



APPENDIX
EXTERIOR IMPROVEMENTS

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EXTERIOR IMPROVEMENTS STANDARDS AND GUIDELINES

32.1 STANDARDS AND RESOURCES

A. Utilize the latest edition of the following standards and resources for projects:

1. North Carolina Department of Transportation; Standard Specifications for Roads and Structures.
2. North Carolina; Erosion and Sediment Control Planning and Design Manual (NCDENR)
3. ANSI Z133 Safety Requirements for Arboricultural Requirements.
4. ANSI Z601; American Standards For Nursery Stock.
5. ANSI A300; Tree, Shrubs, and Other Woody Plant Management.
6. American Association of Nurserymen; American Standard for Nursery Stock.
7. International Society of Arboriculture (ISA).
8. American Joint Committee on Horticultural Nomenclature; Standardized Plant Names
9. Council of Tree and Landscape Appraisal; Guide for Plant Appraisal.
10. National Arborist Association; Tree Care Standards.
11. American Wood Protection Association (AWPA) Standards
12. City of Charlotte; Tree Ordinance Guidelines.
13. City of Charlotte; Erosion and Sedimentation Control Ordinance.
14. NCDA; Crop Fertilization Based on NC Soil Tests.

32.1 DEFINITIONS

A. Exterior Improvement Definitions:

1. Anit-Desiccant: Material applied to plant surfaces for retarding excessive loss of plant moisture and inhibiting wilt. Emulsion to provide a film over plant surfaces permeable enough to permit transpiration.
2. Branch Collar: Wood tissue that forms around the base of a branch between the main stem and the branch. Usually, as a branch begins to die, the branch collar begins to increase in size.
3. Caliper: Diameter of a tree six (6) inches above the ground for trees less than four (4) inches and twelve (12) inches above the ground for trees greater than four (4) inches in diameter.
4. Cambium Layer: Growing point between the bark and sapwood.
5. Closure: Refers to the roll of the wound wood growth around the wounded area.
6. Critical Root Zone (CRZ): Area of undisturbed ground, which contains sufficient roots to preserve a tree's health. Determined by calculating the area with a radius in feet equal to one 12 (12) inches in length for each one (1) inch of trunk diameter measured at Breast Height (54 inches above grade). When an area of ground cannot be protected in a circle of this radius, the CRZ area may be defined as an asymmetrical shape of the same size.
7. Cut, The: The exposed wood area that remains after the branch has been removed.
8. Cut Back: Specified reduction of the overall size of the tree or individual branches but may include the overall reduction of the sides as well as the top of the tree.
9. D.B.H.: Diameter of a tree 54 inches above the average ground line.
10. Dormant: A condition of non-active growth. Deciduous trees are considered to be dormant from the time the leaves fall until new foliage begins to appear.
11. Elevating: The removal of lower branches for under-clearance.
12. Existing Soils: A naturally occurring soil that has not been relocated or was present on site before construction. Shall be natural, fertile, agricultural topsoil, capable of sustaining vigorous plant growth.
13. Girdling Roots: Located above or below ground level; circular growth around the base of the trunk or over the individual roots applies pressure to the bark area, thereby choking or restricting the flow of sap.

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14. Heading Back: The cutting back of terminals of a temporary limb or branch to a lateral branch or bud to slow its growth, while allowing it to produce food resources for the tree. This is a common nursery practice.
15. Lifting: The removal of lower branches for under-clearance or sight line issues.
16. Parent Stem: The main trunk system of the tree.
17. Planting Medium/Mix, Acceptable: A soil mix developed by amending the existing soil or removing the existing soil and replacing with new soil mix (as defined in SOILS). Soil mix shall be of uniform composition throughout, with admixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter.
18. Precut or Pre-cutting: The removal of the branch at least six (6) inches beyond the finished cut to prevent splitting into parent stem or branch.
19. Pruning: The removal of dead, dying, diseased, or live, interfering objectionable and weak branches in a scientific manner.
20. Sap Flow: The definite course assumed by sap in its movement through a tree.
21. Scars or Injuries: Natural or man-made lesions of the bark in which wood is exposed.
22. Small Tree: May be a small maturing (less than 35 feet at maturity) or large maturing tree (more than 35 feet at maturity). This can be either a single trunk or multiple trunk specimens. Limbing needs will be determined by Grounds Superintendent or designee.
23. Suckers: Abnormal growth of small branches usually not following the general pattern of the tree.
24. Temporary Limb: A limb left on a small tree to provide for tree growth until permanent scaffold limbs and adequate top limbs are developed. If large, they are headed back to prevent their challenging the desired terminal for dominance.
25. Thinning Out: The removal of live branches to reduce wind resistance and to create more space.
26. Topsoil: Native soil on site or natural soil harvested from another site than naturally has the texture and composition to meet the specification described under Soils, and is free of noxious weed seed, shall constitute an Acceptable Planting Media (APM).
27. Topping: Pruning practice that results in more than one-third of the foliage and limbs being removed. This includes pruning that leads to the disfigurement of the normal shape of the tree.
28. Tracing: Careful cutting of the bark along the lines of sap flow to encourage wound closure.
29. Tree Training: Pruning young trees in a specified manner to shape their growth in keeping with their genetically determined natural form and the urban requirements immediately surrounding them.
30. Trimming: The same as pruning.
31. Water Breaker: A hose end device used to diffuse a stream of water.
32. Wound Wood: New growth made by the cambium layer around all of a wound.

32.3 DRAWINGS

- A. In addition to the requirements outlined in the University's BIM Standards, including the following on drawings:
 1. Property lines
 2. Setback/side yard lines(s)
 3. Clearly distinguish between existing and proposed conditions. (i.e., contours, structures, etc.)
 4. Survey of existing trees (size and species)
 - a. Trees preserved, show tree protection fencing with dimensions from tree(s)
 - b. Tree preservation notes on grading and erosion control plans
 - c. Existing and proposed overhead and underground utilities
 - d. Existing and proposed irrigation systems
 5. A complete planting material legend including but not limited to planting material, plants, trees, turf, sod, and seeding.
 6. Distinguish between areas receiving material such as topsoil and planting mix.
 7. Erosion Control Drawings: Provide proposed measures, denuded limits delineated, denuded acreage listed, denuded on and offsite drainage areas

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8. Landscaping: Provide notes, electrical line distribution, transmission lines, poles present, staking plan or dimension key landscape areas, locate and label propose trees, plantings, grasses, mulches, and hardscape materials.

32.4 PAVING

- A. Curbs and Gutters: Cast-in-place concrete shall be used unless other design is required to match existing conditions. Show expansion joints on drawings.
- B. All Asphalt scraps from paving or repair projects are to be recycled.
- C. Protection of Asphalt Surface Course: Upon completion of surface course, vehicular traffic and parking is prohibited until surface is fully cured.
- D. Depressions and abutments to existing pavement shall be repaired by cutting out the surfacing to a minimum depth of one inch with vertical cuts, filling, and rolling the areas. Feathering of patches and abutments to existing pavement is prohibited.
- E. Curbs shall pitch to catch or release water as required by adjacent paving grades.
- F. Parking Lot Marking Spacing: Parking layout design shall utilize dimensional requirements as approved by UPM and in compliance with University standards. Parking spaces shall be marked with double lines.

32.5 LANDSCAPE IRRIGATION SYSTEM

- A. Provide underground sprinkler system as a complete unit produced by a single manufacturer for work, including heads, drip lines, valves, piping circuits, controls, and accessories.
- B. Verify exact locations of underground utilities prior to work.
- C. Tree protection and preservation required.
- D. PVC Pipe and Fittings: Pipe specified shall be virgin high-impact Polyvinyl Chloride (PVC) pipe having a minimum working pressure rating of Class 200 up to and including 1-¼ inches and Class 160 or pipe above 1-¼ inches. PVC pipe shall be continuously and permanently marked with manufacturer's name, material size, and schedule. Materials shall conform to US Department of Commerce Commercial Standards. Fittings to be used on specified PVC pipe shall be Schedule 40 PVC, Type 1, and must be made in the USA. Fittings shall be identified as to pressure rating or schedule.
 1. Solvent for use on PVC pipe and fitting shall be of a type approved by the manufacturer of the pipe. Primer shall be purple primer by the same manufacturer as solvent. Solvent and primer application shall be in accordance with the manufacturer's recommendations. Excessive solvent and primer within and outside of the pipe is unacceptable.
- E. Risers and Swing Joint Nipples: Pipe risers ¾ to 1 inch shall be non-plasticized polyvinyl chloride, Schedule 80 threaded pipe. Fittings on risers shall be PVC Schedule 80 threaded elbows. If the plan shows a non-PVC riser, compatible fittings to the riser specified shall be used.
- F. Irrigation Valves: Irrigation valves shall be molded valves with 24-volt solenoid as per the Equipment List noted on the drawings. Valves shall be globe type operated by low-voltage solenoids normally closed, manual flow adjustment.
- G. Backflow Preventer: Provide backflow preventer. Irrigation point of connection is downstream side of the meter. Backflow preventer shall be installed by a licensed plumber or irrigation specialist and shall comply with state and local codes. Backflow preventer selection and installation is to meet or exceed local and state codes, and manufacturer's recommendations.
- H. Meters: Irrigation specialist shall coordinate with Facilities Management/HVAC Supervisor, through Project's UPM, for the installation of the irrigation meter(s) and shall be responsible for all costs and fees associated. Meters and valves installed in public right-of-way shall be installed below-grade. Meter size(s) shall be as indicated on the drawings and part of the record documents.

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- I. Sprinkler Heads: Full and part circle sprinklers shall be of the fixed spray or gear driven variety as is specified on the plans. These sprinklers shall be of the pop-up type with spring retraction. The sprinkler shall be easily serviced from the top. It shall have an accessible screening device and shall perform to the manufacturer's specifications with regard to the diameter of throw and applied volume at a given pressure. Spacing of heads shall not exceed the manufacturer's maximum recommendation. No over spray shall be allowed to encroach on roadways or sidewalks. All pipes crossing under any streets shall be enclosed in a PVC sleeve as noted on plan. Pipe shall be Schedule 80 PVC, Type 1, and must be made in the USA.
- J. Valve Covers, Sleeves, Boxes: Fiberglass or concrete boxes with fiberglass type covers capable of withstanding lawn tractor traffic. Basis of Design: Ametec. Systems shall be approved by University's Grounds through Project's UPM and installed to prevent unnecessary watering after substantial rainfall.
- K. Drainage Backfill: NCDOT number 78M washed stone.
- L. Automatic Control System: Furnish automatic controller as specified in the Equipment List, including 24-volt timer and all connection devices. Electrical hook-up to the controller shall be by others.
- M. Exterior Control Enclosure: Manufacturer's standard weatherproof enclosure with locking cover, complying with the NFPA 70 (National Electric Code).
- N. Control Lines Hydraulic: All control tubing shall be polyethylene tubing. All control tubing shall be rated for a minimum continuous working pressure of 200 psi and have a ¼ inch O.D. + .003 inch. Tubing connections shall be brass compression couplings or tees utilized self-aligning brass ferrules, secured by ¼ inch plastic retainers.
- O. Electrical Installation: Electric control lines from each controller to the automatic valves shall be direct burial UF wire of a different color than the black and white wires used on the 115-volt A.C. power. All 24 V.A.C. single strand wire shall be a minimum of 14-gauge, direct burial. Where multi-connector wire is used; it shall be a minimum of 18 gauge. Manufacturer's recommendations shall be followed concerning waterproofing all connections. The joining of all underground wires shall be by the use of direct burial splice kits. Splices shall be waterproof. In all cases wire shall be adequately sized to avoid excessive voltage drop.
- P. Quick Coupling Valves and Keys: Quick coupling valves and keys shall be as specified on the drawings. Mount on galvanized pipe triple swing joints. A minimum of two keys with swivel ell adapters will be given to the University's Grounds through Project's UPM. Quick couplings shall be stacked with a ¼ inch steel bar and secured with minimum two (2) hose clamps.
- Q. Field observations are required by Landscape Architect of Record.
- R. Staking of sprinkler locations to be approved by the Project's UPM.
- S. It is the Contractor's responsibility to locate and to protect all utilities including irrigation. Any damage to utilities including irrigation shall be corrected and paid for by the Contractor. Damage must be repaired within forty-eight hours of occurrence. All excavation shall be unclassified and shall include all materials encountered. The minimum depth of cover for piping 6 inches and larger shall be 18 inches. The minimum depth of cover for piping less than 6 inches shall be 12 inches. On existing sodded areas, sod shall be removed, preserved, and replaced to its original state once backfilling is accomplished. Root damage within the critical root zone, will result in monetary damages being assessed based on loss of utility and shortened life of the tree. If trenching is necessitated through existing asphalt roadways, saw cut asphalt to the width of the trench plus 12 inches each side prior to trenching. Removal of cut asphalt and replacement of asphalt shall be the responsibility of the Contractor. Repair will be made with full depth asphalt.
- T. Sleeves: Sleeving design is required on new projects. Sleeves to consist of 2–4-inch non-corrugated pipe placed a minimum of every 250 feet. For smaller projects, space every 100 to 150 feet. Place sleeves under new roads and new sidewalks. The sleeving plan shown on the site plan and project changes captures on the project record documents. Note markings on project record documents. Marking of the end of the sleeves will be made by stubbing-up the end of the sleeve (pipe) at 90 degrees and daylighting to the finish grade and/or by placing a metal post at the end of the sleeve, even with the finished grade.

