

Urban & Community Forestry

Best Management Practices Specifications



The following are urban forestry best management practices specifications provided as guidance in securing and completing urban forestry practices and serving as the standards for financial assistance program projects.

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Tree Inventories

- **Qualifications of service provider**
 - Company/firm
 - The company must demonstrate in a brief narrative and at least five (5) years of experience in completing municipal GPS tree inventories and providing and servicing tree inventory management software. Please supply three references.
 - Inventory staff
 - Staff performing the field inventory work must have the following minimum qualifications. Provide a list of their names and qualifications.
 - International Society of Arboriculture Urban Forestry Professional, Certified Arborist or Society of American Foresters Certified Urban & Community Forestry credential and three (3) years of experience completing municipal tree inventories.
 - International Society of Arboriculture Tree Risk Assessment Qualified
- **Inventory type**
 - Sample inventory
 - The objective is to complete a three to six percent (3-6%) random sample inventory of trees located along community streets, on mowed park lands and other public properties defined in the folloing.
 - Inventory methodology
 - International Society of Arboriculture's Tree Inventories Best Management Practices
 - iTree Streets V5 Sample Street Tree Inventory standards or equivalent statistical methodology producing a standard error of less than 10%.



- iTree Eco Sample Inventory for public property/natural areas or equivalent statistical methodology producing a standard error of less than 10%.
- Sample size
 - Population > 50,000 – 6% sample
 - Population between 50,000-150,000 – 5% sample
 - Population between 150,000-250,000 – 4% sample
 - Population > 250,000-150,000 – 3% sample
- Street trees
 - Sample 3-6% of street miles
 - Stratification
 - Minimum – 4 quadrants
 - Zoning districts or other
 - Sample units are street block segments
 - Inventory all trees and planting sites on the sample block segment
- Park and public property trees
 - 3-6% of the property area
 - Sample units are plots
- Level of inspection -- Each tree as defined by the International Society of Arboriculture (ISA) Tree Risk Assessment BMP with work prioritization.
 - ISA Tree Risk Assessment Level 2 -- A walk around visual inspection and assessment of the health and structure of the tree from the ground and surrounding site culminating into a management recommendation. The assessment will include the digital collection of the inventory data and the use of hand tools such as a sounding mallet, probing tool and binoculars to further evaluate the defects present in root crown, trunk and crown of the tree. A complete ISA tree risk assessment and rating will not be completed.
- Complete inventory
 - Walk each street, park/cemetery or property (as provided by the municipality). Inspect and assess the trees, and digitally collect management information for each tree. The following are the specifications for completion of both inventory tasks; the complete street inventory and the park/cemetery inventory.
 - Level of inspection -- Each tree as defined by the International Society of Arboriculture (ISA) Tree Risk Assessment BMP with work prioritization.
 - ISA Tree Risk Assessment Level 2 -- A walk around visual inspection and assessment of the health and structure of the tree from the ground and surrounding site culminating into a management recommendation. The assessment will include the



digital collection of the inventory data and the use of hand tools such as a sounding mallet, probing tool and binoculars to further evaluate the defects present in root crown, trunk and crown of the tree. A complete ISA tree risk assessment and rating will not be completed.

- Partial
 - Drive or walk each street, and walk each property (community name). Identify trees as specified. Catalog tree management and location information for these trees, and make management recommendations as specified.
 - Level of inspection -- level of inspections as defined by the International Society of Arboriculture's (ISA) Tree Risk Assessment BMP plus work prioritization.
 - A Level 1 visual inspection of trees on the (community name) property to identify trees with visually obvious tree defects. Trees with defects that warrant management action will receive Level 2 assessment. This assessment will include the digital collection of the inventory data and the use of hand tools such as a sounding mallet, probing tool and binoculars to further evaluate the defects present in root crown, trunk and crown of the tree. A complete ISA tree risk assessment and rating will not be completed.
- **Tree inventory data specifications**
 - Management recommendations & definitions – recommendations will be assigned one of the following work needs and priority.
 - Management Recommendations/Work Need
 - Tree removals
 - Trees with readily obvious, major health and structural defects present identified per the Level of Inspection methods will be considered for removal. If one-third of a tree's live crown must be removed to remove defect tree parts or reduce the risk of whole tree failure, the tree will be recommended for removal.
 - Pruning needs
 - Prune train young -- a young tree that can be pruned from the ground needs structural pruning to promote desirable growth habits in trees.
 - Prune mature small tree – a small-sized tree that has reached maturity, slowed growth and can be pruned from the ground.
 - Prune mature large tree – a large tree that has reached maturity.

