32 93 00 – Plants

1. Introduction

A. This Construction & Design standard covers planting guidelines to be used in conjunction with other related sections listed below:

   32 01 90       Operation and Maintenance of Planting
   32 01 90.13    Fertilizing
   32 01 90.23    Pruning
   32 01 90.26    Watering
   32 90 00       Planting
   32 91 00       Planting Preparation
   32 91 13       Soil Preparation
   32 91 13.26    Mulch
   32 93 13       Groundcovers
   32 93 43       Trees

B. Designers should coordinate with Duke University Landscape Services (LS) to coordinate selection and execution requirements for Plants.

2. References


C. Interpretation of plant names and descriptions shall reference the following documents. Where the names or plant descriptions disagree between the several documents, the most current document shall prevail.

1. USDA - The Germplasm Resources Information Network (GRIN) http://www.ars-grin.gov/npgs/searchgrin.html


3. **Definitions**

A. Container Plant: Plants that are grown in or are currently in a container including boxed trees.

B. Defective Plant: Any plant that fails to meet the plant quality requirement.

C. End of Warranty Final Acceptance: The date when the Owner’s Representative accepts that the plants and work meet all the requirements of the warranty.

D. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar’s horticultural description, adjusted for the planting site soil, drainage and weather conditions.

E. Kinked Root: A root within the root package that bends more than 90 degrees.

F. Maintenance: Actions that preserve the health of plants after installation.

G. Maintenance Period: The time period which the Contractor is to provide maintenance.

H. Normal: The prevailing protocol of industry standard(s).

I. Owner’s Representative: Person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner’s Representative may appoint other persons to review and approve any aspects of the work.

J. Root Ball: Mass of roots including any soil or substrate that is shipped with the plant within the root ball package.

K. Root Ball Package. Material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for shipping.

L. Root Collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

M. Shrub: Woody plants with mature height approximately less than 15 feet.

N. Substantial Completion Acceptance: The date at the end of installation where the Owner’s Representative accepts that all work in these sections is complete and the Warranty period has begun.

4. **Design Standards**

A. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 “American Standard for Nursery Stock” latest edition.
B. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is required.

C. Root Ball Package Options: The following root ball packages are permitted.

1. Balled and Burlapped (B&B) Plants
   a. All B&B Plants shall be field grown, and the root ball packaged in a natural fiber burlap and natural fiber twine and/or natural fiber burlap and wire basket package.
   b. Plants shall be harvested with the following modifications to standard nursery practices.
      (1) If wire baskets are used to support the root ball, a “low profile” basket shall be used. A low profile basket is defined as having the top of the highest loops on the basket no less than 4 inches and no greater than 8 inches below the shoulder of the root ball package.
      (2) At nurseries where sandy soils prevent the use of “low profile baskets”, baskets that support the entire root ball, including the top, are allowable.

2. Container (Including Above-Ground Fabric Containers and Boxes) Plants
   a. Container plants may be permitted only when approved by the Owner’s Representative.
   b. Plants shall be established and well rooted in removable containers.
   c. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

3. Bare Root Plants
   a. Harvest bare root plants while the plant is dormant and a minimum of 4 weeks prior to leaf out (bud break).
   b. The root spread dimensions of the harvested plants shall conform to ANSI Z60.1 for nursery grown bare root plants for each size and type of plant. Just prior to shipping to the job site, dip the root system into a slurry of hydrogel (cross linked polyacrylamide) and water mixed at a rate of 15 oz. of hydrogel in 25 gallons of water. Do not shake off the excess hydrogel. Place the root system in a pleated black plastic bag and tie the bag snugly around the trunk. Bundle and tie the upper branches together.
c. Keep the plants in a cool dark space for storage and delivery. If daytime outside temperatures exceeds 70 degrees F, utilize a refrigerated storage area with temperature between 35 and 50 degrees.

d. Where possible, plan time of planting to be before bud break.

D. Annual Flowering and Seasonal Color Plants

1. Container or flat-grown plants should be sized in the planting plan and free from defects or disease. Plants shall be well-rooted and healthy.

5. Documentation and Review Requirements

A. Plant growers’ certificates are required for all plants indicating that each meets the requirements of the specification, including the requirements of plant quality, to the Owner’s Representative for approval. Provide submittal eight weeks before the installation of plants.

1. The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these requirements. Regardless of the work of previous growers, the plant’s root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots and that the plant has been grown and harvested to produce a plant that meets these guidelines.

B. Product samples for Owner’s Representative approval should be labeled to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.

C. Plant sources for all plants to be submitted to the Owner’s Representative for approval.

D. Nursery Certificate and/or Nursery License for each source of plant material.

E. Plant maintenance data and requirements.

F. Warranty period site visit record: If there is no maintenance during the warranty period, after each site visit during the warranty period by the Contractor shall submit a written record of the visit, including any problems, potential problems, and any recommended corrective action to the Owner’s Representative for approval.
G. Installation (Logistics) plan submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.

