

S U S T A I N A B L E
C O M M U N I T Y F O R E S T R Y
P R O G R A M

GEORGIA FORESTRY
COMMISSION



Recommended Community Tree Ordinance Tree Conservation Standards



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Section 1: Tree Conservation and Protection during the Land Development Process

A. Planning

- (1) Employ the services of qualified professionals such as a certified arborist or professional urban forester, to assist in the planning, implementation and follow up, including maintenance.
- (2) Evaluate the conservation potential of all trees on site, based on their species, age, health, structural condition and location, in relation to site modifications and proposed structures and utilities.
- (3) Diagram the approximate location of the trees' critical root zones, based on 1.3 feet of radius for every inch (dbh), or greater, based on professional judgment.
- (4) Diagram the approximate location of the tree's root plate, based on 0.5 feet of radius for every inch (dbh) or greater, based on professional judgment.
- (5) Evaluate trees on adjacent properties for a full range of potential impacts, and negotiate mitigating actions with the adjacent property owners.
- (6) Modify the site plans or plan to remove trees that cannot be protected. Generally, trees that suffer 25 percent or greater critical root zone loss do not live sustainably in the landscape. Variables include the nature of disturbance, the potential to mitigate damage, the species of tree, its condition and vigor, or change in soil hydrology.
- (7) The protection of clumps or groupings of trees is more effective than the protection of individual trees.
- (8) Plan for how the full range of site activities could potentially impact the trees. Identify staging areas for parking, material storage, construction debris, and concrete washout.

B. Pre-land disturbance site preparation

- (1) Conduct pre-construction tree maintenance, including the application of mulch (four to six inches) within the critical root zone, fertilization, and pruning to remove structural defects, deadwood, or to improve clearance for equipment and structures. Educate all workers on site about tree protection techniques and requirements.
- (2) Establish a tree protection zone equal to the trees' critical root zones, or as a minimum along the limits of disturbance (*See Figure 1*).
- (3) Install all protective barriers prior to any land disturbance.
- (4) Acceptable tree fencing includes the following (*See Figure 2, 3 & 4*):

- a. A minimum four-foot (4') barrier, constructed in a post and rail configuration. A 2-inch x 4-inch post and a double 1-inch x 4-inch rail are recommended.
- b. Four-foot orange polyethylene laminar safety fencing.
- c. Six-foot chain link fencing. A six-foot chain link fence should be required for the protection of all specimen trees and boundary trees.

Any deviation from the three acceptable tree fencing methods listed above should be authorized by the ordinance administrator.

All tree protection fences should be accompanied by "Tree Save Area: Do Not Enter" signage. These signs should be in both English and Spanish.

- (5) Construction offices, vehicular parking, worker break sites, portable toilets, and material storage and debris areas are to be placed outside of the tree protection zones.
- (6) Underground and overhead utility lines that would require trenching or severe pruning of protected trees should be rerouted. Tunneling or boring can be used to install underground utilities within a tree protection zone. Boring should be at least 24 inches beneath the surface. (*See Figure 5*).
- (7) Where tree roots should be cut, make only sharp, clean cuts to promote root regeneration.
- (8) When clearing and grading is planned in close proximity to a tree protection zone, the limit of disturbance should be defined by a clean trench cut to a depth of 24 inches, to prevent the shredding and tearing of protected roots.
- (9) Grade change in the critical root zones of trees will destroy roots. Retaining walls should be used to minimize the impact grade changes near or within the critical root zones of protected trees. (*See Figures 6 & 7*)
- (10) Monitor tree health and compliance with tree protection requirements regularly during construction.

C. Protection of Critical Root Zones and Root Plates

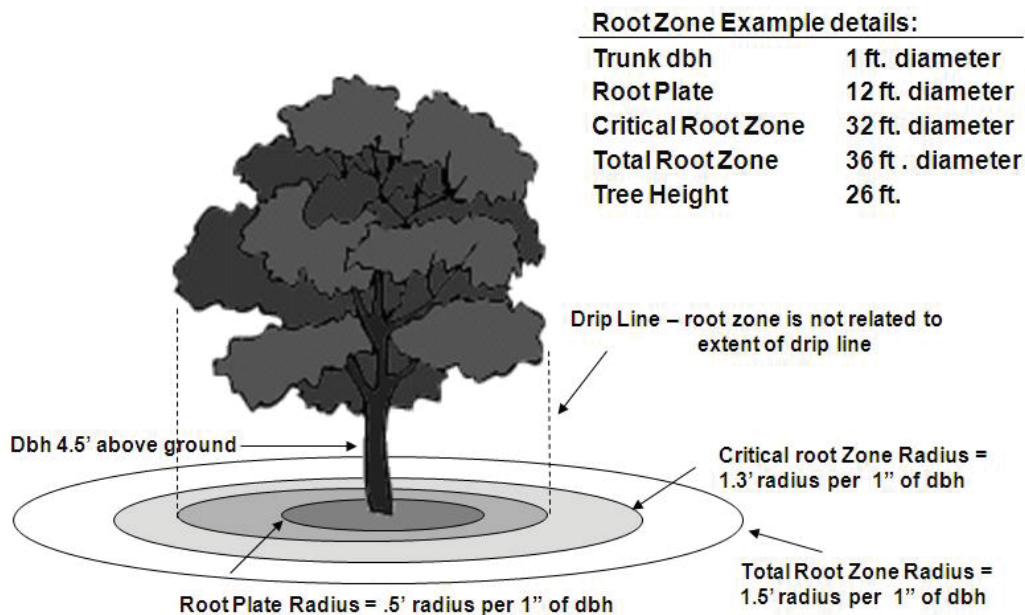
- (1) Critical Root Zone (CRZ) is the minimum area beneath a tree which should be left undisturbed in order to preserve a sufficient root mass to give a tree a reasonable chance of survival (*See Figure 1*). The CRZ will typically be represented by a concentric circle centering on the tree's trunk with a **radius** equal in feet to 1.3 times the number of inches of the trunk diameter measured 4.5 feet above the ground (dbh-diameter breast height). Example: The CRZ radius of a 20-inch diameter tree is 26 feet. This is not to be confused with the Total Root Zone area.
- (2) Root Plate is the area of the root zone comprised of pedestal roots and the zone of rapid taper and roots under compression, with a directional radius based upon the tree

trunk diameter at 4.5 feet above the ground (dbh) (See Figure 1). The root plate will typically be represented by a concentric circle centering on the tree's trunk with a radius equal in feet to one-half times the number of inches of the trunk diameter. Catastrophic failure of the tree could result if roots in this area are damaged or destroyed. Example: The root plate *radius* of a 20-inch diameter tree is expected to be 10 feet.

Figure 1: Root Zone Detail

Definitions for Root Zone Detail:

- Tree Dbh** – diameter breast height measured 4.5 feet above the ground.
- Root Plate** – area of rapid tapering roots supporting the vertical weight of the tree.
- Critical Root Zone** – a minimum root area needed to sustain a healthy tree.
- Total Root Zone** – Maximum extent of root area of healthy tree.
- Drip Line** – furthest extent of live branches: bears no relation to root zone.



D. Tree Protection During Construction

No person in the construction of any structure(s) or improvement(s) or any activity should encroach or place solvents, material, construction machinery or temporary soil deposits within six feet of the area outside the critical root zone, as defined herein, of any specimen tree or any tree within a tree protection zone.

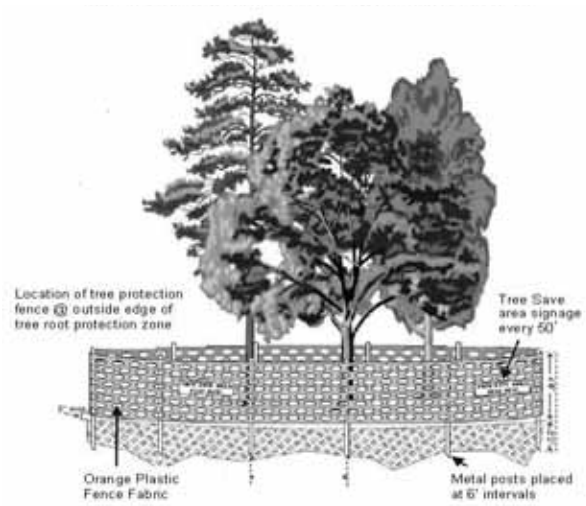
- (1) Before development, land clearing, filling or any land alteration, including removal of impervious surfaces or structures, the developer should erect suitable protective barriers as required, including tree fences, tree protection signs and erosion barriers, until site landscaping is completed.

- (2) In addition to fencing, where active tree protection is required, each tree to be saved should be marked at the diameter breast height (dbh) with surveyor's flagging ribbon with a permanent marker indicating the size and species of tree, or number of the tree which is cross-referenced by tree size and species on a chart on the tree survey plan. The flagging ribbon should encompass the tree.
- (3) Community inspection of tree protection barriers should be required prior to any land disturbance or development.
- (4) All tree protection devices should remain in functioning condition until the certificate of occupancy is issued.
- (5) Authorization to remove the protective devices should be in writing or by the issuance of a final certificate of occupancy.

