



COLUMBUS TREE TECHNICAL MANUAL

Draft for Public Comment



THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

RECREATION AND PARKS
DEPARTMENT

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Tree Technical Manual

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Definitions

The following definitions are provided as a resource for the reader. Words with an asterisk are defined in City Code. Words with double asterisks are defined in the Construction and Materials Specifications.

American National Standards Institute (ANSI). A private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system.

Approval. Permission from the Recreation and Parks Department Forestry Section for a project owner to impact a public tree(s), granted via the signature of the department's plan reviewer OR via a Forestry permit.

Bracing. Structural support for a tree via installing a long, threaded rod through branches or stems where they are weak and likely to split.

Cabling. Structural support for a tree via installing a cable in the upper crown of a tree.

Caliper*. The inches of trunk diameter that is commonly used in the nursery industry to measure tree planting stock. It is measured at six inches (15 cm) above ground level for trees up to four-inch caliper and 12 inches above ground level for larger sizes.

Certified Arborist*. An individual trained in the art and science of planting, caring for, and maintaining trees that has been certified by the International Society of Arboriculture (ISA).

Condition. Tree condition is a term that describes a tree's overall health, structure, and form. It is used as part of tree assessment and appraisal and defined in the Guide for Plant Appraisal, 10th edition. The ratings (Good, Fair, Poor, Critical, Dead) are the standard used in arboriculture across the country, based on professional assessment by ISA Certified Arborists or other natural resource professionals.

Contractor.** The individual, firm, partnership, or corporation contracting with the City for performance of prescribed work, acting directly or through a duly authorized representative and qualified under the requirements of the contract documents.

Cost approach method. A method used by professional tree and plant appraisers to appraise larger trees using the Trunk Formula Technique. This technique extrapolates costs to purchase the largest commonly available nursery tree relative to the size of the appraised tree.

Critical Root Zone (CRZ).** The area of soil extending from the tree trunk in which roots required for future tree health and survival are located. This area is defined as a circle with a minimum radius of 1.5 feet for every 1 inch in trunk diameter at 4.5' above grade, known as Diameter at Standard Height (DSH). Refer to Section 2.1a for examples.

Diameter at Standard Height (DSH)*. The diameter of a tree measured at 4.5 feet above the existing grade. This is an updated name for Diameter at Breast Height (DBH); meaning is still the same.

Fee-in-lieu. A mitigation option establishing a per tree inch replacement rate for payment into the Tree Fund.

Forestry permit. A permit issued by the Recreation and Parks Department Forestry Section to project owners proposing to conduct work on or otherwise impact a public tree.

Guying. A support system to stabilize newly planted trees, via anchor stakes driven into the ground.

Invasive species. Plants designated as invasive by the Ohio Department of Agriculture in Rule 901:5-30-01 Invasive Plant Species.

Maintained landscape. An area that receives services to maintain and preserve the natural assets such as turf, trees, and other plant material. This includes but is not limited to tree lawns, tree wells, medians, street islands, and maintained areas of parks.

Maintenance, emergency versus routine. Emergency maintenance projects include repairs to a failed sewer line or removing a fallen tree from a power line, and can often occur after business hours. Emergency maintenance projects must occur within three days of an issue arising for health or safety reasons. Routine maintenance projects include work like ongoing repairs to failing water lines, pruning trees away from power lines, or repairs to sewer manholes and are typically known about at least 14 days in advance.

Naturalized area. An area that receives minimal maintenance and is intended to primarily serve as habitat and space for natural regeneration. This includes but is not limited to forests, streambanks, pollinator habitats, and ravines.

Natural resource professional. Any credentialed landscape architect, certified arborist, or forester.

Plan review. Any process that a project undergoes to receive review of plans from the City of Columbus, including the Columbus Building and Zoning Departments' One Stop Shop, City capital plans, and Department of Public Services' Right-of-Way permits.

Private property*. All real estate within the city of Columbus except real estate that is owned, leased, controlled or occupied by the United States government, state of Ohio, County governments, city of Columbus or any department or agency thereof.

Property owner*. Presumed to be any one or more of the following:

- (1) The property owner or owners in fee simple of a parcel of real estate including the life tenant or tenants, if any;
- (2) Or the record owner or owners as reflected by the current records in the Franklin or applicable County auditor's office; or
- (3) The purchaser or purchasers of such real estate under any contract for the conditional sale thereof.

Public infrastructure. Basic structures such as utilities (energy, water), roads, sidewalks and publicly owned buildings, which enable a city to function.

Public tree.** Any tree growing on city-owned property, including right-of-way, parks, and other public places owned by the City.

Public tree inventory. A GIS-based database maintained by Columbus Recreation and Parks Department Forestry Section with data on individual public trees, including DSH, species, and condition.

Public Tree Plan. Plan sheet(s) required for any plan with public trees located in the work limits. The Public Tree Plan sheets must be included in any relevant plans along with the date it was generated. The Public Tree Plan shows all existing public trees within the work limits, noting proposed tree protection measures, recommendations for removal or preservation, and any new trees to be replanted.

Public Tree Mitigation.** The removal of Public trees is subject to mitigation, in the form of replanting, payment into the Recreation and Parks Tree Fund, or a combination of both, according to the most recent policies from the Recreation and Parks Department Forestry Section.

Sales comparison method. A method used by a qualified, licensed real estate appraiser to compare the value of a damaged or destroyed property to similar properties. This method uses property sales to compare the estimated contribution that plants and landscapes make to the actual value of property.

Surgery. The repair of damaged trees, including activities such as the removal of broken, dead, or diseased branches and the installation of support systems.

Tree appraisal. An objective, unbiased estimate of the value of a tree.

Tree canopy. The layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

Tree Fund. A City of Columbus trust fund, previously known as the Plant Material Fund that receives deposits from the sale of wood or wood products from the maintenance or removal of trees, or funds generated from the reimbursement of damages for the injury or destruction of public trees.

Tree Protection Zone (TPZ)*. An area of ground extending out from the trunk of the tree in all directions that must be protected during construction. Calculated by multiplying the Diameter at Stand Height (DSH) by 1.5.

Tree tagging. Placing an aluminum, numbered tag with an aluminum nail to a tree in order to label field-located trees on the Public Tree Plan. This is only necessary if the tree is not in the public tree inventory.

Tree well.** An opening or cut-out area within a sidewalk where a tree may be planted.

Volunteer trees. A tree that grows on its own and was not intentionally planted.

Work limits.** The farthest limits of the Contractor's responsibility on a project, including all temporary and incidental construction, with the exception of work zone traffic control devices required for maintenance of traffic. The Contractor is restricted from working beyond the limits shown in the Contract Documents without approval by the City.

** Defined in Chapter 912 of Columbus City Code.*

*** Defined in the City of Columbus Construction Manual and Specifications.*

Section 1: Introduction

1.1 How to Use This Manual

This manual has been developed by the Columbus Recreation & Parks Department to aid City departments, construction professionals and property owners in meeting the standards of care required for public trees.

Columbus City Code Chapter 912: Trees and Shrubs dictates and directs the standards of care for public trees, which are all trees growing on city-owned properties. This manual is promulgated as rules and regulations by the Recreation and Parks Department Director, with the authority of Chapter 912.03. Many other city codes (see inset) also require a standard of care in regards to public trees. All of these codes are in place to ensure and promote preservation of the existing tree canopy cover within the City of Columbus.

This manual is designed to clarify tree preservation, installation, and maintenance requirements called for in city code. These standards are based on best management practices (BMPs), widely accepted practices and standards used by industry professionals based on the best available research. The Columbus Recreation and Parks Department will periodically review and revise this manual as necessary, with opportunity for comment by other City departments.

In the event of inconsistency between an ordinance and these supplemental standards and procedures, the ordinance provisions shall prevail.

Timing of Enforcement

The provisions of this manual will be in full force and effect for:

- Projects undergoing Plan Review (as defined in Section 3.1) that issue an RFP for construction after the manual publication, or July 1, 2024, whichever is sooner.
- Projects occurring outside Plan Review (as defined in Section 3.2) that occur on or after January 1, 2024.

City Code on Trees

- Columbus City Code Chapter 912 – Trees and Shrubs

Other Codes Pertaining to Trees

- Columbus City Code Chapter 905.06 --Sidewalk, shared-use path and driveway entrance maintenance and repair
- Columbus City Code Chapter 4307.23 - Parks, school sites, playgrounds, and street trees
- Columbus City Code Chapter 3321.07 – Landscaping
- Columbus City Code Chapter 3372.707 - Landscaping and screening

1.2 Why Columbus Needs Trees

Public trees are critical to Columbus residents' quality of life. Located along streets and in parks, these trees shade our sidewalks, filter our air and water, and store carbon. Trees in the urban environment, however, face a variety of environmental and physical stresses including pedestrian and vehicular traffic, soil compaction, road salt, air pollution, and drought.

The 2021 Columbus Urban Forestry Master Plan has laid out **three goals for Columbus' urban forest**. First, as a long-term goal, Columbus is aiming for **a future tree canopy of 40%** by 2050. In the shorter term (by 2030), Columbus is striving to **stop net loss of tree canopy** while **prioritizing investments in equitable canopy**. All three goals are critical to achieving our vision for Columbus' urban forest. This manual, and the best practices within, play an important role in advancing these goals.

1.3 Care of Public Trees in Columbus

All trees planted on the public right-of-way, in parks or on other city-owned property are under the jurisdiction of the Department of Recreation and Parks as property of the City of Columbus and are protected by Columbus City Code Chapter 912.