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- U. Boring: Refer to Tree preservation and protection.
- V. Backfill material shall be select backfill if existing soils are deemed unacceptable by Grounds, through UPM.
- W. Installation of the system main shall be in accordance with the manufacturer's instructions and shall proceed from the point of connection of supply for the system pumping station, reservoir, water meter, or existing line ring type or gasketed pipe shall be thrust blocked at all tees, elbows, and end caps per manufacturer requirements. The main and laterals shall be flushed, and pressure tested for 24 hours prior to making any head connection.
- X. Lateral lines may be installed by standard trenching techniques or by "pulling in" pipe. If the "pull in" method is used, the pipe "plow" shall be a vibratory type and equipped with a turf roller device to prevent tearing of the turf. The Mole or Bullet which precedes the pipe and is used to form the opening for the pipe, shall be not less than 1 inch larger in diameter than the outside diameter of the pipe. Starting and finishing holes shall not exceed a 24 inches square opening, with the sod removed from such holes to be preserved and replaced. Lateral pipes and fittings shall be installed in accordance with the manufacturer's recommendations, including the snaking-in of the PVC pipe to prevent excessive strain when contracting in cold weather. All lateral lines shall be thoroughly flushed prior to the installation of any automatic valves or sprinkler heads.
- Y. Sprinklers shall be installed on pop-up risers or as shown on the drawings. The sprinkler head shall be installed so that the top is ¼ inch above the finished grade level. If finished grade has not been established, the sprinkler will be extended a minimum of 4 inches above existing level and marked with a stake to prevent damage by equipment. Backfill around the swing joint and sprinkler shall be free of large rocks, roots, or foreign debris. Matched precipitation will be required on all full and part circle sprinklers operating on the same zone. Mount stationary riser sprinklers on three schedule 80 PVC 90 ells FPT x FPT to make up the three-elbow swing joint. Mount pop-up sprinklers with an 18 inches minimum length of 2-inch polyethylene tubing. Tubing to withstand 400 psi burst test and shall have a wall thickness of 0.1 inch. Fittings for tubing shall be compatible and made by the same manufacturer.
- Z. Control lines shall be installed in a neat and orderly fashion and may be installed either in the main and lateral trenching or in their own separate trench. The lines shall be bundled together and taped every 10 feet. Control line connections shall be as approved in a proceeding section of these specifications. All wire shall be furnished in minimum 2,500 feet reels and spliced only at valve or tee locations. Wire sizing shall be as specified on the plan. The joining of all control wire will be by the use of wire nuts installed in Scotch DBY or DBR or an approved equal direct bury splice per installation instructions provided by manufacturer. A minimum of 18 inches of additional wire shall be looped up at each control valve or head. Control tubing and wire runs shall be installed with enough slack and/or occasional loops to prevent excessive strain due to thermal contraction.
- AA. Automatic valves and controllers shall be installed following the recommendations of the manufacturers of said equipment. The location of controllers shall be approved UPM before the actual installation of said controllers.
- BB. Quick coupling valves shall be mounted on galvanized pipe triple swing joints.
- CC. Valve boxes or any other miscellaneous marker or access box shall be installed so the top of said structure is flush with finished grade. Valve boxes shall be installed so that no portion of the box rests directly on any section of the systems piping. Valve boxes shall be installed so that the top of control valves is easily accessible for maintenance. Extensions of valve boxes necessary to reach proper grade shall be made with extensions approved for that particular brand. Valve box located within the sidewalk shall be concrete.
- DD. BASIS OF DESIGN MATERIALS:
 - 1. Flow sensor: Toro IR 220P.
 - 2. Controller: Sentinel.
 - 3. Meter: Rainbird for Neptune T-10 with Tricon/S Register (located upstream of the controller), meter installed in building preferred.
 - 4. Master Valve: Standard irrigation valve put in after the backflow.

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5. Backflow: Sized per project – reduced pressure backflow
- EE. Testing System: Upon completion of the irrigation system and after sufficient time has been allowed for solvent weld joints to cure, the entire system shall be tested for proper operation. Air will be flushed from the system and components will be checked for proper operation. Balancing and Adjustment: Balance and adjust the various components of the sprinkler system so that overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to pressure regulators, pressure relief valves, part circle sprinkler heads, and individual station adjustments on the controllers.
- FF. Operational Testing: Perform operational testing after hydrostatic testing, backfill is in place, and sprinkler heads are adjusted to final position. Demonstrate University's Grounds representative that the complete system meets coverage requirements and those automatic controls function properly.
- GG. Final Grades at Heads: After completion of sodding, planting and mulching and settlement with establishment of the final grades, carefully adjust all irrigation equipment so it will be flush with or not more than ¼ inch above grade.
- HH. Notice of Completion: When the Contractor is satisfied the system is operating properly, and all work and clean-up is completed, then he shall issue the notice of completion to the PM/Engineer. The notice of completion shall include the request for final inspection. Final Inspection with Landscape Architect/Grounds Superintendent/Project Coordinator; The Landscape Architect/Grounds Superintendent/Project Coordinator will respond to the notice of completion by the Contractor and shall appear at an agreed upon time for the final inspection. Any inconsistencies to the plans or specifications shall be noted by the Landscape Architect and a written copy of corrections shall be given to the Contractor. Record Plan Acceptance: Acceptance of the system is based on the furnishing, by the Contractor, of a completed record plan, which is acceptable to the Owner and /or the PM/Engineer.
- II. Training of Maintenance Personnel in Operation and Maintenance System: Train maintenance personnel of the Grounds Department in the operation and maintenance of the system shall not be waived due to acceptance of the system. Provide the Grounds Department with available parts list, trouble- shooting list, and specification sheet. If this responsibility is not fulfilled, the cost of obtaining the training by the Grounds Superintendent shall be shown as a deduction in the final payment.
- JJ. Work included under this contract shall be guaranteed by the Contractor against all defects and malfunctions due to faulty workmanship or defective material for a period of one year from the date of final acceptance by the Project Coordinator. Upon being informed by the Project Coordinator of any defects or malfunctions; the Contractor shall affect all necessary repairs and/or replacements in a reasonable expedient manner at no additional cost to the Project Coordinator. Emergency repairs, when necessary, may be made by the Grounds Superintendent without relieving the Contractor of his guaranteed obligation. The Contractor shall be obligated to repair any settling of backfilled trenches which may occur during the guarantee period. The Contractor is also obligated to restore any and all damaged plantings, paving, or improvements due to trench settlement or repairs within the year period. If the Contractor does not respond to the Project Coordinator's request for repair work within a period of 5 days, the Project Coordinator may proceed with such necessary repairs and charge the Contractor for all expenses incurred in the repair work.
- KK. Provide complete set of record drawings which shall be corrected daily to show changes in sprinkler locations, controller locations, piping locations, pipe sizes, and any deviations from the original irrigation design drawing. All isolation valve locations, backflow prevention, water meters, and quick couplers shall be shown with actual measurements to reference points so they may be located easily in the field. Upon completion of the work, the Contractor shall furnish the Grounds Superintendent or designee with two complete sets of record drawings showing the irrigation system as installed.

32.6 LANDSCAPE GRADING AND DRAINAGE

- A. Protection:

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1. Benchmarks and Monuments: Maintain carefully all benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed. If found at variance with the drawings, notify the Project Coordinator before proceeding to lay out work.
 2. Protection of Existing Work Remaining: All existing curbs, sidewalks, driveways and paving damaged in performance of this work shall be restored without additional cost to the Owner in the manner prescribed by authorities having jurisdiction.
 3. Tree Preservation and Protection: During all phases of earthwork and site grading, the Contractor shall comply Tree Preservation and Protection Section.
- B. Surplus Material: Remove unsuitable materials and surplus excavated materials from the site and legally dispose of it.
- C. Examine the areas which earthwork and site grading are to be performed and notify the UPM in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- D. Testing:
1. Laboratory: University's Grounds Department shall employ services of a testing laboratory to perform tests required for grading and drainage.
 2. Quality Control Testing During Construction: Notify UPM at appropriate times when Testing is required. Field density tests shall be performed in accordance with ASTM D-698.
 3. Density tests will be provided to Grounds for areas compacted during construction before proceeding with soil work.
- E. Soils and Preparation: Compliance with University's topsoil and planting mix requirements.
1. Soil Test: A sample of the proposed topsoil or planting mix shall be submitted to the Grounds Superintendent 30 calendar days prior to installation and be approved prior to delivery to the site. Organic matter will be defined as organic/humus such as sawdust or leaf-mold that has completed the decomposition process.
 2. Soil preparations for planting areas are divided into four categories depending on the situation.
 - a. Type I
 - 1) The "Type I" planting bed preparation is intended for areas in which the existing soil is of sufficient quality that it can be retained and amended to achieve the plant mix specification. Backfill materials/soils cannot meet this criterion and is covered by Type 2.
 - 2) Existing vegetation shall be removed by scraping away the top 3 inches of existing grade. Subsoil to 12 inches remove rocks (including gravel) and debris and remove from the site.
 - 3) This material shall be hauled away and disposed of in accordance with the contract provisions.
 - 4) Install a sufficient quantity of soil and soil amendments to achieve the desired/specified final grade and soil specification. Soil shall be added in an amount sufficient to account for natural consolidation of the final soil product. Unless otherwise specified, the plant bed shall be graded as follows:
 - a) Roadway medians 2 to 4 inches above top/curb at center of median
 - b) Sidewalk planting strips-achieve positive drainage from front of walk to back of curb
 - c) All soil amendments shall be mixed thoroughly and completely with the existing soil.
 - 5) Stone and debris to be removed from the median areas and shoulder of the roadways. No further work (any new material added) is to proceed until this stone and debris is removed. Hand raking is strongly recommended.

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- 6) There is to be no damage to the existing trees or their root systems during this work. All damages will be the responsibility of the contractor to correct or replace at the direction of Grounds. Turf work is to be outside of the mulch ring areas.

b. Type 2

- 1) The "Type 2" planting bed preparation is intended for areas in which the existing soil is to be removed to a depth of 18 inches and replaced with soil meeting the plant mix specification. This preparation also includes the tilling, loosening, sub-soiling of the material from 18 to 36 inches deep in order to provide aeration and lessen the compaction. Backfill materials/soils fit into this category and must be removed/replaced.
- 2) Existing soil shall be removed and disposed of in accordance with the contract provisions. The existing layer of soil between 18 and 36 inches deep shall be tilled in place and inspected by Grounds prior to plant mix/soil being added to reach final grade.
- 3) Install a sufficient quantity of approved plant mix to achieve the desired/specified grade. Soil shall be added in an amount sufficient to account for natural consolidation. Unless otherwise specified, the plant bed shall be graded as follows:
 - a) Roadway Medians and Planting Beds: Crown height in inches shall be equal to median width in feet with a maximum height of 6 inches.
 - b) Roadway plants strips-achieve positive drainage from front of walk to back of curb
 - c) Plant beds in turf areas or around buildings, 6 inches above surrounding grade at center of bed, 2 inches above grade at edge of bed.
- 4) Planting beds and areas to be mulched shall have a 4-inch V-cut trench installed at the perimeter of the planting bed and adjacent to concrete walks,
- 5) curbing, and grassed areas. The V-cut trench shall form the bed line edge. Trench depth and width shall be consistent and uniform throughout the installation.
- 6) Work shall be achieved from the sides of the planting bed areas. Do not operate equipment on the loosened soil or plant mix.

c. Type 3

- 1) The "Type 3" planting is intended for individual tree and individual/group Shrub planting where no soil replacement is required unless instructed by Grounds.

d. Type 4

- 1) The "Type 4" planting is intended for individual tree planting in medians and roadside planting strips and shoulders. The preparation for installation of the trees shall include the tilling of a 10 by 10 feet area centered on the new tree location. The existing soil shall be broken up to a depth of 18 inches within that 10 by 10 feet area and one cubic yard of composted soil conditioner shall be thoroughly mixed throughout. Soil in the bottom of the tree pit shall be firmly tamped to reduce settling.

- F. Drainage: Subsurface drainage shall be installed in all medians where drain lines can be tied into the existing storm drain system. A 4-inch slotted, corrugated drainpipe shall be installed along each edge of the median in the bottom of the planting area. Drainpipe shall be laid in the specified non-woven geotextile fabric, then covered with a minimum 6 inches of #57 washed stone, then wrapped with the specified non-woven geotextile fabric. Special care shall be exercised when filling medians with soil so as not to crush or damage the drainage system.

32.7 PRUNING AND REMOVAL OF EXISTING TREES

- A. Equipment to be used and all work to be performed must be in full compliance with the most current revision of ANSI Standard Z-133 Safety Standard The Contractor shall be solely

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responsible for pedestrian and vehicular safety and control within the work site and shall provide the necessary warning devices, barricades, and ground personnel needed to give safety protection, and warning to persons and vehicular traffic within the area.

- B. Cleanup: Debris from tree trimming, tree removal, and stumping operations shall be cleaned up each day before the work crew leaves the site, unless permission is given by the University to do otherwise. Lawn areas shall be raked, streets and sidewalks shall be swept, and brush, branches, and logs shall be removed from the site. Areas are to be left in a condition equal to that which existed prior to the commencement or arboriculture operations. Remove and to dispose in a proper and acceptable manner all logs, brush, and debris resulting from the tree maintenance operations at no additional cost to the University.
- C. Work Crew Supervision: Provide qualified supervision of each crew at all times while working under this contract. Each supervisor shall be authorized to accept and act upon all directives issued by the University. Failure for the supervisor to act on said directives shall be sufficient cause to give notice in default of the contract unless directives would create potential personal inquiry of safety hazards.
- D. Large Tree Pruning: Cutting back or topping shall not be permitted. Pruning will be done under the supervision of a certified Arborist according to the latest revision of ANSI 300. The pruning class requirement will be a Medium Pruning as outlined in these documents except where tree training is prescribed for small trees.
 - 1. Generally, the pruning will consist of primarily a Class II, Medium Pruning, unless specified otherwise; and lifting the lower bottom branches of trees for under-clearance as directed by the University. In some cases, there is the need to control extended growth. To remedy this, where noted in the field a drop-crotch / canopy reduction pruning will be used. In no case will trees be topped or rounded over. Trees to receive the drop-crotch treatment will be flagged or identified in the field prior to the work beginning. No more than 1/3 of the total live canopy will be removed. Grounds must be present for this work to proceed.
- E. Under-clearance pruning to provide for pedestrian and vehicular clearance shall be done to provide clearance as directed by the University.
 - 1. Pruning is to be performed by tree workers who, though related training and on the job experience, are familiar with the techniques and hazards of this work including trimming, maintenance, repairing or removal, and equipment used in such operations.
 - 2. The use of climbing spurs or irons is not approved in pruning operations on live trees.
 - 3. This type of work is a potentially hazardous occupation and is to be undertaken only by trained personnel or under the supervision of trained personnel, all of whom are covered with workers compensation, property damage, public liability, and completed operations insurance.
- F. Medium pruning shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch up to one (1) inch in diameter may remain within the main leaf area where it is not practical to remove it. The following specifications shall apply:
 - 1. Cuts shall be made sufficiently close to the trunk or parent limb, without cutting into the branch collar to leaving a protruding stub, so that closure can readily start under normal conditions. Clean cuts with sharp tools shall be made at all times.
 - 2. Cuts at the trunk are to be made with a pruning saw. Heading back large limbs may be done with loppers, pole pruners, or power equipment.
 - 3. Where branches are too heavy to handle, to prevent slipping or peeling the bark, it is necessary to precut these branches. Where necessary, to prevent tree or property damage, branches shall be lowered to the ground by proper ropes or equipment.
 - 4. On trees known to be diseased, tools are to be disinfected with a 20% Clorox solution after each cut and between trees, which there is known to be a danger of transmitting the disease to the tools.
 - 5. Old injuries are to be inspected. Old wounds that are not closing properly and where the callus growth is not already completely established should be traced where appropriate.