E. Tree Protection Fencing

- (1) Materials for active tree protection, for trees to be conserved on the site, and all boundary trees, should consist of chain link, orange laminated plastic, wooden post and rail fencing or other equivalent restraining material.
- (2) Additionally, all specimen trees to be conserved on-site and receiving maximum protection should be provided the following tree protection measures during construction (*See Figures 2, 3 & 4*):
 - a. A six-foot chain link fence around the critical root zone with the support posts for the fencing spaced six feet on center. No gates, doors or openings should be permitted as part of the fencing. Boundary trees should be protected by three foot high polyethylene orange fencing.
 - b. Four to six inches of organic mulch over the critical root zone within the tree protection zone. The mulch is to be spread by hand within the critical root zone. No machinery is allowed within the critical root zone of the specimen tree.
 - c. An automatic above ground irrigation system may be required. There should be no underground irrigation system installed within the tree protection zone.
 - d. Signage should be placed every 50 feet on the tree protection fencing that reads, "Tree Save Area: Do Not Enter" in both English and Spanish.

Figure 2: Tree Protection Fencing for Non-Specimen Trees



***Specimen tree** protection may require orange polyethylene fence be replaced with chain link.

Figure 3: Tree Protection Fencing for a Single Non-Specimen Tree

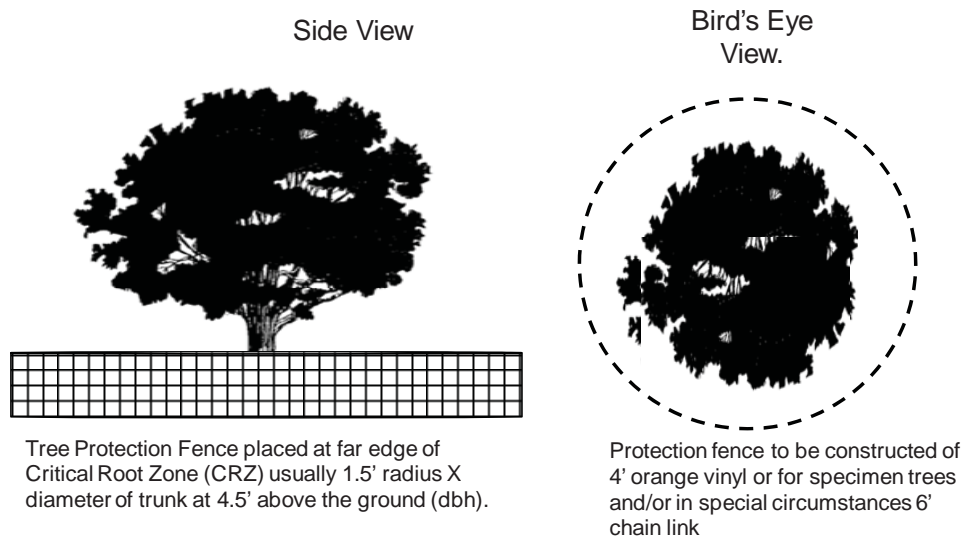
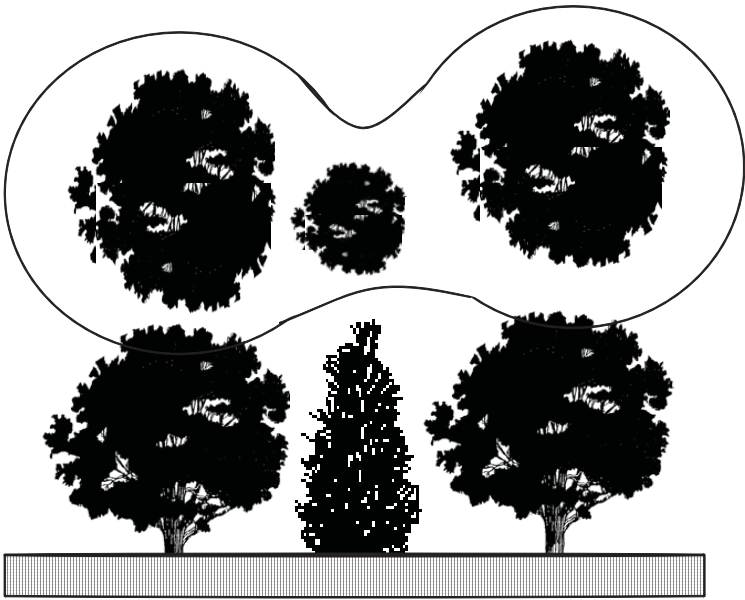


Figure 4: Tree Protection Fencing for Multiple Non-Specimen Trees



Tree Protection Fence placed at far edge of Critical Root Zone (CRZ) of all trees in group

Figure 5: Tunneling or Boring within Tree Root Zones

Figure 6: Acceptable Grade Fills within Root Zones

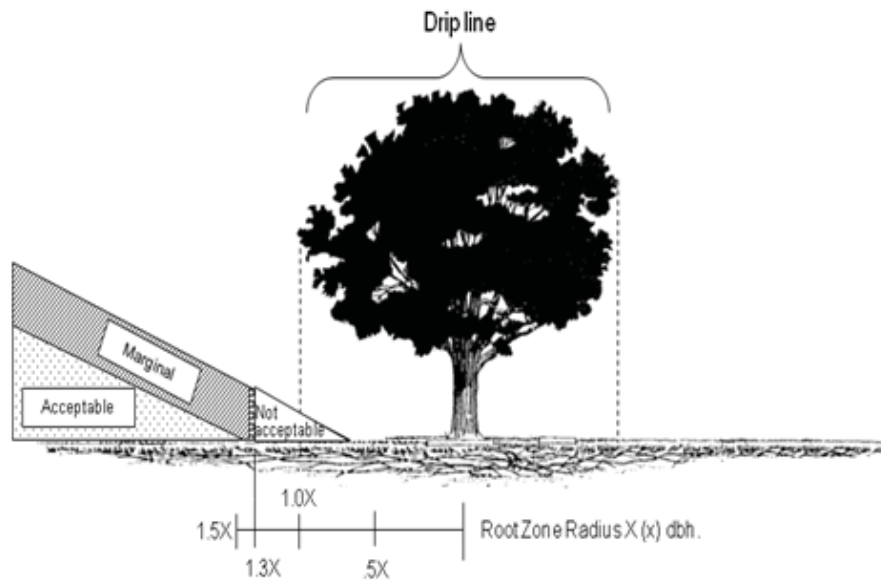
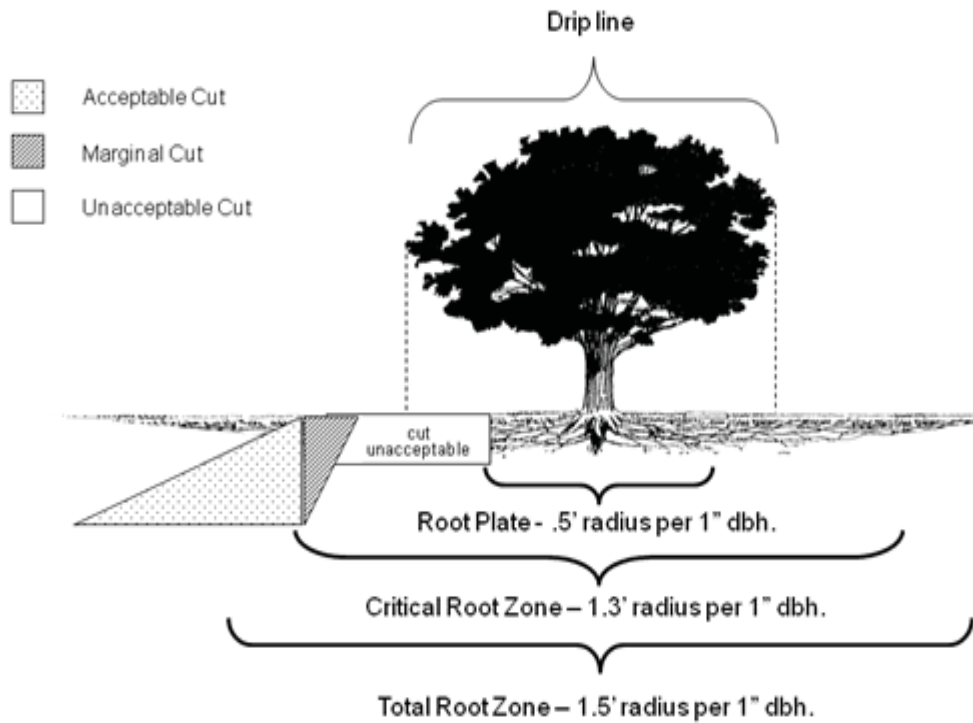


Figure 7: Acceptable Grade Cuts within Tree Root Zones



F. Follow-up Maintenance

- (1) Complete post-construction tree maintenance, including pruning, mulching, fertilization, irrigation, and soil aeration where necessary.
- (2) Apply at least one inch of water per week by deep watering in the absence of adequate rainfall.
- (3) Fertilize trees with phosphorus, potassium, calcium, magnesium, and other macro- and micro-nutrients as indicated by a soil test, but wait at least one year to apply any nitrogen. Fertilize lightly with nitrogen after one year.

