

Best Management Practices for Tree Preservation, Transplanting, Removal and Replacement



CITY OF CHARLOTTESVILLE

Neighborhood Development Services

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Best Management Practices

Best management practices or BMP's are technically corrected and widely accepted dynamic practices and standards used by professional arborists, urban and community foresters, landscape architects and other tree care and landscape professionals. The goal of the BMP is to provide basic and practical information on how to best accomplish the most important tree management activities. As standards and practices are updated, the BMPs should also be updated to reflect the progression of the green industry in sustainable urban forestry and landscape management.

Introduction

Trees improve a community's quality of life by providing environmental and aesthetic benefits such as shade, cooling, and wildlife habitat. Our urban trees are part of our infrastructure and are a valuable asset. Unlike other assets, however, trees are living entities and have basic biological requirements for survival and growth. As such, this unique asset must be actively managed and protected to maintain its health, function, safety, and aesthetic value. Man-made landscapes and our everyday lives keep us in close proximity with trees, recognizing their value as a community resource. This proximity may create conflict, especially in land preparation for construction. Keeping construction activities and trees separated is the easiest and most cost-efficient means to prevent undue stress and damage to such trees. Most trees will survive construction activity if kept separated from equipment, materials and trash. For best results, all phases of construction need to include procedures for the protection of trees. This handbook is to serve as a reference for tree preservation, transplanting and tree removal.

1. DEFINITIONS

Arborist: A specialist in the care of individual trees. Arborists are knowledgeable about the needs of trees and are trained and equipped to provide proper care. ISA Certified arborists are individuals who have achieved a level of knowledge in the art and science of tree care through at least three years of experience and have passed a comprehensive examination. They are also required to continue their education in order to maintain their certification, ensuring that their knowledge is updated on the latest arboriculture techniques.

Street Trees: Large canopy trees planted along existing or proposed public streets. Street trees may be within existing or proposed rights-of-way, but when outside of public right of way, must be within fifteen (15) feet of the edge of such rights-of-way.

Tree Canopy or Tree Cover: All areas of coverage by plant material exceeding five feet in height, and the extent of planted tree canopy at 10 or 20 years maturity. Charlottesville's Master Tree List includes 10-year canopy estimates for selected species.

Tree Protection Zone (TPZ): Area surrounding individual trees or groups of trees to remain during construction, and defined by fencing and signage as described below unless otherwise indicated. The TPZ is 1.50 feet away in radial distance from the tree trunk for every inch in stem diameter. This area is also referred to as the critical root zone (CRZ) or critical root radius (CRR).

2. PLANNING FOR PRESERVATION

2.1 Tree Preservation

Wooded areas are preferred sites for residential development due to the aesthetic and environmental value of the trees, which can raise property values by as much as 20 percent. As such valuable sites, wooded lands are being rapidly developed as cities and suburbs expand. This development reduces the environmental and aesthetic benefits to the greater community. Tree canopy protection and preservation is the first element of the City of Charlottesville's Urban Forest Management Plan.

Tree preservation is preferred to replacement, as a new tree requires 20 to 30 years to provide significant aesthetic, infrastructure, and environmental benefits. Unfortunately, trees are subject to many potentially deadly stresses during construction. Construction activity can cause tree death during a project or tree decline over several years, when the cause may not be as obvious. Trees must be carefully protected throughout the site development process to prevent damage.

2.1.1 How Trees Are Damaged During Construction

Surface and root zone impacts on construction sites can disrupt a tree's interaction with its environment, leading to tree damage or death. Understanding these impacts and their severity is critical to successful preservation.

Surface impacts:

- **Wind damage:** Trees develop strong anchorage only where it is needed, so trees in groups may have less secure anchorage. Removing some trees from a group will expose the remaining trees to excessive wind velocities and lead to wind-thrown trees.
- **Excessive pruning:** Trees are pruned to prevent damage to utility wires and buildings, but careless pruning can cause tree death. When too many branches are removed or the branches have been pruned improperly, the tree may not be able to sustain itself or may experience decay.
- **Physical injury to trunk and crown:** Construction equipment can injure the aboveground portion of a tree by breaking branches, tearing the bark, and wounding the trunk. These injuries are permanent and, if extensive, can be fatal.

Root zone impacts:

- Raising the grade can interfere with gas exchange and suffocate roots, and can also raise the water table and drown the roots.
- Lowering the grade removes topsoil and feeder roots, exposing the other roots to drying and freezing. Lowering the grade can also lower the water table and cause drought.
- Compacting the soil within the drip line blocks air and water from the roots.
- Chemicals dumped in the soil can change soil chemistry and can be toxic to trees.

- Cutting of roots: The roots of the tree are found mostly in the upper 6 to 12 inches of the soil. In a mature tree, the roots extend far from the trunk – typically growing a distance of one to three times the height of the tree. The amount of damage a tree can suffer from root loss depends, in part, on how close to the tree the cut is made. Severing one major root can cause the loss of 5 to 20 percent of the root system. Trenching and excavating in the root zone can damage as much as 40 percent of the root system, causing tree death within a few years.

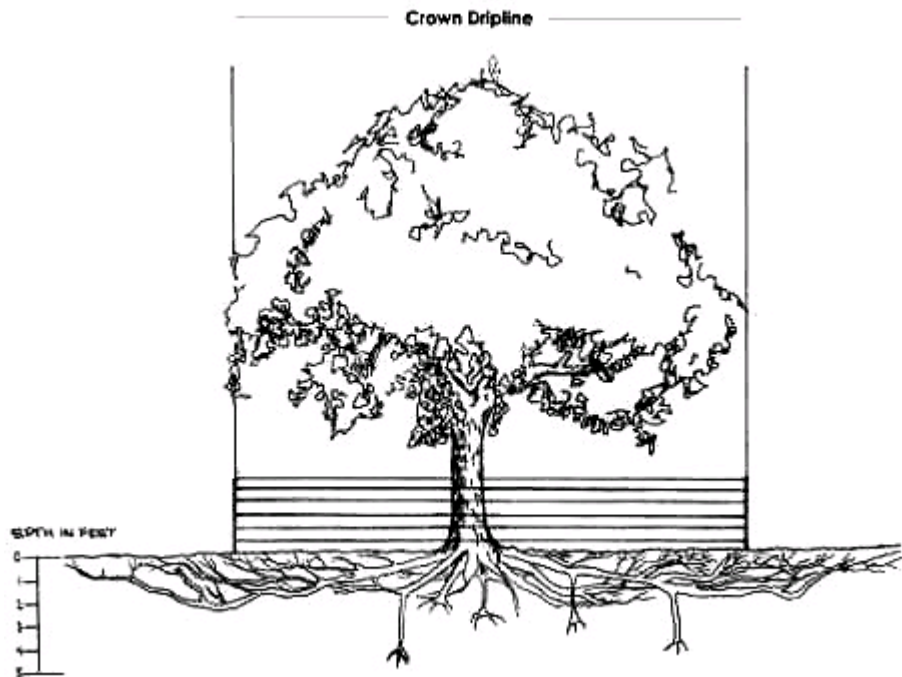


Figure 1: Extent of Root System

Trees can require several years to adjust to injury and environmental changes that occur during construction. Stressed trees are more prone to health problems such as disease and insect infestation. Consulting with an arborist about continued maintenance of trees is essential, along with continued monitoring and periodic evaluation for declining health and safety hazards.

2.1.2 Site Planning for Preservation

Tree preservation should be considered when creating a site plan. A tree survey that identifies species, age, location, and health will help determine the best site layout. Once a tree survey has been completed, the following criteria should be considered to ensure successful preservation:

- Critical areas such as flood plains and steep slopes should be left in their natural condition.
- Roadways should be positioned away from valuable stands, and along original contours to minimize cuts and fills. Cuts and fills present one of the most common causes of tree mortality on construction sites.

- Utilities should be positioned away from the TPZ. Utilities located in the same trench can minimize root damage from trenching.
- Parking and storage should be away from the TPZ.
- Erosion and sediment control measures should be located at the limits of clearing and grading to avoid sediment deposition within the TPZ's of preserved trees. When planning sediment basins, retention basins, or ponds, avoid locations requiring extensive grading and tree removal. Trenchless silt fence construction should be used in Critical Root Zone / TPZ area.

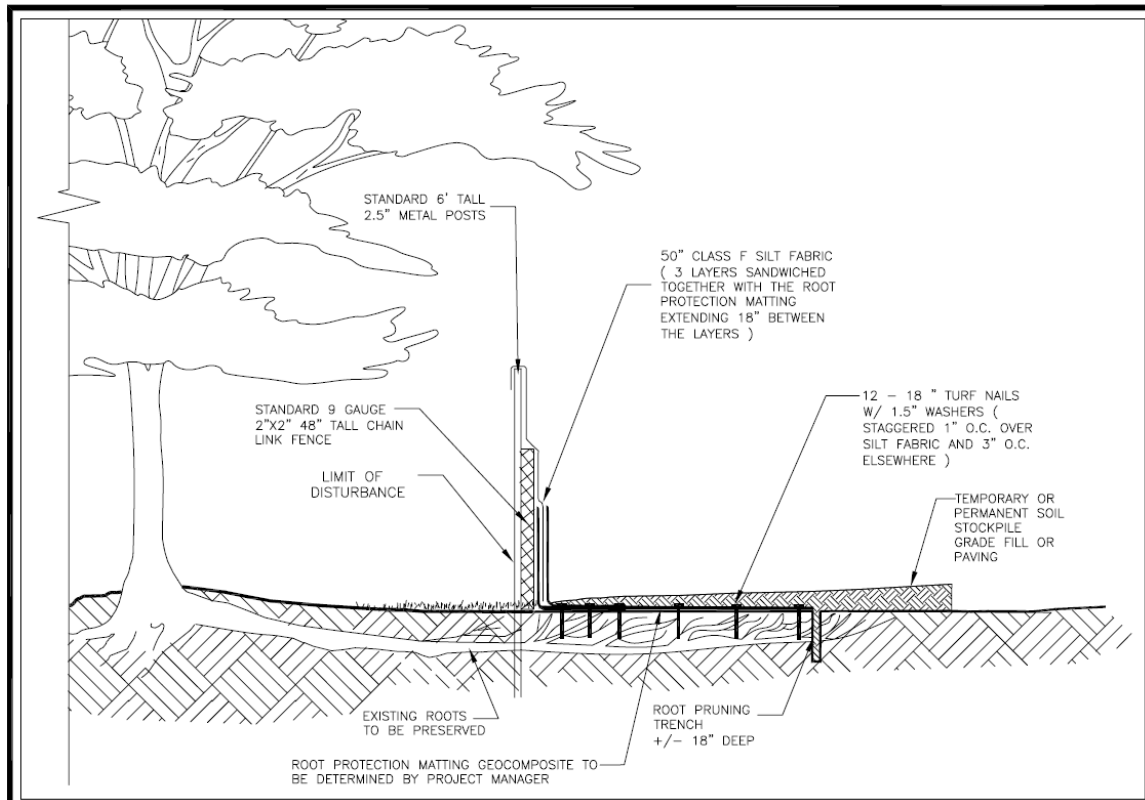


Figure 2.2: Trenchless Super Silt Fence

2.1.3 Tree Inventory

An inventory of all trees on the site must be conducted, including:

- A visual assessment (photos) of the trees for health and condition.
- Recommendations on which trees should be preserved.
- Construction management recommendations regarding tree protection for trees identified to be preserved.

