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for work and deliver to the Urban Forestry & Land Manager before request of final acceptance for the work. The Contractor shall include in the work any labor, materials, services, apparatus or drawings in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

3. The installation of the irrigation system shall be made by an individual or firm duly licensed under Article No. 8751 VTCS, titled "Licensed Irrigators Act," S.B. No. 259, as passed by the 66th Texas Legislature.

G. Existing Utilities:

1. Locations and elevations of various utilities included with the scope of this work have been obtained from the most reliable sources available and should serve as a general guide without guarantee to accuracy. The Contractor shall examine the site and verify to their satisfaction the location and elevation of all utilities, availability of utilities and services required, and their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at their expense, and to the satisfaction of the Urban Forestry & Land Manager, any damage to any utility including existing irrigation systems shown or not shown on the plans. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Urban Forestry & Land Manager for instructions as to further action.

2. Contractor shall make necessary adjustments in the layout to connect to existing stubouts, should such stubouts not be located exactly as shown on the plans. Contractor shall also make necessary adjustments required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Urban Forestry & Land Manager prior to initial acceptance.

H. Record Drawings:

1. Record dimensioned locations and depths for each of the following:
   a. Point of connection to City water supply.

   b. Irrigation pressure line routing. (Provide dimensions for each 100 lineal feet [maximum] along each routing, and for each change in directions.)

   c. Quick coupling valves.

   d. Electric remote control valves.

   e. Control wire routing.

f. Pressure relief valves.

g. Other related items as may be directed by the Urban Forestry & Land Manager.

2. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs or pavements).

3. Record all changes that are made from the Contract Drawings, including changes in the pressure and non-pressure lines.

4. Record all required information on a set of blackline prints of the Drawings. Do not use these prints for any other purpose.

5. Maintain information daily. Keep drawings at the site at all times and available for review by the Owner.

6. Transfer all information to a set of reproducible mylars using permanent India ink when record drawings have been approved by the Owner. Changes using ballpoint pen are not acceptable. Make dimensions accurately at the same scale used on the original drawings, or larger. If photo reduction is required to facilitate controller chart housing, notes or dimensions must be a minimum one-fourth inch (¼″) in size.

7. Reproducible mylars will be furnished by the Owner.

I. Controller Charts:

1. Do not prepare charts until the Urban Forestry & Land Manager has approved record drawings.

2. Provide one controller chart for each automatic controller installed.

3. Chart may be a reproduction of the Record Drawing, if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.

4. Chart shall be black line print of the actual system, showing the area covered by that controller.

5. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire coverage.

6. Following approval of charts by the Urban Forestry & Land Manager, they shall be hermetically sealed between two layers of 20-mil thick plastic sheet.

7. Charts must be completed and approved prior to final acceptance of the irrigation system.

J. Operation and Maintenance Manuals:

1. Provide two individually bound manuals detailing operation and maintenance requirements for irrigation systems.

2. Manuals shall be delivered to the Urban Forestry & Land Manager no later than 10 days prior to initial acceptance of the work.

3. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.

4. Provide the following in each manual:
   a. Index sheet, stating Irrigation Contractor's name, address, telephone number and name of person to contact.

   b. Duration of guarantee period is two years.

   c. Equipment list providing the following for each item:
      1. Manufacturer's name.
      2. Make and model number.
      3. Name and address of local manufacturer's representative.
      4. Spare parts list in detail.
      5. Detailed operation and maintenance instructions of major equipment.
      6. Serial numbers.

   d. The serial number for each irrigation controller and controller enclosure as well as the address for its corresponding electrical service. Contractor shall independently lock each controller and furnish key to Urban Forestry & Land Manager.

K. Electric Power: The Contractor shall be responsible for providing 120 volt, 60 cycle AC electrical power to the irrigation controller whenever it is necessary.

L. Water for Testing: The Contractor shall furnish all water necessary for testing and flushing.

17-13 IRRIGATION INSTALLATION PROCEDURES:

A. General:

1. This section includes installation specifications for all items installed as a part of the irrigation systems. Certain construction procedures or minor equipment installation procedures may have been omitted from these specifications. If no specification, detail or plan provides adequate instructions for installation, the Contractor shall install per the manufacturer’s recommendation.