Inspect trees annually for at least three years and up to five years after construction to look for changes in condition and signs of insects or disease, and evidence of girdling roots.

Section 2: Design Standards for Trees

A. Street Trees

- (1) Where streetscape trees are required as part of the streetscape on either side of the front lot line in accordance with the provisions of this article, placement should be done in accordance with the technical standards. Tree canopy cover should meet the following minimum requirements:
 - a. Street trees that are planted in the right-of-way should be three feet behind the edge of the sidewalk. If a street tree is to be planted on private property, a landscape easement should be provided.
 - b. The installation of root barriers should be considered along sidewalks and curbs to prevent tree roots from heaving and breaking pavers, sidewalks, curbs, and road pavements
 - c. Mature street trees should provide at least eight feet of clearance for pedestrians and bicyclists to avoid hazards created by low branches or trees too close to sidewalks and drives.
 - d. Street trees should provide clearance for large vehicles such as buses and delivery trucks along tree-lined streets and drives.
 - e. Street trees should not impede safety and should not be allowed in traffic vision clearance zones designated by the Director of Community Development.
 - f. Street trees should be planted a minimum of 15 feet from driveways, 35 feet from road intersections for minor collectors, 50 feet for major collectors, and 100 feet (100') for arterial roads (*See Figure 8*).
 - g. Street trees should be of horticulturally appropriate species for use in road frontage areas. Other species may be used as street trees with approval from the community development director (*See Figure 9*).

Figure 8: Minimum Street Tree Spacing and Distances from Intersections

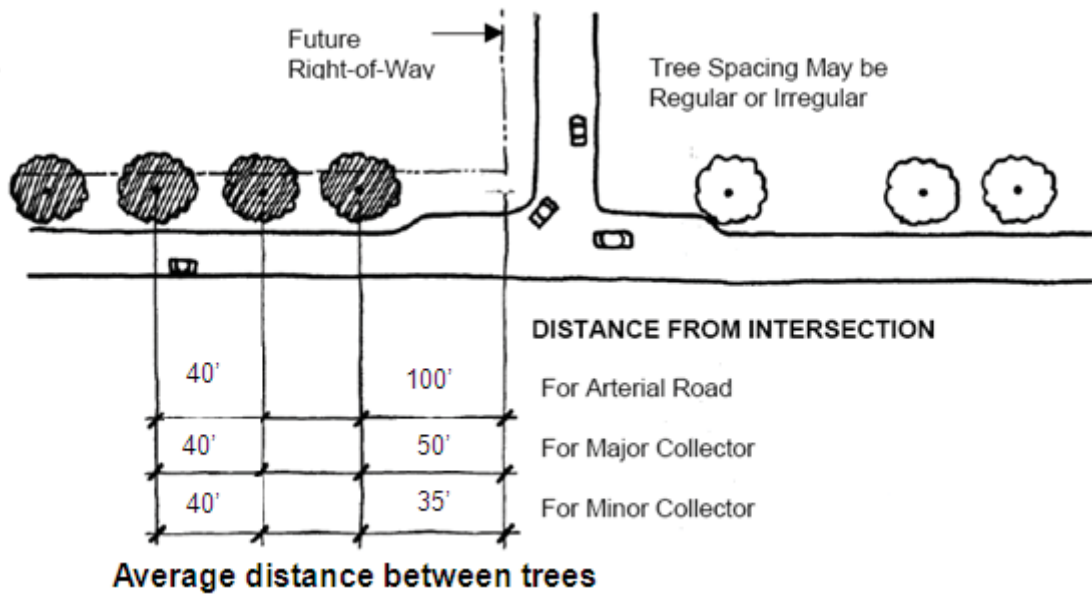


Figure 9: Desirable Street Tree Characteristics

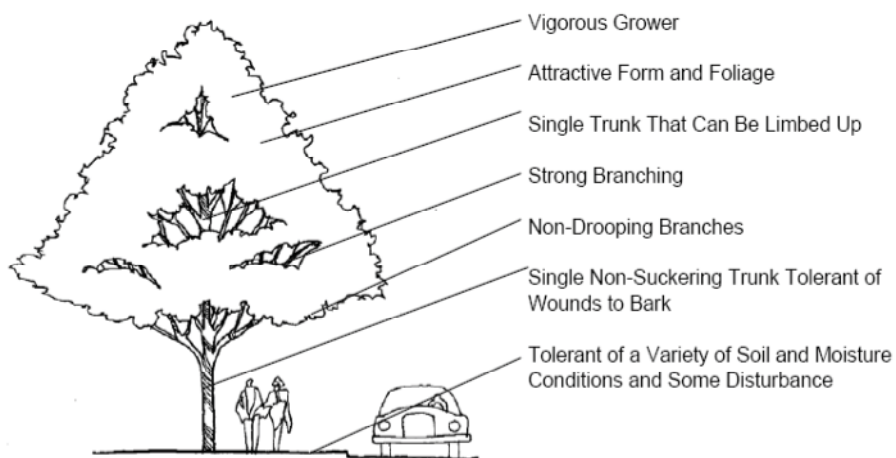


Figure 10: Recommended street tree location for understory trees

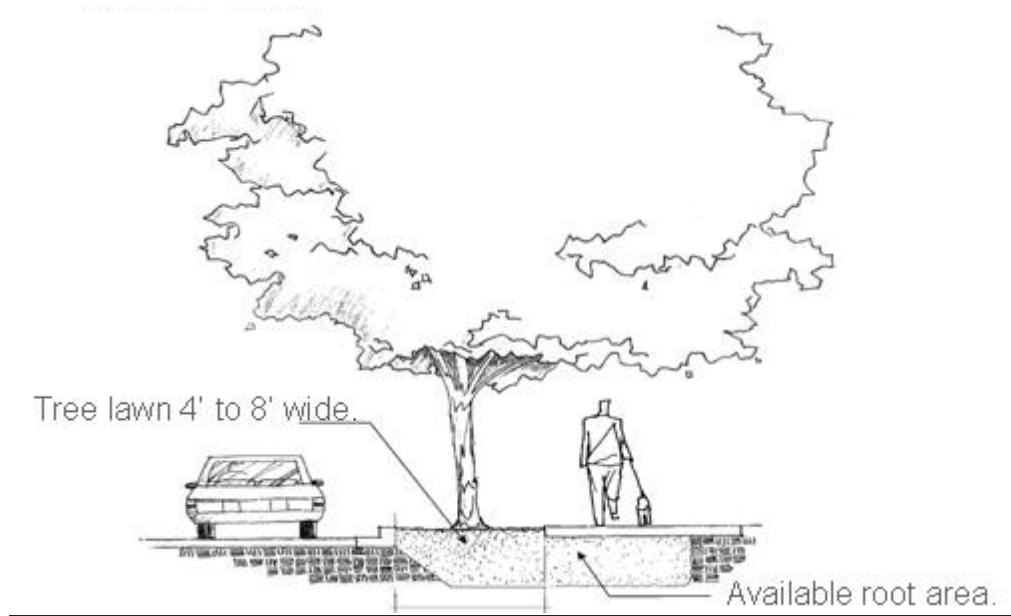
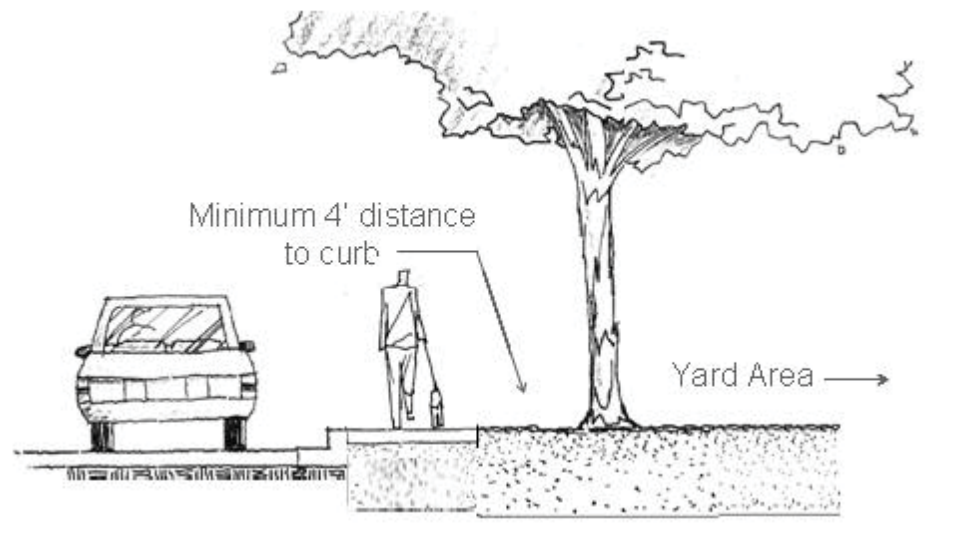