The tree inventory should accompany the tree preservation plan (see Section 2.1.5).

2.1.4 Choosing trees to preserve

One of the first decisions is determining which trees are to be preserved and which should be removed. Consider the size, species, maturity, location and condition of each

tree. The largest, most mature trees are not always the best to preserve. Younger, more vigorous trees can usually survive and adapt to the stresses of construction better. Try to maintain diversity of species and ages. A certified arborist can advise on which trees are more sensitive to compaction, grade changes, and root damage. Consider the following factors when deciding which trees to preserve:

- Life expectancy and present age
- Health and disease susceptibility
- Structure
- Cleanliness
- Aesthetic values
- Comfort
- Wildlife
- Adaptability to the proposed development
- Survival needs of the tree
- Relationship to other trees

See also: Establishing Tree Removal Criteria (Section 5.1).

2.1.5 Tree Preservation Plan

A tree preservation plan must be prepared which includes the tree inventory and tree protection measures for the project. This should be separate from the Landscape Plan. See the City of Charlottesville's Tree Preservation Plan Checklist (Appendix A) for plan requirements.

2.2 Planting and Placement

2.2.1 Selecting trees – characteristics to consider

Planting new trees in the right spaces will help to establish the trees' longevity and continued health while maximizing their benefits to the site. Consult an ISA Certified Arborist when selecting species. Many factors influence the suitability of specific species to specific sites.

- **Native Species**

Use native species whenever possible; choose stock from a reputable nursery whenever possible and inspect the trees' condition prior to planting. It is recommended that trees come from Virginia nurseries that are current members of the Virginia Nursery and Landscape Association Inc.

- **Approved plantings**

The City of Charlottesville's list of approved plantings should serve as a guide for species selection.

- **Tree Function**

Consider the aesthetic and environmental purposes of the tree. Shade trees can make a space more comfortable and reduce cooling costs; ornamental trees produce flowers, fruit, or leaves; evergreens can act as a windbreak. Trees that drop leaves in the fall can allow sunlight to warm the building.

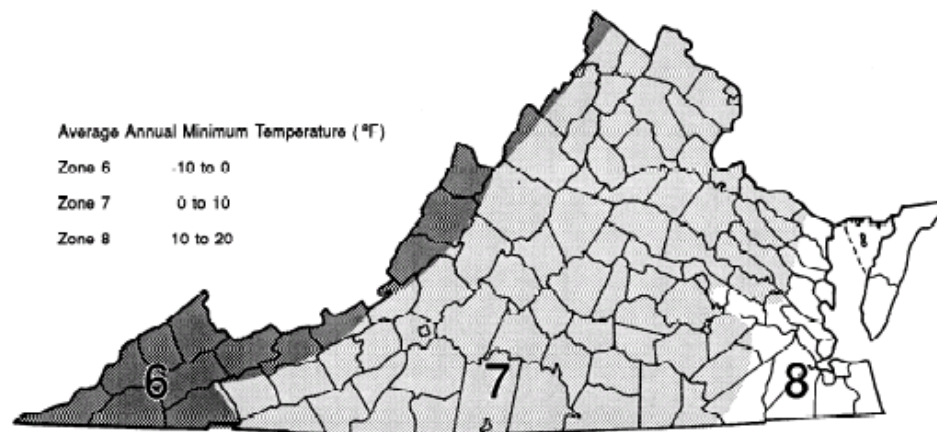
- **Tree Form and Size**

Consider the size and location of the planting site. What size tree works best with the space? Are there vertical restrictions on the space such as utility lines overhead or underground? Soil volume is critical for tree growth and longevity. Allowing adequate soil volume for the mature growth and size of the tree will help eliminate conflicts with hardscape and other infrastructure. Are there horizontal restrictions such as sidewalks or driveways? How many other trees are around the planting space? How will the building elevation and foundation interact with the tree and its roots?

• **Site Conditions**

Consider the following site conditions when selecting a tree:

- Soil – Soil should have adequate quality and volume to support mature tree growth. Test soil before planting, if possible.
- Hardiness zone:



PLANT HARDINESS ZONES IN VIRGINIA FOR TREES, SHRUBS, VINES AND GROUND COVER

Figure 2.3: Plant Hardiness Zones in Virginia

- Exposure to wind and sun – most woody plants require full sunlight, but some do well in light shade. Wind can uproot newly planted trees, cause damage during storms, and dry out soils. Special maintenance may be required to establish trees on windy sites.
 - Space constraints – soil volume and proximity of infrastructure as tree matures.
 - Nearby human activity – what activities will occur around the planting site? Will there be compaction? Vandalism? Will the tree be overwatered by runoff from adjacent sites?
 - Drainage – Poor drainage can deprive the roots of oxygen and kill the tree.
- **Susceptibility to pests and diseases**
Pests and disease affect almost every species, and pest severity varies geographically. Consult an ISA Certified Arborist to help select trees resistant to pest problems in your area.
- **Diversity**

Avoid planting monocultures, which are more susceptible to disease. Plant a variety of species to provide a more sustainable urban forest.

2.2.2 Landscaping plan

Generally, the landscape plan must include details of plant materials; schedule of plantings; classification of street trees; preservation options; and existing landscape features. Consult the City of Charlottesville Code of Ordinances for details on landscaping plans.

3. TREE PRESERVATION ON CONSTRUCTION SITES

3.1 General requirements

Tree protection and preservation provides proactive management of trees and shrubs throughout construction and other activities that may adversely affect trees and to manage and minimize damage to trees from construction practices. Tree maintenance shall be performed only by an ISA Certified arborist who is familiar with the practices and hazards of arboriculture and equipment used in such operations.

3.2 Reference standards

Tree, Shrub and other Woody Plant Maintenance Standard Practices:

Part 1: Pruning (ANSI A300; Most recent edition), and (Most recent edition) ANSI Z133.1 Safety standards

Part 2: Fertilization if approved or required (ANSI A300; current edition)

Part 3: Support Systems: Cabling, Bracing and Guying (ANSI A300; current edition)

3.3 Submittals

- **Tree Maintenance and Mitigation Schedule:** Written schedule from project arborist detailing scope and extent of maintenance and mitigation techniques to be utilized for trees to remain that are affected by construction.
- **Qualification Data:** For tree service firm and arborist.
- **Certification:** From project arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- **Mitigation techniques to be used:** From project arborist, for care and protection of trees affected by construction during and after completing the work.

3.4 Quality assurance

- **Tree Service Firm Qualifications:** An ISA Certified tree service firm that has successfully completed tree protection and trimming work similar to that required for this project and that will assign an experienced, qualified arborist to the project site during execution of tree protection and trimming. The protection of trees identified to remain includes the maintenance of their health and vitality as well as their protection from physical damage and biotic and abiotic disease.
- **Arborist Qualifications:** An arborist certified by ISA or licensed in the jurisdiction where project is located.
- **Tree Pruning Standard:** Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning), and ANSI Z133.1 safety standards.
- **Mitigation Techniques:** Utilize mitigation techniques for trees in construction areas as recommended by ISA in consultation with City Arborist.

3.5 Materials

- **Topsoil:** Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- **Filter Fabric:** Manufacturer's standard, non-woven, pervious, geo-textile fabric of polypropylene, nylon, or polyester fibers.
- **Organic Mulch:** Shredded hardwood, free of deleterious materials.

3.6 Layout and coordination

The contracting arborist will visit the site and familiarize his/herself with the existing conditions including but not limited to soil characteristics, drainage, topography, structures and overhead and underground utilities.

3.7 Execution

3.7.1 Tree Protection Measures

- **Temporary Fencing:** Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete. Fencing should be the last item removed after completion of a project. This fencing will be erected at a radius of 1.50 feet away from the trunk of tree for every inch in stem diameter. Diameter is measured 4.5 feet above the ground. For trees 4 inches or less in diameter the measurement will be at 6 inches above the ground. This radial

distance is termed the “critical root zone” and will serve as the **Tree Protection Zone** (TPZ). Fencing will consist of heavy duty chain link. Fencing will be rigidly supported and maintained during all construction periods at a minimum height of 6.0 feet above grade.

- Signs stating "No Entry, Tree Protection Area," in both English and Spanish, are to be posted at 30 foot intervals.
- Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials.
- Protect root systems from ponding, eroding, or excessive wetting caused by watering operations.
- Mulch areas inside tree protection zones and other areas indicated.
 - Apply 4 inch thickness of organic mulch. Do not place mulch within 6 inches of the tree trunk to allow the trunk to breathe.
- Do not store construction materials, debris, or excavated material inside tree protection zones.
- Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- Maintain tree protection zones free of weeds and trash.



Figure 3.1: Tree Preservation Area Signage

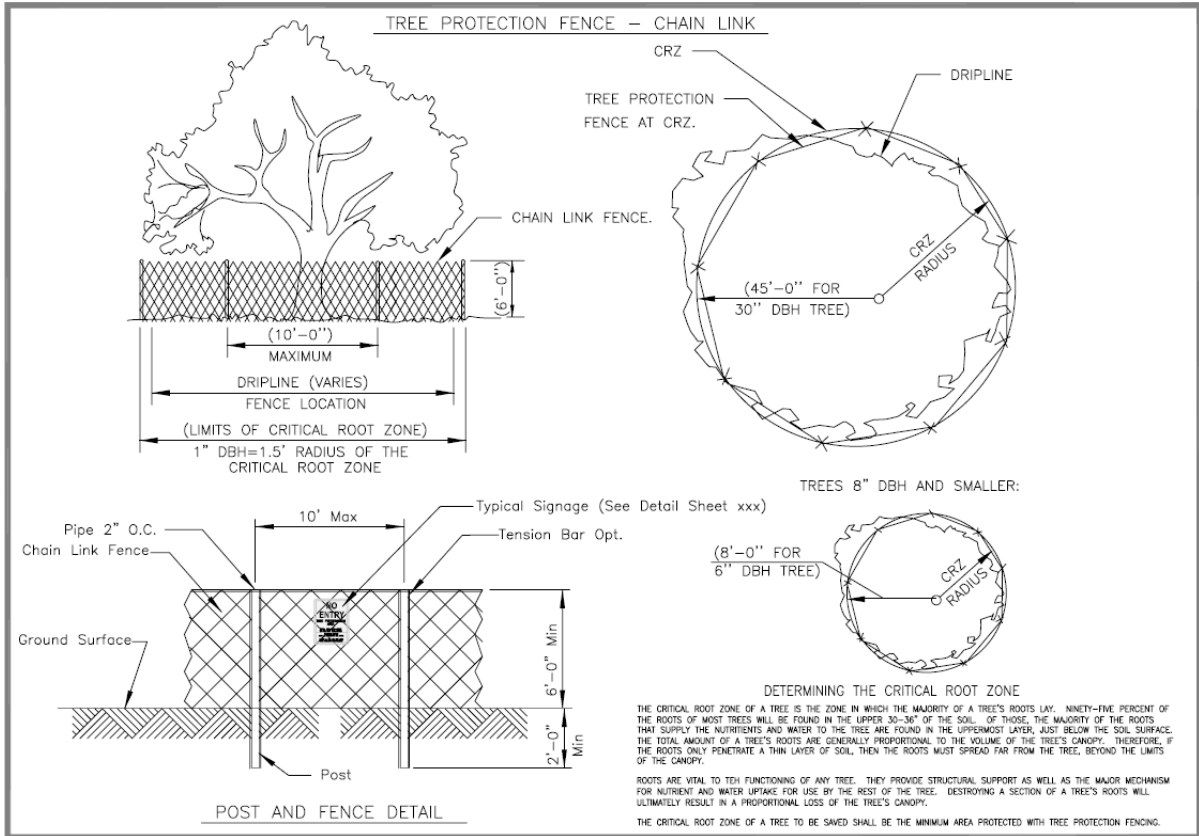


Figure 3.2: Tree Protection Fence



Protective fences should be erected as far out from the trunks as possible in order to protect the root systems.