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- Prune reduce – A large tree with structural defects present that require reduction pruning to reduce the risk of trunk or scaffold branch failure.
- Prune safety – a tree with any of the following defects present.
 - Defective limbs 4 inches in diameter or larger
 - Clearance conflicts
 - Limbs over street being struck by vehicles
 - Limbs hanging into sight line of pedestrians over sidewalks
 - Limbs resting on streetlights, buildings or blocking traffic control signs or devices.
- Management priority -- each tree that has had a removal or safety pruning recommendations will be assigned a management priority based on the targets present, occupancy rates and consequences of failure.
 - Highest
 - Medium
 - Lowest
- Work priorities -- Trees recommended for removal or prune safety will be assigned a work priority to facilitate work planning and the efficient allocation of resources. The actual definition will be provided to the contractor by the client. The priority assignment will be a numeric scale of highest to lowest priority. This is not a complete ISA tree risk assessment.
- Stumps -- Tree stump requiring removal
- Planting sites
 - NCFS U&CF Basic Planting Site Standards Guidance of approved equivalent.
- Tree inventory data fields
 - Each tree/planting site will have the following data collected.
 - Street, address or property name
 - Management unit
 - Open space property. A reference tree may be tagged with a numbered tag attached to select trees to assist with tree inventory location identification.
 - Tree genus, species and common name -- each tree will be identified to genus and species, and a common name will be provided.
 - DBH (diameter breast height) -- Diameter in inches at 4½ feet above grade measured with a diameter tape or Biltmore stick.



- Health – Tree biological health or tree growth indicators such as the condition of foliage and twigs expressed as:
 - Good -- normal or vigorous for the species including shoot growth, wound wood development, foliar color and density, and absence of dieback or damaging pests
 - Fair -- deficiency in several categories; below normal shoot growth, wound wood development, foliar color and density, or presence of dieback or a damaging pest or disease
 - Poor -- below normal or deficiency in most; shoot growth, wound wood development, foliar color and density, or presence of dieback or damaging pests
 - Very Poor -- major deficiencies in all categories; such as shoot growth, wound wood development, foliar color and density, or presence of major dieback or damaging pests
 - Dead -- no living tissues
- Structure – Tree structure or the condition of mechanical or structural portions of the tree, expressed as:
 - Good -- absence of any significant structural defects although minor defects that are unlikely to fail under normal weather conditions may be present
 - Fair -- minor structural defect(s) is present that may fail under storm conditions, or several minor mechanical defects can be found
 - Poor -- one or more significant structural defect is present that may fail under normal weather conditions
 - Very Poor -- several significant structural defects are present that may fail under normal weather conditions
 - Most significant defect present and severity; roots, root crown, trunk, trunk/scaffold union, scaffolds, branches
- Management or work need -- as described above
- Priority -- as described above
- Overhead utilities -- presence of primary or secondary electrical distribution wires or telephone or street lighting
- Site type – type of location the tree is growing in such as lawn area, natural area, border tree, tree lawn or tree pit
- Planting area – most limiting dimension of planting area in feet
- Other – for trees requires further inspection, for example;
 - Risk -- for trees that need a full risk assessment
 - Check ROW -- determine if the tree is in the right of way / on public property
 - Limited access

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- GPS coordinates – GPS coordinates will be collected by point plotting on georeferenced aerial photography or using sub-meter high accuracy GPS units or low accuracy three-meter accuracy units.
- Quality control
 - All data will be reviewed digitally for errors, and errors will be corrected as itemized below or an approved equivalent. The contractor will provide a brief report verifying the findings and corrections to the (municipality) at the completion of each step.
 - Field quality review of 2% of all data points collected in the first week of data collection with particular emphasis on trees identified for removal.
 - Field quality review of 1% of all data points collected each week after the first week of data collection with particular emphasis on trees identified for removal.
 - Cross data collector review (other reviewer than the original data collector) for all data collection personal.
 - Office review of 100% of data for data mismatch errors, for example, appropriate tree health or structural condition rating for "removal" maintenance classification; appropriate street for side street versus on street classification, appropriate diameter size for "train" maintenance classification, and all other similar data reviews that can be completed in the office.
 - Field resolution of data errors identified.
 - 100% correct species identification; no unknowns in data set.
 - Visually review and correct mapped tree data for correct locations.
- **Inventory report**
 - The consultant shall provide an inventory report summarizing the methodologies, urban forest management statistics outlined as follows.
 - Inventory methodologies
 - Management statistics
 - Species distribution
 - Diameter distribution
 - Health distribution
 - Work need
 - Tree species exceeding 10% of the total population
 - Diameter distribution
 - Health distribution
 - Work need