Figure 11: Recommended street tree location for overstory trees



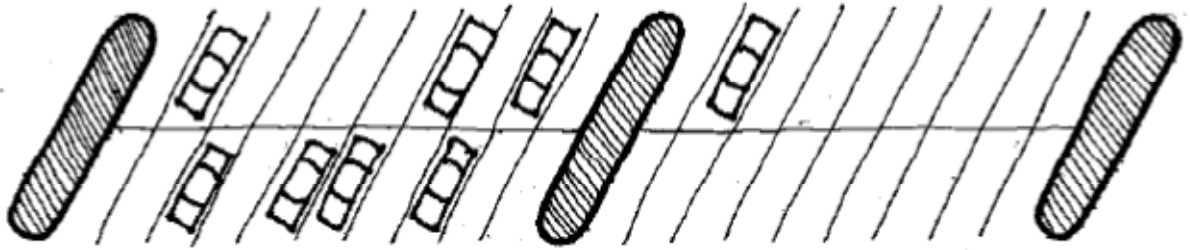
B. Parking Lot Trees

- (1) A sufficient number of trees should be planted in interior portions of parking lots so that every parking space is within 50 feet of the trunk of a tree to assure uniform distribution of trees throughout the parking area (*See Figure 12*).
 - a. All root zones should be a minimum of eight feet in width (measured from back-of-curb where curbing is installed or edge of pavement otherwise) with the use of wheelstops (30" minimum between the wheelstop and the curb) (*See Figure 13*).
 - b. All root zones should be a minimum of 12 feet in width (measured from back-of-curb where curbing is installed or edge of pavement otherwise) without the use of wheelstops (*See Figure 14*).
 - c. The root zone for overstory trees should be a minimum of 400 square feet of soil surface area (*See Figure 15*).
 - d. The root zone for understory trees should be a minimum of 200 square feet of soil surface area.
 - e. Parking lot islands, peninsulas and medians should have clean, cultivated soil to a total depth of two and one-half (2½) feet. Native subsoil is acceptable in parking lot islands, peninsulas and medians if the entire area is amended with appropriate soil improvements and thoroughly tilled. Otherwise, loamy topsoil is required.
 - f. Parking lot islands and medians should be covered with four inches (4") of organic mulch material replaced as needed.
 - g. Parking lot islands should have an automatic irrigation system to ensure new tree survival and improve long term tree health.
 - h. No fastigate (narrow crowned) varieties of trees are permissible in parking lots.
 - i. Trees planted to meet parking lot and street yard requirements are more successful when exceeding two inches caliper.
 - j. Trees planted in parking lots should be ecologically compatible with the harsh growing environment.
- (2) Light poles are not permitted in parking lot islands, peninsulas and medians unless a lighting plan is submitted for review and approved.
- (3) The use of at-grade planting areas in parking lots to promote stormwater runoff treatment and to supplement irrigation needs is encouraged, provided that the trees planted there will not be adversely impacted and that the system is designed by a licensed, professional civil engineer.
- (4) All street yards, where required, should be planted with one tree for each 40 linear feet exclusive of driveways, access ways and sight distance triangles.

- (5) Where street yard trees will be planted within 16 feet of the edge-of-pavement of a public street with a design speed of 45 mph or higher, or in areas beneath overhead utility lines, the use of an understory species is recommended.
- (6) Trees planted to meet the parking lot and street yard requirements should meet or exceed the minimum standards specified in *American Standards for Nursery Stock*.
- (7) When planting rows of trees, the developer should plant an assortment of species to avoid noticeable gaps when one dies or is damaged.
- (8) Parking lot trees should be moderately fast to fast-growing trees to realize tree benefits as soon as possible.

Parking lot planting island examples

Figure 12: Parking Row Planting



There are many possible layouts for parking lots including tree islands, row planters, or a combination of both.