1.4 How to Determine if a Tree is a Public Tree

A public tree is any tree located on property owned by the City of Columbus, which includes parks, right-of-way, and other City-owned land. If you are unsure whether a tree is a public tree, please contact the CPRD Forestry section through 311, at 614-645-6640 or Forestry@columbus.gov.

Trees Growing On Property Lines. The ownership of trees growing on the boundary line between private property and City of Columbus property is determined by the location of the majority of the trunk, to be determined as follows:

- Measure trunk diameter at 54 inches from the ground level, defined as Diameter at Stand Height (DSH)
- If the majority of the trunk, defined as 60% or more of the DSH, is located on City property, the City of Columbus is responsible for the maintenance of the tree. Otherwise, the tree is the responsibility of the private landowner.

1.5 Questions

For questions on any of the processes or standards in this manual, contact Forestry via 311, at 614-645-6640 or Forestry@columbus.gov.

1.6 Penalties and Violations

Penalties for not obtaining prior written approval via processes described in Section 3, or for violations against any of the standards detailed in this manual, are subject to legal action by the City, and are described in City Code 912.99, applicable for each instance of non-compliance.

Section 2: Impact of Construction on Trees

Trees are critical city infrastructure and need to be protected from injury to ensure they reach maturity and thus provide the most services to the community. Construction near trees can impact a tree's health through damage to a tree's root structure, trunk, and crown. Typical negative impacts that may occur during construction include:

- mechanical injury to roots, trunk, or branches
- compaction of soil, which degrades functioning roots, inhibits new root growth, and restricts drainage
- changes in existing grade that can cut or suffocate roots
- raising or lowering the water table
- microclimate change, exposing sheltered trees to sun or wind
- sterile soil conditions, associated with stripping off topsoil.

Basic information on the impacts to roots, trunk and canopy are described below. This is provided to aid in understanding of the tree protection requirements found throughout this manual.

2.1 Root Damage & Tree Protection Zones

Tree roots are concentrated in the top 18 inches of soil and spread two to three times the width of the total tree canopy (all upper branches) (Figure 1). Tree root damage is common from excavation and grade changes and can happen during improper excavation, opening wounds for disease and decay to begin. Fine roots are lost during topsoil removal, stressing trees.

Additionally, structural support is lost by trenching too close to major roots, creating possibilities of total tree failure. Finally, bruising or crushing of roots by heavy equipment (creating soil compaction conditions) also occurs which can further stress a tree, though not be apparent above ground.

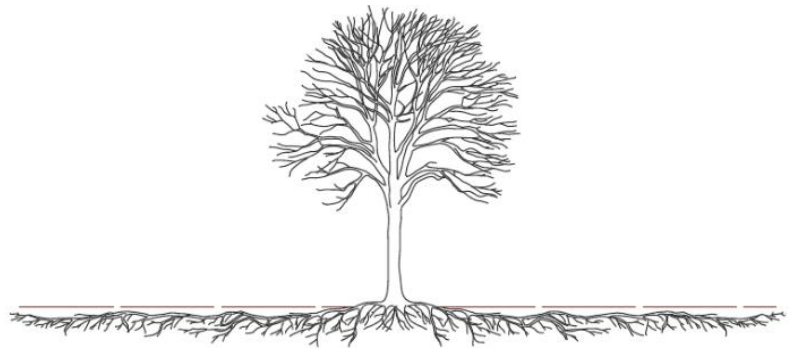


Figure 1. A proportionally accurate depiction of a root span, trunk, and canopy of a tree. Note that roots are shallow and span well beyond the dripline of the tree canopy. Image source: Wrocław University of Environmental and Life Sciences

Root protection is one of the primary areas to protect during construction. Two concepts must be considered for tree protection in construction:

2.1a Critical Root Zone (CRZ) is the area of soil extending from the tree trunk in which roots required for future tree health and survival are located. This area can also be defined as a circle with a minimum radius of 1.5 feet for every 1 inch in trunk diameter at 4.5' (54") above ground, known as Diameter at Standard Height (DSH). No activity, whether construction or maintenance, should impact a public tree's CRZ without Forestry's prior approval.

Tree Diameter (DSH)	Multiplier	Resulting Radius of CPZ from trunk
4 inches	1.5	6 feet
8 inches	1.5	12 feet
20 inches	1.5	30 feet
40 inches	1.5	60 feet

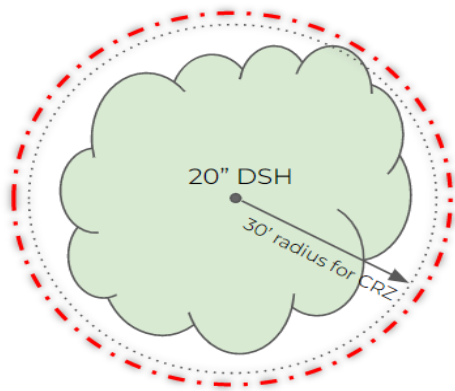
2.1b Tree Protection Zone (TPZ) is the area defined based on the CRZ where construction activities are prohibited or restricted to prevent injury to preserved trees, especially during pre-construction and construction.

The TPZ can then be simply the outline of a single tree's Critical Root Zone (CRZ), or a combined set of CRZ areas, or in the case of street trees, the outline of a tree well or planter strip in a paved area, as shown in the diagrams below.

The TPZ must be protected during construction (described in more detail in Section 6). See Figure 2 for examples of TPZ and CPZ in different scenarios.

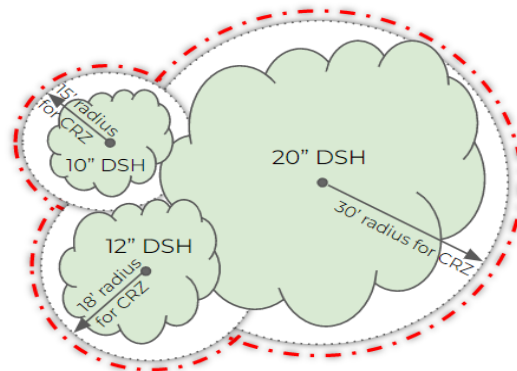
Single Tree in Open Space Setting

TPZ and CRZ are the same.



Multiple Trees in Open Space Setting

TPZ is a combination of all CRZs.



Street Tree in Tree Lawn

TPZ is the exposed areas (soil and roots not under concrete) of the CRZ on public land.

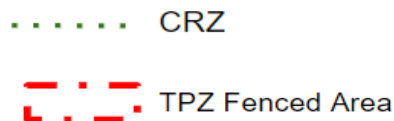
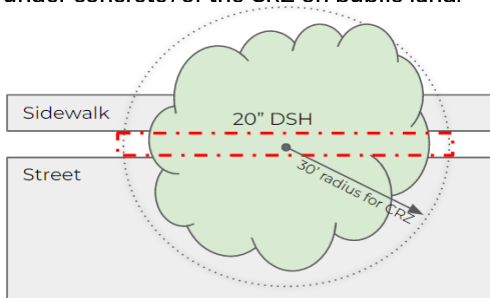


Figure 2. Examples of Tree Protection Zones (TPZ) and Critical Root Zones (CRZ) in multiple scenarios.

2.2 Trunk Damage

Careless movement of construction equipment and storage of building materials often cause wounds to tree trunks and root collars. Wounds in a tree's bark create entry points for disease. A healthy tree is capable of sealing off small wounds and localizing injury. However, stressed trees are not able to easily seal the damaged area, especially if the wound is large. See examples of trunk damage in figures 3 and 4, below.



Figure 3: Trunk damage from nearby construction activities. Image courtesy of Eli Morgan.



Figure 4: Beech tree in Beechwold Nature Preserve with trunk damage from nearby construction. Truck parked in CRZ is also compacting soil and roots.

2.3 Crown and Branch Damage

Damage to the crown, or the branches of a tree, can happen a number of ways. Breaks and scrapes during site clearing and improper pruning that leaves branch stubs create entry points for disease and decay. Losing a substantial amount of leaves will stress the tree because it can no longer produce enough energy.

Section 3: The Process for Obtaining Advance Approval

A permit is required from the Forestry section of the Columbus Recreation and Parks Department in order to impact a public tree. Impacting a public tree means conducting any work on a public tree or within its Critical Root Zone. This includes, but is not limited to, cutting above or below the ground, cutting of roots, planting, tree removal, stump grinding, spraying, fertilizing, bracing, cabling, pruning, or any kind of surgery work on the tree, as well as any intrusion in the Critical Root Zone (prohibited activities listed in Section 6.2a).

The process to receive approval from Forestry in advance of public tree work varies depending on the type of proposed project:

- projects that go through City of Columbus plan review, or
- projects that occur outside of City plan review.

More information about the City of Columbus' One Stop Shop process can be found here: <https://www.columbus.gov/bzs/building-plan-review/Plan-Review/>

More information about the City of Columbus' Right-of-Way Permit process can be found here: <https://www.columbus.gov/publicservice/permits/>

3.1 Forestry Staff Involvement

Forestry staff should be involved in any project that has public trees within its work limits. Contact Forestry via 311, at 614-645-6640 or Forestry@columbus.gov.