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6. Branches are to cut back to a live lateral, which shall be at least 1/3 diameter of the severed branch. Heading back limbs as part of tree trimming pruning is accepted.
7. Girdling roots visible to the eye are to be reported to the Grounds Superintendent or designee.
8. The presence of any structural weaknesses, disease condition, decayed trunk or branches, split crotches or branches should be reported in writing to Grounds Superintendent or designee, and corrective measures recommended.
9. Stubs not callused over shall be pruned in the same manner as outlined above in this action. Care shall be taken so as to not damage the callousing tissue.
10. Cutting back or topping shall not be permitted.

G. Tree Removal:

1. Trees shall be removed in accordance with accepted industry standards and procedures and in accordance with the following minimum requirements. Extreme care shall be taken so as to prevent limbs, branches and trunks from falling and creating damage to adjacent homes, driveways, sidewalks, trees, shrubs, streets and other property, both public and private. Debris and logs shall not be left on the public right-of-way overnight. Remove and dispose in a proper and acceptable manner all logs, brush and debris resulting from the tree removal operation unless otherwise directed by the University Grounds Department. Removal of such debris shall be performed daily so as to not disrupt the work,

H. Stump Grinding:

1. Work shall include, but is not limited to, all labor, equipment, and material necessary to grind all stumps identified in the contract and those identified in the field by University.
2. Exposed portions of the stump (including root flare) shall be ground to a depth of 12 inches below the surrounding average grade.
3. Grindings shall be removed from the site. The resulting hole shall be backfilled with dry soil free from stones, dirt clods, roots, root mats, and other unsuitable material.
4. The resulting hole shall be backfilled in two six-inch lifts. The first six-inch lift shall be compacted to a 65 percent compaction. The final six-inch lift shall be hand tamped and graded to drain.
5. Those that are affected by the stump grinding shall be seeded and mulched per Project Special Provisions, "SEEDING AND MULCHING".
6. Measurement: The stump grinding measurement will be the length measurement of the root flare added to the width measurement of the root flare and divided by two. All measurements in inches. There will be no other measurement for payment. The University will determine the measurement for payment at each location.

32.8 FERTILIZATION OF EXISTING TREES

- A. Quality Assurance: Provider of this service shall be individuals, partnership or corporation actively engaged in arboriculture, horticulture, or a related field.
- B. Fertilizer shall have a minimum analysis of 30-9-4.
- C. Eighty percent of nitrogen will be slow release by means of organic breakdown
- D. Fertilizer shall be manufactured such that it can be applied in the fashion described.
- E. Installation of the fertilizer will be the high-pressure liquid fertilizer method. A hydraulic pump capable of delivering an agitated fertilizer with water as the carrier (with the ability to pump the material at the pressure of 150 psi) will be utilized. A soil spear designed for fertilizing applications will be used.
- F. Injection of the fertilizer shall start 24 to 36 inches from the root flare and be 24 to 36 inches apart continuously to the edge of the limb spread or edge of construction, whichever is less.
- G. Injection will be 10 to 12 inches deep. Rate of application will be determined by a measurement of the diameter of the trunk 24 to 48 inches above ground line. Fertilizer will be applied at a rate of 2 pound per inch diameter of actual nitrogen.

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- H. Soils must be moist prior to application.

32.9 TREE PRESERVATION AND PROTECTION

- A. Woven Textile Fabric: Woven geotextile fabric with a minimum tensile strength of 200 lbs. shall be used under 6 inches of washed stone or suitable alternative whenever construction traffic must pass over the root systems of existing trees in unpaved areas.
- B. Tree Protection Barricades: Barricades shall be constructed of wood. Orange safety fencing, 36 inches or suitable alternative may be used in lieu of wood rails. The installation of orange construction fencing in the right of way shall not inhibit driver and/or pedestrian vision at driveways and/or street intersections.
- C. Trees located on University property shall be protected from damage and/or removal and this includes the following: storm drainage, underground utilities, driveways, sidewalks, etc.
- D. The designer will provide the same level of protection for private property trees on all University funded and/or sponsored projects. The Landscape Architect or University Grounds must be consulted during the planning of the project to determine impacts to the trees based on proposed construction. Alternative alignments, construction methods, tree replacement, etc. shall be considered during that period.

- E. Boring and Trenching:

1. Open trenching, including pilot and/or receiving holes:

TREES DIAMETER (D.B.H.) LESS THAN 6	RADIAL DISTANCE (FEET) LIMB SPREAD
6-9 inches	5 feet
10-14 inches	10 feet
15-19 inches	12 feet
20-30 inches	15 feet
Over 30 inches	20 feet

2. Holes or trenches closer to a tree than noted above will be considered harmful to the trees unless a boring construction method is performed. Any exceptions must be approved by Grounds. Utilities may be tunneled in the root zone at a 24 inches minimum depth providing that plans are approved showing the location and method.

- F. Curb and Gutter Repair and Construction:

1. When working within 20 feet of any tree (12 inches or larger in diameter), plywood forms or suitable alternative will be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed back of curb unless Grounds has provided approval.
2. Root pruning will be in accordance with Section entitled Root Pruning. If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place.

- G. Sidewalk Construction /Repair

1. When working within 20 feet of any tree 12 inches or larger in diameter, plywood forms or suitable alternative will be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed edge of the sidewalk unless the Grounds has provided approval.
2. Root pruning will be in accordance with Section entitled Root Pruning. If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place.
3. Narrow sections of sidewalk will be constructed in accordance with directions from the Landscape Architect and Grounds and no less than 40 inches in width. Bridging of large roots.

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- H. Barricades: Barriers shall surround trees with a radius of not less than 12 inches for every one (1) inch of trunk diameter (critical root zone) unless otherwise detailed.
1. Barricade will be a minimal of six (6) feet. Deviations from this must be approved on an individual basis by the Landscape Architect and Grounds.
 2. Tree protection barriers shall be installed prior to any grading or other land disturbing activity. They shall be constructed from any material substantial enough to designate the protected area and to protect the roots, trunk, and crown of the tree.
 - a. Example: 2 x 4 standards and 1 x 4 rails; 36 inches high orange safety fencing, etc.
- I. Trunk Protection: Batter boards and sandbags will be installed when working within 20 feet of any tree 12 inches or larger. The purpose of these items will be to protect the trunk or root flare from drainage during construction.
- J. Temporary Access: It is recommended that when crossing a critical root zone, mulch 8 to 12 inches deep with woven geotextile fabric with a minimum tensile of 200 lbs. strength laid underneath shall be required in these areas to act as a cushion to prevent soil compaction. Mulch and fabric shall be removed after construction is complete.
- K. Do not store materials or machinery in any portion of the critical root zone.
- L. Fill Around Existing Trees to Remain: Fill dirt deeper than two (2) inches may be allowed over the critical root zone of the tree. This work shall be performed under the supervision of the Grounds.
- M. Clearing Within Critical Root Zone:
1. In the critical root zone, the removal of any portions of old sidewalk, driveway, and/or curb shall be done with extreme care so as not to damage any portion of the branches, trunk or roots.
 2. In the critical root zone any stumps, dead trees and shrub growth to be removed shall be cut flush or ground out. Stump grinding will be accomplished with equipment and methods acceptable in normal arboriculture operations.
 3. Holes will be backfilled completely the same day of the operation. Stumps to be ground out will be designated by the Grounds. No grubbing is permitted in the root zone areas.
- N. Tree Damage:
1. Climbing irons, spurs or spikes shall not be used on trees to be pruned.
 2. Any tree damage during Work is to be repaired immediately at no additional expense and to the satisfaction of the University.
 3. Damages resulting in the disfigurement and/or shortened life expectancy of a tree will be evaluated by the Grounds. The entire value of the tree will be pro-rated by the loss of life expectancy and that value assessed to the Contractor.
 4. Trees damaged beyond repair, as judged by the Grounds are to be removed at no expense to the University and replaced by trees of size and species designated at no additional expense to the University; or the dollar value of such damaged trees as determined by the Grounds is deducted from the monies owed the Contractor.
 5. The tree values will be determined by using the guidelines in the Tree Evaluation Guide by The International Society of Arboriculture (ISA).
 6. A MINIMUM FINE OF \$50 WILL BE ACCESSED FOR EACH INCIDENT OF BARK AND CAMBIUM DAMAGE OF 4-inch WIDTH OR LESS WHERE RESTRICTIONS ARE VIOLATED. IF DAMAGE IS LARGER, DAMAGES WILL BE ASSESSED USING ISA's TREE EVALUATION GUIDE PROCEDURES.
- O. Discontinuance of Work: Practice obviously hazardous to people or harmful to the trees, as determined by the University, shall be immediately discontinued by the Contractor upon receipt of either written or oral notice to discontinue such practice.
- P. Root Pruning:
1. Root pruning shall be kept to an absolute minimum. In no case shall any root be pruned that is 1 ½ inches in diameter or greater without the express permission of the Grounds.

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2. Roots proposed to be cut shall be located in advance at a point 6-12 inches outside the proposed cut by using a shovel, a probe, a high-pressure stream of water, or other convenient method. The cut is to be made no more than 6 inches behind the back of the curb, wall, or other structure to be built. The cut shall be made only to the minimum depth required for the structure.
 3. The roots shall be cut cleanly leaving a smooth surface.
 4. Root pruning equipment shall be kept sharp to ensure that roots are cut cleanly and are not broken or torn by dull or unsuitable equipment.
 5. Root pruning shall be done with the approval of Grounds.
- Q. Pruning and Thinning of Existing Trees: Pruning shall be in accordance ANSI 300.
- R. Tree Preservation: Large or rare trees shall be highlighted by the designer. Grounds must approve all tree removals.
- S. Clean Up: Remove all barriers upon completion of project and fill the holes with suitable soil restore area to original condition.
- T. Tree Protection: It is desirable to save trees whenever possible. During design, the Designer should identify specifically those trees to be saved and those which must be removed. Trees which must be damaged by construction to the point that they have little chance to survive should be considered for removal.
1. Trees to remain shall have protective barriers set outside the drip line of the tree. Barriers shall be installed prior to any construction and shall remain until construction and site cleanup is complete. The barriers shall be of substantial material.: 4 by 4-inch posts with 2 by 6-inch rails set at a minimum height of four feet. No construction material, debris, or excavated material shall be stored within the barricade area.
 2. Protect root system from flooding, erosion, and noxious materials in solution from spillage of construction materials.
 3. Excavation around trees:
 - a. Excavate within drip lines of trees only were indicated on plans.
 - b. If excavation will damage trees extensively, the trees should be removed.
 - c. Where trenching for utilities is required within the drip line, tunnel under or around roots by hand digging. Do not cut main lateral or tap roots. Cut smaller roots with a sharp pruning tool; do not chop or break.
 - d. Do not allow exposed roots to dry out while exposed; provide temporary earth or moist burlap cover.
 - e. Any tree to remain that has had excavation within the drip line shall be pruned by a professional arborist according to the National Arborist Association Standards Class IV- Cutting Back or Drop Crotch Pruning.
 4. Grading: Maintain existing grade outside drip line of trees, unless otherwise indicated on plan. Do not leave open excavations in the vicinity of protected trees for longer than 2 days to prevent soil moisture reduction.
 5. Fertilization:
 - a. Where tree roots within the drip line will be covered with asphalt or concrete, feeders shall be installed as recommended by the National Arborist Association Standards.
 - b. Install extended feeders where construction of walls is required within drip line.
 - c. The design must provide a yard hydrant, irrigation system, or other convenient water sources adjacent to trees that remain.
 - d. Define proper fertilization and fertilize affected trees during construction.
 6. Repairs and Damaged Trees:
 - a. Repairs to damaged trees shall be performed by a professional arborist.
 - b. Trees damaged beyond repair, which do not survive to be removed. Replacement cost will be determined by design and paid by contractor. The University reserves the right for the contractor to replace damaged tree with one of equal size and quantity.
- U. Tree Pruning

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1. For Grounds Maintenance Levels I, II & III. This is a highly skilled procedure that must be supervised by a qualified and professionally trained arborist. This will ensure that all trees are pruned according to their natural growth habit to evenly form and balance the tree to promote proper health and growth and prevent interference with pedestrian and vehicular traffic.
2. Prune to remove dead, damaged, diseased or structurally weak limbs.
3. Removes branches that extend over buildings, endanger roofs, eaves or windows, or hang over walkways, parking lots or driveways. Provide clearance for buses, moving vans, delivery trucks, and similar vehicles along streets.
4. Cut back branches that overhang or grow into power lines. Anticipate the effects of wind on branches or trees which might fall on power lines and remove growth to prevent these problems; shapes entire tree through selective pruning rather than a “hat racking” method and prevents growth of small trees in front of windows and over entrance ways or walks which will obstruct vision at street intersection. Prune according to National Arborist Association standard for pruning and maintaining shade trees.
5. Tree pruning shall be performed in accordance with the following specific requirements:
 - a. Remove crossed or rubbing limbs or branches.
 - b. Make all cuts close to parent stem to promote healing. All limbs, 2 inches in diameter and over must be precut to prevent splitting.
 - c. Lower to the ground with ropes all branches three inches or more in diameter and other branches being removed that would cause damage in falling.
 - d. Cut off all low hanging branches to a minimum clearance height of 14 feet over roads and to a minimum clearance height of 8 feet over sidewalks.
 - e. Cable and/or bolt any branches that are structurally weak, split crotches, or branches that are dangerous but worth saving. Guying shall be accomplished in accordance with National Arborist Association Standard for cabling, bracing, and guying for shade trees.

32.10 SOIL

A. Soil Types:

1. Topsoil: Native soil on site or natural soil harvested from another site that naturally has the texture and composition to meet the specification described below, and is free of noxious weed seed, shall constitute an Acceptable Planting Media. (APM)
2. Planting mix for Lawn, Turf or Seeding Areas:
3. A planting mix may be developed that will be an Acceptable Planting Media by amending the existing soil or by removing the existing soil and replacing it with new planting mix. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter. It shall contain no man-made materials unless otherwise specified. Planting mix shall not be used while in a frozen or muddy condition.
4. Unless there are unusual circumstances with project and unless otherwise specified in the contract documents and approved by the Grounds and/or designee, the Acceptable Planting Media shall contain the following specified percentages of constituents:

CLAY	Minimum 10%/Maximum 40%
SAND	Minimum 20%/Maximum 50%
SILT	Minimum 20%/Maximum 50%
ORGANIC MATTER	Minimum 5%/Maximum 10%
5. Organic Matter is defined as compost/humus such as sawdust or leaf mold that has completed the decomposition process. Percentage of organic matter shall be determined by loss on ignition of moisture free samples dried at 65 degrees.

APM shall have an acidity range of pH 6.5 to 7.0.