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- Ecosystem services of trees
 - **Tree inventory data** – a shapefile of the inventory data will be provided to the NCFS

Tree Canopy Cover Assessment

- **Qualifications of service providers**
 - The company must demonstrate in a brief narrative and at least five (5) years of experience in completing municipal tree canopy cover assessments and provide three references.
- **Objectives**
 - Provide land cover analysis to provide management information of the municipality and geographic areas within the municipality for urban forestry and land use planning.
 - Quantify ecosystem services provided.
- **Methodologies & outputs**
 - Geospatial/GIS high resolution imagery analysis
 - Analysis as listed below or approved equivalent
 - Latest available high resolution NAIP aerial imagery
 - Quality control and quality assurance process
 - Statistical confidence 94% or greater
 - Land cover outputs %
 - Tree canopy cover
 - Impervious space
 - Other vegetation, shrub cover
 - Soil/bare earth
 - Surface water
 - Possible tree planting area
 - Quantify ecosystem services provided at municipal scale
 - Geographies to be analyzed
 - Municipality or subject area limits
 - Land use
 - Residential
 - Commercial
 - Industrial
 - Public property
 - Street rights of way
 - Park land
 - Other public property
 - Census block groups
 - Watersheds
 - Zoning districts
 - Extraterrestrial jurisdiction (if applicable)



- **Reporting**
 - Report -- A simple, infographic style tree canopy cover assessment report with limited narrative and graphics that summarizes the purpose, methods and findings for a non-U&CF professional and public audience. The expectation is a report template design will be developed for use on all analyses completed, no customization.
 - Purpose
 - Methods
 - Findings
 - Land cover analysis results
 - Planting opportunities
 - Ecosystems services provided
 - Maps
 - Municipality illustrating land cover categories
 - Each geography
 - Copy of shape files

Tree Planting

- **Planting sites and tree species selection**
 - Shall meet the guidance provided by our [Urban Forestation and Tree Planting webpage](#) and associated guidance documents and resources
 - Listed on the NCFS Urban Tree List or a preapproved alternate
- **Trees**
 - Trees shall be true to the botanical name. Trees shall be grown in nurseries in USDA Plant Hardiness Zones equal to or colder than tree planting location. Trees shall meet the most current standards of the “American Standard for Nursery Stock”; ANSI Z60 Standard, American Association of Nurserymen 1250 I St. NW, Suite 500, Washington, D.C. 20005.
 - Type 1 & 2 shade trees shall have a strong center lead for a minimum of three-fourths of the overall tree height and a branching height of 6 feet for shade trees.
 - Type 3 & 4 ornamental street trees with 2.5-to-3-inch caliper shall have a branching height of 4½ feet. Trees with 3-to-3.5-inch caliper shall have a branching height of 5 feet.
 - Preplanting care
 - Trees shall be placed standing upright with crowns untied for storage and inspection. Adequate watering and mulching shall be provided during storage. Trees shall be covered with a horticultural transport tarp during transport.
 - Preplanting quality assurance inspection
 - Inspection of all trees before planting is required. Trees will be inspected for adherence to ANSI Z60 standards, general health, strong center lead, branch height, apparent shipping damage, root ball diameter or bare root

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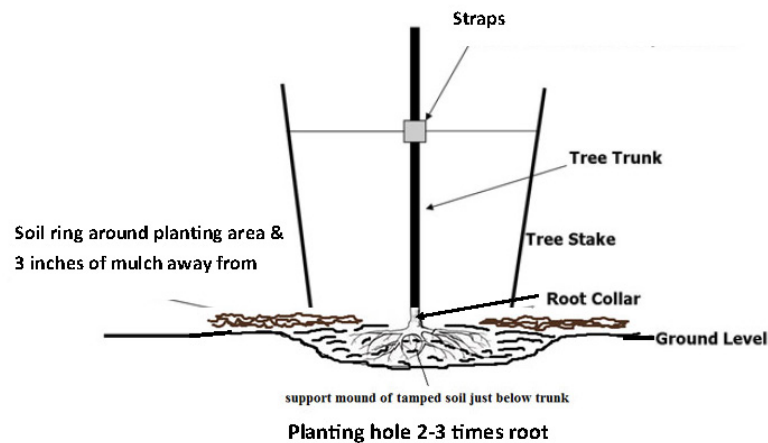


spread, moisture content, wind burn and caliper. Trees not meeting these standards will be rejected.