Forestry staff involvement includes:

- Invitation to pre-design meetings
- Notification of project start dates
- Opportunity to verify site conditions
- Inspection of tree installations and tree protection measures
- Final inspection walk-throughs and project close-out
- Monitoring one-year warranty periods of newly planted trees and preserved trees

For all public tree plantings, Forestry staff must approve the Public Tree Plan and proposed tree species, quantities, locations, and plant material. Note that if the plantings are not required as part of mitigation, no inspection fees are incurred.

For tree protection, Forestry staff must approve proposed tree protection measures for public trees within work limits, either as a condition of the Public Tree Plan or the permit. Note that no inspection fees are incurred for tree protection.

For tree mitigation (replacements or payment-in-lieu), Forestry staff must approve proposed mitigation for tree removals resulting in fee-in-lieu, replantings, or both (described in Section 5). Note that mitigation replantings require an additional fee to cover site inspections (see Section 5.5).

Inspection Timelines. Typical response times are inspections within two weeks for planned work, within 72 hours for modifications, and within 24 hours for emergency work.

3.2 Projects Undergoing Plan Review

Any projects processed through City of Columbus plan review that propose impacting public trees must receive a Forestry permit after receiving approval via a signature from Recreation and Parks' plan reviewer on the entire plan set. This includes plans processed via the Columbus Building and Zoning Departments' One Stop Shop, City capital plans, and Department of Public Services' Right-of-Way permits. Mitigation (detailed in Section 5) applies to any tree removals resulting from these projects.

For each project:

- Plans must include a Public Tree Plan (see Section 4) approved by Forestry before the Recreation and Parks Department will approve the plans.
- Project owners must apply for a Forestry permit after plan approval.
- The project owner must pay all applicable mitigation fees (see Section 5.3), including the inspection fee (see Section 5.5) if mitigation replantings are proposed, before the project can be approved.
- Forestry staff should be involved (as described throughout Section 3.3) throughout the course of the project.

3.3 Projects Occurring Outside Plan Review

Projects that happen outside of the plan review process include routine maintenance work by city departments and utilities, as well as emergency maintenance.

3.3a: Routine Maintenance by City Departments or Private Utilities

Routine maintenance projects include work like ongoing repairs to failing water lines, pruning trees away from power lines, or repairs to sewer manholes.

To streamline workflow, City departments or private utilities have the option to set up an annual permit from Forestry, as advance permission to conduct necessary routine maintenance that impacts public trees. For the purposes of this manual, routine maintenance consists of projects that are known about at least 14 days in advance. If a routine maintenance project is not known about 14 days in advance, the permit holder must notify Forestry as soon as possible before the work is to take place. The same permit can contain provisions for both routine and emergency maintenance projects.

If an annual permit is valid and current, site-specific Public Tree Plans are not required for routine maintenance projects. In these cases, Forestry will serve as the required natural resources professional and will conduct inspections on the public trees that will be impacted as a result of the proposed work.

As a condition of this permit, the permit holder agrees to contact Forestry at least 14 days prior to the proposed date of work, including all necessary information on the location and need for the public tree impact, so that Forestry staff can inspect the project site. Forestry staff will guide necessary tree protection and inspect to ensure tree protection is occurring according to set specifications.

Mitigation (replacements or payment-in-lieu, detailed in Section 5) applies to any tree removals resulting from routine maintenance, on a schedule communicated by Forestry to the permit holder.

3.3b: Emergency Maintenance by City Departments or Private Utilities

Emergency maintenance projects include repairs to a failed sewer line or removing a fallen tree from a power line and can occur after business hours. For the purposes of this manual, emergency maintenance consists of projects that must occur within three days of an issue arising for health or safety reasons.

To streamline workflow, City departments or private utilities have the option to set up an annual permit from Forestry, as advance permission to conduct necessary emergency maintenance that impacts public trees. The same permit can contain provisions for both routine and emergency maintenance projects.

If an annual permit is valid and current, site-specific Public Tree Plans are not required for emergency maintenance projects. In these cases, Forestry will serve as the required natural resources professional and will conduct inspections on the public trees that were impacted as a result of the emergency work.

As a condition of this permit, the permit holder agrees to share tree-specific information with Forestry, including the date of work, location and nature of work, tree ID from City public tree inventory, and size (DSH). A timeframe is provided from Forestry at the bottom of the permit and is typically coordinated between an arborist and permittee.

Mitigation (replacements or payment-in-lieu, detailed in Section 5) applies to any tree removals resulting from emergency maintenance and should occur on a schedule communicated by Forestry to the permit holder.

3.3c: Maintenance by Property Owners on Private Property that Impacts Public Trees

Private property projects include repairs to infrastructure that serve the property that could have a potential negative impact on a public tree, such as a repair to a water or sewer line.

If a property owner is conducting infrastructure repairs on private property that will impact a public tree, they must receive a no-cost permit in advance from Forestry. See permit example in Appendix I.

If the repair must be done immediately because it is a health or safety emergency, the property owner may apply for the permit after the work is completed. In the case of emergency maintenance, property owners must apply for a Forestry permit within 10 business days of the repair.

Mitigation will be required, as detailed in Section 5.4g.

3.3d Property Owner Requesting to Conduct Work on a Public Tree

Other activity by adjacent property owners that will require a permit include tree planting, removal, pruning, or any other work within the Critical Root Zone of a public tree.

The property owner must hire an ISA certified arborist, who will in turn apply for the Forestry permit. After an application is received from the certified arborist, a City arborist will review the application and inspect the tree and/or site to determine approval or denial of the request. If approved, the type and method of work approved along with a set of conditions and specifications that shall be adhered to will be provided to the certified arborist as part of the permit. See permit example in Appendix I.

To inquire about obtaining a permit, contact the City 311 Service Center at 614-645-3111 or visit 311.columbus.gov.

Section 4: Public Tree Plans

The Public Tree Plan is a plan sheet(s) that is required for any plan with public trees located in the work limits. The Public Tree Plan sheets must be included in any relevant plans along with the date it was generated. The Public Tree Plan shows all existing public trees within the work limits, noting proposed tree protection measures, recommendations for removal or preservation, and any new trees to be replanted. All tree information should be collected by a natural resource professional and recorded on the site plan and in a data table, including the mitigation fees to be paid (if applicable).

The Public Tree Plan will be used during a project's design phase and will ensure the accuracy of any in-lieu fees that will be incurred. It will also be used to conduct on-site inspections throughout the project.

4.1 Natural Resource Professional Required

Tree information on a Public Tree Plan must be provided by a natural resource professional, such as a landscape architect, ISA Certified Arborist, or forester. Any credentialed landscape architect, certified arborist, or forester is eligible. If a project owner proposes a professional outside of these categories who the project owner feels is qualified to collect this information, Forestry must approve.

In the case of small-scale projects that have six (6) or less public trees within work limits, Forestry staff will serve as the natural resources professional.

4.2 Elements of the Public Tree Plan

A Public Tree Plan must include two elements: a site plan and a corresponding tree data table. If no public trees are located in the project's work limits, a note must be added to the plan set indicating this.

4.2a Site Plan

The site plan must be drawn to scale and include the following:

- Natural resources professional contact information

- Work limits (boundaries of construction work, proposed grade changes if applicable and cross-sections)
- Location of existing and/or proposed utilities
- All public trees growing within work limits, labeled with a public tree inventory number OR a tree tag number. If the public tree is already geolocated in the public tree inventory, use the number assigned to the asset. If the trees are not yet geolocated in the public tree inventory, tree tagging is required and the number from the tags should be listed on the plan. The tree tag number comes from field tagging work, which requires geolocation (mapping) and physically tagged trees in the field by the natural resources professional
- Outline of the Tree Protection Zone (location and detail, per Section 2.1)
- Trees proposed for removal are marked with an X.
- Location of proposed replacement trees (with an ID number), taking into account spacing requirements in Section 7.6
- Data table (see below)

**About the City of Columbus
Public Tree Inventory**

The City of Columbus maintains a GIS-based inventory of all existing street trees. This inventory is publicly available and shall serve as a resource for location and species of street trees. The inventory data do not take the place of a natural resources professional surveying the trees in the field, but the inventory should be consulted and represented visually in Project Tree Plans.

4.2b Data Table

A corresponding table to the site plan above provides further details on the trees, mitigation efforts, and preservation measures that will be put in place. The table should include the following:

- Tree tag number if tree is not in public tree inventory, correlating with the number on the site plan (above).
- Columbus public tree inventory ID number if available (see inset).
- Tree species (common and botanical naming convention)
- Diameter at Standard Height (DSH = inches at 4.5 feet from uphill side of grade)
- Condition (Good, Fair, Poor, Critical, Dead based on Natural Resource Professional's evaluation)
- Critical Root Zone size, radius feet from trunk (see Section 2.1)
- Notation of Preserve or Remove for each tree
- Any relevant notes
 - pertaining to tree health, structure, species profile, etc.
 - Any notes, reasoning or backstory for removal or preservation (ex. only option for utility, etc.)
- Proposed mitigation, whether replanting, fee-in-lieu, or a combination. Must include calculations.
- Tree protection measures put in place for each tree within Tree Protection Zone (fencing, trunk protection, etc.)

An example of a Public Tree Plan can be found in Appendix C: Public Tree Plan template.

4.3 Suggested Steps to Create a Public Tree Plan

To create a Public Tree Plan, the following steps are suggested for the natural resources professional to follow:

1. Consult the Columbus public tree inventory to determine if public trees are already inventoried (contact Forestry for data).
2. Inspect, inventory, and tag the public trees on site that are within work limits.
3. Recommend removal or preservation for each tree (on site plan and in table)
4. Recommend tree protection measures for each preserved tree, in accordance with this manual (on site plan and in table)

Section 5: Tree Mitigation

Because of the value of trees in Columbus, and in efforts to achieve city urban forestry goals, the City of Columbus takes removal of a public tree seriously. For this reason, if a removal is approved, steps will be required to make up for the loss of that tree – a practice that is termed **tree mitigation**.