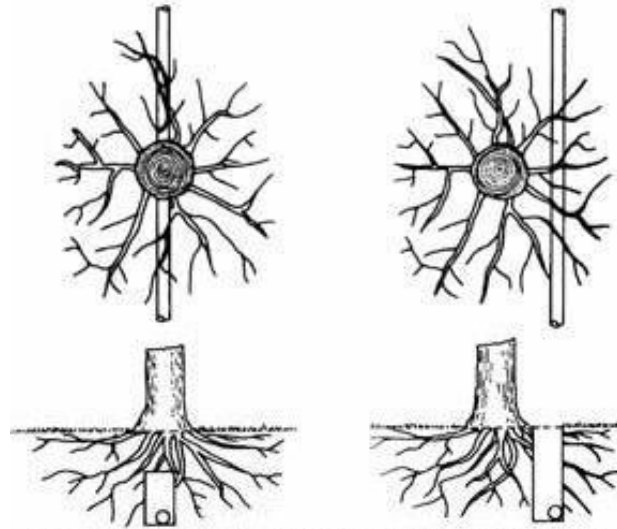
3.7.2 Excavation

Do not excavate within tree protection zones, unless otherwise indicated and approved. Before excavation, pad preparation, or grading for foundations, footings, walls, or trenching, relevant trees shall be root pruned 1 foot outside the tree protection zone as described below.

Where excavation for new construction is required within tree protection zones and approved, hand prune or utilize root pruning techniques described below prior to excavation.

Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with organic material and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

Where utility trenches are required near tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand around individual roots to mitigate damage to the root system and tree. A Supersonic Air tool (air spade) can also be used safely to open trenches without severing roots. See diagram below.



Less damage is done to tree roots if utilities are tunneled under a tree (left, top and bottom) rather than across roots (right, top and bottom).

Figure 3.3: Utility Trenches

Root Pruning: where required and approved, shall be done mechanically with a root pruning machine, vibratory plow, or with a narrow trencher with sharp blades. Once a trench is opened up, all exposed roots will be hand pruned to provide clean-cut ends.

Do not cut main lateral roots or buttress roots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or pull with backhoe or similar equipment.

3.7.3 Regrading

Grading Limitations within the Tree Protection Zone:

Lowering the grade around trees can have an immediate and long-term effect on trees. Typically, most roots are within the top 3 feet of soil, and most of the fine roots active in water and nutrient absorption are in the top 12 inches.

- Grade changes within the Tree Protection Zone are not permitted.
- Grade changes outside the Tree Protection Zone shall not significantly alter drainage.
- Grade changes under specifically approved circumstances shall not allow more than 6 inches of fill soil or allow more than 4 inches of existing soil to be removed from natural grade, unless mitigated.
- Grade fills over 6 inches or impervious overlay shall incorporate an approved permanent aeration system, permeable material, or other approved mitigation.
- Grade cuts exceeding 4 inches shall incorporate retaining walls or an appropriate transition equivalent.

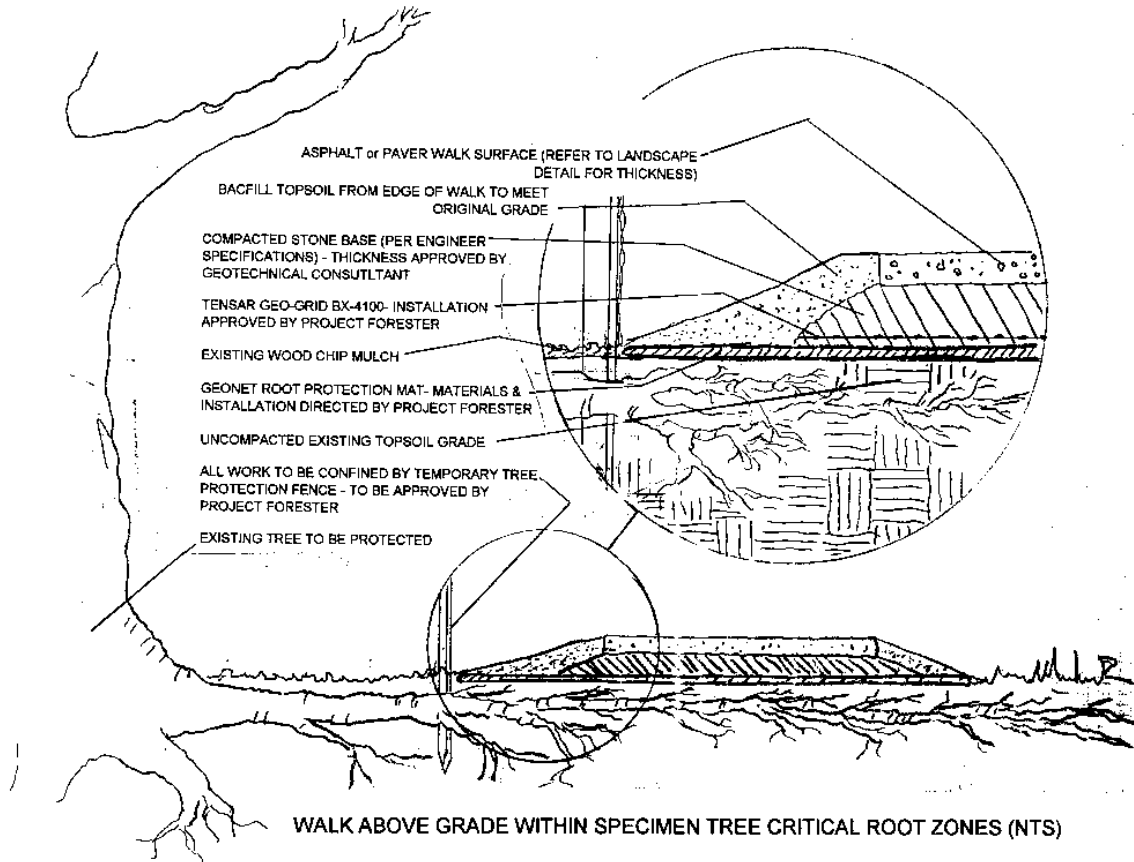


Figure 3.4

3.7.4 Tree pruning (if required)

Trees to remain that are affected by temporary and permanent construction shall be pruned as indicated.

Pruning Standards: Prune trees according to current ANSI A300 pruning standards.

3.7.5 Damage Mitigation and Replacement

Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

Remove and replace trees indicated to remain that die or are damaged during construction operations that the arborist determines are incapable of restoring to normal growth pattern.

Provide new trees of caliper size and species selected by owner when damaged trees are required to be replaced. Plant and maintain new trees as specified.

Aerate surface soil, compacted during construction, 10 feet beyond the drip line and no closer than 36 inches to the tree trunk using vertical mulching techniques or radial aeration techniques as instructed by City.

3.7.6 Disposal of waste materials

Remove excess excavated material and displaced trees from owner's property.

4. SELECTING AND TRANSPLANTING TREES

4.1 Selecting Trees: Common Problems

Root problems, injuries, and form are common problems when buying trees. Keep this in mind, buy high-quality trees, and plant them properly. Poor tree quality will lead to maintenance problems even if the tree is properly cared for.

Root problems

Trees for sale have one of two root treatments:

- Root-balled stock: roots in soil are held in place by fabric or in a wire basket. The basal trunk flare should be visible and the root ball should be flat on top. The tree should not have many crushed or torn roots. The root ball diameter should be at least 10-12 times the trunk diameter measured 6 inches above the trunk flare.
- Container-grown stock. Roots should not circle in the container, and the trunk flare should be obvious, not buried.

Injuries

Be sure to remove trunk wraps and check for injuries before purchasing trees. Incorrect pruning cuts are major problems that can lead to disease and defects.

Form

- Branch spacing: Branches should be evenly spaced and firmly attached to the trunk. Squeezed branches and weak branch unions will be problems as the tree grows larger.
- Trunks: If the tree has multiple trunks, make sure the trunks are well separated at the ground line. Trunks expand as the tree grows, so two trunks that are only slightly separated will squeeze together later.
- Cracks: Look for signs of vertical trunk cracks, especially at branch unions. Cracks could signal a future fracture.

4.2 Transplanting

4.2.1 Site Selection

Criteria for site selection:

- Soil conditions
- Exposure to sun and wind
- Human activity

- Drainage
- Space constraints
- Hardiness zone

There are great differences in the environmental requirements for each tree species. Consult with an arborist or landscaper if necessary.

4.2.2 Best Season to Transplant

The ideal time to plant trees and shrubs is during the dormant season in the fall after the leaf drop, or early spring before bud break. Weather conditions are cool and allow plants to establish roots in the new location before spring rains and summer heat stimulate new top growth.

4.2.3 Storing and Transporting

Trees and shrubs that have been dug for transplanting should be planted as soon as possible. Cover a root ball with damp material which will retain moisture (burlap, peat moss, canvas, plastic, etc.) until planting.

If any woody plants cannot be planted for more than a week, their roots should be covered with mulch or moist soil and the plants should be placed in a protected and shaded area. In all cases root systems should not be allowed to dry out; dry roots can severely decrease the potential for transplant success.

Trees and shrubs must be protected when transporting to a planting site. Covered trucks and vans are best, but if a pickup truck is used, a tarp must be in place to protect the plant canopies and roots from drying winds in transit.

4.2.4 Planting and Post-Planting Care

Adequate planting holes are vital to initial tree survival during transplants. Tree pits should be dug two to three times wider than the transplant tree's root ball. If the soil is clay and the sides of the hole become glazed during digging, the sides of the hole should be roughened with a shovel or spade. Tree pits should be pre-watered before planting in dry soils, as this prevents initial post-plant water from migrating away from the root ball. Transplanted trees should be replanted at the same depth from which they were removed for successful transplant.

Damaged roots caused by transplanting should be clean-cut with a sharp blade prior to planting to prevent stress. If any circling or kinked roots are discovered during the transplanting procedure, sever them to prevent future girdling of the plant. Orient the tree in the same direction, relative to the sun, as it was facing in its previous location.

Post-planting care should include:

Watering. Too much or too little water after transplanting is a major cause of tree transplant failure. The site should be thoroughly watered immediately after planting, after which the soil must be regularly monitored to prevent drying out. If rainfall is inadequate, the soil around the plant's roots should be deeply watered approximately every 10-14 days. If you are not sure if the soil is drying, dig down 3 to 4 inches next to the plant. Wet soil at that depth verifies watering is not needed at that time.