B. Planting mix for Tree and/or Bed/Shrub Planting Areas:

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1. A planting mix may be developed that will be an Acceptable Planting Media by amending the existing soil or by removing the existing soil and replacing it with new planting mix. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter. It shall contain no man-made materials unless otherwise specified. Planting mix shall not be used while in a frozen or muddy condition.
 2. Unless there are unusual circumstances with project and unless otherwise specified in the contract documents and approved by the Grounds Superintendent and/or designee, the Acceptable Planting Media shall contain the following specified percentages of constituents:

CLAY: Minimum 10 percent/Maximum 40 percent
SAND: Minimum 20 percent/Maximum 50 percent
SILT: Minimum 20 percent/Maximum 50 percent
ORGANIC MATTER: Minimum 15 percent/Maximum 20 percent
 3. Organize Matter is defined as compost/humus such as sawdust or leaf mold that has completed the decomposition process. Percentage of organic matter shall be determined by loss on ignition of moisture free samples dried at 65 degrees.
 4. APM shall have an acidity range of pH 6.5 to 7.0.
- C. Soils can be placed on a pre-approved list by the Grounds Superintendent and/or designee, after a vendor has proved that they have the ability to provide the soils as described and be consistent with the mixtures. The Grounds Department retest soils and recompiles this list annually. Other soils can be tested throughout the year and placed on the list, if approved, at the contractor's or vendor's request. Thirty calendar days for approval is required. Grounds Management will collect the samples and submit the first soil samples for laboratory testing. Any sample that requires re-submittal for approval will be the contractor's or vendor's responsibility and must be tested by a reputable soil testing lab.
- D. Soil Conditioner:
- E. Work covered in this special provision includes supplying and applying composted soil conditioner. Soil conditioner is an organic soil additive that is mixed with the soil in order to improve its internal drainage, structure, nutrient holding capacity, nutrient holding capacity or to improve organic matter composition. Composted soil conditioner must be thoroughly mixed and tilled into the top 8 and 10 inches of the existing soil in all areas to be planted.
1. Soil conditioner shall be composted and aged pine bark, screened to be 9/16-inch size or smaller. It shall be black in color, not be fresh, have no pine bark smell and have an acidity of pH 5.8 to 6.0. A sample of the composted soil conditioner must be submitted to the Grounds Department for approval prior to installation.
- F. Product supplied must meet the specification above as determined by soil testing at an approved lab or be supplied from a vendor on the Grounds Department's pre-approved list. Soil shall not be handled or spread when moisture content is excessively high.

32.11 STRUCTURAL SOIL MIX FOR TURF AREAS AND FIRE LANES

- A. Provide a Structural Soil Mix using the three components below to meet ASTM Standards as follows:
1. The Structural Soil Mix shall be a special pre-mixed blend of 75 percent 5/16 inch graded Expanded Slate Aggregate and 25% approved sand-compost blend compacted to a minimum depth of eight inches.

5/16 inch Expanded Slate	75%
USGA Root Zone mix *	20%

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Certified Compost* 5% typical

* Percentages may vary to meet testing requirements Saturated Drained Weight: 66 pounds per Cubic Foot

2. Minimum finished depth shall be not less than 8" (eight inches) deep.

B. 5/16-inch Rotary Kiln Expanded Aggregate

1. ASTM C29 Unit Dry Weight loose (48 lb./cf to 55 lb./cf)
2. ASTM C127 Specific Gravity to meet 1.45 to 1.60, SSD
3. ASTM C330: ASTM Gradation 3/8" - #8 size 3/8 inch - #8 PermaTill Expanded Aggregate

Sieve Size	% Passing
1/2 inch	100
3/8 inch	80 - 100
#4	50 - 40
#8	0 - 20
#16	0 - 10

4. Test for degradation loss in accordance with ASTM C131 modified method FM 1-T096. No more than 28 percent of the weight of the aggregate must be lost to degradation.

5. USGA Root Zone Sand

Grain Size Distribution Sieve Size	% Retained
2.00 mm	<3%
1-2 mm	10% max
0.5 -1 mm	45% max
.25 - .5 mm	35% - 75%
.15 - .25 mm	15% max
.05 - .15 mm	5% max
organic matter	5% - 10%

C. Compost

1. Compost must be certified and derived from a non-sewage sludge feedstock source. The addition of yard waste to the composting process must also meet certification requirements.
2. Finished compost must be screened to minus 1/2 inch, protected, and free from any outside
3. contaminants during and after screening and curing.
4. Metals and contaminants must meet or exceed US EPA Standard 40

D. Mixing Procedures:

1. Structural Soil: Mechanically mix the sand and compost thoroughly.
2. Saturate the 5/16 inch expanded slate aggregate with water and mechanically mix 3:1 with the dry sand-compost until the slate particles are completely coated.
3. When stockpiling the finished mix, cover the pile with a plastic tarp to prevent drying out or soil separation from rain. Install the mix within 48 hours after mixing.

E. Preparation: Obtain approval for each layer installed. Provide access for and cooperation with testing agency.

1. Adequacy of the final compaction of all elements requiring compaction shall be determined in the field by the engineer by proof roll.

F. Preparing Subgrade:

1. Remove all organic matter, debris, loose material and large rocks.
2. Dig out soft and mucky spots then replace with suitable material.

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3. Loosen hard spots and uniformly compact the subgrade to 95 percent of its maximum dry density.
- G. Optional Perforated Underdrain System
1. The underdrain system shall be installed, included with sock or soil separator fabric, according to drawing and specifications, and connected to the storm drain.
- H. Placing Structural Soil Mix:
1. Adequacy of the final compaction shall be determined in the field by the engineer by proof roll.
 2. Place geo-tech mesh where specified.
 3. The SSM shall be placed in approximately eight (8) inch uniform lifts over the entire area of project and each lift compacted to provide a finished depth of 8 inches. Construction equipment, other than for compaction, shall not operate on the exposed structural soil mix. Over-compaction should be avoided.
 4. Final compacted depth of the material shall be not less than eight (8) inches deep.
 5. Optional for grades steeper than eight (8) percent slope. Turf rings shall be installed immediately after the last lift is compacted and tested. No equipment traffic will be allowed on the compacted material until the sod has been placed.
 6. Irrigation systems are to be installed and tested prior to the root zone laying course installation to avoid disturbing the compaction of the mix.
- I. Compacting: Use of portable vibratory plate compacting machine (Recommended).
1. Place structural soil mix in horizontal lifts not exceeding 8 to 10 inches of compacted
 2. depth. Use a minimum of four passes of not less than 10 seconds per pass, before moving the vibratory plate to the next adjacent location. Additional passes may be required and should be determined in the field by the engineer to insure stability of the layer. Continue placing and
 3. compacting eight (8) inch lifts until the specified depth is reached.
 4. Use of vibratory steel roller for large areas.
 5. For large spaces, a vibratory steel roller weighing no more than 12 tons static weight can be used. Horizontal lifts should not exceed 10" compacted. The minimum number of passes is two and maximum number is four. Additional passes may be required and should be determined in the field by the engineer to insure stability of the layer.
- J. Optional Root Zone Mix Installation for Seeding
1. Install mix as per drawings and specifications. Depth of root zone mix over the structural soil to be determined based on traffic requirements. Typically, 1 to 2 inches on top of the fire lane applications.
 2. No vehicles or heavy equipment are permitted on the root zone layer course until the turf is completely established.
- K. Sod Installation
1. Only sod grown in a sand base soil may be used in this application. Basis of Design: Bermuda sod/" Tifway 419" or "Grand Tif" or "Zoysia" sod – "Palisades." Other sod varieties as directed by Grounds.
 2. Place sod directly on the structural soil as specified by Grounds.

32.12 SEEDING AND SODDING TURFGRASS & LAWNS

- A. Warranty: A live stand of permanent grass consisting of 95 percent coverage minimum for seeded grass with no bare spots greater than one (1) square foot. Acceptance will be made after the grass has been mowed three times and shows sufficient stand and cover as specified.
- B. Seed: Seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and approved by the North Carolina Department of Agriculture. All seed shall be furnished in sealed standard containers. Seed which has become

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wet, moldy or otherwise damaged in transit or in storage will not be acceptable. The seed quality requirements for this project are as follows:

1. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, Witchweed and Crotalaria.
 2. Seed shall not contain more than 2 percent, singly or collectively of crop seed other than the kind or kinds of seed specified.
 3. Minimum guaranteed germination rate for all seed shall be 85 percent.
 4. The Crop Seed quality requirements are: Minimum 80 percent pure live seed; maximum 1 percent total weed seed; maximum 2 percent total other crop seed; maximum 100 restricted noxious weed seed per pound.
- C. Soil Amendments Lime shall be ground limestone containing not less than 85 percent of total carbonates and shall be ground to such fineness that at least 50 percent will pass through a 100-mesh sieve and at least 90 percent will pass through a 20-mesh sieve. Coarser will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the 100- mesh sieve, but no additional payment will be made for the increased quantity.
- D. Superphosphate: Finely ground phosphate rock containing minimum 18% available phosphoric acid.
- E. Fertilizer: Fertilizer shall be the product of an approved commercial fertilizer manufacturer and shall be 10-10-10 grade, uniform in composition, free-flowing material suitable for application with approved standard equipment. The fertilizer shall conform to the applicable State fertilizer laws and shall be delivered to the site in bags or other convenient containers each fully labeled and bearing the name, trademark and warranty of the producer.
- F. A soil analysis shall be prepared by a testing agency approved by the designer. The contractor shall provide all elements recommended by the analysis.
- G. Soil samples must be submitted to Grounds or designee 30 days prior to installation for approval.
- H. Mulch shall be a Polyacrylamide Powder, unless otherwise noted.
1. Matting will only be used if approved on very limited basis and approved by Grounds Superintendent or designee.
 2. Matting: Plain open weave jute rolls, 18 inches wide. Jute yarn shall be loosely twisted construction not varying in thickness more than 1/2 its normal diameter and having 76 to 80 warp ends per 18 inches width, 40 to 42 weft ends per yard length.
 3. Mat anchors: Baling twine and soft-wood pegs ½ by 1 by 12 inches long.
- I. Specifications/Compliances:
1. ANSI/NSF Standard 60 Drinking water treatment chemicals.
 2. 48h or 96h Acute Toxicity Tests (*D. magna*, *P. promelas*, or *O. mykiss*).
 3. 7-day Chronic Toxicity Tests (*P. promelas* or *C. dubia*)
- J. Technical Information:
1. Appearance: White granular powder
 2. Bulk Density: 40-50 lbs/cubic foot
 3. Percentage Moisture: 15 percent maximum
 4. pH 0.5 percent solution: 6-8
 5. Shelf Life, up to 5 years
- K. Coverage:
1. 10-20 # powder/Acre – gentle to moderate slopes (flat to 4:1) Dry Spread Application
 2. 20-50 # powder/Acre – steep slopes (3:1 to 1:1) Dry Spread Application
 3. 3.5-5 # powder/1,000 gallons water per 1/3 Acre – Hydroseed Application
- L. Directions for Use:

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1. Dry Form: Polyacrylamide Erosion Control Powder may be applied by hand spreader, mechanical disc, or hand sowing. Slope or ditch application may require artificial support, such as double-shredded hardwood mulch, to reduce down slope movement. Areas of high-water velocity will require benching or tier structuring to reduce velocity. Sheet flow applications are best.
2. Liquid Form: Polyacrylamide Erosion Control Powder may be applied with hydroseeders, water trucks or other spraying devices. All spraying devices must have a mechanical agitator or mixing apparatus or hydraulic recirculation. Caution-Do Not mix powder into a spraying device that does not contain a mixing apparatus.
3. Mixing: Sprinkle powder into the water with the mixing apparatus operating as the last material to be added to the mix. Three to Five minutes of mixing will be required after the powder is sprinkled into the water. Add the powder slowing, adding the powder too fast will result in clumping resulting in poor performance. Longer mixing times will create high viscosity solutions possibly causing some types of spray equipment to undergo cavitation. Caution-Do Not exceed 8 lbs/1500 gallons as viscosity of the water may damage spraying equipment. (This will treat ½ acre).

M. Clean-Up:

1. Spilled powder should be cleaned up dry as best as possible using broom or vacuum. Extreme slippery conditions will result. In event of skin contact, wash powder from skin as soon as possible using soap and water.

N. Precautions/Limitations:

1. Prevent inhalation of the powder, use adequate dust mask.
2. Clean up spills quickly. Do not use water unless necessary, extremely slippery conditions will result.
3. Do Not add water to the Polyacrylamide Erosion Control Powder, add the powder (sprinkle) to the water slowly.
4. Polyacrylamide Erosion Control Powder will remain viable on the soil surface for 60-90 days. Longer viability will occur when applied powder is covered with double-shredded hardwood mulch.
5. Polyacrylamide Erosion Control Powder has been specifically tailored to specific soil types. Soil types in varying geographical areas will require testing.

O. Landscape Management:

1. Increased development of the campus creates the greater demand for efficient landscape planning. The introduction of new signage, plant materials, benches walk, lights, etc. into the landscape all effect long-term maintenance. Therefore, it is necessary to develop guidelines that must be reviewed by anyone involved in the planning and design of elements. Long term plans for walkways, roads and buildings must be considered when locating signage, benches or plant materials in proposed designs.
 - a. Turf strips less than two feet between walkways, curbs or buildings will not be allowed.
 - b. Planting beds shall have large sweeping edges for ease of lawn mower cutting.
 - c. Place signs, lights and other permanently installed objects in mulch or planting beds, when possible, for ease of lawn maintenance. This will also protect these objects from mower and weed eater damage.
 - d. Select ground covers, shrubs and trees for natural size and habit for an area to avoid overgrowing and unnecessary pruning.
 - e. Do not plant low branching trees in turf areas.

P. Turf Maintenance

1. Level I. Turf maintained at this level is highly maintained turf which is mowed, fertilized, edged, with pre and post emergent herbicides utilized to prevent/eliminate all broad leaf weeds and weedy grasses. These areas exist at various locations throughout the campus proper. Mowing frequency is based on weather conditions.
 - a. Fescue turf is maintained at a mowing height of 3 to 3-1/2 inches.