- **Planting**
 - Qualifications of service providers
 - Contractor
 - The company must meet all the legal and insurance requirements to work in North Carolina and complete tree planting work plus the following requirements
 - Five years of experience completing tree planting work, and
 - A tree care industry association accredited company, or
 - Ownership and supervisors are International Society of Arboriculture (ISA) certified arborists, board certified master arborists, and
 - A North Carolina licensed landscape contractor, and
 - Tree-planting staff
 - ISA certified arborists or National Association of Landscape Professionals certified landscape technician
 - Specifications
 - A list of planting locations will be provided to the contractor by address. The (project management authority) will mark specific planting locations at an address with a white line on the curb or pavement and sidewalk, or by marker flag. The tree is to be centered in the tree lawn area on an imaginary line between the two marks.
 - Bare root planting
 - The planting hole shall be at least 6 feet in diameter. All rock, soil, fill or underground obstruction shall be removed to a depth and width, as necessary, to permit planting. All debris shall be removed. The area under the root or system ball shall be hand tamped to avoid settling.
 - Plastic bags shall be removed from the root system. Trees shall be set plumb, and the root crown shall be 1-to-3 inches above the existing tree lawn grade. Tree roots shall be evenly aligned in a radiating pattern in the planting hole without breaking the roots of the plant.
 - Native soil may be used as backfill. All large earth clumps shall be broken to a diameter no greater than 1 inch before use as backfill. All rock greater than 1 inch in diameter shall be removed from the native soil before use as backfill. All foreign material shall be removed from the native soil before use as backfill. Backfill material shall be evenly dispersed throughout the planting hole and thoroughly settled by watering with fresh water.

- A saucer dike capable of holding water shall be formed around the edge of the planting hole.
- Mulch shall be placed to a depth of 3 inches. Mulch shall be placed to within 6 inches of the tree trunk. Mulch shall cover the saucer dike.

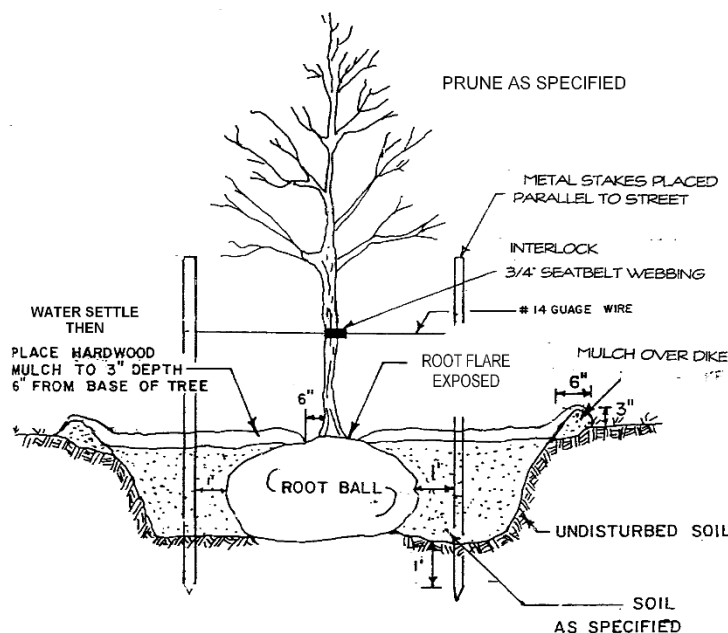
Bareroot Tree Planting



- B&B & container
 - The planting hole shall be at least two times the diameter of the root ball.
 - All rock, soil, fill or underground obstruction shall be removed to a depth and width, as necessary, to permit planting. All debris shall be removed. The area under the root ball shall be hand tamped to avoid settling.
 - The root crown shall be exposed and excess soil removed on the top of the root ball to an imaginary line parallel with the root crown before setting the plant.
 - Containers shall be removed from the root ball and root-scored with a knife. Wire baskets and burlap shall be removed for the top three-fourths of the root ball. String around the trunk shall be removed and burlap pulled back from around the top 8 inches of the root ball and buried.
 - Trees shall be set plumb, and the root crown shall be 1-to-3 inches above the existing lawn grade.
 - Native soil may be used as backfill. All large earth clumps shall be broken to a diameter no greater than 1 inch before use as backfill.