2. A Licensed Irrigator or Licensed Irrigation Installer shall be present at the project site at all times as work is in progress. The Urban Forestry & Land Manager may demand that work stop until the Contractor provides for a Licensed Irrigator or Licensed Irrigation Installer to be present at the project site and supervising all irrigation work.

3. A pre-construction site observation will be conducted prior to construction to observe conditions and note features which may be considered inoperable or have prior damage.

4. Irrigation plans are diagrammatic due to scale. Significant system modifications required by field conditions are permitted with consent from the Urban Forestry & Land Manager. In no situation shall the Contractor install valves or heads under or in concrete paving areas. In any situation that the plans show a conflict in the actual site conditions, it shall be the Contractor's responsibility to notify the Urban Forestry & Land Manager of the conflict to receive direction. Irrigation work shown on the drawings within tree dripline areas is not diagrammatic, and must be constructed exactly as shown on the drawings.

B. Product Handling: The Contractor shall be responsible for correct procedures in loading, unloading, staking, transporting, and handling all materials to be used in the system. The Contractor shall avoid rough handling which could affect the useful life of equipment. Pipe shall be handled in accordance with the manufacturer's published recommendations on loading, unloading, and storage.

C. Excavation and Trenching:

1. The Contractor shall perform all excavation to the depth indicated in these specifications and drawings. The banks of trenches shall be kept as nearly vertical as practicable. The width of the trenches shall not be greater than necessary to permit proper jointing, tamping, backfilling, bedding or any other installation procedures that may be necessary. Trencher shall be wide enough to allow a minimum of four inches (4″) between parallel pipelines or electrical wiring. Pipes shall not be vertically stacked. Where rock excavation is required, or where stones are encountered in the bottom of the trench that would create a concentrated pressure on the pipe, rock or stones shall be removed to a depth of six inches (6″) minimum below the trench depth indicated. The overdepth rock excavation and all excess trench excavation shall be backfilled with loose, moist earth or sand, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the trench bottom, such shall be removed to a depth and length required, and the trench backfilled to trench bottom grade as hereinafter specified with course sand, fine gravel or other suitable material.

2. Excavation and trenching shall be true to line and at the width and depth specified in other sections of these specifications. The full length of each section of the pipe shall rest solidly upon the pipe bed. Bottom of trench grade shall be continued past ground surface deviations to avoid air pockets and low collection points in the line. The minimum cover specifications shall govern regardless of variations in ground surface profile and the occasional deeper excavation required at banks and other field conditions. Excavation shall be such that a uniform trench grade variation will occur in all cases where variations are necessary.

3. Trench excavation shall comprise the satisfactory removal and disposition of all materials and shall include all shoring and sheeting required to protect the excavation and to safeguard employees.

4. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance back from edge of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be removed from the site as directed by the Urban Forestry & Land Manager. When excavated material is of a rocky nature and the topsoil or any other layer of excavated material is suitable for pipe bedding and backfill in the vicinity of the pipe, such material shall be separately stockpiled for use in such bedding and pipe backfill operations, unless satisfactory imported material is used.

5. All excavations and backfill shall be unclassified and covered in the basic bid. No additional compensation will be allowed for rock encountered.

6. The Contractor shall restore all surfaces and/or existing underground installations damaged or cut as a result of the excavations to their original conditions in a manner acceptable to the Urban Forestry & Land Manager.

D. Depth of Bury:

1. There shall be a minimum of 18 inches and a maximum of 20 inches of cover from proposed grade to top of pipe for all pipe installed in parks and public buildings.

2. There shall be a minimum of 24 inches and a maximum of 36 inches of cover from adjacent top of curb to top of pipe for all pipe installed in street medians. There shall be a minimum of 24 inches and a maximum of 36 inches of cover from adjacent top of curb to top of pipe for all pipe installed in parkways.