Mitigation can take the form of replanting, payment into a tree fund, or a combination of both.

The preference of the City is to replant on site. If it is not possible to replant on site due to site limitations, planting at other approved locations on public property, fee-in-lieu, or a combination of both are possible per the approval of Forestry.

Tree mitigation required in Chapter 912 and detailed in this manual is intended to be a floor, not a ceiling. This manual does not preclude other city departments from imposing more stringent requirements than those detailed here.

In addition to mitigation work, there are additional fees associated with any replanting, set by Forestry to account for multiple inspections that must occur throughout the project (see Section 5.5).

These mitigation details are found in the following pages.

5.1 Determination of Mitigation Requirements

The Public Tree Plan must include suggested mitigation. However, as part of the approval process, Forestry staff provide the final determination required mitigation. This will happen through the approval process (see Section 3), with the goal of maintaining and growing Columbus' tree canopy (see Section 1).

There are some adjustments to mitigation rates for specific situations, including invasive species, trees in sensitive areas, large scale projects and more. These are detailed in Section 5.4.

5.2 Tree Replacement Rate of 1:1

If replacement mitigation is required, the rate of tree replacement will be inch for inch, meaning the number of replacement trees' caliper inches shall collectively add up to the total DSH trunk inches of the tree(s) removed.

Examples of Tree Replacement Quantities:

1. A red maple street tree that will be removed has a DSH of 4 inches. The replacement tree will be four inches in diameter, so one four-inch tree is sufficient mitigation for the removed tree. Two two-inch caliper trees would also be appropriate replacements.
2. A pin oak tree to be removed in a park has a DSH of 21 inches. The replacement trees will be two inches in diameter, so 11 trees must be planted to replace the original pin oak.
3. An invasive callery pear growing in a tree pit that will be impacted by a construction project has a DSH of 12 inches. Because it is an invasive tree growing in a maintained landscape area, it will be mitigated for half of its inches. Three two-inch caliper trees will mitigate the removed tree. See section 5.4c on invasive tree mitigation.
4. An invasive tree-of-heaven growing in a city-owned forest has a DSH of 18 inches. Because it is in a naturalized area and is invasive, its removal does not require tree replacement. See section 5.4c on invasive tree mitigation.

Note the following additional replacement requirements:

- *Size Minimum for New Trees.* Replacement trees are to be a minimum of two inches in caliper or larger at the time of installation.
- *Species Selection of New Trees.* All replacement trees shall be selected from the most recently approved Recommended Street Tree List (see Appendix B), or otherwise approved by Forestry. Species shall factor in planting site dimensions (see Planting Standards section). Selection of species will also take into account efforts to improve tree species diversity based on other species in place in the surrounding area, following the 10-20-30 Rule. The 10-20-30 Rule is a guideline to reduce the risk of catastrophic tree loss due to pests or disease. It recommends an urban tree population include no more than 10% of any one tree species, 20% of any one tree genus, or 30% of any tree family.
- *Location of New Trees.* All tree(s) will be replaced within the work limits where they were removed. When not feasible due to functional limitations, a new site on public property may be proposed with City approval. Proposed tree locations should be the closest available tree planting opportunities to the relative project site. The planting opportunities will be limited to street tree, park, and right-of-way stocking sites.

5.3 Payment When Replacement Is Not Possible: Fee-in-Lieu - \$260 per inch

When it is not feasible to replace the public trees that have been approved for removal, the secondary mitigation option of a fee-in-lieu of planting will apply. These funds will be used by the City for planting and young tree care activities. If approved for use, the following will be used to determine the Fee-In-Lieu amount:

A fee of **\$260 per removed inch** shall be assessed and deposited into the Tree Fund. This value will be reviewed annually to assess changes in planting costs and average appraisal values. CRPD reserves the right to appraise any public tree at its discretion. In the case of appraisals, the method followed by the city arborist will depend on where the tree is growing.

- *Maintained Landscape.* Trees in a maintained landscape area (tree lawns, tree pits, common areas, islands, maintained areas of parks, etc.) will be appraised using the Cost Approach - Trunk Formula Technique.
- *Naturalized Area.* Trees in a naturalized area can be assessed with either the Cost Approach -Trunk Formula Technique or the Sales Comparison Approach – Market Value method, depending on the number of trees and total land area involved. The inspecting City arborist will determine which method will be used during the site inspection.

Specifics on both appraisal formulas can be found in Appendix E: Tree Valuation Formulas.

Examples of Fees-in-Lieu:

1. A red maple street tree that will be removed has a DSH of 4 inches. Its fee-in-lieu would be four inches multiplied by \$260/inch for a total of \$1,040.
2. A pin oak tree to be removed in a park has a DSH of 21 inches. Its fee-in-lieu would be 21 inches multiplied by \$260/inch for a total of \$5,460.
3. An invasive callery pear growing in a tree pit that will be impacted by a construction project has a DSH of 12 inches. Because it's an invasive tree growing in a maintained landscape area, it will be mitigated for half of its inches. Its fee-in-lieu would be six inches multiplied by \$260/inch for a total of \$1,560. See section 5.4c on invasive tree mitigation.
4. An invasive tree-of-heaven growing in a city-owned forest has a DSH of 18 inches. Because it is in a naturalized area and is invasive, its removal does not require a fee-in-lieu payment. See section 5.4c on invasive tree mitigation.

Required standards for tree removal can be found in Section 9: Tree Removal Standards.

5.4 Mitigation Rate Specifics

There are minimums, exceptions, or adjustments to be made to mitigation rates, whether replacement or payment-in-lieu, depending on a number of factors.

5.4a Minimum Size Thresholds

The size of tree that requires mitigation will vary, depending on whether it is a maintained landscape area or naturalized area. The Recreation and Parks Department Forestry Section will determine if a city-owned property is to be considered a naturalized area or maintained landscape for mitigation purposes, if there are any questions.

- *Maintained Landscape Areas.* Trees with a 2” caliper or above growing in mowed turf areas on city property shall be mitigated. Examples of landscaped areas include but are not limited to street trees in tree lawns or tree pits, street islands, and maintained areas of public parks.
- *Naturalized Areas.* Trees with 4” DSH or above, growing in city-owned natural areas, shall be mitigated. Examples of naturalized areas include but are not limited to forested areas, woodlots, and conservation parkland.

5.4b Large-Scale Project Mitigation: Wooded Areas over Two Acres

A 100% census inventory is required for all wooded areas that are two acres or less, referring to the forested area and not the entire parcel. All trees four inches DSH or larger must be surveyed according to 5.4a.

For wooded areas that exceed two acres in size, a credentialed property appraisal professional must be contracted by the project owner. This professional must be accredited through the Ohio Division of Real Estate and Professional Licensing and shall assess the property value of the wooded acres. The appraisal value will be used to generate the monetary value of the trees growing on the wooded acres. This monetary value will be used as the fee-in-lieu payment. Should the project owner prefer replanting and it is deemed feasible by Forestry, Forestry will calculate the number of trees that should be replanted by dividing the monetary value by the average cost of a nursery tree.

5.4c Invasive Tree Species

Mitigation rates for trees deemed invasive by the Ohio Department of Agriculture will be adjusted in the following ways:

- In maintained landscape areas, invasive trees shall be mitigated at a discount: replanting at 50% of the DSH inches; 50% of the fee-per-inch; or appraisal at a reduced value as determined by the city arborist.
- In naturalized areas, invasive trees will not be required to be mitigated.

The rationale to mitigate trees in maintained landscapes at a discount is because: 1) invasive trees provide benefits to residents, including carbon storage, shade, and air and water filtration; 2) These trees were deliberately planted in the past, before they were considered invasive. Residents should not lose out on tree replacements because the trees are now invasive. 3) If these trees were not mitigated, then whole streets or park areas could be devoid of trees like Callery pear, with no consideration to replant.

5.4d Trees in City Parkland

Trees growing on city-owned property managed by the Recreation and Parks Department may require additional steps or deviation from these guidelines altogether to preserve the parkland and the benefits trees provide to the parkland. Impacts to trees are prohibited under City Code 919.09, unless the person has the rights to do so—via approval by the Recreation and Parks Department Director. Therefore, additional consideration may be required for requested tree removals in City parkland.

5.4e Dead, Dying, or Hazardous Trees

Any tree that is determined to be dead, dying, or hazardous by Forestry staff will not require any mitigation.

5.4f Volunteer Trees Causing Current or Potential Damage to Public Infrastructure

A volunteer tree is one that grows on its own and was not intentionally planted. In the specific circumstances detailed below, volunteer trees will not be required to be mitigated.

1. **Landfill caps.** Landfill caps are containment technology forming a barrier between disposed waste and the surface. Plants with deep root systems may be detrimental to the function of the cap system, and Ohio EPA Division of Materials and Waste Management discourages establishing trees on landfill caps.

Volunteer trees growing on or within five feet of the landfill cap may be removed as part of the maintenance of the infrastructure.

2. **Bridge abutments.** Bridge abutments are structures that connect the deck of a bridge to the ground, at the ends of a bridge span, to support its weight horizontally and vertically.