All rock greater than 1 inch in diameter shall be removed from the native soil before use as backfill. All foreign material shall be removed from the native soil before use as backfill. Backfill material shall be evenly dispersed throughout the planting hole and thoroughly settled by watering with fresh water.

- A saucer dike capable of holding water shall be formed around the edge of the planting hole.
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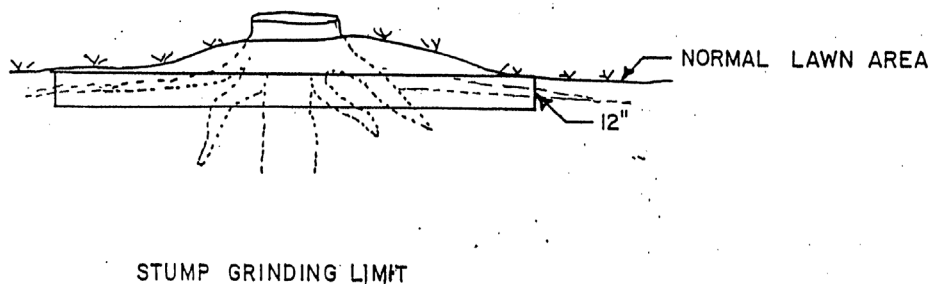


LOOSEN AND BLEND THE SOIL IN THE ENTIRE PLANTING AREA AS DIAGRAMED. THE PLANTING PIT SHALL BE 2 TIMES THE BALL DIA.

- Staking (if required)
 - Wiring shall not be set to allow several inches of sway of the trunk.
 - Stakes shall be set as detailed in the diagram above.
- Pruning
 - Codominant stems (if applicable)
 - The less dominant shall be removed or headed.
 - Broken or dead branches shall be pruned.
- Post-planting care warranty period
 - A contractor shall provide supplemental care including watering after planting until final acceptance by the project management authority.
 - The tree planting shall be warrantied for two years after final acceptance.

Tree Maintenance

- **Qualifications of service providers**
 - The company must meet all the legal and insurance requirements to work in North Carolina and complete tree work plus the following requirements.
 - Five years of experience completing tree work, and
 - A tree care industry association accredited company, or
 - Ownership and supervisors are International Society of Arboriculture (ISA) certified arborists, board certified master arborists, and
 - Tree workers performing the tree work are ISA certified arborists, tree climbers or aerial lift specialists or TCIA certified workers
- **Standards**
 - All work shall be completed by qualified personnel in accordance with all federal, state and local regulations, the most current edition of the American National Standards Institute's ANSI Z133.1; Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush – Safety Requirements and the following specifications.
- **Tree removal**
 - Trees or limbs being removed that are large enough to cause hardscape or structural damage on impact shall be lowered using roping and rigging techniques. The tree stump shall be flush cut as close as possible with the existing tree lawn grade.
- **Stump removal**
 - Stumps shall be ground to a minimum depth of 12 inches below normal grade level (See Figure 1) or to a 6-inch depth within 2 feet of an identified underground utility. All adjoining surface roots shall be ground to a depth of 12 inches or chopped out with an axe. All grindings shall be placed back in the stump hole if the site restoration is not completed at the same time as the grinding. Adjacent to a sidewalk, roots shall be removed to the edge of the sidewalk without damaging the sidewalk.