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- b. Bermuda at "to 1 inch and over seeded rye at 1-1/2 to 2 inches.
 - c. Leaves are vacuumed, blown and removed from these turf areas during the Fall season.
 - d. Turf areas receive three applications of dry turf grade homogenous 18-5-9 or 23-5-9 fertilizer per year (March, June and October) at rate of 1 lb. Nitrogen/1000 sq. ft. All turf fertilizer is slow-release nitrogen type 50 percent WSN, 50 percent WIN with minor elements. Over seeded rye lawns will be mowed twice monthly (Dec.-March)
 - e. Sidewalks and curbs are maintained by edging.
- Q. Level II. Turf maintained at this level is mowed weekly during the growing season, normally April 1 - December 1. These turf areas exist around residence halls, campus buildings, common campus areas, park areas, road shoulders and parking lots.
 - 1. Leaves are vacuumed, blown and removed during the fall season.
 - 2. Sidewalks and curbs are to be mechanically edged.
 - 3. Turf areas to receive three applications of dry turf grade homogenous 18-5-9 or 23-5-9 fertilizer per year (March, June & October) at rate of 1 lb. Nitrogen/1000 sq. ft. Fertilizer type it as in TM Level I.
 - 4. Level III. Turf maintained at this level relates to slopes and banks too steep to mow including fences guardrails, ditches and similar areas. These areas will be maintained using string trimmers.
 - a. Turf/ground cover height will be maintained at 3-4 inches.
 - b. Areas are to receive three applications of turf grade homogenous 18-5-9 fertilizer (March, June, and October) at rate of 1 lb. Nitrogen/1000 sq. ft. Fertilizer types it as in TM Level I. Adjacent walkways/curbs will be kept free from weeds, litter and other debris.
- R. Edging
 - 1. Edging shall be performed in a manner that is free of scalping, rutting, bruising, and uneven and rough cutting.
 - 2. Vegetation shall not be cut back more than 1 inch from pavement.
 - 3. Edging of sidewalks, driveways, curbs, and other paved surfaces and around gardens and other cultivated areas shall be performed as follows:
 - 4. Level I, II & III: Edging shall be done so that there is no vegetation growing over pavement.
- S. Trimming
 - 1. For Grounds Maintenance Level I and II, trimming shall be around trees, shrubs, cultivated areas, fences, poles, walls, fire hydrants, sprinkler heads, valves, and other similar objects. Trimming shall be done in such a way as to avoid damaging the trunk, bark or roots or trees and shrubs. After trimming, all cuttings and debris shall be collected and disposed of in a mulch pile/compost area. Trimming within any given parcel shall be completed within one day of each mowing.

32.13 NEW LAWNS

- A. A sample of the proposed topsoil mix shall be submitted to the Grounds or designee 30 calendar days prior to installation and be approved prior to delivery to the site.
- B. Soil Amendments
 - 1. Gypsum: Gypsum shall be pelletized Gypsum.
 - 2. Fertilizer: The following is a list of acceptable starter fertilizers for new seeding:
 - a. Analysis 13-25-12 Appl. 340 lbs./acre or 8 lbs/1000 feet.
 - 3. Substitutions as directed by Grounds.

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4. Commercial fertilizer applied at seeding time shall be per analysis listed above in which 50 percent of the nitrogen is slowly available. All fertilizer shall be uniform in composition, dry, free flowing and shall be delivered to the site in the original unopened container, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged will not be accepted.
- C. Grass seed shall be turf type tall fine fescue grass or other varieties approved by Grounds Superintendent and/or designee and as specified on plans with a 95 percent minimum purity and 85 percent minimum germination, and be free of noxious weed seeds, as certified by the North Carolina Co-op Improvement Association or its approved equivalent by the Grounds or designee.
 1. Seed shall be delivered to the site in sealed standard size containers, showing weight, analysis, name of vendor and germination test. Seed, which has become wet, moldy, over one year old, or otherwise damaged, will not be accepted.
 2. Approved turf type tall fine fescue cultivars: 'Millennium' – or approved equivalent by Grounds or designee.
 3. Approved annually by Grounds or designee.
 4. New cultivars will be considered for review. Following test information from TCNC/N.C. State University/Extension Service or approved authority.
- D. Lawn mulch shall be Polyacrylamide powder or oat straw from the latest available harvest crop and shall be free of noxious weed seeds and foreign material.
- E. Specifications/Compliances:
 1. ANSI/NSF Standard 60 Drinking water treatment chemicals.
 2. 48h or 96h Acute Toxicity Tests (*D. magna*, *P. promelas*, or *O. mykiss*).
 3. 7-day Chronic Toxicity Tests (*P. promelas* or *C. dubia*)
- F. Technical Information:
 1. Appearance: White granular powder
 2. Bulk Density: 40-50 lbs./cubic foot
 3. Percentage Moisture: 15% maximum
 4. pH 0.5 percent solution: 6-8
 5. Shelf Life: up to 5 years
- G. Coverage:
 1. 10-20 # powder/Acre – gentle to moderate slopes (flat to 4:1) Dry Spread Application
 2. 20-50 # powder/Acre – steep slopes (3:1 to 1:1) Dry Spread Application
 3. 3.5-5 # powder/1,000 gallons water per 1/3 Acre – Hydroseed Application
- H. Directions for Use:
 1. Dry Form: Polyacrylamide Erosion Control Powder may be applied by hand spreader, mechanical disc, or hand sowing. Slope or ditch application may require artificial support, such as double-shredded hardwood mulch, to reduce down slope movement. Areas of high-water velocity will require benching or tier structuring to reduce velocity. Sheet flow applications are best.
 2. Liquid Form: Polyacrylamide Erosion Control Powder may be applied with hydroseeders, water trucks or other spraying devices. All spraying devices must have a mechanical agitator or mixing apparatus or hydraulic recirculation. Caution-Do Not mix powder into a spraying device that does not contain a mixing apparatus.
 3. Mixing: Sprinkle powder into the water with the mixing apparatus operating as the last material to be added to the mix. Three to Five minutes of mixing will be required after the powder is sprinkled into the water. Add the powder slowly adding the powder too fast will result in clumping resulting in poor performance. Longer mixing times will create high viscosity solutions possibly causing some types of spray equipment to undergo cavitation. Caution-Do Not exceed 8 lbs./1500 gallons as viscosity of the water may damage spraying equipment. (This will treat ½ acre).
- I. Clean-Up:

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1. Spilled powder should be cleaned up dry as best as possible using broom or vacuum. Extreme slippery conditions will result. In event of skin contact, wash powder from skin as soon as possible using soap and water.
- J. Precautions/Limitations:
1. Prevent inhalation of the powder, use adequate dust mask.
 2. Clean up spills quickly. Do not use water unless necessary, extremely slippery conditions will result.
 3. Do Not add water to the Polyacrylamide Erosion Control Powder, add the powder (sprinkle) to the water slowly.
 4. Polyacrylamide Erosion Control Powder will remain viable on the soil surface for 60-90 days. Longer viability will occur when applied powder is covered with double-shredded hardwood mulch.
 5. Polyacrylamide Erosion Control Powder has been specifically tailored to specific soil types. Soil types in varying geographical areas will require testing.
- K. Sod: Variety of sod, where shown, shall be as specified on plan. Sod shall be two years old minimum thickness of 1/2 to 5/8 inch depending on type plus thickness of top growth and thatch.
- L. Soil Testing: Testing shall be requested 14 working days prior to delivery of topsoil or planting mix shall be corrected by the Contractor. Retesting cost shall be at the Contractor's expense.
- M. Preparation of Seed Bed: Site work required by this contract shall be complete and in place before grassing operations are begun.
- N. Work may be completed in parts if so, requested by the Contractor and approved by the UPM. Prior to seeding operations, all proposed lawn areas shall be scarified to 6-inch depth and pulverized until the surface is smooth, friable and of a uniformly fine texture. Remove stones and foreign material over one inch in diameter and grade for positive drainage as required to prevent ponding of water. Finish grade will be made by hand raking (all seeded areas).
- O. Lime shall be broadcasted and worked into the soil at all areas at the rate dictated by the soil test that will provide a PH level of 6.5 to 7.0.
- P. Seeding and Fertilizing: The following schedule will be required for seeding.

TYPE OF SEED

DATE

Turf Type Tall Fine Fescue See previous schedule.

- Q. Tall fine fescue may be seeded year-round, however any variance in the above seeding schedule will require at least one over seeding application after September 15 to ensure 90% coverage. This over seeding is considered incidental and there shall be no separate measurement or payment for over seeding.
- R. Written requests for a variance must be approved by Grounds or designee.
- S. At seeding time add fertilizer at a rate of 250 lbs. per acre to all areas.
- T. Apply tall fescue at the rate of 8 lbs. per 1000 square ft. for new areas, 3 to 5 lbs. per 1000 square ft. for overseeded areas.
- U. Mulch shall be spread uniformly at the rate of 1-2 bales (90 pounds) per 1,000 square feet.
- V. Tacking of mulch shall be necessary on all roadway projects using liquid asphalt applied at 150 to 300 gallons per acre depending on conditions. Refer to plan for specific details.
- W. Hydroseeding Hydraulic Mulching: Hydraulic mulching shall consist of the mixing of wood fiber mulch, grass seed, fertilizer and/or other additives with water. It shall be mixed in standard hydraulic mulching equipment to form homogenous slurry. This slurry shall be sprayed, under pressure, uniformly over the soil surface at the material application rate recommended by the manufacturer. The hydraulic mulching equipment shall contain a continuous agitation system that keeps all materials in uniform suspension throughout mixing and distribution cycle.

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1. Application: Using standard hydraulic mulching equipment, the wood fiber mulch, seed and fertilizer slurry shall be applied evenly over the soil surface in a one-step operation.

TERRAIN

MULCH APPLICATION RATE

Flat soil surfaces	(minimum) 1,500 lbs. per acre
Slope 3 to 1 or steeper	2,000 lbs. per acre
Critical areas*	2,500 lbs. per acre

*Potential slope instability, extreme low moisture availability or high intensity of rainfall.

2. The mulch material shall consist of virgin wood fibers manufactured expressly from whole wood chips. The chips shall be processed in such manner as to contain no growth or germination inhibiting factors. (Fibers shall not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and research paper plants).
3. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the mulch material shall form a blotter-like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold grass seed in contact with the soil.
4. The wood fiber mulch shall conform to the following specifications:

Percent moisture content	10.0 % $\pm$ 3.0%
Percent organic matter (wood fiber)	99.2 % $\pm$ 0.8% oven dried beans
Percent ash content	0.8 % $\pm$ 0.2% oven dried beans
PH	4.8 % $\pm$ 0.5
Water holding capacity (minimum) (grams of water per 100 grams of fiber)	1,000

X. Sodded/Sprigged Areas:

1. Soil Testing: Testing shall be requested 30 working days prior to delivery of topsoil or planting mix or the work site. Deficiencies in the topsoil or planting mix shall be corrected by the Contractor. Retesting cost shall be at the Contractor's expense.
2. Preparation of Bed: Unless otherwise approved by Grounds or designee, all other site work required by this contract shall be complete and in place before grassing operations are begun.
3. Work may be completed in parts if so, requested by the Contractor and approved by the Grounds Superintendent or designee. Prior to planting operations, all proposed lawn areas shall be scarified to 6-inch depth and pulverized until the surface is smooth, friable and of a uniformly fine texture.
4. Remove stones and foreign material over one inch in diameter and grade for positive drainage as required to prevent ponding of water.
5. Pre-emergent Herbicide: A pre-emergent herbicide and fertilizer combination (oxadiazon + fertilizer or approved equal) shall be broadcast according to label recommendations.
6. Sod / Sprig Planting: Prepare sub-grade as specified above. Allow for thickness of sod to finished grade.
7. Turf types for sod or sprigs to be used will be specific to that given job / project. To be approved by Grounds or designee prior to installation.
8. Where Bermuda sod or sprigs are to be used – 'Tifway 419' Bermuda or approved equivalent will be used as specified by Grounds or designee.
9. Lay sod within 24 hours from time of stripping. Protect any sod stored on site from damage due to weather. Do not lay sod on frozen ground.
10. Sprigs should be fresh used within 24 hours from digging.
11. Soil should be moist, but not wet, prior to laying sod. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to sub-grade or sod. Tamp or roll lightly

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to ensure contact with sub-grade. Work sifted soil into minor cracks between pieces of sod and remove excess to avoid smothering of adjacent grass.

12. Anchor sod on slopes with wood pegs to prevent slippage. Lay sod perpendicular to slope directions.
13. Sprigged areas will be rolled with 250pd. rolled weight. Sprigs must be pushed into the ground with a grooved roller.

Y. Maintenance and Establishment of Plant

1. Prior to acceptance: The Contractor shall be responsible for all maintenance of plants, turf and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.
2. Seeded Areas: Maintenance of seeded areas shall consist of fertilization, erosion repair, reseeding and incidental operations as necessary to establish a vigorous, healthy and uniform stand of specified grass. All areas which fail to show a uniform stand of grass for any reason shall be treated properly until a uniform stand of at least 90 percent coverage is attained with no bare areas.
3. Grass mowing operations shall be performed by the Contractor until final acceptance of the work. Trash and debris shall be removed prior to mowing. Mowing shall be
4. performed only when the grass is dry. Mowing of Fescue shall be performed whenever grass height is 5 inches. It shall be cut to a height of 3 to 4 inches. All maintenance performed prior to acceptance shall be considered incidental to the project and no separate payment shall be made.
5. Sodded/Sprigged Areas: Contractor shall maintain Sodded / sprigged areas as follows:
 - a. Watering: Water sod / sprigs immediately after installation. Soak sod / sprigs thoroughly enough to penetrate soil below the newly installed sod / sprigs. Then water as follows:

0-14 day's	170 gallons/1,000 s.f. every day
15-28 days	225 gallons/1,000 s.f. every other day
29-42 days	340 gallons/1,000 s.f. every three days
43-84 days	680 gallons/1,000 s.f. once per week
After 84 days	As needed to maintain acceptable turf
 - b. In the event the project is accepted prior to the watering requirements being fulfilled, the contractor will be required to provide water up to 90 days after sodding/ sprigging.
6. Fertilizing Sodded / Sprigged Areas: Fertilizing will be specific to the given job or as follows:
 - a. Fertilize sod 2 to 3 weeks after laying sod with high phosphorus fertilizer. Apply a complete nitrogen fertilizer every three weeks until the sod has achieved satisfactory establishment.
 - b. As a follow-up for Bermuda sod /sprigs, the contractor or University (applicator is to be specified in the contract) will apply ½ pd. of Nitrogen from Ammonium Nitrate (34-0-0) or Ammonium Sulfate (28-0-0) within 4 weeks of the initial installation.
7. Mowing Sodded / Sprigged Areas: Mowing will be specific to the given job or as follows:
 - a. Grass mowing operations shall be performed by the Contractor until final acceptance of the work.
 - b. Trash and debris shall be removed prior to mowing.
 - c. Mowing shall be performed only when the grass is dry.
 - d. Mowing of Fescue shall be performed whenever grass height is 5 inches. It shall be cut to a height of 3 to 4 inches.
 - e. All maintenance performed prior to acceptance shall be considered incidental to the project and no separate payment shall be made.
8. Fertilizer Top-Dressing: Where directed, Contractor shall top-dress lawn areas as described in Section 886 of NCDOT Standard Specification for Roads and Structures.