Trees growing in the embankment above the culvert or in the berm area can cause deterioration of the structure. Preventative maintenance recommended by the Ohio Department of Transportation recommends removal of trees from bridge abutments. Volunteer trees growing on or within five feet of the bridge abutment may be removed as part of the maintenance of the infrastructure.

3. **Dam embankments.** An embankment dam is a water impounding structure constructed from excavated natural materials. The Federal Emergency Management Agency states that trees interfere with safe operation of dams and can cause dam failure, due to their extensive root systems that can destabilize the dam through loosening embankment soils and providing paths for erosion.

Embankments, areas adjacent to spillway structures, vegetated channels, and other areas associated with a dam require continual maintenance of the vegetal cover. Volunteer trees growing on embankments or within five feet of the embankment may be removed as part of the maintenance of the infrastructure.

4. **Alley clearance for City-owned service vehicles.** Volunteer trees growing within an alley right-of-way adjacent to the road's surface may be pruned or removed to allow for clearance of city-owned service vehicles requiring access, such as refuse trucks providing residential waste services.

5.4g: Private Property Owners Impacting Public Trees for Immediate Repair of Utility Infrastructure

If a private property owner undertakes immediate repair of utility infrastructure that causes impacts to an adjacent public tree, as detailed in Section 3.2d, the owner must receive a permit from Forestry prior to the work beginning. If the collective value of the public tree(s) that will need to be removed due to these impacts exceeds a threshold of \$5,000, mitigation will be required. Otherwise, the City will waive mitigation requirements.

5.4h: Mitigation for Annual Permits

For permit holders with annual permits, inspection fees will be charged for individual projects. However, the permit holder may conduct mitigation mass planting efforts across planting seasons.

5.5 Inspection Fees for Mitigation Replantings

When tree mitigation involves replacement tree plantings, Forestry staff must review plans, consult on species/quantity/location of new plantings, and perform up to five field inspections throughout the project's life cycle, as well as complete reporting and data management. This necessary work requires inspection fees, which are in addition to the fee-in-lieu mitigation explained in 5.3. The fee will be assessed on any replanting, whether it occurs at the removal site or on other city property.

Fees are calculated based on staff hours and will be deposited into the Tree Fund. These fees will be updated periodically by Forestry to capture increased staff costs.

Replanted Tree Quantities	Inspection Fee
1-19	\$700
20-49	\$1,342
50-99	\$3,079
100-150	\$4,629
Each 50 trees above 150	\$671 per 50 trees

Section 6: Tree Protection Standards

Any public tree must be preserved and protected from any damage during construction. Trees can experience significant damage during construction, affecting roots, trunk and crown, and those impacts may not appear for years after construction ends.

6.1 Tree Protection Measures

Tree protection measures are required when public trees are to be preserved during a construction project. For projects undergoing plan review, tree protection measures must be proposed by the natural resource professional and detailed within the Public Tree Plan. For projects outside plan review, Forestry staff will determine the necessary tree protection measures for the permit holder to be in compliance.

The following pages provide best practices and standards for protection. These can be separated into pre-construction, during construction, and post-construction.

6.2a Protection Pre-Construction

Pre-construction, the Tree Protection Zone (TPZ) must be determined (see Section 2). This area must then be protected by fencing off the area with signage (see Appendix D) prohibiting

access to the TPZ at all times. A Forestry inspector will ensure the fencing is compliant with the requirements.

Fencing. Fencing must be installed around trees along the established TPZ to exclude any construction equipment or materials (Fig.5 & 6). Fencing must be in place for the duration of the construction phase, though short-term projects, where work within the TPZ will last 45 calendar days or less, shall be inspected by a Recreation and Parks Forestry representative to receive relief from general fencing requirements. Projects lasting for more than 45 calendar days must install fencing. In the event that a tree's CRZ extends onto private property, the project owner is not expected to install fencing on the portion on private property.

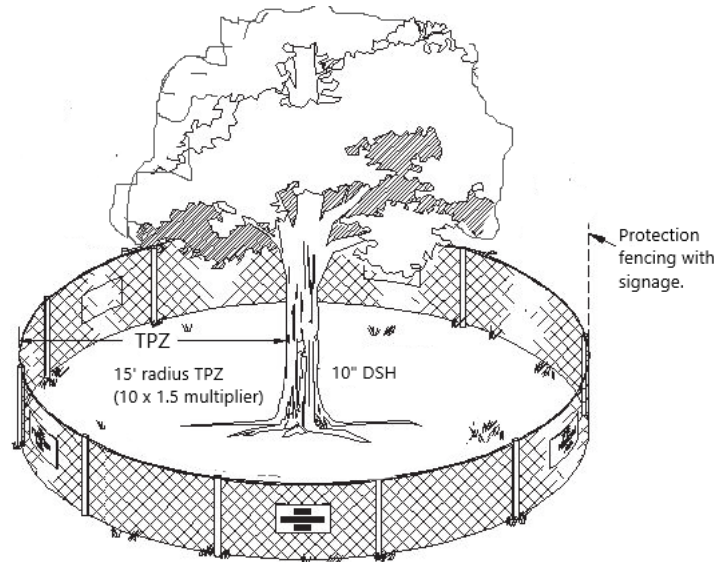


Figure 5. Tree protection fencing example.

Fencing requirements:

- Fencing shall be flush with the initial undisturbed grade.
- Fencing material shall be a minimum of 11.5-gauge galvanized chain link that is 6 feet in height; either in panel form or in continuous length with poles installed every 8 to 10 feet with wire stringers at top and down of fencing.
- Solidly anchored to the ground.
- Maintain the fencing in place until the City authorizes removal.do

For street trees, the fencing should be installed along the edge of the tree lawn or right-of-way that is unpaved. Fencing installation should consider the door swing of parked vehicles. Ensure that sight lines and pedestrian access are not impeded by this fencing, as well as emergency access to fire hydrants, power poles, manholes, and other utility infrastructure.



Figure 6: Tree protection fencing for a street tree in a tree well. Source: DeepRoot.com

Signage. Tree Protection Signs (see examples in Appendix D) must be attached to the fencing every 50' or centered if less than 50'. Signage must be attached at regular intervals to the fencing. DO NOT affix signs to trees themselves.

Surface Covering. The TPZ must be covered with 6 inches of wood chip mulch. Wood chips limit competition with weeds and grass, improve the soil profile, and reduce water stress via soil drying from exposure. The means of application can be manual (by hand), blown-in via a mulch blower, or with a small mini-skidsteer weighing no more than 2000 lbs.

No Activity in Protected Root Zone Area Without Advance Approval. No construction activity shall occur within the protected zone of any tree without prior written approval from the Recreation and Parks Forestry Section. If construction activities are desired in those areas, the City shall be given at least 24-hour notice prior to the anticipated commencement of construction activities.

The following activities are prohibited within the Tree Protection Zone:

- Dumping of construction waste;
- Storage of materials, such as building supplies, soil, waste items, vehicles, or equipment
- Parking vehicles
- Trenching;
- Changing soil grade or drainage patterns to the tree(s);
- Compacting soil with vehicle or equipment traffic;
- Installing pavement of any kind;
- Attaching anything to trees using nails, crews and/or spikes; or,
- Causing injury by fire or excessive heat.
- Any landscaping done in the CRZ subsequent to the removal of the fencing shall be accomplished by hand operated equipment or, when not feasible to be done by hand, shall be conducted with the smallest mechanized equipment necessary.

6.2b Protection During Construction

During the construction period, protection must be maintained for the ground surface, tree trunk and branches, and supplemental irrigation provided if any traffic or construction activities are to extend into the TPZ of any public tree in the work limits.

Surface Protection. If traffic and construction activities must encroach into the Tree Protection Zone, it must be approved by Recreation and Parks Forestry in advance as part of the Public Tree Plan or via a Forestry inspection for maintenance projects. In this case, the following actions must be taken to disperse the vehicular load and/or surface compaction to protect the roots and minimize root damage. Surface protection measures include one or more of the following:

- Applying 6 to 12 inches of wood chip mulch to the area (Mandatory)
- Laying ¾-inch plywood over 4 x 4 wood beams over a 6-inch-thick layer of wood chip mulch
- Applying 4 to 6 inches of gravel over a taut, staked geotextile fabric
- Placing steel plates on top of a 4+inch thick layer of wood chip mulch
- Placing commercial or logging road mats on top of a 4+inch thick layer of wood chip mulch

Trunk Protection. To avoid any trunk damage, wood planks should be installed around the trunk of the tree, following these specifications:

- Install 2-inch-thick wood planks around the trunk of the tree with ¼" or greater closed-cell foam pads between the trunk and planks; see Figure 7.
- The height of the wood planks shall be 4 feet minimum, or match the height of the vehicle clearance, whichever is greater.
- Use textile straps (i.e. ratchet straps) to bind the planks in place.
- DO NOT drive fasteners into the tree.
- If the protective planks are to be in place for longer than 6 months, loosen and adjust the planks every 3 months to allow for growth.



Figure 7: Example of tree trunk protection during construction. Source: National Park Service

Supplemental Irrigation. Trees can become stressed nearby and within construction sites, especially during the growing months. Irrigating to provide adequate water to respond to that stress is critical to the health of the tree.