E. Pipe and Fittings:

1. Installation of plastic pipe and fittings shall be in accordance with the specifications list within and, when specifications do not clearly depict the scope, install per the manufacturer's recommendation.

2. Caution shall be exercised by the Contractor in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be stored and transported in a vehicle with a bed long enough to allow the pipe to lie flat without subjecting it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged or in any other way found to be defective, either before or after laying, shall be replaced with sound pipe without additional expense to the Owner.

3. Material storage in median areas is not permitted.

4. Before installing the pipe, all rubbish and rocks shall be removed from the trenches. Before installation, the inside of the pipe shall be cleaned of all direct and foreign

matter and shall be kept in a cleaned condition during and after laying of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other foreign substances will enter the pipe or fittings. Where pipe ends are left for future expansion or connections, they shall be valved and capped, as directed on the drawings.

5. All PVC pipe and fittings shall be assembled to permit the pipe or fittings to be joined at the true parallel position of the fitting. Placement of pipe in curving trenches which causes bending and stress on pipe and fittings will not be permitted. No excess piping or fittings shall be permitted in the installation of the system, which may increase pressure loss or potential blockage.

6. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work. Any water which may be encountered or may accumulate in the trenches or excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the trench or excavation free and clear of water during the progress of the work.

7. PVC pipe will expand or contract at the rate of one (1) inch per 100 feet per 10 degrees F change in temperature. Therefore, the pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

8. Unless otherwise specified on the drawings, all piping passing under sidewalks, roadways, parking lots, etc., shall be sleeved in a SCH 40 PVC pipe two sizes larger than the pipe to be sleeved.

9. When more than one pipe is installed in the same trench, at all times the four (4)-inch separation shall be maintained.

10. PVC pipe and fittings shall be assembled with the following requirements:
    a. Solvent. Use only solvent recommended by manufacturer to make solvent-welded joints following standards noted herein. Thoroughly clean pipe and fittings of dirt, dust and moisture with an approved PVC primer before applying solvent.

    b. PVC to Metal Connection. Work metal connections first. Use a non-hardening pipe dope such as Permatex No. 2 or "Teflon" tape on threaded PVC to metal joints. Use only light wrench pressure.

    c. Threaded PVC Connections. Where required, use threaded PVC adapters into which pipe may be welded.

11. After all irrigation piping, risers, valves, thrust blocks, etc., have been installed and partially backfilled as specified in other parts of these specifications, the control valve shall be opened and a full head of water used to flush out the system. After the system is thoroughly flushed, risers shall be capped off and the system pressure tested in

accordance with the testing section of these specifications. At the conclusion of the pressure test, the heads shall be installed and the backfill operation completed. No backfill shall occur before the Urban Forestry & Land Manager inspects the piping and approves the work.

F. Solvent Welding:

1. PVC plastic pipe shall be squarely cut.

2. Burrs left from cutting shall be wiped off with a clean, dry cloth.

3. Utilizing a colored cleaner/primer, thoroughly clean the mating pipe end and the fitting socket with a clean dry cloth.

4. Apply a uniform coat of solvent cement to the outside of the pipe end with a non-synthetic brush or dauber.

5. In like manner, apply a thin coating of solvent cement to the inside of the fitting socket.

6. Re-apply a light coat of solvent cement to the pipe and quickly insert it into the fitting to the full depth of the fitting socket.

7. Rotate the pipe or fitting approximately 1/4 turn to insure even distribution of the solvent cement.

8. Hold in position for approximately 30 seconds.

9. Wipe off any excess solvent cement that forms as a bead around the outer shoulder.

10. Care should be taken so as not to use an excess amount of solvent cement that could cause burrs or obstructions to form on the inside of the pipe joint.

11. Solvent weld joints shall be allowed to cure for at least 24 hours before pressure is applied to the system.

G. Tree Bubbler Heads: Each tree shall have two bubblers each they must be placed one must be placed on the upward slope of the tree and the other on the side of the tree that is on the inner median side. No bubblers may be placed on the lower slope or curb side of the tree. The bubbler placement should allow full water flow to cover the entire rootball. All bubblers must be hard piped in; no funny pipe is allowed.