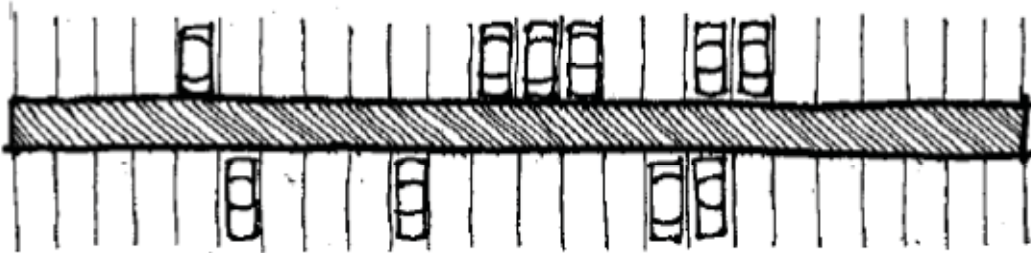


Figure 13: Placement of Trees along Entrance Drives

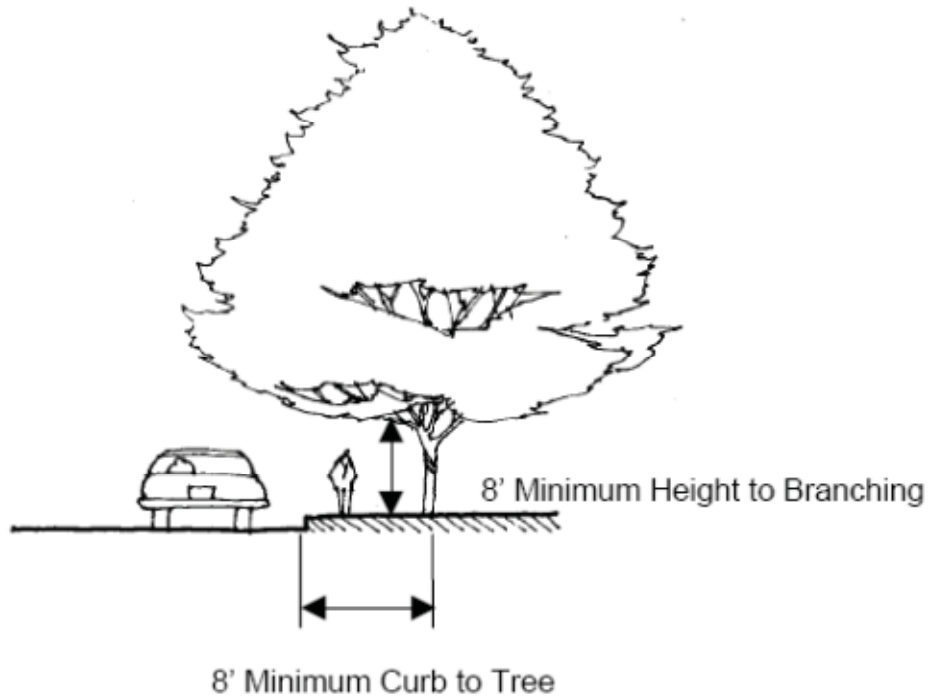


Figure 14: Planting Between Parked Cars

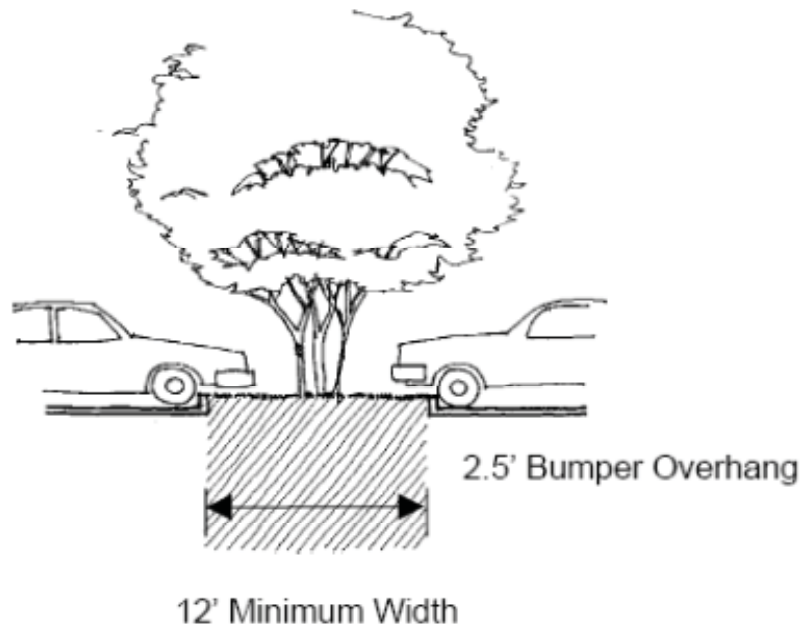


Figure 15: Parking Lot Aisle Caps

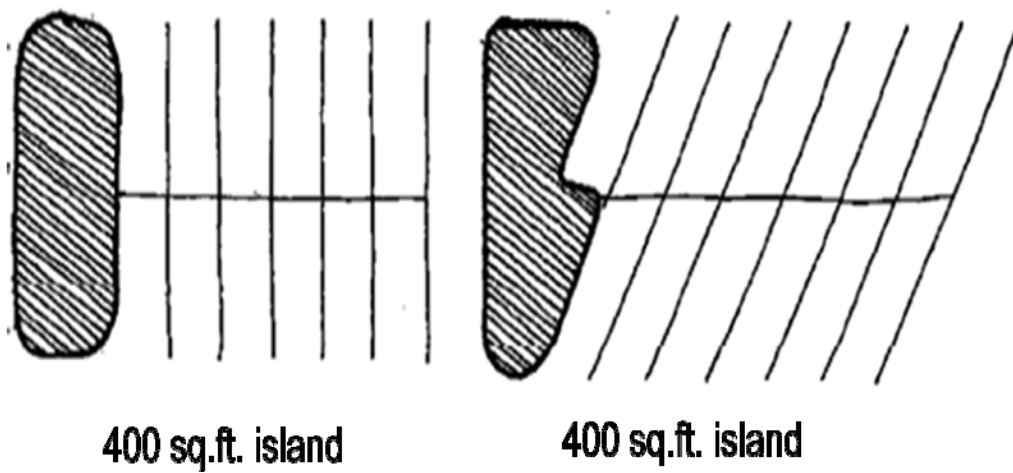


Table 1: Recommended Parking Lot Island Trees

Common Name	Latin Name
Ginkgo (male cultivars only)	<i>Ginkgo biloba</i>
Golden Honey Locust	<i>Gleditsia triacanthos var. inermis</i>
Golden Rain Tree	<i>Koelreuteria paniculata</i>
Crapemyrtle	<i>Lagerstroemia species</i>
American Hophornbeam	<i>Ostrya virginiana</i>
Persian Parrotia	<i>Parrotia persica</i>
Chinese Pistache	<i>Pistacia chinensis</i>
Sawtooth Oak	<i>Quercus acutissima</i>
Georgia Oak	<i>Quercus georgiana</i>
Scarlet Oak	<i>Quercus coccinea</i>
Overcup Oak	<i>Quercus lyrata</i>
Lacebark Elm, Chinese Elm	<i>Ulmus parvifolia</i>
Trident Maple	<i>Acer buergeranum</i>
Shumard Oak	<i>Quercus shumardi</i>
Japanese Zelkova	<i>Zelkova serrata</i>

Table 2: Trees Unsuitable for Parking Lot Islands

Common Name	Latin Name
Red Maple	<i>Acer rubrum</i>
Norway Maple	<i>Acer platanoides</i>
Silver Maple	<i>Acer saccharinum</i>
River Birch	<i>Betula nigra</i>
Hackberries	<i>Celtis species</i>
Beeches	<i>Fagus species</i>
Sweetgum	<i>Liquidambar styraciflua</i>
Southern Magnolia	<i>Magnolia grandiflora</i>
London Planetree	<i>Platanus x acerifolia</i>
American Sycamore	<i>Platanus occidentalis</i>
Pin Oak	<i>Quercus palustris</i>
Willow Oak	<i>Quercus phellos</i>
Live Oak	<i>Quercus virginiana</i>
Weeping Willow	<i>Qalix babylonica</i>
American Elm	<i>Ulmus americana</i>

C. Buffers

- (1) Required undisturbed buffers should remain undisturbed and actively protected in perpetuity.
- (2) All buffer plant materials are subject to approval.
- (3) Successful buffers should be replanted to meet the following standards:
 - a. They should provide a visual barrier. To accomplish this screening, the plant materials should be a minimum of five-feet in height at time of planting and a moderately fast growing evergreen with full branching to the ground.
 - b. Slower growing trees may be used if larger materials are planted.
- (4) Drainage within or through buffers is subject to approval.
- (5) Encroachment into buffers for the construction of retaining walls, footing, or wall supports is not permitted unless otherwise specified in the conditions of rezoning. Encroachments into buffers should require zoning modifications or variances as applicable.
- (6) All buffers require a 10-foot improvement setback interior adjacent to the buffer. No grading is allowed in this improvement setback unless permission is obtained.

Section 3: Tree Selection and Planting Standards

A. Standards for Selecting Quality Trees

- (1) Trees selected for planting should meet the minimum requirements as provided below.
- (2) Trees and landscape plant material should be free from injury, pests, disease, or nutritional disorders, and be of good vigor.
- (3) The following criteria should be used for the determination of vigor:
 - a. Foliage should have a green or dark green color.
 - b. Vigorous trees will have large leaves and dense foliage when compared to trees of the same type with poor vigor.
 - c. Smooth or shiny bark on the trunk and branches of a young tree usually signifies good vigor; conversely, rough, cracked and dull bark could indicate poor vigor. Do not accept trees that have damaged or “skinned” bark from loading or transport or whose root balls have been “dropped” when off loaded.
- (4) Trunk taper: the trunks of vigorous trees will have an increase in diameter with a decrease in height. Trees with reverse tapers or no taper should not be selected.
- (5) Root color: young roots of most trees will be light in color.
- (6) Trees selected for planting should have no less than four feet between planted grade and lowest branch on the trunk for a two inch caliper tree.
- (7) Trees selected for planting should have radially symmetrical branching with a dominant leader.
- (8) Trees selected for planting should be free of root defects. Three types of root defects generally occur:
 - a. Kinked roots, in which taproots, major branch roots, or both are bent more than 90 degrees with less than 20 percent of the root system originating above the kink. A tree with such roots will probably bend at the soil line when released from a supporting stake.
 - b. Circling or girdling roots which circle 50 percent or more of the root system by 360 degrees or more. A tree with such roots would ultimately have less than 20 percent of its system available for support.
 - c. Trees planted too deep in containers or landscape. Excavate soil surrounding trunk to determine where first root flare exits the trunk and use this point as a planting guide (*See Figure 16*).

B. Planting Standards for Trees

- (1) Employment of proper planting techniques will be more favorable for tree establishment and will reduce attrition.
- (2) Transplanting procedures should follow standards established by the International Society of Arboriculture in the "Trees and Shrub Transplanting Manual." The following is a summary of several key practices:

a. Pre-Planting Considerations:

1. Check for underground utilities prior to digging.
2. Only healthy trees with a well-developed root system and a well formed top, characteristic of the species, should be planted. Standards for selecting quality stock are provided in "American Standards for Nursery Stock ANSI Z60."
3. Trees selected for planting should be compatible with the specific site conditions.
4. Make certain there is adequate soil volume for the tree and the potential size of the tree is appropriate for the site, including potential conflicts with sight distance, traffic and pedestrian clearance, and overhead utilities.
5. Deciduous and evergreen trees should be planted between the end of October and mid-February.

b. Planting procedures

1. Planting holes should be no less than three times wider than the root ball or bare roots of the tree being planted. A planting hole up to five times the width of the root ball is recommended and may be necessary for poor or compacted soils. (See *Figure 17*).
2. Trees should be planted 10 percent higher than they were in their former location or container. Be sure to inspect root balls to determine where the first root flare exits the trunk and plant this point 10 percent higher than surrounding undisturbed soil level.
3. Spade compacted bottom and sides of the planting hole should be roughed or scarified to allow the penetration of developing roots.
4. Root barriers should be used where planting occurs adjacent to sidewalk and other hardscape surfaces, to encourage deeper rooting and to minimize root conflicts.
5. Good water drainage from the bottom of the planting hole is essential for root establishment.
6. The application of soil amendments or fertilizer at the time of planting is not recommended.