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32.14 EXTERIOR SHRUB AND GROUNDCOVER PLANTING

A. Substitutions:

1. The species or varieties, materials, products or sizes specified herein by botanical and common name shall be provided as specified. Only upon written application by the Contractor to the Landscape Architect, and when such application is approved in writing by said Grounds or designee, will substitutions be permitted.
2. Request for permission to substitute will not be entertained unless adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution. The contractor must submit a list of a minimum of 10 sources of plant suppliers that have been contacted. The list must include the name of the plant supplier, contact name, date and time.
3. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for use of the nearest available size or similar variety with a corresponding adjustment of the contract price.

B. Energy And Water Efficient Landscaping:

1. Buildings shall be landscaped for energy efficiency and water conservation. Bushes and large trees provide shading and act as a wind breaks.

C. Planting Mix: Planting Mix will meet standards under Soils. "Soils." Planting mix may be developed that will be an Acceptable Planting Media by following the standards under Soils. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks and other extraneous matter. Planting mix shall not be used while in a frozen or muddy condition.

D. Will meet standards under Soils. Unless otherwise specified in the contract documents the Acceptable Planting Media shall contain the specified percentages of constituents shown under Soils.

E. A sample of the proposed planting mix shall be submitted to the Grounds or designee 30 calendar days prior to installation and be approved prior to delivery to the site.

F. Plant Approval Process:

1. Representative samples of each plant type shall be submitted to Grounds or designee for approval. This approval process will require 7 working days. Clear, high-quality photographs may be accepted in lieu of actual samples at the discretion of the Grounds or designee.
2. No plants shall be delivered to the project site, except for required samples, until inspection has been made in the field or at the nursery, or unless specifically authorized in writing by the Grounds or designee. Inspection of plants to be balled and burlapped must be made, and plants must be approved by the Grounds or designee before they are planted. Inspection shall be for quality, size and variety only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.
3. *PermaTill Manufacturer-Carolina Stalite Company, 217 Klumar Rd., PO Box 1037, Salisbury, NC 28144**Unless specific for that contract.
4. Supply all plants as specified in plant list as shown on drawings. Plants shall be typical of their species and variety, have normal growth habits, have well-developed branches, be densely foliated, be vigorous, and have fibrous root systems.
5. No plants will be accepted unless they show healthy growth and satisfactory foliage conditions.
6. Size of plants, spread of roots and size of balls shall be in accordance with American Standard for Nursery Stock 260.1, as published by the American Association of Nurseryman, Inc. All plants of each particular variety shall be uniform in size and configuration and shall be labeled with correct plant name and size.
7. Balled and burlapped plants shall be nursery grown and freshly dug. Burlap shall be untreated and biodegradable. Nursery grown plants shall have been transplanted or root pruned at least

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once in the past three (3) years. No plants showing evidence of “made” root balls will be accepted.

8. Containerized plants shall have a root system sufficient enough in development to hold the soil intact when removed from the container. The root system shall not be root bound a condition where the root system is dense in mass, excessively intertwined, and has established a circular growth pattern.
9. Labels shall be attached securely to all plants, bundles and containers of plant materials delivered. Plant labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process lettering. These labels shall be removed by the Contractor after the final acceptance.
10. Plants shall conform to measurements specified in the plant lists, except that plants larger than specified may be used if approved by Grounds or designee.
11. Use of such 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 in accordance with the American Standards of Nursery Stock.

G. Shipment and Delivery:

1. The Contractor shall promptly notify the Grounds or designee, at least three days in advance, when the approved plant material is to be delivered, the nursery source, and the manner of shipment. The Contractor shall furnish therewith an itemized list of the actual species, variety, quantity and sizes.
2. The Contractor shall deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting.
3. When shipment is made by open truck, pack all plants material to provide adequate protection against climate and breakage during transit, and tie to prevent whipping. The tops shall be covered with tarpaulin to minimize wind-whipping and drying.
4. Exercise care at all times during handling operations to prevent damage to bark, branches, and root system. Employ a suitable method of handling to insure the careful, workmanlike delivery of heavy bald plants to preclude loose or crushed plant balls. All balled and burlap plants shall have wire baskets.
5. Plants shall be free from defects and injuries and shall be certified by the State and Federal Departments of Agriculture to be free from plant diseases and insect infestations.

H. Landscaping Design: Refer to the University Landscape Architect for assistance. Plant lists shall contain both common and technical names, quantities, and plant delivery method (B & B, bare roots, etc.)

I. Plants (Shrubs and Trees): Shall be provided as shown on the Drawings. All plant material furnished shall be well branched and proportioned, full-foliaged, and in a healthy condition, free of disease and insect infestation. There shall be no substitutions without express written permission of Grounds. The following requirements pertain to all plant material:

1. Quality: Unless specifically noted otherwise, all plants shall be of specimen quality, exceptionally heavy, symmetrical, thickly branched, so trained or treated in their development and appearance as to be unquestionably of first quality in form, branch structure, buds, fruit, compactness and symmetry.
2. Nomenclature: The scientific names of plants listed in the Plant List conform to that of "Standardized Plant Names" (the latest edition) prepared by the American Joint Committee on Horticultural Nomenclature.
3. Standards: Requirements for definitions, grading tolerances, balling and burlapping, container grown plants and bare-root plants shall be in accordance with the "USA Standard for Nursery Stock," latest edition, adopted by the American Association of Nurserymen, Inc. Plants shall be measured before pruning with branches in normal position, and any necessary pruning shall be performed at time of planting. Where plant sizes are given in a range, the plants provided shall average the median of the range or better.
4. Inspection: The Owner has the right to inspect the plants and trees at their place of growth, but such inspections shall not preclude the right of rejection at the site. The Owner shall be notified as to the location of plant material for inspection.

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5. Certificates of Inspection: The Contractor shall obtain all necessary certificates of inspection required by law for the transportation or shipments of plants to the project site and shall maintain files of all certificates.
 6. Disease and Damage: All plants shall be free of disease, insect infestations, eggs or larvae; and shall have thickly developed, well-proportioned and healthy root systems. Plant material shall be free from physical damage or conditions that prevent the desired quality appearance and growth characteristics; or inhibit the plants thriving ability, hardiness, or adaptability.
- J. Soil Preparation: Prior to completing the project, there shall be a 6-inch layer of organic topsoil across the site in areas where any planting is to occur. If there is topsoil on site, the Contractor may store it within the Project Limit or at a location away from the University. This work shall be included in the Base Bid.
- K. Soil Amendments: Shall be any decomposed compost such as, horticultural dehydrated cow manure composed of not less than 90percent decomposed organic matter by weight on an oven dried basis. Organic matter shall be delivered in a workable condition, free of lumps, containing not more than 35 percent moisture or ash, by weight.
- L. Fertilizer: Shall be commercial nursery slow-release granular fertilizer: STA-Green Nursery Special or approved equal. Fertilizer shall be delivered to the site in original bags bearing the manufacturer's guaranteed analysis of 12-6-6 or 14-7-7 of which 50 percent of the nitrogen is derived from urea formaldehyde.
1. Fertilizer for Shrubs and Groundcovers:
 - a. The fertilizer shall be one from the following listed below or equal fertilizer approved by the Grounds Superintendent or designee.
 - b. The fertilizer shall have 50 percent water insoluble nitrogen. The chlorine content is not to exceed 5 percent.
 2. Shrubs and Groundcovers:
- | FERTILIZER
PRODUCT | ANALYSIS | APPL.RATE |
|--------------------------------|-----------------|--------------------|
| Ornamental
plant fertilizer | 12-6-6 | 2 lbs./100 Sq. Ft. |
| Ornamental
plant fertilizer | 14-7-7 | 2lbs./100 Sq. Ft |
- M. Mulch: Shall be free of debris and wood chips. It shall be aged Shredded Bark free of excess tannic acid. A sample of bark mulch shall be provided for Grounds approval prior to delivering the mulch. The Owner reserves the right to reject any mulch which is considered to be unsuitable.
1. Mulch shall consist of pine bark mulch, double hammered pine bark, shredded hardwood bark or other mulch as specified on the plans.
 2. All mulches shall be free of any foreign materials, pieces larger than 6 inches, and/or green wood.
- N. Water: Water shall be free from oil, acids, alkalis, salts or any other substance that is toxic or otherwise harmful to vegetation.
- O. Anti-Transparent: An emulsion which provides a protective film over plant surfaces, sufficiently permeable to permit controlled transpiration, and shall be administered according to the manufacturer's recommendations. Anti-transparent shall be "Vapor-Gard" as manufactured by Miller Chemical and Fertilizer Corporation, Hanover, Pennsylvania, 17331, or Wilt-Pruf, or approved equal.

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- P. Pre-emergence Herbicide: "Eptam", granular form, as manufactured by the "Stouffer Chemical Company", or Ronstar "G", or Treflan granular, or approved equal, consistent with pesticide label for recommended plant material.
- Q. Bracing Materials: Utilize #9-gauge galvanized steel wire: ¾ inch diameter reinforced rubber hose of suitable length; treated guy stakes 2 by 4 by 36 inches long, guy wire flags of yellow plastic standard surveyor's flagging, capable of lasting through the bracing period.
- R. Herbicides: Three (3) working days prior to the planting of shrubs and groundcovers, but subsequent to planting bed preparation, Grounds or designee shall be notified and be on hand when the pre-emergent is applied to the planting project. The first application of the chemical trifluralin, oryzalin, or approved substitute by the Grounds Superintendent or designee should be applied per labeled instructions. (See instructions under Mulching for Application Rate).
- S. Plant Protection on Site: Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected with soil, wet wood chips, or other acceptable material and shall be kept well-watered.
 - 1. Plants remaining unplanted for longer than Three (3) days after delivery may be deemed unacceptable after inspection by Grounds or designee. Plants shall not be bound with wire or rope at time so as to damage the bark or break branches. Plants shall be lifted and handled using suitable support of the ball to avoid damage to the root ball, trunk, or branches.
 - 2. Before excavations are made, cover the surrounding turf, if existing, in a manner that will satisfactorily protect all turfed areas that are to be driven over, and upon which soil is to be temporarily stacked pending its removal or reuse. Barricade existing trees, shrubbery and beds that are to be preserved in a manner that will effectively protect them during planting operations or as specified on the plans.
- T. Subsurface Improvements: Do not disturb or damage subsurface improvements.
 - 1. Prior to excavations, Contractor shall notify North Carolina One-Call-Center, Inc.
 - a. 1-800-632-4949 to ascertain locations of any locations not identified by the University such as gas lines. Notify the designer and University should the above-mentioned subsurface improvements present an obstruction in locations designated for planting. In such situations, proceed after an alternate location has been approved by Grounds or designee. Damages caused by the Contractor shall be the responsibility of the Contractor to repair in a timely manner (not to exceed 48 hours) to the satisfaction of the Owner.
- U. Locations of Plants: The Contractor shall stake out or paint locations for plants and outlines of areas to be planted and obtain approval of the Grounds Superintendent or designee before excavation is begun. A minimum of 30 percent total planting must be staked before inspection will be made.
- V. Excavation: No excavation or planting shall be done in soil that, in the opinion of Grounds or designee, is too wet, too dry or not properly conditioned. During working hours Grounds or designee may designate holes to be barricaded if holes are determined to present a pedestrian hazard.
- W. Detrimental Soil Conditions: The Contractor shall notify the Grounds and designer in writing of all soil and drainage conditions which the Contractor considers detrimental to growth of plant material. State condition and submit proposal in writing to the Grounds and designer for correcting condition.
- X. Obstructions: If rock, underground construction work, tree roots, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Grounds or designee. Where locations cannot be changed as determined by Grounds or designee, remove the obstructions to a depth of not less than 6 inches below the required pit depth. Proceed with work after approval from Grounds or designee.
- Y. Plant Installation:

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1. Planting Beds: The extent of the planting bed shall be as indicated on the construction plans. The planting bed for shrubs, groundcover plants, and trees shall be prepared wide enough to accommodate all roots without crowding or twisting.
2. Planting beds shall be prepared in accordance with Types 1, 2, 3 or 4, in accordance with the plans or specifications.
 - a. Backfilling of Balled and Burlapped Plants: Backfilling shall be done in accordance with the following steps.
 - b. Place root ball two (2) inches above adjacent grade- see detail 40.05 A&B
 - c. When partially backfilled and compacted, cut away the ball ties and cut and improve any wire loops that may protrude above the surface of the soil at any time. Cut and remove all wires, rope, burlap, or other ball wrapping materials from the top 1/3 of the root ball. Cut or adjust to prevent the formation of air pockets. No burlap shall be pulled from under the balls.
 - d. Backfill one-half (1/2) of remaining hole with planting mixture specified, and water thoroughly. Backfill rest of hole with planting mixture. Firm down, eliminating all air pockets. Do not pack.
 - e. Build a four (4) inches high berm around the edge of the root ball to form a basin for holding water. The bottom of the basin shall be at surrounding finish grade.
3. Watering: Containerized plants shall be watered thoroughly prior to planting so as to provide adequate moisture to the plant during the planting process.
 - a. Thoroughly water all plants immediately after planting. This shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting.
 - b. Apply water only by open-end hose at a very low pressure to avoid air pockets and injury to the roots. When planted, watered, and fully settled, the plants shall be vertical, and the top of the root ball shall not be below the existing grade.
 - c. Fill basin with water, being careful not to break down berm with hose stream, or to gouge out holes in the backfill.
4. Pruning: No pruning is to do except to remove broken branches, street/sidewalk obstructions, and for correcting irregularities including removal of soft wood or sucker growth and/or broken or badly bruised branches.
 - a. This pruning shall be done at the direction of Grounds or designee.
 - b. Prune with harp tools; make cuts even and clean.
5. Mulching Applications: Within two (2) days after planting, mulch all planting areas, entire shrub and groundcover beds with a four (4) inches layer of mulching material. Taper mulch to ground level at the trunk. Do not allow mulch to pile up against the trunk.
 - a. Prior to mulching, apply trifluralin, oryzalin pre-emergent herbicide or approved equal as specified by Grounds Superintendent or designee to surface according to label directions. Then apply a second application after mulching. Application shall not proceed without the presence of a representative of Grounds or designee.
6. Name Tag Removal: Remove nametags attached to installed plants prior to final inspection. The contractor shall remove all nametags from installed plants within two (2) weeks after final inspection.
7. Abandoned Plant Pits: When utility lines or other unsuitable subsurface conditions are encountered in plant pits, Grounds or designee will direct those plants be relocated in satisfactory locations. Backfill-abandoned pits with suitable topsoil to compacted finished grade. Unsuitable material shall be removed from property. These areas shall be reseeded in compliance with the turf and lawn specifications.
- Z. Prior to acceptance: The contractor shall be responsible for all maintenance of plants and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.

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AA. Watering After Acceptance: In order to properly establish the plant material, watering of plant material shall be the responsibility of the Contractor until the expiration of the one-year warranty period. The Contractor shall perform watering operations only at intervals approved by Grounds or designee and shall notify Grounds or designee at least 24 hours prior to commencing watering operations so that a representative of Grounds or designee may be on hand.