H. Drip Irrigation Tube: The Netafim .9 tubing shall be placed 12” apart and stapled down to keep the tubing from rising up and popping up through the mulch. The emitters shall be triangulated providing optimum watering. Each drip zone must have at least one air release valve at the end of the run.

I. Ball Valves: Each zone shall have a ball valve in front of it to shut down only that section if a repair must be made.

J. Backfilling:

1. Underground inspection shall be made after trenches or ditches are excavated, piping and control wiring installed and before any backfill is put in place in accordance with current City Ordinance. After completion and acceptance of the hydrostatic test, wiring and piping inspection for a particular section of the irrigation system, the backfill operation can be completed. (Rev. 3/09)

2. All backfill material shall be subject to approval by the Urban Forestry & Land Manager. Backfill material shall be free from rubbish, rock large stones, brush, sod, frozen material or other unsuitable substances that may damage pipe during the backfilling operations.

3. In the event that the material from the excavation or trenching is found to be unsuitable for use in backfill, it shall be removed from the site and properly disposed of by the Contractor and at the Contractor's expense. The Contractor shall then, at no additional cost to the Owner, arrange for, purchase, and furnish suitable backfill material consisting of earth, loam, sandy clay, sand, or other approved materials free of large clods of earth or sharp stones.

4. Backfill shall be placed in horizontal layers "lifts" not exceeding six (6) inches in depth and shall be thoroughly tamped, rolled or otherwise compacted. Backfill shall be placed to the original ground level or to the limits the installer feels that total settlement in three (3) months shall be flush to finish grade. If settlement of trenches below finished grade occurs any time within the two-year warranty period, it shall be the Contractor's responsibility to refill trenches and re-seed or sod the repaired areas. The Contractor shall be notified in writing of areas that have settled, and the Contractor shall fix the settled ditches within five (5) working days.

K. 4″ Pop-Up Bubbler Heads: Contractor shall provide heads and nozzles as specified and install in locations as shown on the drawings. Pop-up bubbler heads shall be installed on a flexible PVC nipple directly on to lateral piping as detailed on drawings/plans. Heads shall be installed with the top of head flush with the finished grade. Contractor will be required to adjust heads as necessary after establishment of trees so that bubblers are located inside tree wells and away from curbside. In areas where slope is prominent, install heads on the high side of the tree.

L. Irrigation Heads:

1. Irrigation heads shall not utilize above-ground spray emission devices in landscapes that are less than 60 inches not including the impervious surfaces in either length or width and which contain impervious pedestrian or vehicular traffic surfaces along two or more perimeters. Qualifying areas less than 60 inches may be irrigated utilizing subsurface or drip irrigation, pressure compensating tubing, or be designed without irrigation. If pop-up sprays or rotary sprinkler heads are used in a new

irrigation system, the sprinkler heads must direct flow away from any adjacent surface and shall not be installed closer than 4 inches from a hardscape, such as, but not limited to, a building foundation, fence, concrete, asphalt, pavers, or stones set with mortar in accordance with current City Ordinances. Heads shall be installed in the vertical positions, hand backfilled, and compacted to near original density. Spray heads must be Rain Bird 1800 PRS Series with Rain Bird MPR fixed pattern spray nozzle. Any rotors will be Rain Bird 5000 Series PRS. (Rev.6/2016)

2. Irrigation head spacing shall not exceed the spacing shown on the drawings and shall be in the approximate locations and configuration as shown on the drawings. Contractor shall verify area dimensions while staking irrigation head locations. Irrigation heads shall be spaced so that they are equal distance from one another for the given lengths and widths of the area to achieve uniform coverage.

3. After all piping and risers are in place and connected, and before installation of the irrigation heads, all control valves for a given section shall be fully opened and a full head of water shall be used to flush out the system.

4. If water pressure without the heads installed is not sufficient to provide adequate water flow from end risers, the Contractor shall cap off enough heads closest to the water source to provide adequate flushing of the end riser assemblies.