Mulch. Mulches help conserve moisture, moderate soil temperature and control weeds around trees and shrubs. They are placed on the soil surface over the tree or shrub root system. They should be applied 3 to 4 inches deep. Maintain a 4 to 6 inch mulch-free area adjacent to the woody stems.

Fertilizer. Newly planted trees should not require fertilizer. Only fertilize if a soil test indicates a deficiency. Transplanted trees should be fertilized around one year after planting. The best material for small trees is well-rotted stable manure, added as a two-inch layer of mulch around the tree annually. If chemical fertilizers are used, a formulation such as 10-8-6 or 10-6-4 is preferred. Use about 2 lbs per inch dbh. For evergreens, use half the recommended amount of chemical fertilizer, or use only organic fertilizers. Make holes 18 inches deep and 2 feet apart with punchbar, crowbar, or augur, around the drip line of the tree. Distribute the fertilizer evenly into the holes, and close the holes with the heel of the shoe, or by filling with topsoil or peat moss. Fertilize trees in late fall or early spring before leaves emerge.

Pruning. Pruning may be required when transplanting trees. The amount of pruning depends on the size of the root ball and plant canopy, health of the plant, and the species transplanted. Insect-infested stems or those infected with disease should be removed during transplanting. Any broken stems should be removed as well. Additional pruning of shrubs may be required to balance the leaf area with the reduced size of the root system, but further pruning of deciduous trees should be postponed for at least one year after transplanting. Pruning should be limited to diseased, insect-infested and broken limbs.

Pruning Standards: Prune trees according to current ANSI A300 pruning standards.

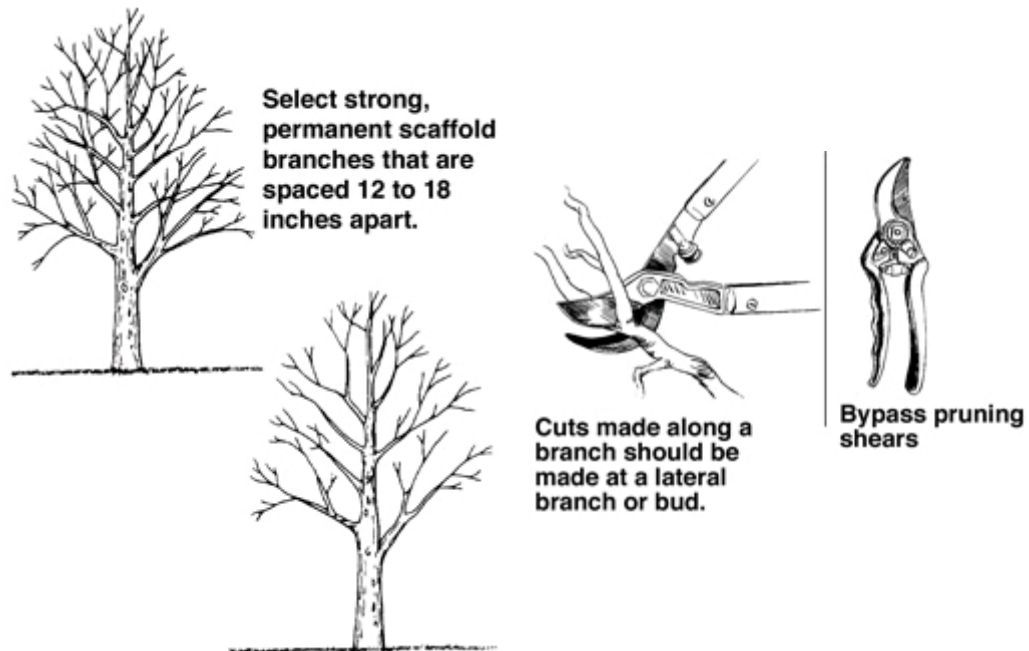


Figure 4.1: Pruning

A good structure of primary scaffold branches should be established while the tree is young. The scaffold branches provide the framework of the mature tree. Properly trained young trees will develop a strong structure that requires less corrective pruning as they mature.

The goal in training young trees is to establish a strong trunk with sturdy, well-spaced branches. The strength of the branch structure depends on the relative sizes of the branches, the branch angles, and the spacing of the limbs. Naturally, those factors vary with the growth habit of the tree.

Mechanical Support. Mechanical support for trees may be necessary when the tree is tall, slow to recover, heavily foliated, or planted in a sandy site. Most small trees do not require staking or other support and will develop strong trunks faster if allowed to move freely with the wind. For trees that do require mechanical support, staking may be used. Two stakes can be placed opposite of each other and the tree anchored to the stakes with a nonabrasive material, such as a soft, broad, fabric strap. Any support provided to a tree should be removed as soon as the tree can stand alone, usually after the first growing season. The sooner the support is removed, the faster the tree will become stronger.

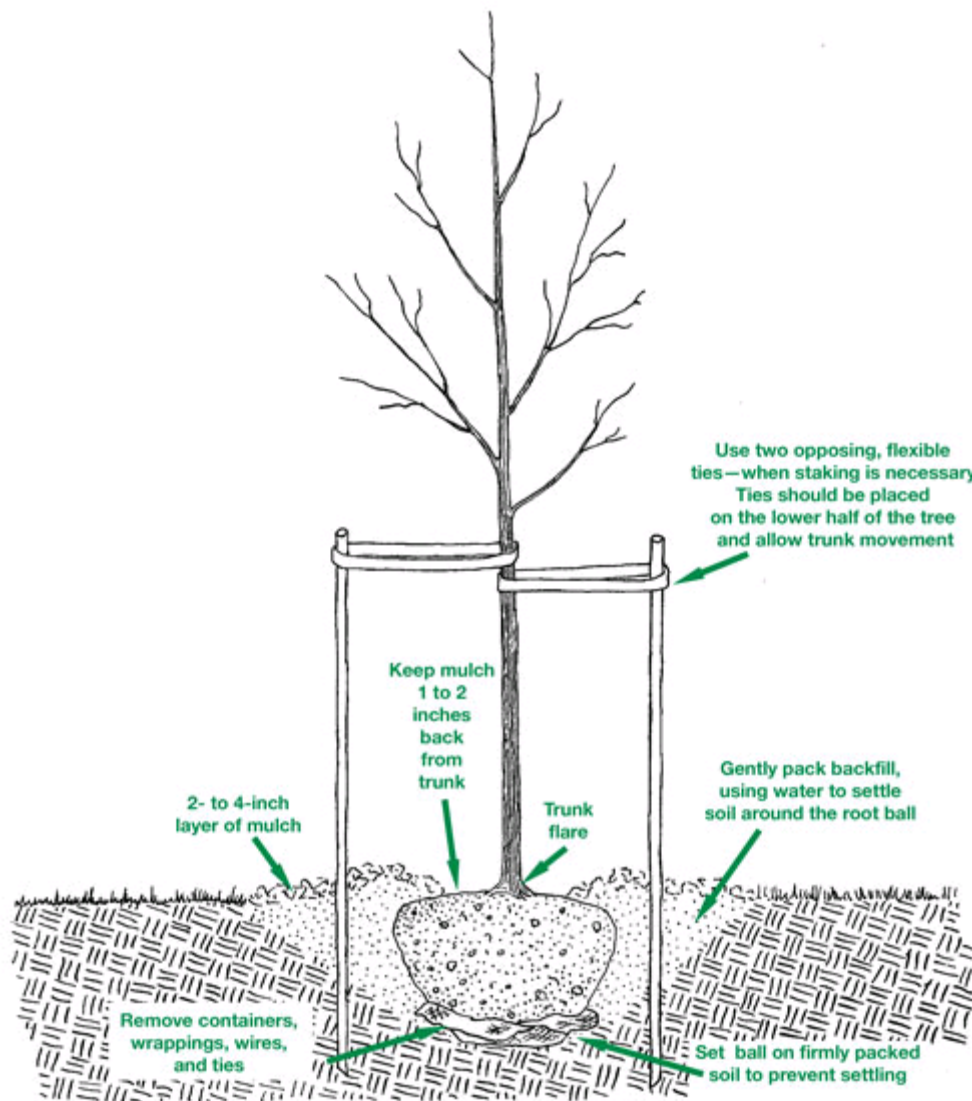


Figure 4.2: Mechanical Support

5. TREE REMOVAL

5.1 Establishing Tree Removal Criteria

The decision on which trees to preserve and which trees to remove should be based on tree evaluation.

1. Positively identify ownership before authorizing tree removal.
2. Have an ISA Certified Arborist evaluate tree health and risk for failure before removing.
3. Use only experienced, certified professionals to remove trees.

4. Evaluate trees at risk for failure using ISA approved methods, which include the assessment of the probability of failure, the size of the part that may fail, and the targets that may be affected should the tree fail.

Trees located within a certain distance of new construction, generally 20 feet or less, are almost always recommended for removal. Tree condition is also a good assessment for whether a tree would be a candidate for removal. Young, vigorous, healthy trees are the best candidates for protection, because they grow new tissue quickly and adapt readily to new environments. However, it is large, old trees that are most often the focus of preservation. Of course, it is possible to preserve old trees as long as they are healthy, but younger ones may give the best return on investment. Vigorous trees usually have full canopies and healthy leaves. Three conditions indicate poor tree health. First the leaves are small and pale for the species. Second, some of the branches are dead. Finally, most of the foliage arises from short twigs along the major limbs, known as epicormic growth. Trees with large cavities or other structural weaknesses are not good candidates for preservation, unless the problems can be alleviated by pruning, cabling or bracing.

Evaluation guidelines for possible removal:

- Tree is dead or dying.
- Tree is deemed hazardous, when the hazardous condition cannot be corrected through pruning or other reasonable arboricultural practices.

When trees are not deemed dead, dying or hazardous, the following factors will be considered:

- Life expectancy of the tree.
- Desirability of the tree species.
- Amount of space available for tree growth.
- Overall quality and structural integrity of the tree.
- Persistent and uncontrollable insect, disease or fruiting problems.
- Frequency and extensiveness of the tree's maintenance requirements.
- Feasibility and timeliness of planting a replacement tree.
- Proximity and quality of trees near to the one considered for removal.
- Wishes and desires of the property owner/resident.
- Quality and extent of past pruning and other tree maintenance practices the tree has undergone.
- Extent and frequency of damage the tree is causing to surrounding infrastructure such as sidewalks, streets, sewers, etc.
- Location of the tree with regard to streetlights, traffic control devices, intersection sight lines and the requirements of the tree related to available growing space.

Unless the tree is deemed a hazard, there must be a minimum of two weeks between the time it is marked for removal and the actual removal date. Shortly after the tree is removed the stump must be ground out.

6. TREE REPLACEMENT

In the event that a tree or trees designated for preservation on an approved Tree Conservation Plan, Site Plan or Erosion and Sediment Control Plan are severely damaged, destroyed or removed, they shall be replaced upon notice by the Zoning Inspector at the rates recommended below.