- If construction activities are conducted within the protection zone during the months of May through September, supplemental irrigation must be provided. This can be done through hand watering or another regular source of water.
- Trees shall be irrigated to provide at least 1 inch of water applied once a week directly to the root system using a slow delivery method to allow for adequate infiltration.
- The water delivery method shall be identified on the Public Tree Plan.
- All trees to be preserved through construction shall be monitored for signs of drought stress. Signs of drought stress include leaf curling or rolling, leaf drop, early fall color, dieback on leaders (esp. in conifers). If signs of drought stress persist or worsen after providing regular irrigation, promptly notify the City.

Arranging for Clearance. If existing tree branches limit access of needed equipment, these branches must be proactively managed to avoid unnecessary damage. This can be done through pruning or tie-up of branches, depending on the extent of clearance needed. Descriptions of pruning and tie-up methods follow.

- *Pruning.* If pruning branches, the crown raising method of pruning (see Section 8: Tree Maintenance Standards for details on this method) shall be applied to achieve

clearance. Typical vehicular clearance is 14.5 feet over vehicular trafficked areas. For pedestrian access, typical clearance is 8 feet over sidewalks. No more than 25% of the tree canopy may be pruned.

- *Tie-Up*. Where excessive pruning (more than 25% of canopy) would be necessary for construction clearance, temporary tie-up of lower limbs may be considered appropriate so long as the limbs are not structurally damaged. Limbs should not be tied up for more than 24 hours. See Figure 8.



Figure 8: Temporary tie-up of lower limb of a public tree in a Columbus park.

Tunnel Rather than Trench. Trenching is not allowed in TPZ as it cuts off a large portion of the protected tree’s roots, while tunneling (or boring) under the tree does virtually no damage (see Figure 9). Because most roots live in the top 18 inches of soil, a tunnel 2 feet underground often does little damage. However, placing the tunnel 3 to 4 feet deep is safer.

- All soil disturbance must occur at a minimum depth of 2 feet below grade and 1-2 feet away from the tree's center to avoid any taproot.
- The insertion point must be located outside the defined TPZ of each tree
- The diameter of the tunnel must not exceed 6 inches.

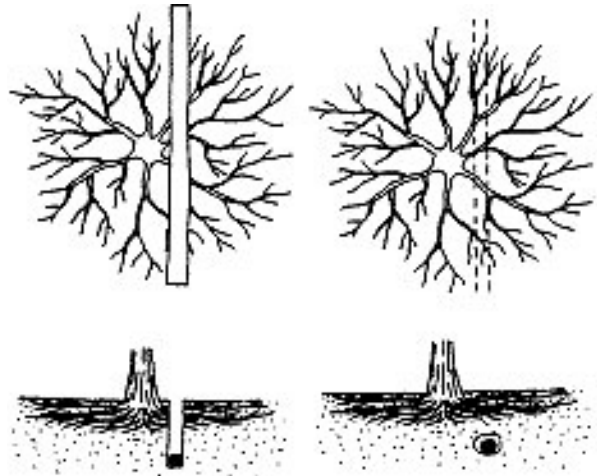


Figure 9: Trenching vs. Tunneling. Trenching near a tree (left) can kill almost half its roots. A tunnel or boring (right) in the same place will do virtually no damage to the tree. Source: Missouri Extension

6.2c Post-Construction Monitoring

Post-construction monitoring shall be conducted by Columbus Recreation and Parks Department Forestry staff during the one-year tree protection warranty period.

A city arborist will conduct a site inspection of all trees retained through construction both at project completion and at the end of the warranty period. Should any protected tree die or be deemed dying or hazardous due to the construction, mitigation will be required for the loss of the protected tree.

6.3 Reporting of Injury to Tree

The project owner shall report any damage or injury to protected public trees from construction during the project duration within the same day it occurs to the Recreation and Parks Forestry Section.

6.4 Warranty for Tree Preservation

Trees protected during construction will be monitored by Forestry staff for impacts to health for one year. Project owners are responsible for mitigation if Forestry determines the tree is hazardous or dying at the end of the warranty period as a result of the construction. If trees have to be replaced at the end of the warranty period, they must survive an additional year warranty period.

Section 7: Tree Planting Standards

7.1 Planting and Young Tree Establishment Standards

Tree planting and young tree establishment shall be performed and specified according to the American National Standards Institute (ANSI) A300 Standards Part 6, along with the planting details found in the following sections. These standards apply to planting of all public trees, whether or not they are required as mitigation. According to Chapter 912, any and all work to maintain, plant, or remove a tree shall be conducted by certified arborists or by people working under the supervision of a certified arborist.

7.2 Tree Size Classes

Forestry classifies tree species as large, medium, or small based on their height at maturity, as well as their mature width.

- **Large trees** grow to a height of 50' or taller.
- **Medium trees** grow to a height of 25-50'.
- **Small trees** grow to a height of less than 25'.

7.3 Species Selection

Project owner shall hire a qualified natural resource professional, such as a certified arborist, forester, or landscape architect, to propose diverse tree species appropriate to the space. All species selection must be approved by Forestry staff. If tree species change during construction, those substitutions must also be approved by Forestry.

7.4 Nursery Stock Standards

Trees to be installed must be healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of 2 years. If plant material is unavailable from local sources, the proposed source shall originate from states immediately adjacent to Ohio or further north. Plant material must be sourced from no further south than Zone 7a of the USDA Plant Hardiness Zone Map (PHZM). At the time of planting all plants shall

have a root system, stem, and branch form that will not restrict normal growth, stability, and health for the expected life of the tree. Additionally, trees must be protected from deterioration during delivery and storage. Adequately protect trees from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.

7.5 Timing of Planting

Spring plantings may occur from March 1 to May 31. Fall plantings may occur from September 15 through December 31. Forestry staff must approve planting times if they vary from those indicated, prior to planting.

7.6 Site Selection

Guidelines on spacing for Tree Planting sites follows:

- **Tree lawn widths:** Large trees require a 7' minimum tree lawn width. Medium trees require 5' tree lawn width. Small trees require 3' minimum tree lawn width.
- **Overhead obstructions:** The tree's mature height should be used to determine appropriate species when there are overhead obstructions such as power lines. No tree with a mature height over 25' should be planted beneath overhead utilities.
- **Spacing.** Generally, large trees should be planted a minimum of 40' apart, though spacing can vary depending on species. Medium trees should be planted a minimum of 30' apart. Small trees should be planted a minimum of 20' apart. These plus additional spacing requirements follow:

Object	Minimum separation from tree trunk (feet)
Large class tree	40
Medium class tree	30
Small class tree	20
Raised objects in parks, such as curbs, parking stops, poles, benches, trash cans, and tables	10
Light poles	20 for small class trees; 10' if large class tree
Power Poles	25
Street Intersections	30
Driveways	10

Alleys	10
Stop signs	50, taking into account sight triangles
Street signs	10
Fire hydrants	10
Utility taps	6

7.7 Utilities Protection

Protect existing utilities, paving and other facilities from damage caused by landscaping. Contact Ohio Utility Protection Service (OUPS) at 811 before doing any work.

7.8 Installation Specifications

Planting specifications for the actual installation of the tree depends on the type of tree being planted: container, balled and burlapped, or bare root.

7.8a Installation specifications for nursery trees of all formats:

- If a tree is to be planted in a confined planter pit or sidewalk area, the planting hole shall be excavated to a minimum of 30-inches deep x the width of the exposed area. In all other areas, excavate the hole's width a minimum of three times the diameter of the container, and deep enough to allow the root ball of the container to rest on firm soil. Scarify the sides and the bottom of the pit. Do not place sand or gravel in the planting hole.
- The top of the intact root ball should be level with the surrounding grade. Backfill with native soil.
- Remove all rope, tags and tree wrap from trunk and limbs.
- Use the same soil to fill the planting hole as was removed. Use no amendments.
- Fill the planting hole by half, gently tap soil, and water to remove air pockets. Continue filling, tapping and watering until the soil is at grade.
- Use remaining soil to build a watering berm just outside the planting hole.
- For trees planted on a slope, the grade of the back of the planting hole (on the high side of the slope), must match the required planting grade, as shown in the image below. The lower end of the slope planting area must be built up to the root ball grade. See Figure 10 for a diagram of a tree planting on a slope.