M. Electrical Remote Control Valves and Valve Boxes:

1. All electric remote control valves shall be of the type and size as indicated on the drawings and shall be installed where shown on the drawings, following the published recommendations of the manufacturer and in accordance with these specifications and drawings.

2. A ball valve and remote control electric valve, in that order or as detailed on the drawings, shall be installed in a rectangular valve box as specified and shall be set with a minimum of six inches (6″) of space between their top surface and the bottom of the valve box. Valves shall be fully opened and fully closed to ensure that all parts are in operating condition. Valve boxes shall be set plumb, vertical and concentric with the valve stem with top of box flush with finished grade. Any valve box which has moved from this required position after final acceptance and during the guarantee period shall be reset by the Contractor at his or her own expense.

3. Any DC-powered system must provide automatic valve DC latching solenoids at no additional cost to Owner.

4. The valve boxes shall be locking and of the size and type as shown on the drawings. Valve boxes shall be installed as shown on the drawings.

5. Valve wire splices shall be waterproofed using dry splice connectors. The Contractor shall leave 24 inches of wire coiled to facilitate raising the wire out of the valve box for repairs.

N. Quick Coupling Valves: Quick coupling valves shall be installed on a swing-joint assembly as detailed on the drawings. Under the warranty, the Contractor shall return after grass is established and adjust the valve boxes to the proper grade.

O. Mainline Manual Drain Valves:

1. No 90º ells shall be accepted or used in mainlines. Mainlines are "all pipe downstream of water meter and upstream of station valves".

2. If shown on plan, manual drain valves of the size and type indicated on the drawings shall be installed at all low points of mainline piping, or at any other points that may be indicated on the irrigation system drawings or indicated elsewhere in these specifications.

P. Sleeved Crossings and Electrical Conduit:

1. Sleeves and electrical conduits shall be installed as noted on the drawings. Contractor shall be responsible for locating all sleeves and conduits at no additional cost to the Owner.

2. Unless otherwise noted on drawings, all piping installed under sidewalks, roadways, parking lots, etc., shall be one, 4" sleeve for both wire and pipe.

3. Every effort shall be made by the Contractor to install sleeving prior to the pouring or construction of the sidewalks, roadways, parking lots, etc. If prior sleeving is not possible, all crossings must be bored unless written authorization for an open cut is obtained from the Urban Forestry & Land Manager. Reference typical irrigation sleeve under paving.

Q. Thrust Blocks: Thrust blocks shall be constructed at all direction changes and/or termination points, or at any point of the system that will result in an unbalanced thrust. Thrust blocks shall be poured against undisturbed earth and in accordance with the drawings and details. Do not obstruct the outlets of fittings that are intended for future connections.

R. Controller Enclosure: The Contractor shall install the enclosure according plan and manufacturer specifications. The Contractor shall provide, in the controller enclosure, one (1) ground fault interrupter duplex receptor, the clock and all sensors required by the manufacturer and ordinances.

S. Controller:

1. The controller location is indicated on the drawings. The Contractor shall be familiarized with the requirements of making power connections. Installation shall be performed by a licensed electrician. The electrical power for the controller shall be considered a part of this contract but bid as an incidental item to the controller, and is not a pay item.

2. The controller shall be mounted and wired according to the manufacturer's recommended procedures and as specified in these specifications and on the drawings.

3. Electric control valves shall be connected to controller in the numerical sequences as shown on the drawings.

4. Controller shall be installed in a locking controller enclosure as specified on the drawings.

5. In situations where a computerized central controller system is utilized, the Contractor is responsible for providing and installing the flow sensor wire to the water meter or electronic valve.

6. Contractor shall provide a green wire for the common flow wire, and a blue wire for the pulse signal on the flow meter. Ground wire and rod shall be installed inside the controller pedestal.

7. All wiring is subsidiary to controller installation.

T. 24-Volt Control Valve Wiring:

1. All control wire less than one thousand feet (1,000′) in length shall be continuous without splices or joints from the controller to the valves. Connections to the electric valves shall be made within eighteen inches (18″) of the valve using connectors specified. ALL wire splices shall be covered with a valve box. All wire passing under existing or future paving, sidewalk, construction, etc., shall be encased in PVC Schedule 40 conduit extending at least thirty-six inches (36") below the top of curb..
2. All wire installation procedures as described herein shall be checked to conform to local electrical codes.