1. Grounds or designee reserves the right to direct the schedule of watering operations. When so directed by Grounds or designee, the Contractor shall commence watering operations within 24 hours.
2. Watering shall be applied at a rate specified by Grounds or designee or in accordance with the contractor documents. The Contractor shall be responsible for all necessary traffic control during watering operations.
3. The quantity of the water to be paid for will be the actual number of 1,000-gallon units of water which have been furnished and applied to plants during the establishment period. Measurements of water will be made by means of an approved metering device at the source of supply, or by determining the volumetric capacity of tank trucks used to deliver water to the project and recording the number of loads delivered by each truck.
4. The quantity of water, measured as provided above will be paid for at the contract unit price for "Watering after Acceptance."
5. Plant Materials shall be watered as described by the following ratios:

TREE CALIPER

GALLONS OF WATER

Under 1 inch

5

1 – 1½ inches

5 - 10

2 inches

10 - 15

2 - 2 ½ inches

15 - 20

3 – 3 ½ inches

25 - 30

3 ½" + inches

(Shall be monitored and receive water in an amount and frequency to maintain soil moisture).

6. Execution: Watering is to be done a minimum of once per week. Watering shall begin approximately April 15 and continue until November 1, unless otherwise directed by Grounds or designee. A set weekly schedule is to be established and maintained by the contractor, and adequate notice given of any change. Grounds will notify the contractor to omit watering when he determines there has been adequate rainfall the previous week. The contractor shall notify Grounds or designee of the completion of each watering cycle.

GROUND COVER AND SHRUBBERY

GALLONS OF WATER

Per Square Foot (1 inch of Water)

1.6

7. Cleanup: During the installation, the Contractor will be required to keep all areas clean.
 8. At the time of final inspection of work and before issuance of the final payment, the Contractor shall clean paved areas thoroughly by sweeping and/or washing. Any defacement of stains caused by the work of this Section shall be removed.
 9. The Contractor shall remove construction equipment, excess materials, tools, and all debris and rubbish from the site. All dirt and debris shall be legally disposed of by the Contractor in areas approved by the Grounds Superintendent or designee.
- BB. Final Acceptance: Upon completion of planting operations, including cleanup, the Contractor shall notify Grounds or designee and accompany him or her on inspection of planting. Any items found to be unsatisfactory shall be corrected prior to approval for final acceptance. The one-year guarantee period shall begin on the date of final acceptance.
- CC. Name Tag Removal: The contractor shall not remove the nametags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.

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- DD. Warranty and Replacement: The Contractor shall warranty plants (shrubs and ground covers) and all other materials and workmanship for a period of twelve (12) months from the date of final acceptance by Grounds or designee. The Contractor shall replace any plants that have more than one third die-back, or any other portion of the project that fails due to faulty materials or workmanship. All plants shall be insect and /or disease free. Plants damaged by pathogen activity through the warranty period shall be replaced. A six (6) month and eleven (11) month inspection will be held during the warranty period. Damage prior to final acceptance shall be the responsibility of the Contractor.
1. Plant replacements shall be the same as specified in the plant list. Replacement plant sizes shall be the same as other existing plants of the same species on the project. Plants, plant soil mix, fertilizer and mulch etc., shall be replaced as originally specified.
 2. During the warranty period any plant that is dead or not in satisfactory growth, as determined by Grounds or designee, shall be removed from the site. These and any missing plants shall be replaced as soon as conditions permit, but during the normal planting season. If plant(s) is (are) not removed within five (5) days of notice from Grounds or designee, the Owner will remove dead plant(s), dispose of it (them), and charge the contractor for the cost of removal and disposal.
 3. Plants and items repaired or replaced shall have an extended warranty period of twelve
 4. (12) months from the date of acceptance of the repaired item.
- EE. Landscape Management: Increased development of the campus creates the greater demand for efficient landscape planning. The introduction of new signage, plant materials, benches walk, lights, etc. into the landscape all effect long-term maintenance. Therefore, it is necessary to develop guidelines that must be reviewed by anyone involved in the planning and design of elements. Long term plans for walkways, roads and buildings must be considered when locating signage, benches or plant materials in proposed designs.
1. Turf strips less than two feet between walkways, curbs or buildings will not be allowed.
 2. Planting beds shall have large sweeping edges for ease of lawn mower cutting.
 3. Place signs, lights and other permanently installed objects in mulch or planting beds, when possible, for ease of lawn maintenance. This will also protect these objects from mower and weed eater damage.
 4. Select ground covers, shrubs and trees for natural size and habit for an area to avoid overgrowing and unnecessary pruning.
 5. Do not plant low branching trees in turf areas.
 6. Levels Of Landscape Management:
 - a. Internal standards included to illustrate level of care required if contractor is responsible for if maintaining a landscaped area on campus for the duration of a project:
 - b. Level I:
 - 1) This designation is used for areas requiring the highest level of maintenance. Areas requiring this level of maintenance and landscaping will be limited to high visibility areas such as, but not limited to: Main entrance, Hwy. 29 entrance, North, East and West entrance, Belk Tower Quad, East Quad, West Quad, 49er Island, all Classroom buildings, Administration buildings, Residence Halls, Student Activity Center, Belk Gymnasium, Parking Decks, Belk Track & Field Pavilion and Wachovia Field House.
 - 2) Trees and shrubs planted at new and renovated landscaped sites are to be properly fertilized twice a year (March 1 and June 1) with a 12-6-6 slow-release fertilizer with a urea form nitrogen source 50 percent WSH. and 50 percent WIN such as "STA-Green" brand. If soil tests are conducted fertilizer schedules and mixtures may be amended.
 - 3) Plant material is to be pruned in late February and early June and treated with necessary pesticides to maintain plant material insect and disease free and plant beds free of all weeds/grasses.
 - 4) Plant beds and trees are mulched in Spring (March - May) with approximately 3 inches of aged, shredded pine bark. All plant beds will be maintained using a 4

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inches depth “V” trench, border method edging to retain bark mulch neatly. Leaves are removed from beds in late Fall.

- 5) Newly installed ground covers and shrubs are to be watered via irrigation systems if available, or hand watered weekly during the first year growing season, which include dry winter periods.
- 6) Newly installed trees are to be watered via irrigation systems if available, or hand watered at least twice a week during dry periods the first year growing season, which includes winter.

c. Level II:

- 1) This designation is used for areas normally defined as “semi-improved grounds” which include existing trees and shrubs around parking lots, some campus lawn areas, parks, natural areas and walkways.
- 2) The lawns and shrubs/trees are fertilized in March and June similar to plant material in Grounds Maintenance Level I.
- 3) Shrubs are pruned in same manner referred to in G.M. Level I and trees are pruned periodically as required to remove dead/diseased trees and limbs and maintain sound structural/aesthetic integrity. Shrubs and trees are fertilized in the same manner referred to in G.M. Level I.

d. Level III.

- 1) This designation is used for areas normally defined as unimproved grounds. These areas will require only minimal levels of work that will include grass and weed control, perimeter fencing, immediate removal of dead trees, tree pruning, brush clearing and removal and other ground cover in low visibility areas or areas that impair safe sight distance for security or vehicular purposes.

7. Ground Cover Cutting: (e.g., lawn areas, grass/weeds/other vegetation). Ground cover areas shall be maintained in a manner that promotes proper health, growth, rich natural green color and neat appearance.
8. Lawn areas are to be free of broad leaf weeds, weedy grasses that present an unsightly appearance, dead vegetation, and debris.
9. All surface disruptions (e.g., rodent and insect mounds), are to be raked level and any resulting holes filled prior to mowing.
 - a. Grass cutting is to be accomplished in a manner such that it is free of scalping, rutting, bruising, and uneven or rough cutting. Grass clippings shall be either mulched or removed immediately after mowing. Where practical, each successive mowing shall be at approximate right angles to the previous mowing.
 - b. Prior to mowing, all refuse, debris, leaves, rocks, paper, and other portable objects shall be removed within the maintenance area lodged in shrubs, hedges, fences, and along foundation walls.
 - d. Plant And Shrub Pruning: For Grounds Maintenance Level I and II, all shrubs, bushes, hedges, and other cultivated plants shall be pruned according to their natural growth habit, for proper health, attractive appearance and to prevent interference with pedestrian and vehicle traffic. Pruning is to be done in a manner that:
 - 1) Prevents growth in front of windows, over entrance ways and walks; prevents obstructing vision at street intersections; removes dead, damaged, or diseased wood, and naturally forms and balances the shrub, bush or plant.
 - 2) With the exception of flowering plants, shrubs, and ornamentals, which shall be pruned to accommodate their flower cycle, pruning of the entire plant or shrub shall be performed not less than once per year to maintain their established shape and appearance.
 - 3) Prune to maintain the plants natural habit except for formal hedges. Prune back to an outward facing bud.
 - 4) Prune to prevent safety hazards, and to maintain pathways and walks.

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- 5) All pruning shall be performed according to applicable N.C. Cooperative Extension standards.

32.15 TREE PLANTING

A. Substitutions:

1. The species or varieties, materials, products or sizes specified herein by botanical and common name, shall be provided as specified. Only upon written application by the Contractor to the Grounds Superintendent or designee, and when such application is approved in writing by Grounds or designee in coordination with Grounds Superintendent or designee, will substitutions be permitted.
2. Request for permission to substitute will not be entertained unless adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution.
3. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for use of the nearest available size or similar variety with a corresponding adjustment of the contract price.
If the specified plant(s) proves to be unavailable, the use of a substitute plant will be considered.

B. Topsoil: In compliance with requirements "Soils".

C. Planting mix in compliance with requirements "Soils. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks and other extraneous matter. Planting mix shall not be used while in a frozen or muddy condition.

D. Plant Approval Process:

1. Representative samples of each plant type shall be submitted to the Grounds Superintendent or designee for approval. This approval process will require seven (7) working days. Clear, high-quality photographs may be accepted in lieu of actual samples at the discretion of Grounds or designee.
2. No plants shall be delivered to the project site, except for required samples, until inspection has been made in the field or at the nursery, or unless specifically authorized in writing by Grounds or designee. Inspection of plants to be balled and burlapped must be made, and plants must be approved by Grounds or designee before they are planted. Inspection shall be for quality, size and variety only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.
3. Supply all plants as specified in plant list as shown on drainage. Plants shall be typical of their species and variety, have normal growth habits, have well-developed branches, be densely foliated, be vigorous, and have fibrous root systems. No plants will be accepted unless they show healthy growth and satisfactory foliage conditions. Size of plants, spread of roots and size of balls shall be in accordance with American Standard for Nursery Stock 260-1 as published by the American Association of Nurserymen, Inc. All plants of each particular variety shall be uniform in size and configuration and shall be labeled with correct plant name and size.
4. Balled and burlapped plants shall be nursery grown and freshly dug. Burlap shall be untreated and biodegradable. Nursery grown plants shall have been transplanted or root pruned at least once in the past three (3) years. No plants showing evidence of "made" root balls will be accepted.

E. Tree Root Ball Specifications:

1. Trees supplied must have been properly planted and grown in the nursery. The original root crown (also called the trunk flare) shall be evident near the top of the ground. Any excess soil, up to and including three (3) inches covering the root crown will have to be removed carefully by hand, in order to prevent root scrapes. The tree is then to be planted with the root crown in the proper relation to the surrounding grade. Any trees with more than three (3) inches of soil on top of the root crown will be rejected. The nursery owners may dig oversize

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- balls and remove the soil in order for the root system diameter (which is the required root ball diameter) to meet the specification for the trunk caliper required. (see detail 40.09).
2. Ball and burlapped (B & B) plants must have firm, natural balls of earth, of diameter not less than recommended in the "Tree and Shrub Transplanting Manual" and be of sufficient depth to include the fibrous and feeding roots. Plants moved with a ball will not be accepted if the ball is dry, cracked, or broken before or during planting operations.
 3. Containerized plants shall have a root system sufficient enough in development to hold the soil intact when removed from the container. The root system shall not be root bound a condition where the root system is dense in mass, excessively intertwined, and has established a circular growth pattern.
 4. New trees must have straight trunks with a single leader intact, unless multi-stem trees are specified. Bark shall be free of abrasions, and all cuts shall be completely callused over. Trees will not be accepted which have had their branches shortened, leaders cut, or which have leaders damaged so that cutting is necessary. Unless otherwise specified, large maturing trees shall be free of branches up to six (6) feet from top of ball, well branched, and have straight stems.
 5. Labels shall be attached securely to all plants, bundles and containers of plant materials delivered. Plant labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process lettering. These labels shall be removed by the Contractor after the final acceptance. Plants shall conform to measurements specified in the plant lists, except that plants larger than specified may be used if approved by Grounds. Use of such 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 in accordance with the American Standards of Nursery Stock.
- F. Shipment and Delivery:
1. The Contractor shall promptly notify the Grounds t or designee, at least three (3) days in advance, when the approved plant material is to be delivered, the nursery source, and the manner of shipment.
 2. The Contractor shall furnish therewith an itemized list of the actual species, variety, quantity and sizes. The Contractor shall deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting.
 3. When shipment is made by open truck, pack all plant materials to provide adequate protection against climate and breakage during transit, and tie to prevent whipping.
 4. The tops shall be covered with tarpaulin to minimize wind-whipping and drying.
 5. Exercise care at all times during handling operations to prevent damage to bark, branches, and root system. Employ a suitable method of handling to insure the careful, workmanlike delivery of heavy bald plants to preclude loose or crushed plant balls. All balled and burlap plants shall have wire baskets.
 6. Plants shall be free from defects and injuries and shall be certified by the State and Federal Departments of Agriculture to be free from plant diseases and insect infestations.
- G. Fertilizer for Trees:
1. No fertilizer is to be applied at time of planting.
 2. The tree fertilizer is to be applied at the 6 month or 12-month warranty inspection time; whichever is closer to early spring beginning of growth.
 3. The fertilizer shall be one from the following listed below or equal fertilizer approved by the Grounds or designee.
 4. The fertilizer shall have 50 percent water insoluble nitrogen. The chlorine content is not to exceed 5 percent.
 - a. Trees
 - 1) Application shall be at a rate .16 lb. minimum to .20 lb. maximum nitrogen/inch caliper of tree. Source of nitrogen shall be Urea Formaldehyde, or a similar slow-release source approved by the Grounds. In addition to the nitrogen, the following shall be used, .05 lb. phosphorous and .05 lb. of pot ash per inch caliper.