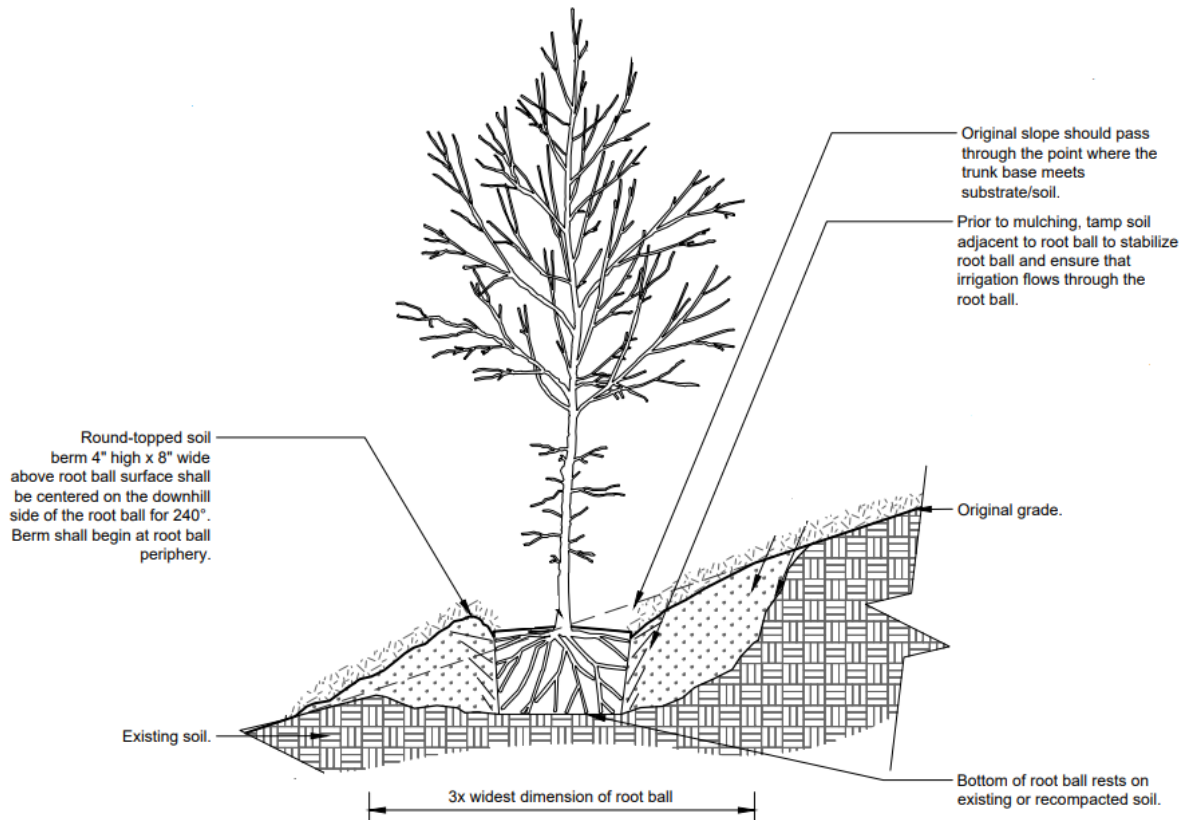


Figure 10: Diagram for Tree Planting on a slope. Source: ISA

7.8b Additional specifications for nursery trees in containers:

- Trees in containers often have roots that circle the container and must be addressed at the time of planting. Tree should be removed from the container and the rootball shaved (see below), before placing it in the planting hole.

About Rootball Shaving. The outer surfaces of ALL container trees (sides and bottom of the root ball) must be shaved or scarified to remove all circling, descending, and matted roots. This can be performed using saws, knives, sharp shovels, or other suitable equipment that is capable of making clean cuts on the roots. Shaving or cutting should remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

- Trees should be lifted by the container or by supporting the bare root ball. Trees should not be lifted by the trunk or limbs.
- Loosen the root ball from the container and place in the planting hole.
- If containerized trees are provided by the City, return all empty containers to the Forestry Section.

7.8c Additional specifications for nursery trees in ball & burlap (B&B):

- Plant during the dormant season, after leaf fall in the autumn and before bud break in the spring.
- Neither plastic twine, nor plastic or synthetic burlap, shall be used on any B&B stock. Jute twine and burlap shall be used.
- Trees to be held on site longer than 24 hours before planting should be held in the shade or with enough mulch to cover the root ball. The root ball should be sufficiently watered to prevent drying.
- Trees provided by the city should be planted within 24 hours of delivery or pick up.
- The planting hole should be no deeper than the root ball, but two times wider.
- Check the root ball for soil added above the root flare by the nursery at time of digging. If present, remove added soil to the root flare.
- Trees should be moved by handles on the basket or by strapping placed around the root ball. Trees should not be lifted by the trunk or limbs.
- Find the trunk flare and ensure that it is 1-2 above grade when placed in the planting hole. In areas with poor drainage, the tree may be planted with the root flare 1" above grade. In all other instances the root flare should be placed at ground level. In no instance should the root flare be placed below grade.
- Do not loosen any of the burlap, twine or wire basket until after the tree is situated in the planting hole.
- Once the tree is in the planting hole, remove all surface level burlap and twine. Peel back wire basket away from top, leaving basket in place overall, but cut wires around top 6"-8" of sides, or top one-third of root ball, to ease future root growth.

7.8d Additional specifications for nursery trees that are bare root:

- Provide established and well-rooted field grown plants. Harvest bare root plant while the plant is dormant and a minimum of 4 weeks prior to leaf out (bud break).
- The root spread of the harvested plants shall conform to American National Standards Institute (ANSI) Z60 Standards Part 1 for nursery grown bare root plants for each size and type of plant.
- Bare root stock shall be protected from drying out at all times. Roots must be covered and packed in moist straw, sawdust, or other suitable moisture-holding packing material.
- Keep the trees in a cool dark space for storage and delivery. If daytime outside temperatures exceed 70 degrees F, utilize a refrigerated storage area with temperature between 35 and 50 degrees.
- Planting holes can be slightly smaller than for container or ball and burlap trees, only requiring a diameter to match the spread of the roots to the correct depth. Dig hole to a depth so the located trunk flare, at the first order lateral root, matches finished grade.

Spread all roots out radial to the trunk in the prepared hole making the hole wider where needed to accommodate long roots. Root tips shall be directed away from the trunk. Prune any broken roots removing the least amount of tissue possible. Maintain the trunk plumb while backfilling soil around the roots. Lightly tamp the soil around the roots to eliminate voids and reduce settlement

7.8e Additional specifications for planting in tree wells (cut-out areas within a sidewalk):

- New tree's root flare elevation must be between 3" to 5" below sidewalk grade to allow for reinstallation of tree grate.
- Once grates are re-installed, pea gravel must be applied to fill the remaining space from the top of soil to the top of the tree grate.

7.9 Finishing Installation

Once the tree has been installed and the planting hole has been filled, the tree should be immediately mulched, staked and watered thoroughly.

- *Mulch.* Immediately after planting, smooth out all grades between plants before mulching. Apply 2-3 inches of mulch, covering the entire planting bed area. Do not pile any mulch against the trunk of the tree; the trunk flare must be exposed. Place no mulch within 2" of the trunk. For trees planted in lawn areas the mulch must extend to a 5 foot radius around the tree covering the soil berm. Use only shredded hardwood mulch. The mulch shall be either un-dyed, brown or black as specified in the project material list. Substitutions will only be accepted with prior written permission from Forestry and will not be made on-site, at the time of installation.
- *Watering.* After initial watering at installation, the tree must receive at least 10 gallons of water per 1" tree caliper per week during the first growing season. Water trees and plants within the first 24 hours of initial planting and not less than once per week until project completion. During the warranty period, water as needed to keep each plant alive. Gator bags or other watering accessories may be used but must be removed during the winter months, and removed permanently after the warranty period.
- *Staking.* Staking and guying should only be used in areas of high wind or when trees will not stand on their own. When guying is not required, staking alone may be used to reduce lawnmower damage. Trees should be guyed loosely enough to allow the trunk to sway from the base. All guying materials should be removed within one year.
 - Tree guying is to be flat woven polypropylene material, 3/4 inch wide, with 900 pound break strength.
 - Stakes shall be 2 inch by 2 inch hardwood stakes free of knots (or approved equal) and of lengths appropriate to the size plant required to adequately support the plant.
 - Dead men for Large Trees (where required on the drawings) shall be 4 inch by 4 inch by 4 feet long wood (or approved equal). Wood shall NOT be treated for rot protection.

- Submit manufacturer's product data for approval.
- *Mower Guards.* Mower guards are recommended but not required on trees planted in an area surrounded by lawn.

7.10 Post Planting Care and Tree Establishment Warranty Period

It is the responsibility of the installing party to maintain and care for the new tree for a **one year warranty period**.

- Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
- Keep all tree planting areas free of weeds. Hand-remove all weeds; chemical herbicides are not permitted.
- Refresh mulch once during the warranty period to maintain complete coverage, but do not over mulch. At no time shall the overall mulch thickness be greater than 4 inches. Do not apply mulch against any trunks.
- Remove any staking and ties at the end of the warranty period.
- At the end of the warranty period, any trees that did not survive must be replaced by the installing party.
- For warranty periods that end when the trees are dormant in winter, the inspection to determine tree survival should occur in early fall (September) or in spring (May) to observe trees while they have leaves.

Section 8: Tree Maintenance Standards

Any tree maintenance performed - tree pruning or tree health care - must be done in accordance with the standards detailed below. According to Chapter 912, any and all work to maintain, plant, or remove a tree shall be conducted by certified arborists or by people working under the supervision of a certified arborist. This is different from the natural resources professional (Section 4.1) who simply collects information and recommends tree protection measures; in this section, the actual tree care must be done by or supervised by a certified arborist.

8.1 Pruning

Proper pruning of landscape trees improves their structural strength, maintains their health, enhances beauty, and increases their value.

8.1a When to Prune

Pruning public trees must occur in accordance with American National Standards Institute (ANSI) A300 Standards (tree care practice industry standards) Part 6 Pruning Standard and ANSI Z133 Part 1 Safety Standard. Pruning becomes advisable under the following circumstances:

- **Defects.** Trees have crossing branches, weak branch unions, or other defects.

- **Deadwood.** Branches are dead, dying, decayed, or potentially hazardous.
- **Clearance.** Lower branches interfere with people or vehicles, or block visibility of signs.
- **Utilities.** Branches are growing into buildings or utility wires.
- **Storm Damage.** Limbs have been broken by storms.

8.1b Pruning Around Utilities

All employees pruning trees in areas where there are utility lines present must be “Qualified Line Clearance Tree Trimmer Trainees” or “Qualified Line Clearance Tree Trimmers” as defined in A.N.S.I. Standard Z-133.1.