Figure 16: Root Flare Detail

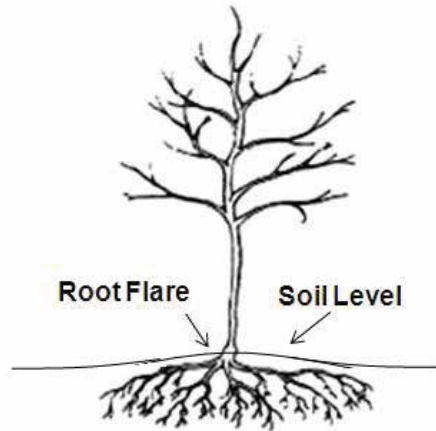
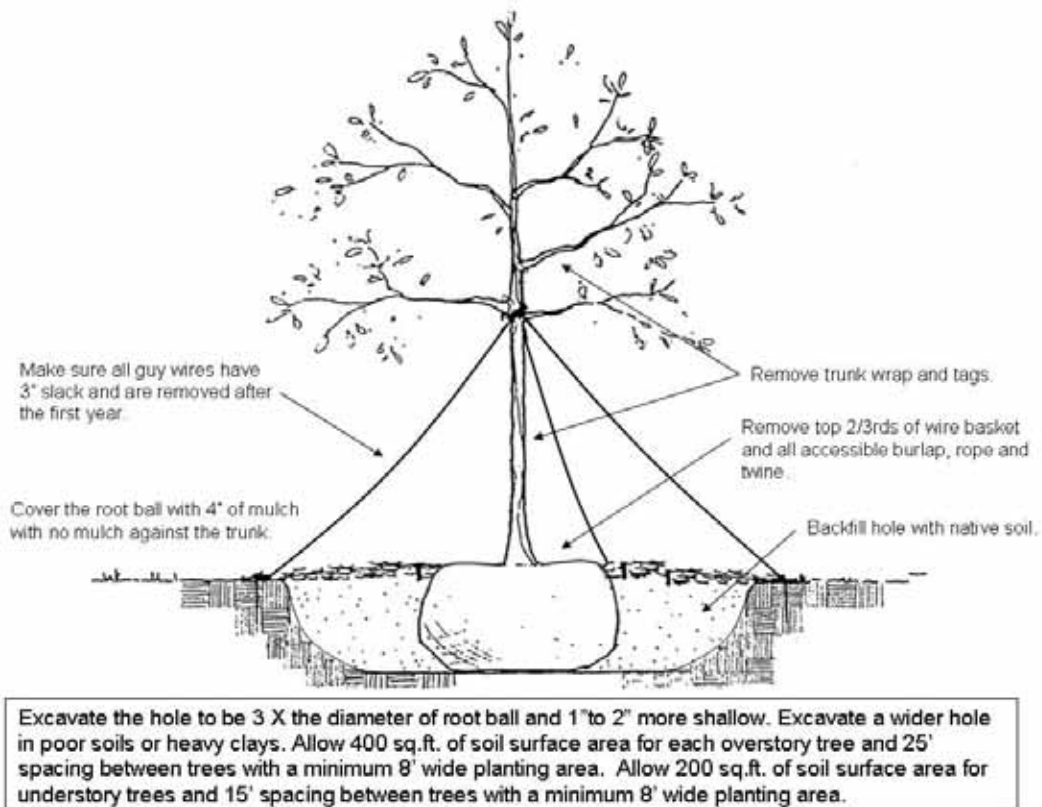


Figure 17: Tree Planting Detail



C. Undesirable Tree Species List

The following plant species are **not** recommended when complying with the provisions of these standards.

Species (Latin Name)

Acer ginnala

Acer saccharinum

Acer platanoides

Arecaceae family

Ailanthus altissima

Albizia julibrissin

Crataegus monogyna

Crataegus laevigata

Morus alba

Populus alba

Salix species

Sapium sebiferum

Sophora japonica

Common Name

Amur Maple

Silver Maple

Norway Maple

All Palms

Tree of Heaven

Mimosa

Singleseed Hawthorn

English Hawthorn

White Mulberry

White Poplar

Willow

Chinese Tallow Tree

Japanese Pagoda Tree

Section 4: Tree Removal

- (1) Positively identify ownership before authorizing tree removal.
- (2) Have a certified arborist evaluate tree health and risk for failure before removing old, large, landmark or historic trees, or trees damaged in a storm.
- (3) Hire only experienced professionals to remove trees. Reduce the number and frequency of necessary tree removals through proper tree selection, placement, protection, and maintenance.
- (4) Evaluate trees at risk for failure using standard methods, which include the assessment of the probability of failure, size of part that may fail, and the targets that may be affected should the tree fail.
- (5) Remove trees in irreversible health decline and poor condition.
- (6) Removes trees creating a hazardous situation that cannot be remedied with pruning, cabling and bracing, or removal of the target.
- (7) Consider removal of trees with characteristics in conflict with the site (oak with large acorns planted in a parking lot or thorny leaves near pedestrian areas).
- (8) Remove trees located where growing space is inadequate.
- (9) Remove trees with unattractive form, or messy, hazardous, or noxious flowers or fruit.
- (10) Replace trees wherever and whenever possible, planting large canopy trees if space permits.
- (11) Request the local power company to remove trees located near or beneath utility lines; do not attempt to remove these trees yourself.
- (12) To preserve landmark or historic trees with an increased risk of partial or whole tree failure as long as possible, consider removing the target by restricting public access or moving valuable structures.
- (13) Make certain that tree removal companies have a workman's compensation and liability insurance policy in force before they begin work.

Section 5: Recommendations for Utility Corridors

- (1) Avoid trees with aggressive root systems near underground water and sewer lines.
- (2) Plant only small maturing trees beneath overhead electrical power lines to ensure line clearance can be maintained.
- (3) Maintain adequate clearance from all overhead and underground utility lines to facilitate repairs and minimize impacts to trees.
- (4) Plant trees at least 10 feet from sewer lines, 15 feet from underground electrical power distribution lines, and 20 feet from underground electrical or gas transmission lines (*See Figure 18*).
- (5) Plant understory trees at least 20 feet from overhead electrical distribution lines (*See Figure 19*).
- (6) Plant overstory trees at least 40 feet from overhead electrical distribution lines (*See Figure 19*).
- (7) Prune trees according to professional standards, employing natural target pruning to remove undesirable limbs at the branch collar.
- (8) Employ crown-reduction pruning instead of tree “topping” to reduce tree size beneath utility lines.
- (9) Remove trees in conflict with overhead electrical power lines if clearance cannot be maintained through proper pruning.
- (10) Tunnel instead of trench beneath tree roots within the CRZ for the installation or repair of cable, phone, electric, gas, water or sewer lines, irrigation systems, or any utility.
- (11) Never use spikes to climb trees during overhead utility line installation or repair.
- (12) Maintain at least 15 foot clearance between overhead power lines and tree limbs.

Figure 18: Underground Utilities

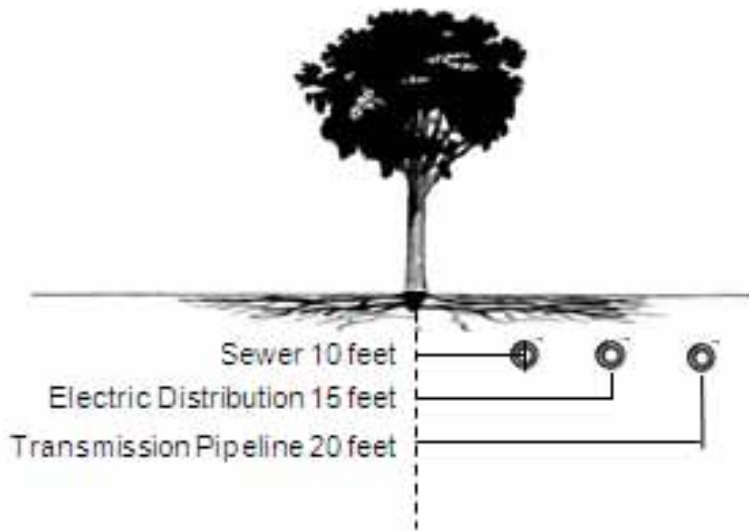
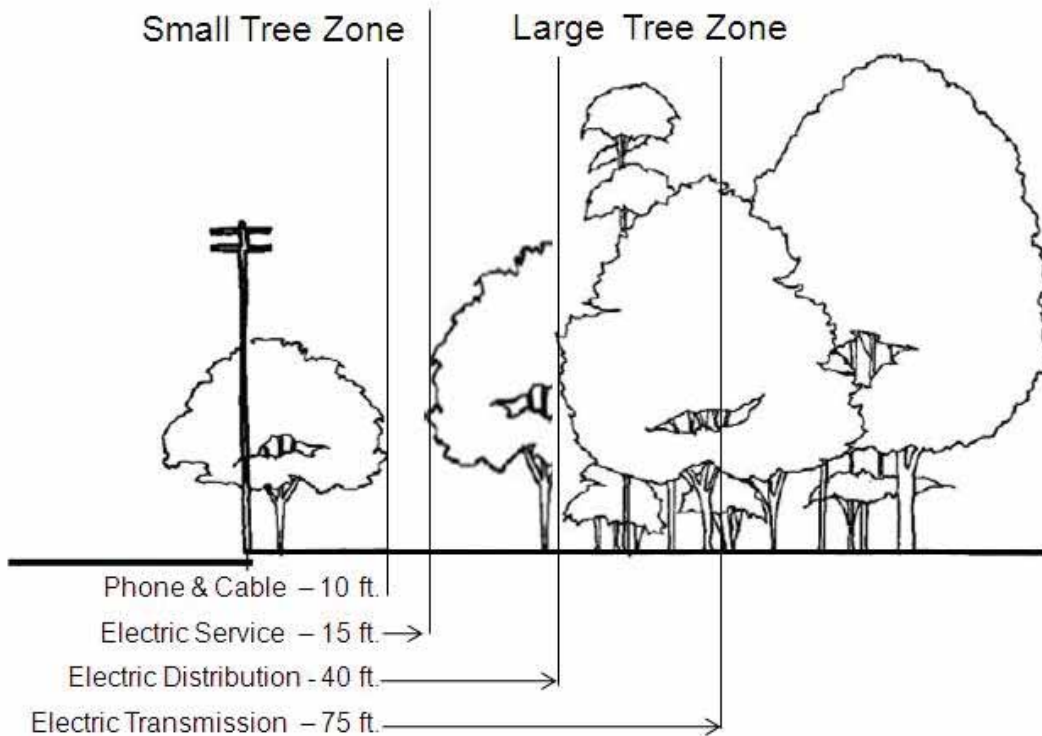