6.1 Tree Replacement Standards

1. Replacement tree(s) shall be of nursery grade quality, balled and burlapped and installed on site. Where replacement trees are required but not suitable for the particular site prescribed due to the size of the site, (insert municipal name) shall deposit the trees into a community tree bank. Trees deposited into the community tree bank shall be utilized for planting on public lands (Policy Decision).
2. The type of replacement tree(s) shall be the same as the species removed from the site, an native species or other as approved by the Director,
3. All tree replacements shall be 3" in caliper or greater
4. The planting of all replacement trees shall be done by or supervised by a person with horticultural training in tree care and planting methods.
5. Newly planted replacement trees shall be monitored for a period of one year to ensure the health of the trees. If the replacement trees die within the one-year period, the developer/applicant shall replace the dead tree.
6. All required tree replacement and other required mitigation shall be completed prior to the issuance of the certificate of occupancy or at a time determined by the director if seasonal or weather conditions at the time of issuance would jeopardize plant survival.

6.2 Tree Replacement Schedule

All trees designated for preservation on an approved Tree Conservation Plan, Site Plan or Erosion and Sediment Control Plan that have been severely damaged, destroyed or removed shall be replaced at the following increments:

Caliper of Existing Tree Removed	Number of Replacement Trees (3" caliper)
Less than 6 inches	1
Between 6 & 12 inches	3
Between 12.1 & 18 inches	4
Between 18.1 & 24 inches	5
Between 24.1 & 30 inches	7
Between 30.1 & 36 inches	10
Greater than 36 inches	The equivalent of 3" caliper trees or greater needed to equal the DBH of the removed tree

6.3 Tree Replacement Exemption

Removal or damage of protected trees shall not require tree replacement if the Director of Neighborhood Development Services determines that any of the following circumstances exist:

1. When a tree is categorized as an unhealthy or undesirable tree and appropriate for removal.
2. When a tree, at the time of the inventory, due to natural causes, is dead or irreversibly declining, is in danger of falling, or interferes with any existing or proposed public improvements, is in dangerous proximity to any public utility lines or related facilities, creates unsafe vision clearance, or constitutes a health hazard to persons, property or other trees when removal is necessary to observe good forestry practices.

Conclusion

The topics outlined in the handbook should be consulted, before, during and after construction to plan for tree preservation, mitigate the effects of construction on local trees and serve as a reference for future plantings. These recommendations, along with the International Society of Arboriculture, should serve as valuable references for planners, developers and contractors alike to preserve and enhance Charlottesville trees.

7. REFERENCES

- Field Guide: A Resource for Builders and Developers to Follow When Preserving, Protecting, and Restoring Trees. Tree Trust, Minnesota. December 2002.
- International Society of Arboriculture. <http://www.isa-arbor.org>
- Preserving Trees in Construction Sites. Mississippi State University, Extension Service. 2004.
- Standards for Planting and Preservation of Trees on Site Plan Projects. Arlington County Street Tree Focus Group. June 2003.
- Tim Hughes, City of Charlottesville Arborist.
- “Transplanting Trees and Shrubs.” North Dakota State University, Department of Agriculture. <http://www.ag.ndsu.edu/pubs/plantsci/trees/f1147w.htm>
- Trees Are Good. <http://www.treesaregood.org>. International Society of Arboriculture. 2009.
- “Tree Protection and Removal Model Ordinance.” Rockaway River Watershed Cabinet, <http://www.manasquanriver.org/>
- “Tree Removal Program.” Department of Parks, Recreation, & Waterfront. City of Berkley, CA. <http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=8838>
- Virginia Erosion and Sediment Control Handbook. Virginia Department of Conservation and Recreation. 1992.

APPENDIX A: Tree Preservation Plan Checklist

City of Charlottesville Tree Preservation Plan Checklist

All final plans submitted for review must include a copy of the Tree Preservation Plan Checklist signed by a responsible party.

Project Name _____

Tax Map and Parcel _____

Physical Street Address _____

Property Location _____

Please use this checklist to ensure a complete tree preservation plan and avoid multiple submittals. A complete tree preservation plan includes:

- Site boundaries
- Graphic scale and north arrow
- Inventory of existing trees on the site (species, size (dbh), health, quantity)
- Method of inventory indicated; size and location of sample plots, if applicable
- Critical areas such as steep slopes, wetlands and floodplains
- Location of proposed structures and paved areas
- All construction entrance and exit routes
- Trees to be preserved and trees to be removed, clearly indicated
- Tree Protection Zone (TPZ) for all trees to be preserved
The TPZ is 1.50 feet away in radial distance from the tree trunk for every inch in stem diameter. Diameter is measured 4.5 feet above the ground. For trees 4 inches or less in diameter the measurement will be at 6 inches above the ground.
- Drip line for all trees to be preserved
- Limits of clearing and land disturbance shown and labeled.
Limits of clearing and land disturbance must be located outside any TPZ and at least 5 feet from any tree trunk.
- Areas and quantity to be mulched
Tree Protection Zones require 4" of organic mulch. Do not place mulch within 6" of tree trunks. 6" of mulch must also be applied to all entrance and exit routes to protect soil and tree roots from compaction.
- Proposed tree canopy cover of site, shown and quantified
- Tree cover requirements
Refer to the City Zoning Ordinance, Article VII, Section 34-869 "Tree cover requirements."

City of Charlottesville
Best Management Practices for Tree Preservation.....

- Existing and proposed location of underground utilities and easements
- Location and depth of all trenching and tunneling activity
- Existing and proposed contours
- Tree protection measures where grade changes occur near any TPZ
 - *Grade changes under specifically approved circumstances shall not allow more than 6 inches of fill soil or allow more than 4 inches of existing soil to be removed from natural grade, unless mitigated.*
 - *Grade fills over 6 inches or impervious outlay shall incorporate an approved permanent aeration system, permeable material, or other approved mitigation.*
 - *Grade cuts exceeding 4 inches shall incorporate retaining walls or an appropriate transition equivalent.*
- TPZ fencing and signage details
 - Heavy duty chain link fencing must be installed around all TPZs. Fencing will be a minimum 6.0 feet above grade. Signs stating "No Entry, Tree Protection Area" must be posted at 30-foot intervals.*
- Any proposed landscaping to be located inside TPZs
- Location of material storage areas
 - Material storage cannot be located within any TPZ*
- Location of any worker parking
 - Parking cannot be located within any TPZ*
- Pre-construction photographs of trees to be preserved
- Fertilization details for trees to be preserved
- Approval of Urban Forester or Certified Arborist
- The following notes:
 - "Tree protection fencing must be installed and inspected prior to or concurrent with any clearing or grading."
 - "Contractor is responsible for compliance with Tree Preservation Plan (Sheet x). Failure to fully comply with the restrictions, conditions, and mitigation measures of the Tree Preservation Plan will result in the issuance of a stop-work order, and may also result in the imposition of fines, penalties, or both."

Comments:

Applicant's signature

Date

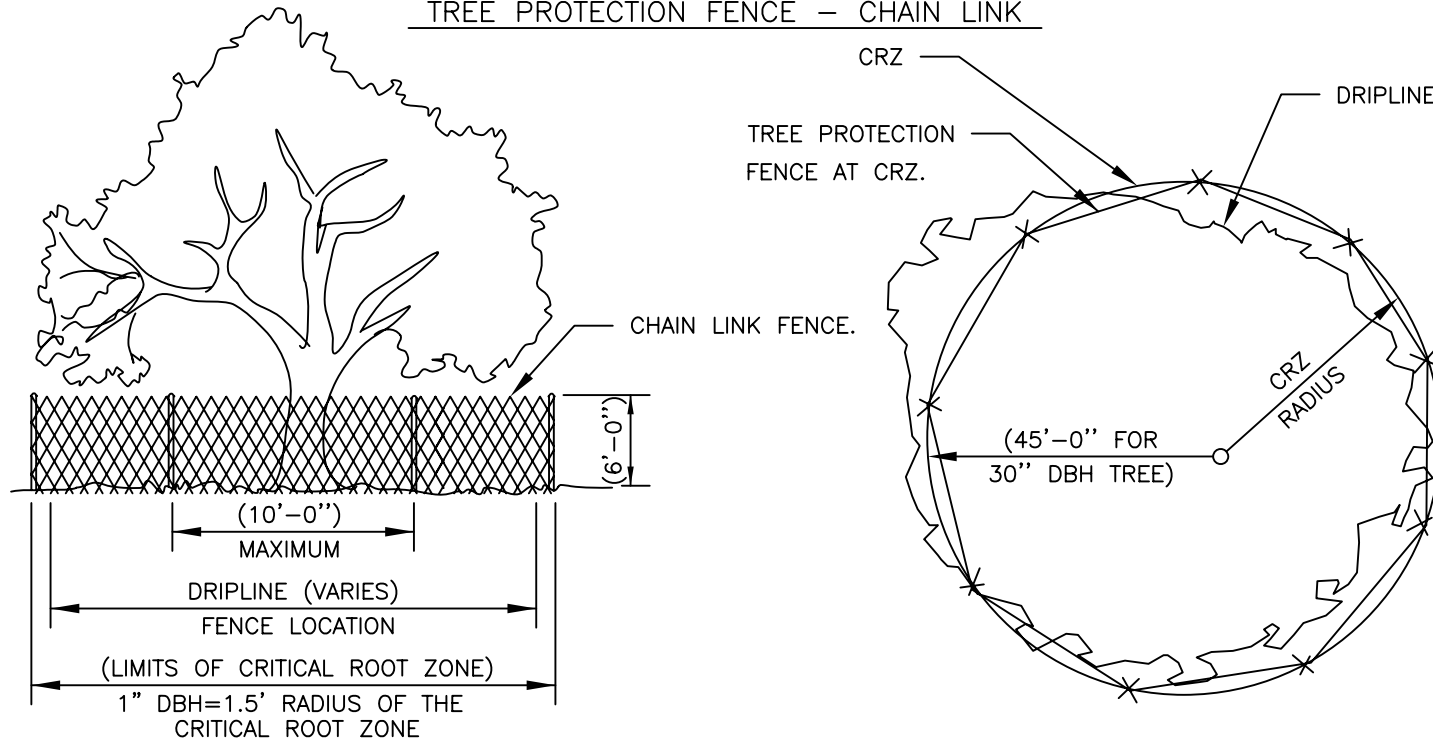


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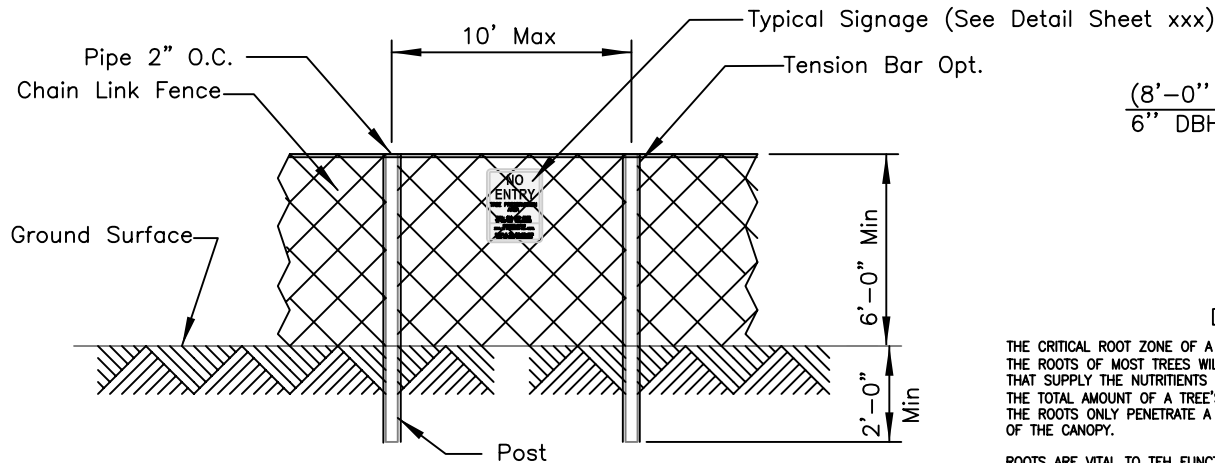
REVISION	DATE