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- **Tree Pruning**
 - **Standard**
 - Tree pruning shall be completed by qualified tree workers and, at a minimum, supervised by ISA certified arborists or a ISA board master certified arborist and qualified in accordance with current federal, state and local laws. The work shall be completed in accordance with the most current editions of the American National Standards Institute's ANSI A300 "Tree, Shrub and Other Woody Plant Maintenance – Standard Practices"; American National Standards Institute's ANSI Z133.1; Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush – Safety Requirements, the International Society of Arboriculture's Pruning Best Management Practices, and the following specifications.
 - **General**
 - No more than 25% or one-fourth (1/4) of the live crown shall be removed unless limbs present a hazard.
 - All cuts shall be made with sharp pruning tools as close as possible to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub.
 - All branches too large to support by one hand shall be precut to avoid splitting or ripping of the bark. When necessary, ropes or other equipment shall be used to lower large branches or stubs to the ground.
 - The use of climbing spurs or hooks is prohibited.
 - Reduction cut pruning should be avoided. Removing the entire limb is preferable. Where reduction cut pruning may be considered, the whole limb or leader shall be removed to the parent leader or limb unless the ratio of the live wood to leaf area of the limb or leader is sufficient to support that limb or leader. If more than one-fourth leaf surface area of the limb or leader needs to be removed, remove the whole limb.
 - When removing a parent leader or limb to a lateral (reduction cut), the lateral shall be at least one-third (1/3) the diameter of the parent leader or limb being removed.
 - Priorities for pruning. The following priorities shall be followed to assist in the decision-making process for limb removal:
 - Risk mitigation
 - Clearance
 - Restoration
 - Structural
 - Clearance. Clearance is specified in two diameter ranges. These are guidelines. Crown raising shall be completed to provide adequate clearance based on the site conditions and location of the tree. Limb removal decisions should be based on the goal of reaching clearance standards through whole limb removal and the health of the tree.



Generally, lateral branches should not be removed below one-third the total height of the tree.

- Safety prune
 - Objective
 - The purpose of this pruning is to remove hazardous branches, prune storm damage, provide adequate clearance from permanent structures and elevate for under canopy clearance.
 - Risk mitigation -- Hazardous limbs to be removed
 - Broken limbs lodged in the tree.
 - Broken hanging limbs in the tree.
 - Dead or split branches 1 inch or greater in diameter.
 - Decaying branches with less than 33% sound wood 1 inch or greater in diameter.
 - Restoration – storm damaged branches to be removed
 - Broken lateral branches and leaders living or dead 1 inch or greater in diameter.
 - Waterspouts – where removing an entire lateral or leader with sprouts may not be desirable, leave one to three sprouts. More vigorous sprouts should be thinned or headed to control length growth or ensure adequate attachment for the size of the sprout.
 - Clearance – clearances over the right of way and from buildings, traffic control devices, signs and streetlights
 - Trees 6-12 inches in diameter at breast height;
 - Limbs shall be removed to provide 5 feet clearance over and from the side of permanent structures.
 - Limbs shall be removed from the lower one-third of the tree to provide under canopy clearance.
 - Trees 13 inches or greater in diameter at breast height;
 - Limbs shall be removed to provide 10 feet clearance over and from the side of permanent structures.
 - Limbs shall be removed to provide an overhead clearance of 15 feet over the street.
 - Limbs shall be removed to provide an overhead clearance of 10 feet over the sidewalk and under the canopy.
- Crown reduction prune
 - Objective
 - Reduce the structural stresses on limbs or leaders with decay present or codominant stems with included bark by reducing the length or height of limbs or leaders.
 - Where specified or if defects are revealed while pruning the tree, reduce the height or length of limbs or leaders by one-third using



- proper reduction pruning techniques as specified above in section 1.0, e & f.
 - Perform a safety prune as specified.
- Structural prune
 - Objective
 - Promote a single central leader, strong scaffold branch structure and suitable permanent branch selection for clearance requirements at maturity on young and semi-mature trees.
 - Remove broken, dead, diseased or dying branches
 - Trunk development – one central leader
 - Tree species that do not form a single central leader, skip this step.
 - Branches forming multiple leaders in a single leader type tree shall be removed. Leave the most dominant leader or select one. If you cannot remove a competing leader, subordinate with a reduction or heading cut to reduce the height of the less dominant leader.
 - Clearance
 - At least one-half the foliage should originate on branches in the lower two-thirds of the tree. Remove branches that are below the height of the tree that will maintain this proportion.
 - Permanent branches – branches attached to the trunk that will remain on the tree throughout its lifetime
 - The lowest branches should be selected on each side of the tree to meet clearance standards.
 - Permanent scaffold branches should be spaced 6-12 inches apart by thinning for the first five years then 18 inches apart thereafter. Branches directly above should be spaced 15-36 inches for small-to-medium-sized trees and 60 inches for large trees.
 - A permanent branch should be less than one-half the diameter of the parent limb.
 - Remove branches to meet this desired spacing or if this will require removing too much leaf area, prune them as temporary branches.
 - Temporary branches – branches that will be left at this pruning but will eventually be pruned in later pruning
 - Head or reduce these branches to suppress their growth and allow the permanent branches to develop.

More guidance and contract specifications can be found on the [NCFS U&CF webpages](#).