Figure 19: Overhead Utilities

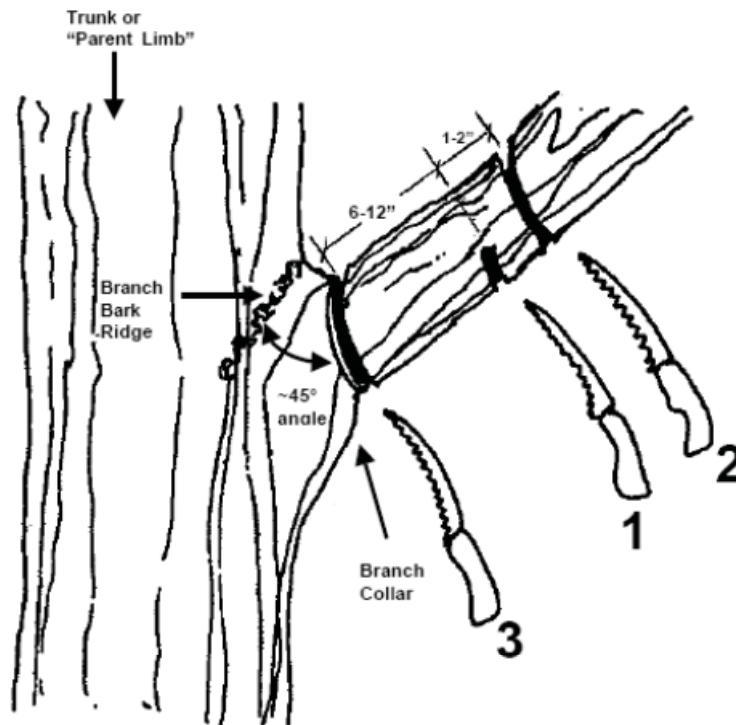


Section 6: Tree Care and Maintenance Practices

A. Tree Pruning

- (1) Only experienced professionals should prune trees and all tree pruning should conform to ANSI A-300 Standards for Tree Care Operations. Arborists certified by the International Society of Arboriculture have tested to ensure a minimum level of arboricultural competency and maintain their certification with continuing education.
- (2) The objectives for tree pruning should be established prior to commencement of pruning activity.
- (3) Tree should never be “topped.” Topping a tree permanently damages its structure, destroys its value, damages its health, and decreases the tree’s safety.
- (4) Climbing spikes should never be used when pruning trees.
- (5) Always prune branches back to parent branches or branches at least one-third the diameter of the branch being pruned.
- (6) No more than one-quarter of the foliage of a mature tree should be removed in any one growing season.
- (7) Make proper pruning cuts, using the three cut method (*See Figure 20*). Avoid stub cuts, flush cuts and wounds on the remaining limbs and trunk.
- (8) Pruning cuts should be made just on the outside of the branch collar (*See Figure 20*).
- (9) At the time of planting, prune only dead, damaged, broken crossing, or rubbing branches.
- (10) Do not remove more than one-third of the foliage from a young tree during any one growing season.
- (11) Prune trees when young to develop branch structure, strength, and form.
- (12) Prune to remove one of two leaders on trees with co-dominant (forked) stems.
- (13) Prune trees regularly throughout their life to maintain vehicular, pedestrian, and sight clearance, and to remove deadwood and broken branches.

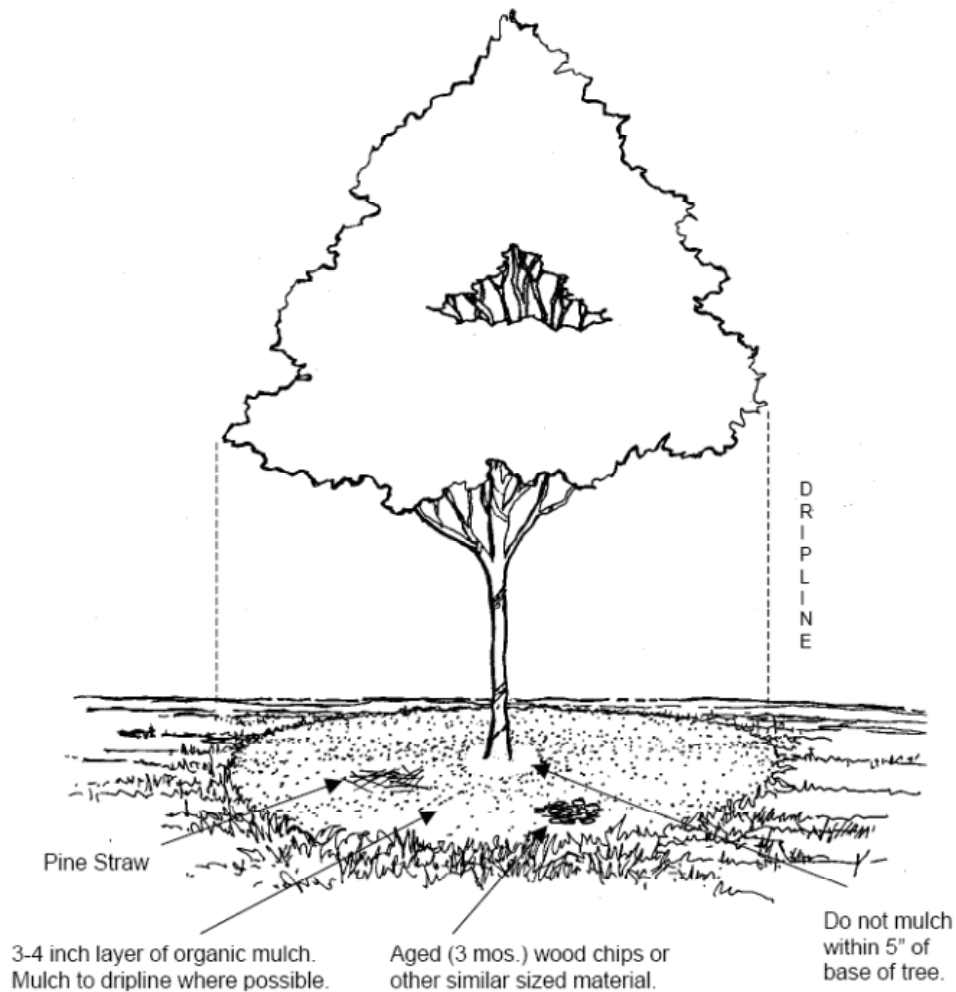
Figure 20: Tree Pruning Detail



B. Tree Mulch

- (1) Tree mulching is very beneficial to trees because it help retain soil moisture, moderates soil temperature, suppresses weed growth, reduces soil compaction, and reduces the potential for mower and string trimmer damage to trees (See Figure 21).
- (2) Use organic materials such as pine straw, leaves, aged wood chips and compost. Avoid grass clippings, plastic, and rocks.
- (3) Use the tree's own fallen leaves for mulch if not diseased.
- (4) Spread mulch in an even layer, three to four inches deep. Avoid mounding the mulch around the tree's trunk.
- (5) Keep mulch at lease five-inches from the tree's trunk.
- (6) For newly established trees, mulch and area at least six-feet in diameter.
- (7) For older established trees, mulch out as far as practical. Mulching to the drip line is most desirable.
- (8) Mulch twice per year, in the late spring and in fall during leaf-fall.

Figure 21: Tree Mulching Detail



C. Soil Environment

- (1) Maintaining healthy soils reduces tree stress and improves tree survival, growth and longevity, improves root structure, and reduces the potential for tree failure.
- (2) Adequate soil volume should be maintained throughout the lifetime of the tree. In a normal surface planting environment with average soil depths greater than or equal to three feet, soil volume calculations can be based on surface areas as follows:

Understory tree = 200 square feet of soil surface area.

Overstory tree = 400 square feet of soil surface area.

- (3) Soil organic matter content should be maintained at about five percent.

- (4) Mulching trees will increase soil nutrient levels, organic matter content, improve soil structure and reduce the likelihood of string trimmer damage.
- (5) Root barriers should be used to redirect root growth away from sidewalks, curbs and driveways.
- (6) Avoid soil compaction within the critical root zones of trees. Soil compaction results in an increase in soil bulk density, reduces soil pore space, decreases soil oxygen, and limits the availability of water.
- (7) Parking, driving, and the temporary storage of construction material within critical root zones will result in soil compaction.

D. Fertilization

- (1) Trees that are in an urban growing environment with limited natural nutrient cycling should be fertilized on a regular basis, every three to five years.
- (2) If trees are exhibiting symptoms of nutrient deficiency, soils should be tested prior to fertilization, and the fertilizer formulation should be adjusted to address the specific deficiency.
- (3) Newly planted, drought stressed or severely damaged or injured trees should not be fertilized.
- (4) Fertilizer should be applied when roots are actively growing. The best times are late winter, and early spring through early summer.
- (5) Nitrogen, phosphorus, and potassium (NPK) in a ration of 3:1:1 is most desirable.
- (6) Use slow release organic fertilizers with a salt index of less than 50.
- (7) Slow release nitrogen should be applied at a rate of two to four pounds (of elemental nitrogen) per 1000 square feet of rooting area (*See Table 3*).
- (8) Fertilizer should be applied within the entire root zone of trees. Broadcast application is best where soils are not compacted.
- (9) The use of trunk fertilizer injections or implants is not recommended.
- (10) Consider sub-surface applications of fertilizer where turf or groundcover exists, or where runoff is likely.