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- 2) EXAMPLE OF TREE FERTILIZATION: 1 cup of 31-7-7 analysis fertilizer or 2 cups of 12-6-6-analysis fertilizer per inch caliper.
- H. Mycorrhizal Fungi: All trees will be treated/inoculated at the root zone with mycorrhizal fungi for root growth stimulation using either ecto and/or endo mycorrhizal fungi: dependent on the particular tree species as approved by Grounds or designee, who may appoint a representative to oversee the inoculation of these root balls.
- I. Mulch (Trees): Mulch shall consist of pine chips and bark, or hardwood bark as specified on the plans. Pine bark chips shall be 1/8-inch nominal thickness with at least 50 percent having an area of not less than 1 square inch and no piece having an area of more than 6 square inches. All mulches shall be free of any foreign materials, pieces larger than 6 inches, and/or green wood.
- J. Water: Water shall be free from oil, acids, alkalis, salts or any other substance that is toxic or otherwise harmful to vegetation.
- K. Root Control Barricades: These general guidelines must be followed in all barrier installations. Use instructions based upon manufacturers recommendations. Review site-specific design plan with the Grounds Superintendent for all applications specifically for depth of barriers required and **ESPECIALLY IF ROOT TRIMMING IS REQUIRED!**
- L. Plant Protection on Site: Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected with soil, wet wood chips, or other acceptable material and shall be kept well-watered.
1. Plants remaining unplanted for longer than 3 days after delivery maybe deemed unacceptable after inspection by Grounds. Plants shall not be found with wire or rope at any time so as to damage the bark or break branches. Plants shall be lifted and handled using suitable support of the ball to avoid damage to the root ball, trunk, or branches.
 2. Before excavations are made, cover the surrounding turf, if existing, in a manner that will satisfactorily protect all turfed areas that are to be driven over, and upon which soil is to be temporarily stacked pending its removal or reuse. Barricade existing trees, shrubbery and beds that are to be preserved in a manner that will effectively protect them during planting operations or as specified on the plans.
- M. Subsurface Improvements: Observe proper precautions so as not to disturb or damage subsurface improvements.
1. Prior to excavations, Contractor shall notify North Carolina One-Call Center, Inc. at 1-800-632-4949 to ascertain locations of any locations not identified by the University, such as gas lines. Notify Grounds should the above-mentioned subsurface improvements present an obstruction in locations designated for planting. In such situations, proceed after an alternate location has been approved by Grounds or designee. Damages incurred by the Contractor shall be the responsibility of the Contractor to repair in a timely manner (not to exceed 48 hours) to the satisfaction of the Owner.
- N. Locations of Plants: The Contractor shall stake out or paint locations for plants and outlines of areas to be planted and obtain approval of Grounds or designee before excavation is begun. A minimum of 30 percent total planting must be staked before inspection will be made.
- O. Excavation: No excavation or planting shall be done in soil that, in the opinion of e Grounds or designee is too wet, too dry or not properly conditioned as provided in these specifications. All excavations shall be in accordance with Typical Planting Detail Sheets included in the Landscape Construction Standards Manual or as otherwise specified. Tree pits shall not be excavated more than 24 hours prior to tree installation. Holes left open after working hours shall be completely barricaded and clearly marked by the Contractor. During working hours, the Grounds or designee may designate holes to be barricaded if holes are determined to present a pedestrian hazard.
- P. Detrimental Soil Conditions: The Contractor shall notify Grounds in writing of all soil and drainage conditions which the Contractor considers detrimental to growth of plant material. State condition and submit proposal in writing to Grounds for correcting condition.

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- Q. Obstructions: If rock, underground construction work, tree roots, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Grounds. Where locations cannot be changed as determined by the designer and Grounds, remove the obstructions to a depth of not less than 6 inches below the required pit depth. Proceed with work after approval of PM/Engineer.
- R. Tree Installation:
1. Planting Beds: The extent of the planting bed shall be as indicated on the construction plans. The planting bed for shrubs, groundcover plants, and trees shall be prepared wide enough to accommodate all roots without crowding or twisting.
 - a. Backfilling of Balled and Burlapped Plants: Backfilling shall be done in accordance with the following steps.
 - b. Set rootball 2 inches (no more) above adjacent grade-see detail 40.01
 - c. When partially backfilled and compacted, cut away the ball ties and cut and remove any wire loops that may protrude above the surface of the soil at any time. Cut and remove all wires, rope, burlap, or other ball wrapping materials from the top 1/3 of the root ball. Cut or adjust to prevent the formation of air pockets. No burlap shall be pulled from under the balls.*
 - d. Backfill one-half (1/2) of remaining hole with planting mixture specified, and water thoroughly.
 - e. Backfill rest of hole with planting mixture. Firm down, eliminating all air pockets. Do not pack.
 - f. Build a four (4) inches high berm around the edge of the root ball to form a basin for holding water. The bottom of the basin shall be at surrounding
 2. Watering: Containerized plants shall be watered thoroughly prior to planting so as to provide adequate moisture to the plant during the planting process. The Contractor shall thoroughly water all plants immediately after planting. This shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting. Apply water only by open-end hose at a very low pressure to avoid air pockets and injury to the roots. When planted, watered, and fully settled, the plants shall be vertical, and the top of the root ball shall not be below the existing grade.
 - a. Fill basin with water, being careful not to break down berm with the hose stream, wash away any mulch, or to gouge out holes in the backfill.
 3. Pruning: No pruning is to be done except to remove broken branches, street/sidewalk obstructions, and for correcting irregularities including removal of soft wood or sucker growth and/or broken or badly bruised branches. This pruning shall be done at the direction of the Arborist/Horticulturist. Prune with sharp tools; make cuts even and clean.
 4. Wrapping: There is to be no wrapping of the tree trunk. Any wrapping from the nursery to protect the trees in transit shall be left on the trunk until it is planted, and then all tree wrapping must be removed.
 - a. Brown or gray plastic tree trunk protectors shall be installed on all single trees in turf areas as directed by Grounds or designee. Do not lock the ends together. *Mycorrhizal fungi shall be placed in the root zone between the rootball and the backfill.
 5. Staking: There is to be no staking until examination by the Grounds Superintendent or designee 2-3 weeks after planting, and then stake only the trees, which they specify. Staking, using as many stakes as necessary, will only be used to straighten a leaning tree. Use only 3/4 inch green nylon strap with a slip knot and a stop knot 3-6 inches larger than the tree trunk to allow for growth. No cord, rope, wire, or hose will be allowed. Dig the root ball loose only if necessary. Do not stomp the root ball to straighten the tree.
 - a. If oversize planting pits are specified and the soil is loosed to 18 inches, use stakes long enough, up to 36 inches, to achieve a solid anchor. Drive the stakes in line with the strap, with the stake point directed away from the tree. In place of wood stakes, use #40 duck bill anchors for trees 2.50 inches in caliper and under. Use #68 duck bill

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anchors for trees larger than 2.50 inches in caliper. Set the anchors well before strapping to the tree. If trees begin to lean, within three weeks after staking is completed, turnbuckles will be required at the expense of the contractor.

- b. Where required, wrap or cover straps with fluorescent flagging.
6. Mulching Application: Within two (2) days after planting, mulch all planting areas, individual tree pits, and entire shrub and groundcover beds with a four (4) inch layer of mulching material. Taper mulch to ground level at the trunk. Do not allow mulch to pile up against the trunk.
7. Name Tag Removal: The contractor shall not remove name tags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.
8. Root Control Barriers: Where large maturing trees will be planted within closed proximity to brick paver sidewalks or other hardscapes, root control barriers will be installed. Closed proximity will be defined within eight feet of the sidewalks or other hardscapes from the side of the tree. These barriers are to hinder root growth from pushing up paver sidewalks or other hardscapes by the undermining of these hardscapes by root intrusion.
 - a. Review site-specific design plan with Grounds or designee for all applications specifically for depth of barrier required and **ESPECIALLY IF ROOT TRIMMING IS REQUIRED!**
 - b. Contact utility companies prior to digging or trenching if there are possibility service lines are present.
 - c. Wear chemical resistant gloves when handling the barrier to prevent staining. See product label and MSDS sheet for further information.
 - d. Do not allow gaps in fabric during installation or backfilling.
 - e. Many severed roots can regenerate, so they should always be completely removed. If removal is not possible, a systemic herbicide must be applied to severed roots to prevent re-growth. The systemic herbicide should be carefully applied, according to manufacturer directions, ensuring that it does not come in contact with existing tree roots. This could damage or kill the tree.
 - f. In high organic soils (>10 percent) with aggressive root species in close proximity to olefin plastics, spray or saturate trench walls with liquid trifluralin.
 - g. When joining two pieces of barrier, be sure they do not become separated at any point.
 - h. Seaming can be accomplished by using construction adhesive and/or overlapping. If the latter is used, seams should be overlapped at least 3 inches (or 2 nodule widths). Sod pins may also be used for seams, but make sure there are no gaps.
 - i. Barrier should not be left exposed to surface water or sunlight.
 - j. Barrier products are for non-food uses only.
 - k. Barrier stops roots within -1 inch of a nodule. Proper placement is very important. It is only effective where it is.
- S. Relocation of Trees Execution: Trees to be relocated shall be as shown on the drawings and specified herein. Trees are to be relocated in areas staked by Grounds t or designee.
 1. Trees shall be removed with a root ball sized in proportion to their calipers. Root balls shall be 12 inches in diameter for each 1 inch of tree caliper. Trees 4 inches in caliper and smaller are to be measured 6 inches from the ground. Trees 4-8 inches calipers are measured 12 inches from the ground, trees 8 inches caliper or larger are measured from breast height.
 2. Trees which are to be relocated in areas which do not require grading are to be placed directly into their new location and installed in accordance with the installation specifications contained herein.
 3. Trees transplanted off site in full leaf shall be covered entirely with a protective cloth covering prior to transporting. Trees transplanted on site do not require the covering.
 4. Trees which are to be relocated in areas to be graded are to be stockpiled in an area or areas identified by Grounds or designee. Stockpiled trees shall be well heeled in and protected from excessive wind and sun. Stockpiled trees shall be installed in their final position according to other provisions of Planting Preparation or Planting Procedure: The Contractor shall provide water to maintain a healthy condition.

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5. All transplanted trees shall be maintained and guaranteed throughout the project and until final acceptance. Replacement trees shall be provided by the Contractor at no additional cost to the University and shall be of the same caliper, species, and form. Exceptions for replacement stock from the site may be made by Grounds or designee.
 6. Abandoned Plant Pits: When utility lines or other unsuitable subsurface conditions are encountered in plant pits, Grounds or designee will direct those plants be relocated in satisfactory locations. The Contractor shall backfill-abandoned pits with suitable topsoil to compacted finished grade.
 7. Unsuitable material shall be removed from property by Contractor. These areas shall be reseeded as specified with the turf and lawn specifications contained herein.
- T. Prior to Acceptance: The Contractor shall be responsible for all maintenance of plants and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.
- U. Watering After Acceptance:

1. In order to properly establish the plant material, watering of plant material shall be the responsibility of the Contractor until the expiration of the one (1) year warranty period. The Contractor shall perform watering operations only at intervals approved by Grounds or designee and shall notify Grounds or designee at least 24 hours prior to commencing watering operations so that a representative of Grounds or designee may be on hand. Grounds or designee reserves the right to direct the schedule of watering operations. When so directed by Grounds or designee, the Contractor shall commence watering operations within 24 hours.
2. Watering shall be applied at a rate specified by Grounds or designee or in accordance with the contract documents. The Contractor shall be responsible for all necessary traffic during watering operations.
3. The quantity of water to be paid for will be the actual number of 1,000-gallon units of water which have been furnished and applied to plants during the establishment period. Measurement of water will be made by means of an approved metering device at the source of supply, or by determining the volumetric capacity of tank trucks used to deliver water to the project and recording the number of loads delivered by each truck.
4. The quantity of water measured as provided above will be paid for at the contract unit price per 1,000 gallons for "Watering after Acceptance".
5. All trees shall be watered to the following specifications after installation, as part of routine maintenance and Watering After Acceptance.
6. Trees shall be watered as described by the following ratios:

CALIPER	GALLONS OF WATER
Under 1 inch	5
1 - 1½ inches	5 - 10
2 inches	10 - 15
2 - 2 ½ inches	15 - 20
3 – 3 ½ inches	25-30
3 ½" + inches	Shall be monitored and receive water in an amount and frequency to maintain soil mixture.

7. Execution: Watering is to be done a minimum of once per week. The beginning shall be approximately April 15 and continue until November 1, unless otherwise directed by Grounds or designee. A set weekly schedule is to be established and maintained by the contractor, and adequate notice given of any change. Grounds or designee will notify the contractor to omit watering when he determines there has been adequate rainfall the previous week. The contractor shall notify Grounds or designee of the completion of each watering cycle.
8. During the installation, the Contractor will be required to keep all areas clean.

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9. At the time of final inspection of work and before issuance of the final payment, the Contractor shall clean paved areas thoroughly by sweeping and/or washing. Any defacements or stains caused by the work of this Section shall be removed.
10. The Contractor shall remove construction equipment, excess materials, tools, and all debris and rubbish from the site. All dirt and debris shall be legally disposed of by the Contractor in areas approved by Grounds or designee.
11. Upon completion of all planting operations, including cleanup, the Contractor shall notify the Grounds Superintendent or designee and accompany him or her on inspection of planting. Any items found to be unsatisfactory shall be corrected prior to approval for final acceptance. The one-year guarantee period shall begin on the date of final acceptance.
12. At the end of the one-year guarantee period, and upon written notice submitted by the Contractor at least ten days before the anticipated date, an inspection will be made by the Grounds Superintendent or designee and the Contractor. At this one-year inspection, the Contractor shall remove all tree guys, guy collars, and guy stakes from all guyed plants. Guys and staking may also be removed at any time after the 6-month warranty check, after approval by the Grounds Superintendent or designee.
13. Name Tag Removal: The contractor shall not remove name tags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.

V. Warranty and Replacement

1. The Contractor shall warranty all trees and all other materials and workmanship for a period of twelve (12) months from the date of final acceptance by Grounds or designee. The Contractor shall replace any plants that have more than one third die-back, or dead central leader if single stem tree, or any other portion of the project that fails due to faulty materials or workmanship. All plants shall be insect and/or disease free. Plants damaged by pathogen activity through the warranty period shall be replaced. A six (6) month and eleven (11) month inspection will be held during the warranty period. Damage prior to final acceptance shall be the responsibility of the Contractor.
2. Plant replacements shall be the same species as specified in the plant list. Replacement plant sizes shall be the same as other existing plants of the same species on the project. Plants, plant soil mix, fertilizer and mulch etc., shall be replaced as originally specified.
3. Any plant that is dead or not in satisfactory growth, as determined by Grounds or designee, shall be removed from the site. These and any plants missing shall be replaced as soon as conditions permit, but during the normal planting season. If plant(s), dispose of it (them), and charge the contractor for the cost of removal and disposal.
4. Plants and items repaired or replaced shall have an extended warranty period of twelve (12) months from the date of acceptance of the repair or replacement.

END OF APPENDIX