CITY STANDARDS	
TYPICAL SIGNAGE FOR TREE PRESERVATION AREA	
SCALE: N.T.S.	STANDARD NUMBER: XX-1

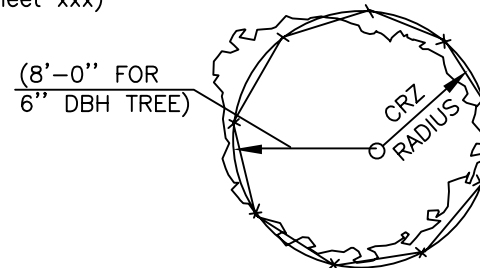
TREE PROTECTION FENCE – CHAIN LINK



TREES 8" DBH AND SMALLER:



POST AND FENCE DETAIL



DETERMINING THE CRITICAL ROOT ZONE

THE CRITICAL ROOT ZONE OF A TREE IS THE ZONE IN WHICH THE MAJORITY OF A TREE'S ROOTS LAY. NINETY-FIVE PERCENT OF THE ROOTS OF MOST TREES WILL BE FOUND IN THE UPPER 30-36" OF THE SOIL. OF THOSE, THE MAJORITY OF THE ROOTS THAT SUPPLY THE NUTRIENTS AND WATER TO THE TREE ARE FOUND IN THE UPPERMOST LAYER, JUST BELOW THE SOIL SURFACE. THE TOTAL AMOUNT OF A TREE'S ROOTS ARE GENERALLY PROPORTIONAL TO THE VOLUME OF THE TREE'S CANOPY. THEREFORE, IF THE ROOTS ONLY PENETRATE A THIN LAYER OF SOIL, THEN THE ROOTS MUST SPREAD FAR FROM THE TREE, BEYOND THE LIMITS OF THE CANOPY.

ROOTS ARE VITAL TO THE FUNCTIONING OF ANY TREE. THEY PROVIDE STRUCTURAL SUPPORT AS WELL AS THE MAJOR MECHANISM FOR NUTRIENT AND WATER UPTAKE FOR USE BY THE REST OF THE TREE. DESTROYING A SECTION OF A TREE'S ROOTS WILL ULTIMATELY RESULT IN A PROPORTIONAL LOSS OF THE TREE'S CANOPY.

THE CRITICAL ROOT ZONE OF A TREE TO BE SAVED SHALL BE THE MINIMUM AREA PROTECTED WITH TREE PROTECTION FENCING.



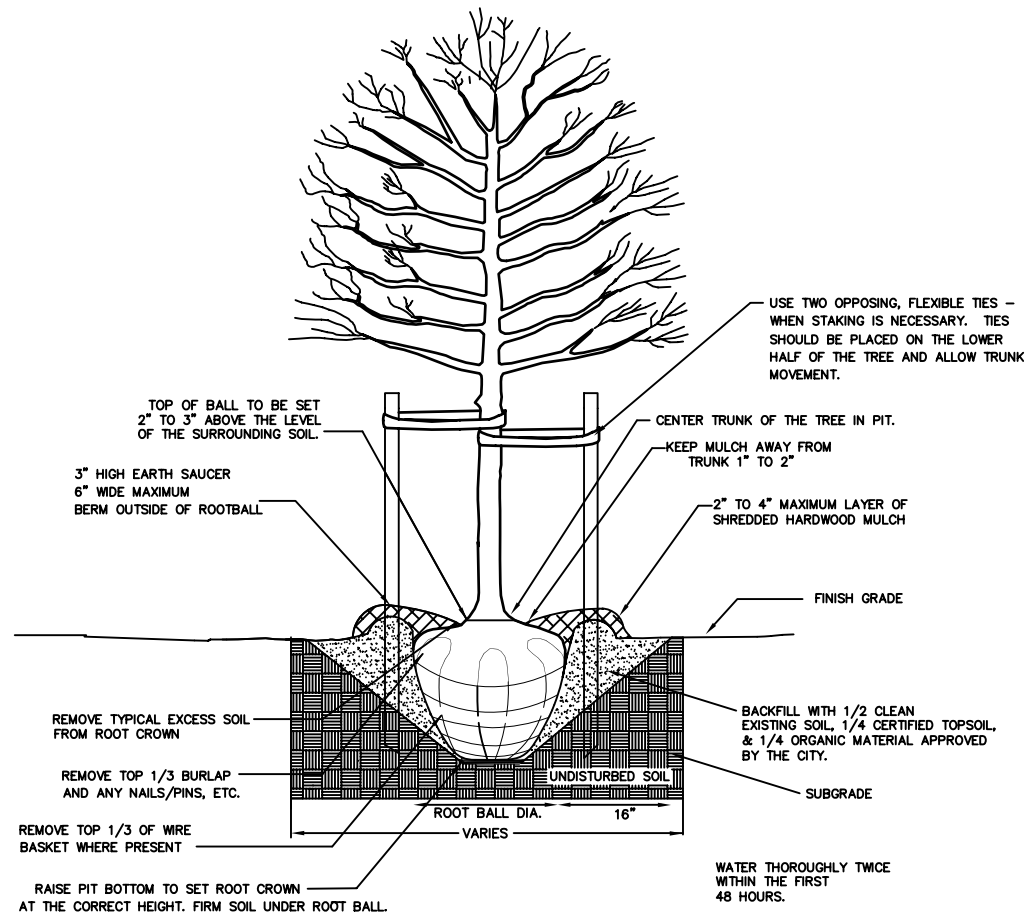
CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS	
TREE PROTECTION DETAIL – CHAIN LINK FENCE	
SCALE: N.T.S.	STANDARD NUMBER: XX-1

NOTES:

1. REMOVE WIRE AND NYLON TWINE FROM BALL AND CANOPY.
2. SOAK ROOT BALL AND PLANT PIT IMMEDIATELY AFTER INSTALLATION.
3. STAKING IS REQUIRED FOR ALL TREES IN R.O.W. OR UPON REQUEST OF ARBORIST.
4. REMOVE EXCESS SOIL FROM SITE AND DISPOSE OF IN A LEGAL MANNER.
5. RESEED UNMULCHED, DISTURBED AREAS.
6. AT PLANTING PRUNE ONLY CROSSING LIMBS, CO-DOMINANT LEADERS, BROKEN OR DEAD BRANCHES, AND ANY BRANCHES THAT POSE A HAZARD TO PEDESTRIANS.



NOT TO SCALE



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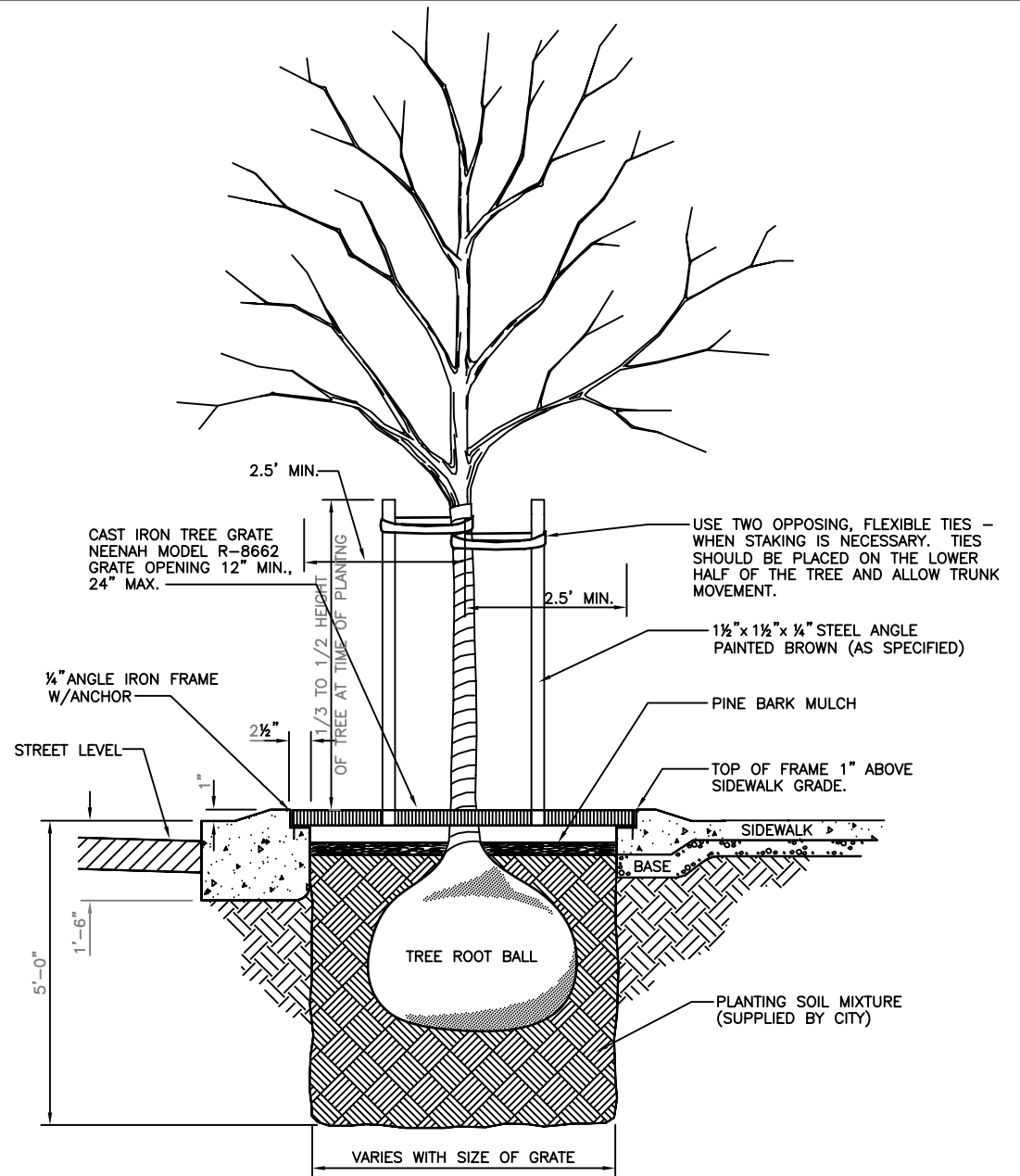
REVISION	DATE

CITY STANDARDS
 PLANTING TREES IN OPEN
 AREA OR GRASS STRIP

SCALE: N.T.S.