Table 3: Amount of Fertilizer of Various Formulations to Apply Per 1000 Square Feet to Achieve Specific Rates of Nitrogen Fertilization

N-P-K Fertilizer Formulation	Pounds of Fertilizer to Apply Per 1000 Sq Ft to Achieve a Rate of		
	2.0 lbs of N	3.0 lbs of N	4.0 lbs of N
5-X-X	40.0	60.0	80.0
10-X-X	20.0	30.0	40.0
15-X-X	13.3	20.0	26.7
20-X-X	10.0	15.0	20.0
30-X-X	6.7	10.0	13.3

E. Irrigation

- (1) Adequate soil moisture levels result in better tree growth, reduced stress, and reduced susceptibility to insect or disease problems.
- (2) Excessive soil moisture can result in anaerobic conditions, nutrient deficiencies, and tree decline.
- (3) Tree species should be matched to anticipated soil conditions.
- (4) Mulching trees helps conserve water.
- (5) Water trees before they show signs of water stress.
- (6) Due to varying water restrictions, check with the local water department for appropriate watering schedules prior to manually watering or using an automatic irrigation system.
- (7) Plant trees at or slightly above ground level to avoid creating a place where excessive water accumulates.
- (8) In the absence of adequate rainfall trees should be irrigated at the rate of five to seven gallons every seven days for every inch of trunk caliper or equal to one inch of rainfall every seven to ten days. Refer to *(Table 4)* for approximate duration of water applications.
- (9) Water should be applied evenly throughout the outer 75 percent of a tree’s critical root zone. Runoff should be avoided.
- (10) Water less often with greater amounts of water, rather than more often with smaller amounts of water.
- (11) Water during winter droughts, especially evergreen trees, but only if the soil surface temperature is greater than 40 degrees.

Table 4: Approximate Watering Time to Apply One Inch of Water Across Various Sized of Critical Root Zones

Radius of CRZ (ft)	Volume of Water (gals) to Equal 1"	Total Application Time (minutes and hours) at a Delivery Rate of 5 Gallons Per				
		5 Sec	15 Sec	30 Sec	45 Sec	60 Sec
5	37	1 min	2 min	4 min	6 min	7 min
10	147	3 min	7 min	15 min	22 min	30 min
15	330	6 min	17 min	33 min	50 min	1 hr
20	587	10 min	29 min	1 hr	1 hr 30 min	2 hrs
25	917	15 min	46 min	1 hr 30 min	2 hr 30 min	3 hrs
30	1,322	22 min	1 hr	2 hrs	3 hr 30 min	4 hrs 30 min
35	1,799	30 min	1 hr 30 min	3 hrs	4 hr 30 min	6 hrs
40	2,349	39 min	2 hrs	4 hrs	6 hrs	8 hrs
45	2,973	50 min	1 hr 30 min	5 hrs	7 hrs 30 min	10 hrs
50	3,670	1 hr	3 hrs	6 hrs	9 hrs	12 hrs

F. Pest Management

- (1) Plant trees where their needs will match the site conditions to prevent stress and predisposition of trees to pest attacks.
- (2) Mulch to relieve soil moisture stress and to suppress weeds; pull weeds by hand where necessary around the bases of trees.
- (3) Protect tree roots, trunks, and limbs from wounds. Wounds are entry points for insects and diseases.
- (4) Learn the habits and life cycle of the pests affecting your trees, and know when to apply pesticides for the greatest effect.
- (5) Hire only experienced and knowledgeable professionals to apply pesticides; the state of Georgia has a licensing program for pesticide applicators.
- (6) Do not apply any soil activated herbicides or weed-and-feed lawn formulations over the root systems of trees.
- (7) Contact the Cooperative Extension Service or Georgia Forestry Commission for instructions on collecting insect and disease organisms or signs for analysis and identification.

Section 7: Suggested Tree Selection List

Suggested Tree Species Selection List										
Species Common Name	Canopy Size	Large Landscape Areas	Road Frontage Street	Road Frontage Yard	Parking Lot Trees islands >200 sq ft	Parking Lot Trees islands 100 to 200 sq ft	Buffers	Riparian/ Drainage Areas	Utility Corridors	Urban Tolerant
Baldcypress	Medium	X			X			X		X
Basswood, American (Linden)	Large	X						X		X
Beech, American	Large	X						X		
Catalpa, Southern	Medium	X						X		
Cedar, Deodar	Medium	X		X			X			
Cedar, Lebanon	Medium	X		X						
Cherry, Japanese Flowering	Small			X			X	X	X	
Cherry, Yoshino	Small			X			X		X	
Cherry, Kwanzan	Small			X			X		X	
Cherry laurel, Carolina	Medium			X		X	X	X		
Chinquapin, Allegheny	Medium	X								
Cleyera	Small						X			
Crabapple, Japanese Flowering	Small		X	X			X		X	
Cryptomeria	Small	X					X			
Cypress, Arizona (Carolina Sapphire)	Medium	X		X			X			X
Cypress, Leyland	Small	X								
Dogwood, Flowering	Small	X		X			X		X	
Elm, American (Princeton)	Large	X		X						
Elm, Chinese (Athena, Bosque, etc)	Medium	X	X	X	X	X				
Ginkgo (male)	Large	X	X	X	X					
Golden Rain Tree	Small		X	X	X	X				
Hawthorn, Washington	Small		X	X		X			X	
Hickory (spp.)	Large	X								
Holly, American	Very Small			X	X		X			
Holly, Chinese	Very Small			X			X			
Holly, English	Very Small			X			X			
Holly, Longstalk	Very Small			X			X			
Holly, Lusterleaf	Very Small			X			X			
Holly, Savannah	Very Small			X						
Holly, Penny	Very Small			X			X			
Holly, Yaupon	Very Small			X			X			
Hornbeam, American	Medium	X		X	X	X		X		
Hornbeam, European	Medium		X	X	X	X	X			
Juniper, Hetzi	Small						X			
Juniper, Pfitzer	Small						X			
Katsura Tree	Medium	X		X	X	X				
Locust, Black (seedless)	Medium	X						X		X

Suggested Tree Species Selection List (cont.)

Species Common Name	Canopy Size	Large Landscape Areas	Road Frontage Street	Road Frontage Yard	Parking Lot Trees islands >200 sq.ft.	Parking Lot Trees islands 100 to 200 sq. ft.	Buffers	Riparian/ Drainage Areas	Utility Corridors	Urban Tolerant
London Planetree	Medium	X	X	X						X
Magnolia, Southern	Large	X					X	X		
Magnolia, Southern "Little Gem"	Medium								X	
Magnolia, Sweetbay	Medium	X		X			X	X		X
Maple, Red	Medium	X	X	X	X		X	X		
Maple, Southern Sugar	Medium	X	X	X	X	X	X	X		
Maple, Sugar	Large	X	X	X				X		
Maple, Amur	Medium	X	X	X			X			
Maple, Autumn Blaze	Large	X		X			X	X		X
Maple, Hedge	Small	X					X			
Maple, Trident	Small	X	X	X	X	X	X		X	X
Myrtle, Wax	Very Small						X			
Oak, Black	Large	X	X	X	X					
Oak, Chestnut	Large	X	X	X	X					
Oak, Darlington	Large	X	X	X	X					
Oak, Japanese Evergreen	Large	X	X	X	X					
Oak, Laurel	Large	X	X	X	X					
Oak, Northern Red	Large	X	X	X	X					
Oak, Nuttall	Large	X	X	X	X	X				
Oak, Overcup	Large	X	X	X	X	X				
Oak, Post	Large	X	X	X	X					
Oak, Sawtooth	Large	X	X	X	X					
Oak, Scarlet	Large	X	X	X	X					
Oak, Shumard	Large	X	X	X	X					
Oak, Southern Red	Large	X	X	X						
Oak, White	Large	X	X	X	X					
Oak, Willow	Large	X	X	X	X					
Pagodatree, Japanese	Large	X		X						
Pecan	Large	X	X	X						
Pine, Virginia	Medium						X			
Pistache, Chinese	Medium		X	X	X	X				X
Planetree, London	Large	X	X	X	X					
Popular, Tulip	Large	X						X		
Redbud, Eastern	Small	X	X	X	X		X		X	
Redcedar, Eastern	Medium	X		X			X			
Redwood, Dawn	Medium	X		X			X			
Serviceberry, Downey	Small	X	X	X			X	X	X	X
Smoketree	Very Small			X					X	
Sourwood	Medium	X		X						
Sycamore, American	Large	X			X					
Yellowwood, American	Medium	X		X						
Zelkova, Japanese	Large	X			X	X				

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