H. Selection and Observation of Plants

1. The Owner’s Representative may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.

2. Plant Selection: The Owner’s Representative reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications. If a particular defect or substandard element can be corrected at the nursery, as determined by the Owner’s Representative, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements. Any work to correct plant defects shall be at the contractor’s expense.

   a. The Owner’s Representative may make invasive observation of the plant’s root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.

   b. Corrections are to be undertaken at the nursery prior to shipping.

   c. Submit to the Owner’s Representative, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements.

3. The Owner’s Representative may choose to attach their seal to each plant, or a representative sample. Viewing and/or sealing of plants by the Owner’s Representative at the nursery does not preclude the Owner’s Representative’s right to reject material while on site. The Contractor is responsible for paying any up charge for the Owner’s Representative to attach their seal to specific plants.

4. Where requested by the Owner’s Representative, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Owner’s Representative via photograph does not preclude the Owner’s Representative’s right to reject material while on site.
I. Plant Substitutions For Plants Not Available

1. Submit all requests for substitutions of plant species, or size to the Owner’s Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

6. Installation and Performance Requirements

A. For planting requirements refer to 32 90 00 Planting.

B. Site Conditions

1. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner’s Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

   a. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner’s Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner’s Representative of such conditions, he/she shall remain responsible for plant material under the warranty clause of these guidelines.

2. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Owner’s Representative.

3. Actual planting shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practices.

   a. Do not install plants into saturated or frozen soils. Do not install plants during inclement weather, such as rain or snow or during extremely hot, cold or windy conditions.

C. Plant Quality:

1. Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant.
2. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified.

3. Plant Quality At or Below The Soil Line:
   a. Plant roots shall be normal to the plant type. Root observations shall take place without impacting plant health. Root quality at or below the soil line shall comply with the following:
      (1) Roots shall be reasonably free of scrapes, broken or split wood.
      (2) The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.
      (3) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
      (4) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.
      (5) The root collar shall be within the upper 2 inches of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.
      (6) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
      (7) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

D. Installation of Plants:
   1. Observe each plant after delivery and prior to installation for damage or other characteristics that may cause rejection of the plant. Notify the Owner’s Representative of any condition observed.
   2. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.
3. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Owner’s Representative to meet these quality standards.

   a. Modifications, at the time of planting, to meet the requirements for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner’s Representative may choose to reject the plant rather than permitting the modification.

   b. The resulting root ball may need additional staking and water after planting. The Owner’s Representative may reject the plant if the root modification process makes the plant unstable or if the plant is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty.

   c. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.

4. Container Root Ball Shaving: The outer surfaces of ALL plants in containers including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

5. Exposed Stem Tissue After Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.

E. Plants larger than specified may be used if acceptable to the Owner’s Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.

F. Plant Warranty

1. The Contractor agrees to replace defective work and defective plants. The Owner’s Representative shall make the final determination if plants meet the guidelines or that plants are defective.
2. Plants warranty shall begin on the date of Substantial Completion Acceptance and continue for the following periods, classed by plant type:
   a. Trees – 1 Year.
   b. Shrubs – 1 Year.
   c. Ground cover and perennial flower plants – 2 Years.
   d. Bulbs, annual flower and seasonal color plants – for the period of expected bloom or primary display.

3. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant shall terminate at one time.

4. All plants shall be warrantied to meet all the requirements for plant quality at installation. Defective plants shall be defined as plants not meeting guideline requirements. The Owner’s representative shall make the final determination that plants are defective.

5. Plants determined to be defective shall be removed immediately upon notification by the Owner’s Representative and replaced without cost to the Owner, as soon as weather conditions permit and within the specified planting period.

6. Any work to correct plant defects including the removal of roots or branches, or planting plants that have been bare rooted during installation to observe for or correct root defects shall not be considered as grounds to void any conditions of the warranty. In the event that the Contractor decides that such remediation work may compromise the future health of the plant, the plant(s) in question shall be rejected and replaced with plants that do not contain defects that require remediation or correction.

7. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements of this guideline. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.

8. The warranty of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended warranty period, the Owner’s Representative may elect one more replacement of plant(s) or credit for each. These tertiary replacement items are not protected under a warranty period.

9. During and by the end of the warranty period, remove all tree wrap, ties, and guying unless agreed to by the Owner’s Representative to remain in place. All trees that do
not have sufficient caliper to remain upright, or those requiring additional anchorage in windy locations, shall be staked or remain staked, if required by the Owner’s Representative.

10. End of Warranty Final Acceptance

a. The Owner’s Representative shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.

b. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.