3. All wire used for the 24 volt wiring from the controller to the electric control valves shall be type "UF", 600 volt, solid copper, single conductor, PVC insulated and bear UL approval for direct burial underground feeder cable. Unless otherwise specified on the drawings, the 24 volt common wires shall be wire No. 12 AWG and the remaining 24 volt control wires shall be No. 12 AWG, and of colors other than white. These colors shall be noted on the "as-built" record drawings.

4. The Contractor shall install the 24 volt control valve wiring in the same trench as the irrigation system mainline. In no situation shall the wire be installed above the spring line of the mainline. The wires shall be laid loose in the trench to allow for contraction. Control wires shall be taped together in 10'0" increments.

5. Wire splices, other than at valve box locations, shall be kept to a minimum. If needed, they shall be made only at common splice points and placed in a concrete valve box, reference irrigation electric valve detail. The location of these wire splice boxes shall

be shown on the "as-built" record drawings. No buried wire splices shall be permitted. All wire splices shall be made waterproof using dry splice connectors.

6. In no case shall wires of different colors be spliced together.

7. Control wires shall be identified with E-Z Coder WDR Series Tape at each valve and at the controller and at splices. Valves shall be numbered on the "as-built" record drawings.

8. All wiring shall be subsidiary to control valve installation.

U. 120 Volt Controller Power Wiring:

1. The Contractor shall familiarize himself/herself with the work required to complete this portion of the installation. All 120 volt wiring shall be installed in accordance with State and local electrical codes and regulations. The 120 volt service shall consist of one black and one white wire. The neutral wire must be bonded. All wiring is subsidiary to project.

2. Contractor shall provide and install 120 volt power to the controller location. All electrical work shall be performed by a Licensed Electrician.

V. Hydrostatic Tests:

1. Upon completion of the irrigation system's mainline; the entire mainline shall be tested for a four (4) hour period at 100 psi. Prior to testing, the mainline shall be partially backfilled, leaving all joints and connections exposed for visual observation. All dirt shall be flushed from the system and the line filled with water to remove air. The mainline shall be brought to static pressure. A pressure gauge and temporary valve shall be installed at the end of the mainline to permit hydrostatic pressure to be applied to the main. A pressure of 100 psi must be retained for a four (4) hour period. Any leaks resulting in the four (4) hour pressure test shall be repaired and the system retested until the system passes the test.

2. Upon completion of the irrigation mainline, all lateral irrigation piping must be pressure tested for one (1) hour at 100 psi. The procedure shall be the same as used for the mainline. If after one (1) hour no visual leakage has occurred and the 100-psi pressure has been retained, the heads shall be installed, and the backfill operation completed. Any leaks resulting from the hydrostatic test shall be repaired and the system retested until the system passes the test.

W. Final Adjustment:

1. After installation has been completed, the Contractor shall make final adjustment of irrigation system prior to Urban Forestry & Land Manager final inspection.

2. The Contractor shall completely flush system to remove debris from lines by removing bubbler head nozzles and turning system on.

3. After lateral lines have been thoroughly flushed, the Contractor shall replace nozzles and check each bubbler for proper operation.

4. The Contractor shall operate each section as long as necessary to insure all bubblers are working properly.

17-14 IRRIGATION METERS AND WATER ACCOUNT: Contractor will be responsible for payment of the impact fee and activation fee for the irrigation meter(s) on this project. Contractor shall establish the water account under their name and inform the Water Customer Care representative that the meter(s) are for a City's project and that it will later be owned by the Parks and Recreation Department. Once the irrigation system is tested, inspected, and accepted by the Parks and Recreation Department, the Parks and Recreation Department will have the water account transferred to the City. A bid item is included in the PROPOSAL for reimbursement of this expense. (Rev. 6/2016)

END OF SECTION