STANDARD NUMBER: XX-2

1. STREETScape TREES SHALL BE PLANTED ALONG ALL EXISTING OR PROPOSED PUBLIC STREETS.
2. STREETScape TREES SHALL BE LARGE CANOPY TREES; HOWEVER, UPON A DETERMINATION BY THE DIRECTOR THAT SITE CONDITIONS WARRANT SMALLER TREES, THE DIRECTOR MAY APPROVE THE SUBSTITUTION OF A MEDIUM CANOPY TREE.
3. STREETScape TREES SHALL BE PLANTED WITH EVEN SPACING IN A ROW, AT INTERVALS SUFFICIENT TO ALLOW FOR THEIR HEALTHY GROWTH AND DEVELOPMENT.
 - A) ONE (1) LARGE TREE SHALL BE REQUIRED FOR EVERY FORTY (40) FEET OF ROAD FRONTAGE, OR PORTION THEREOF, IF TWENTY-FIVE (25) FEET OR MORE; OR,
 - B) WHERE PERMITTED, ONE (1) MEDIUM TREE SHALL BE REQUIRED FOR EVERY TWENTY-FIVE (25) FEET OF ROAD FRONTAGE, OR PORTION THEREOF, IF TWENTY (20) FEET OR MORE.
4. STREETScape TREES MAY BE PLANTED IN THE CITY'S EXISTING OR PROPOSED RIGHTS OF WAY WITH THE APPROVAL OF THE DIRECTOR OF NEIGHBORHOOD DEVELOPMENT SERVICES. SUCH APPROVAL SHALL SPECIFY PLACEMENT AND TYPE(S) OF TREES TO BE PLANTED.
5. THE DEVELOPER MUST INCLUDE A STATEMENT IN THE PRELIMINARY AND FINAL SITE PLANS GUARANTEEING THE MAINTENANCE AND, IF DEEMED NECESSARY BY THE CITY'S ARBORIST, REPLACEMENT OF ANY AND ALL STREETScape TREES PLANTED IN THE CITY'S EXISTING OR PROPOSED RIGHTS OF WAY. SUCH GUARANTEE BY THE DEVELOPER FOR MAINTENANCE AND/OR REPLACEMENT SHALL BE IN EFFECT FOR A PERIOD OF TWO (2) YEARS FROM THE DATE OF PLANTING.
6. STREET TREES SHALL BE NURSERY GROWN TREES WHICH MEET THE REQUIREMENTS FOR STREET TREES SET FORTH IN THE AMERICAN STANDARD FOR NURSERY STOCK - ANSI Z60 AND SHALL BE TYPICAL OF THEIR SPECIES HAVING FULLY DEVELOPED CROWNS AND SINGLE LEADERS. THEY SHALL BE BRANCHED TO ONE THIRD OF THEIR HEIGHT AT THE TIME OF PLANTING AND ELEVATED AS NECESSARY DURING THEIR GROWTH TO ASSURE A CLEARANCE FOR PEDESTRIANS AT MATURITY. GREATER CLEARANCE MAY BE REQUIRED IN SITUATIONS WHERE TRUCK AND BUS TRAFFIC MUST BE ACCOMMODATED.
7. ALL NURSERY STOCK USED AS STREET TREES SHALL BE VIGOROUS, HEALTHY, AND FREE OF DISEASE OF INFESTATION. ALL PLANTS SHALL BE INSPECTED AT THE NURSERY AND SHIPMENTS SHALL BEAR THE APPROPRIATE CERTIFICATE OF INSPECTION PROVIDED BY THE STATE OF ORIGIN FOR PLANTING MATERIALS.
8. ALL TIES AND STAKES SHALL BE REMOVED AFTER ONE GROWING SEASON.



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REVISION	DATE

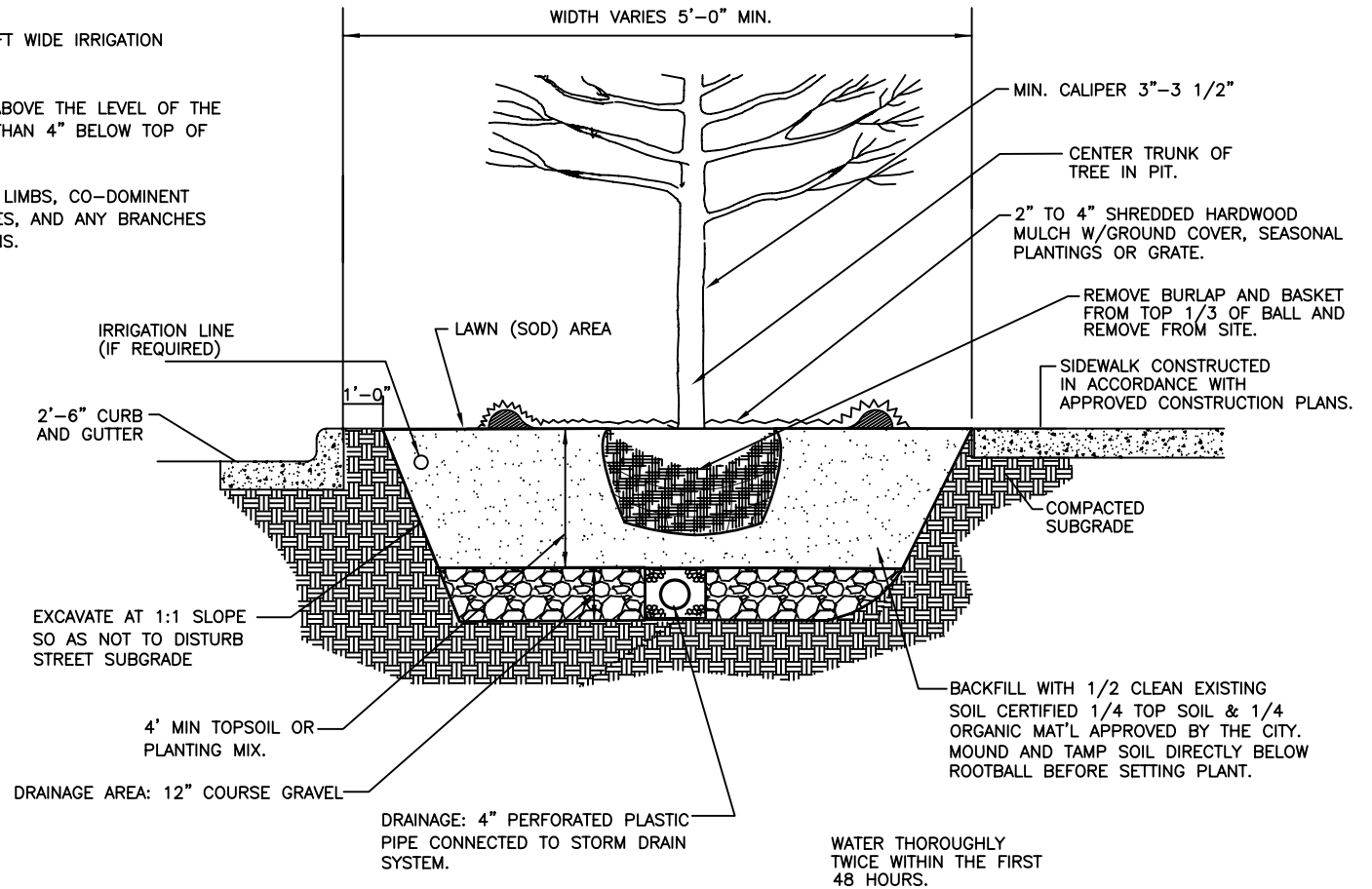
CITY STANDARDS
GENERAL STANDARD FOR
TREE PLANTING

SCALE: N.T.S.

STANDARD NUMBER: XX-3

NOTES:

1. FOR NEW PLANTING AREAS, REMOVE ALL PAVEMENT, GRAVEL, SUB-BASE AND CONSTRUCTION DEBRIS BEFORE PREPARING SOIL AND PLANTING TREES
2. REMOVE COMPACTED SOIL AND ADD 4' MIN NEW TOPSOIL WITH PLANT MIX OR UNCOMPACT AND AMMEND TO 4' OF EXISTING SOIL TO MEET TOPSOIL WITH PLANTING MIX STANDARDS FOR TREES. (SEE DETAIL)
3. IF PLANTING STRIP IS LESS THAN 8 FT WIDE IRRIGATION AND SUBDRAIN ARE REQUIRED.
4. TOP OF BALL TO BE SET 2" TO 3" ABOVE THE LEVEL OF THE SURROUNDING SOIL AND NOT MORE THAN 4" BELOW TOP OF SIDEWALK.
5. AT PLANTING PRUNE ONLY CROSSING LIMBS, CO-DOMINANT LEADERS, BROKEN OR DEAD BRANCHES, AND ANY BRANCHES THAT POSE A HAZARD TO PEDESTRIANS.



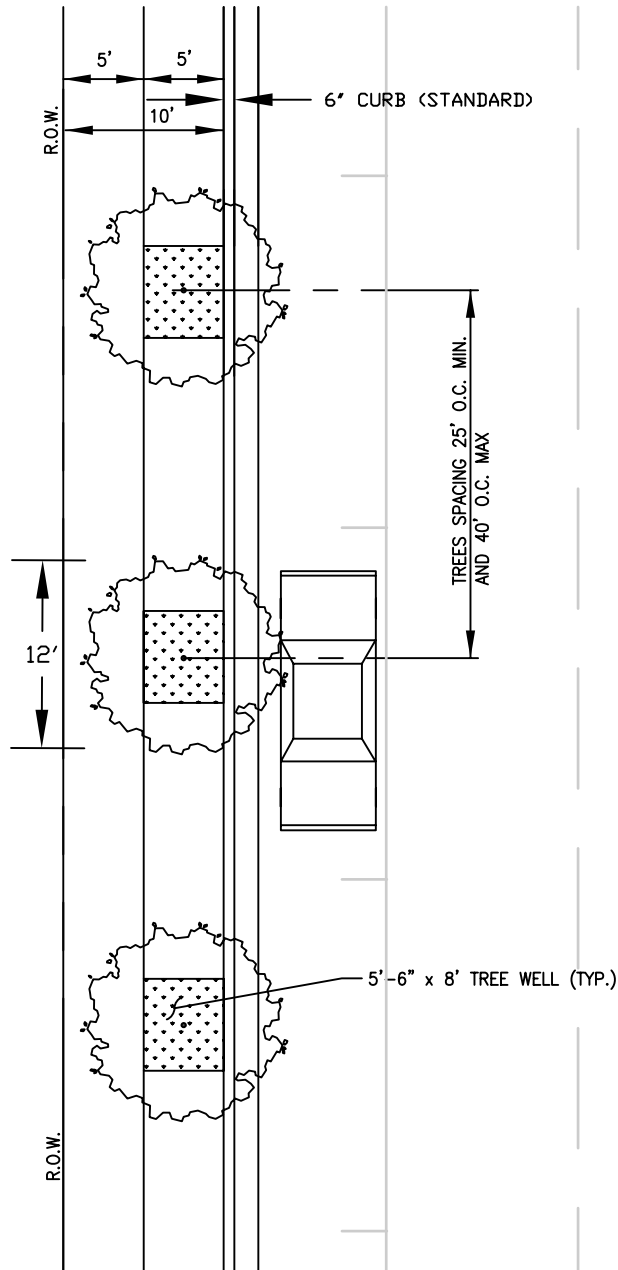
WATER THOROUGHLY TWICE WITHIN THE FIRST 48 HOURS.



CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS	
TREE PLANTING DETAIL FOR STREET TREE IN PIT	
SCALE: N.T.S.	STANDARD NUMBER: XX-4



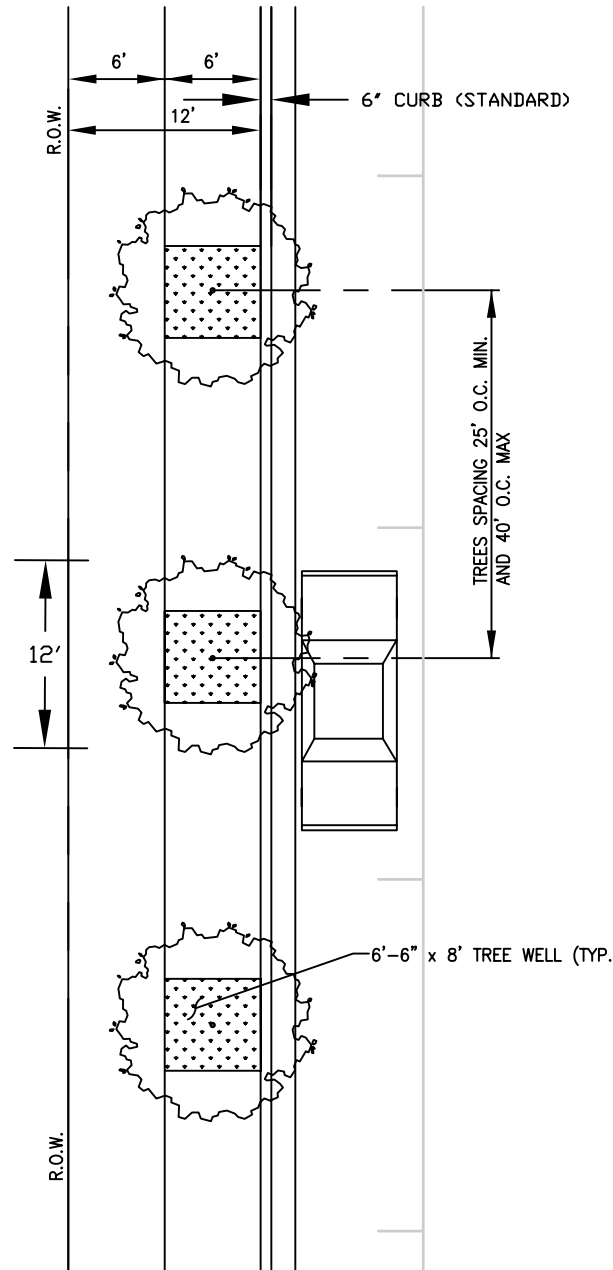
TEN FOOT COMBINED SIDEWALK AND PLANTING AREA



CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS	
TREE PLANTING STANDARDS FOR SITE PLAN PROJECTS	
SCALE: N.T.S.	STANDARD NUMBER: XX-5



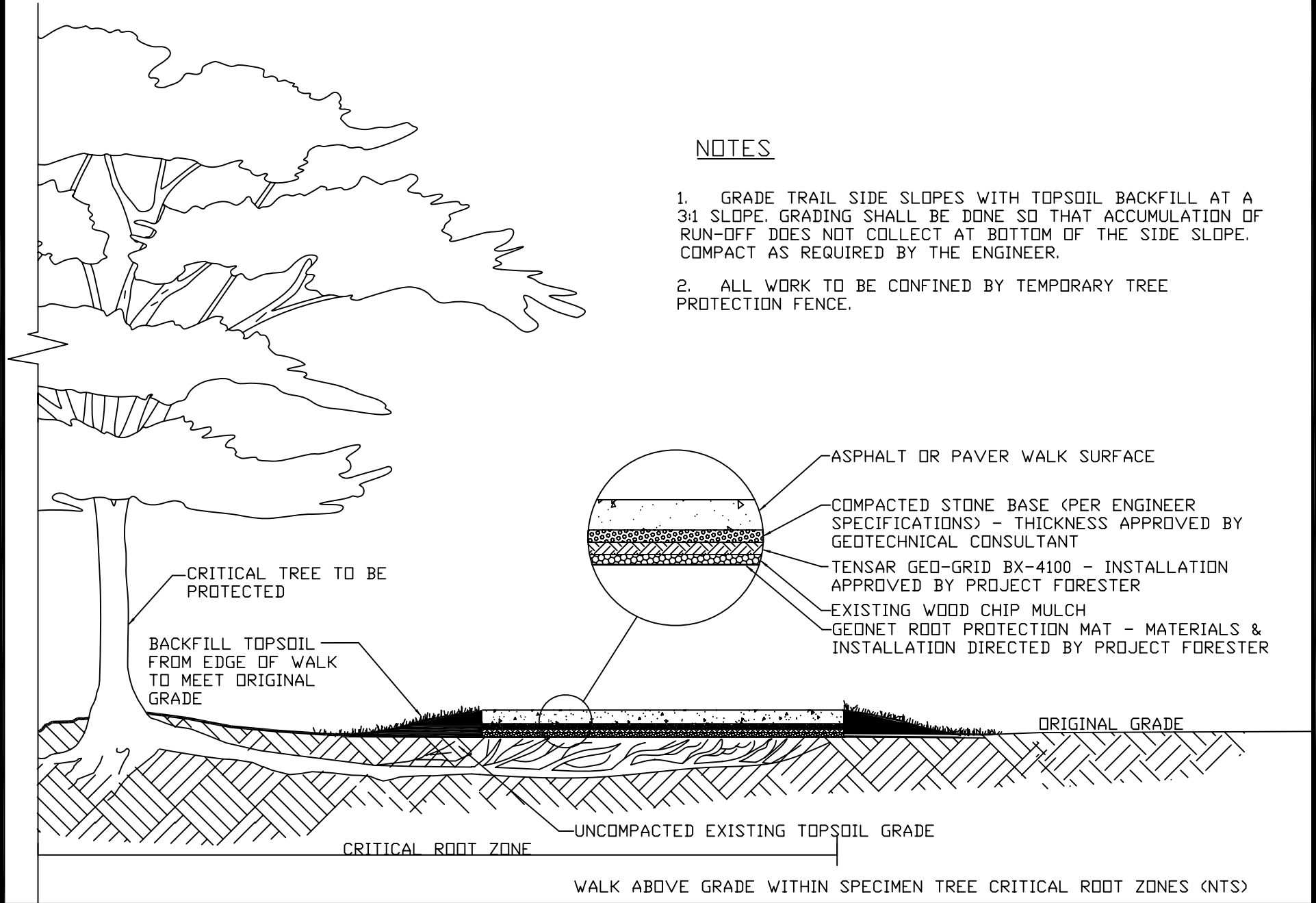
TWELVE FOOT COMBINED
SIDEWALK
AND PLANTING AREA



CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS	
TREE PLANTING STANDARDS FOR SITE PLAN PROJECTS	
SCALE: N.T.S.	STANDARD NUMBER: XX-6



NOTES

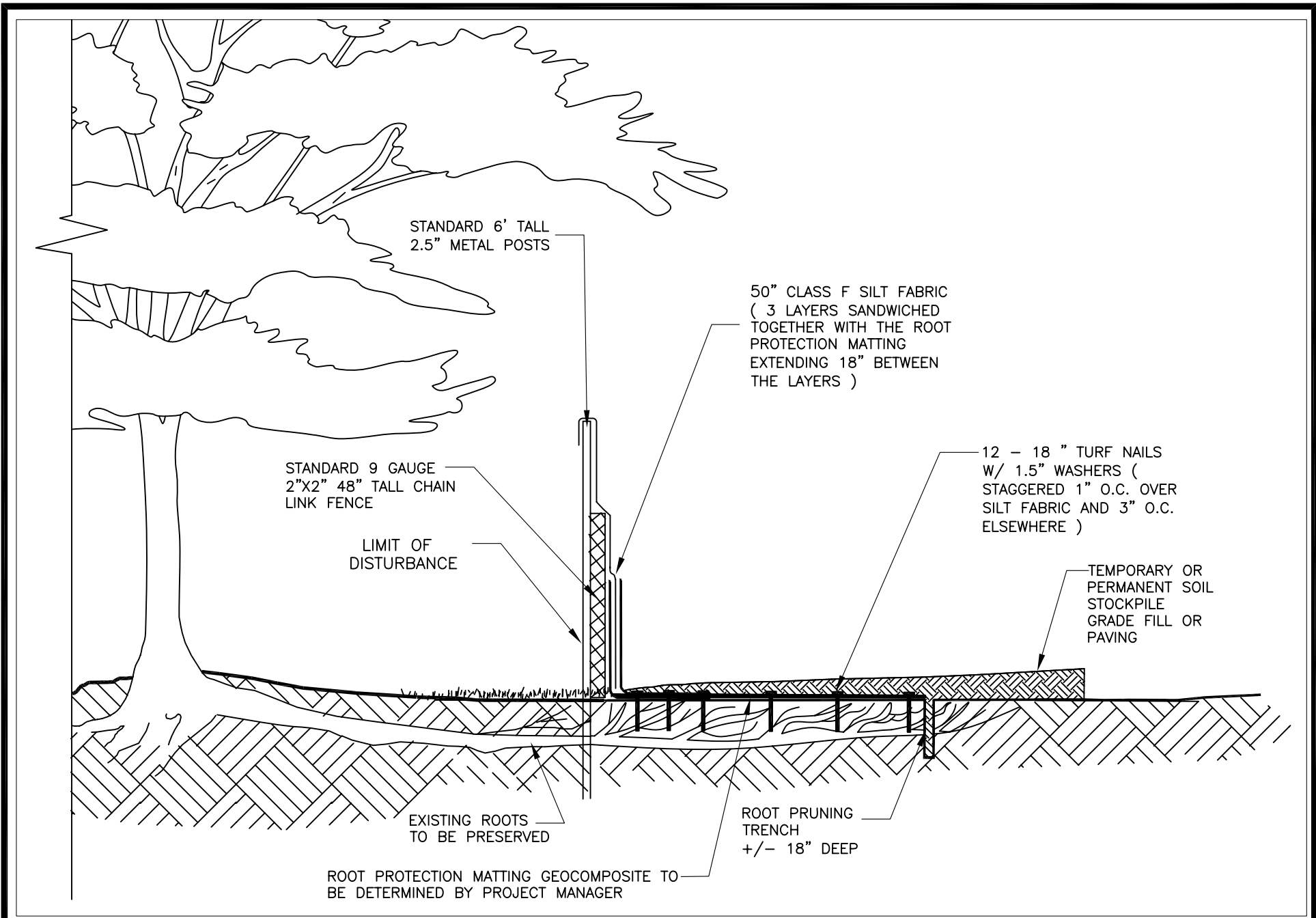
1. GRADE TRAIL SIDE SLOPES WITH TOPSOIL BACKFILL AT A 3:1 SLOPE. GRADING SHALL BE DONE SO THAT ACCUMULATION OF RUN-OFF DOES NOT COLLECT AT BOTTOM OF THE SIDE SLOPE. COMPACT AS REQUIRED BY THE ENGINEER.
2. ALL WORK TO BE CONFINED BY TEMPORARY TREE PROTECTION FENCE.



CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS	
WALK ABOVE GRADE	
SCALE: N.T.S.	STANDARD NUMBER: XX-7



CITY OF CHARLOTTESVILLE

REVISION	DATE

CITY STANDARDS
**TRENCHLESS SUPER
 SILT FENCE**

SCALE: N.T.S. | STANDARD NUMBER: XX-8