Project owner must:

- Locate and identify existing underground and overhead services and utilities within work limits.
- Provide adequate means of protection of all utilities and services.
- Perform all work in accordance with the requirements of the applicable utility company or agency involved.
- Immediately report and repair utilities damaged during site work operations.

8.1c Defining Pruning Cuts

Pruning cuts are defined here, and shown in Figure 11 below.

- A **branch removal cut** (previously termed a "thinning cut") removes a branch at its point of origin on the trunk while retaining the branch collar and branch bark ridge.
- A **reduction cut** (previously called "cutting to a lateral") shortens a limb to a lateral branch large enough to resume growth of the pruned limb, typically at least one-third the diameter of the branch or stem being removed (review image below).
- **Heading** and **stub cuts** result in exposed areas of the tree that can't heal, and are thus prohibited.

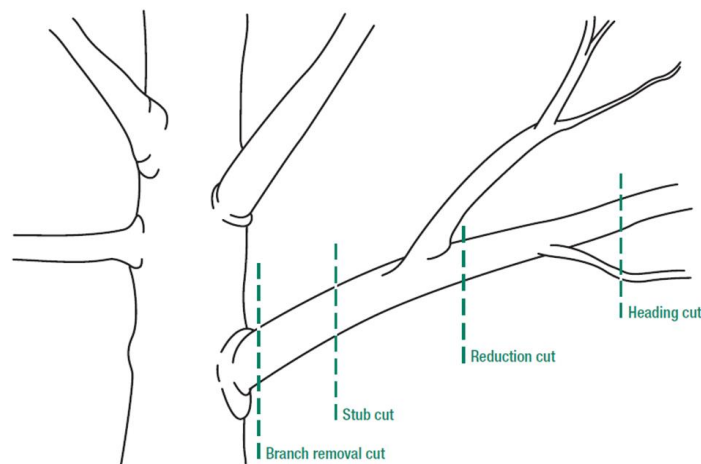


Figure 11: Depiction of pruning cuts.

8.1d Proper Pruning Technique

Proper pruning practices remove a branch while protecting the branch collar, which is essential for wounds to close (also called natural target pruning).

To promote quick closing of a pruning wound, always use the precut method when removing a branch over 1 inch. This pruning method protects the branch collar and prevents tearing the bark.

As shown in the Figure 12, the first cut (A) ensures the limb does not tear down into the trunk bark when removed, the second cut (B) removes the majority of limb weight, and the last step (C/D) achieves the final finished cut that can most easily heal over the coming months.

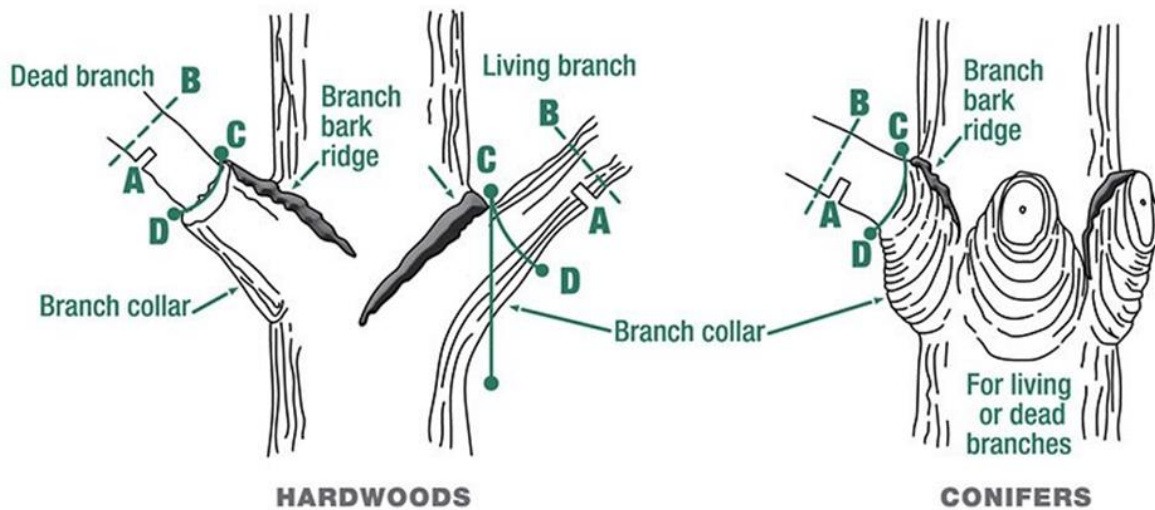


Figure 12: Precut method in tree pruning.

Do not leave a stub and do not cut flush against a trunk. Use sharp tools and keep wounds as small as possible, clean, and smooth.

8.1e Young Tree Pruning

Young trees should be pruned three to five years after initial installation. These few cuts at an early age can have significant impacts on the longevity and success of the tree over the coming decades. See Figure 13 for a diagram of young tree pruning. Follow the below steps to prune a young tree.

1. Identify competing leader(s). If there are competing leaders present, remove or prune back the less vigorous branch(es) to prevent potential structural weaknesses.
2. Prune any malformed branch.
3. Remove any crossing branch, which will affect the other branch's growth and create an undesirable form.
4. Remove no more than one-third of water sprouts (upright sucker growth in the crown of tree) in any one year.
5. If branch attachment is narrower than is common for the species, remove the branch while the tree is young.
6. Prune any broken or badly damaged branch.
7. Prune temporary branches back with reduction cuts or remove them completely over time. Removing these branches over the first few years provides clearance for signs, vehicles (min. 14 feet over roadway), and pedestrians (min. 8 feet over walkways).
8. If possible, twist and yank out suckers when young instead of cutting to decrease chance of resprouting.
9. Apply 2 to 3 inches of composted mulch at the tree base. Keep mulch 2 to 3 inches away from the trunk to prevent the chance of rot.

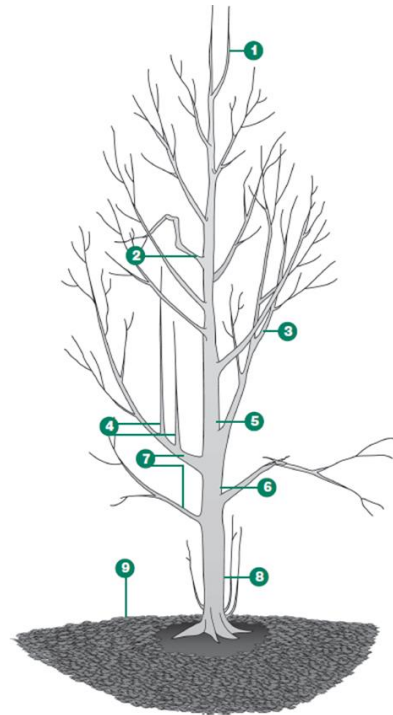


Figure 13: Diagram for young tree pruning.

8.1f Mature Tree Pruning

By the time a tree reaches maturity, providing it has had its maintenance needs met throughout its life, it should only need pruning for specific purposes such as:

- **Managing risk.** Removing dead or dying limbs 1 inch and larger in diameter or limiting branch end weight to aid in retaining tree structure.
- **Clearance.** Removing or reducing branches from infrastructure.
- **Restoration.** Pruning post storm damage.

Protect and preserve the tree's natural form. Pruning a mature tree excessively or incorrectly can cause more harm than good. Every vigorous branch removed reduces photosynthesis and the manufacture of sugar. Any cuts allow decay organisms to enter the wound.

8.1g Pruning Prohibitions

- Climbing irons or spikes may NOT be used on any tree that is scheduled for pruning.
- Trees shall be raised to no more than one third the height of the tree. Exceptions will be made to clear infrastructure. None of these actions shall render the tree unbalanced or harmed.

8.2 Plant Health Care

Any plant health care such as treatment of a disease or pest, or application of fertilizer, must be approved by Forestry and applied by a certified arborist with a pesticide applicator's license.

Section 9: Tree Removal Standards

Any tree removals and stump grindings performed must conform to the most current revision of the American National Standards Institute, Standard A300(Part 1) and Standard Z-133.1: "Safety Requirements for Pruning, Trimming, Repairing, Maintaining, Removing Trees and for Cutting Brush." According to Chapter 912, any and all work to maintain, plant, or remove a tree shall be conducted by certified arborists or by people working under the supervision of a certified arborist. Tree removals are evaluated by the criteria in Appendix A.

9.1 Tree Removal

If a tree to be removed does not have roots or branches extending into the Critical Root Zone of a protected tree, no specific requirements for removal are required.

However, if a tree to be removed has roots or branches that extend into the Critical Root Zone area of a protected tree, the following applies:

- Removal shall not be attempted by demolition or construction personnel, grading or other heavy equipment.
- An ISA Certified Arborist or a tree care worker working under the direction of an ISA Certified Arborist shall remove the tree carefully in a manner that causes no damage above or below ground to trees that remain.

Tree crowns shall be stripped before removal unless conditions permit felling; no trees or trunks shall be felled onto pavement. All trunks shall be removed flush with the ground, in preparation for stump grinding. Work shall also include removal of all basal sprouts, brush, and weeds within three feet of the stump, and the stump itself.

Climbing irons or spikes may only be used on a tree that is scheduled for removal.

All limbs and trunks shall be removed and controlled as necessary to prevent damage or injury to people, utilities, buildings, property, pavement, and other trees. No wood, debris, etc. shall

remain on site or in the public right-of-way, past the end of the work day. Assure minimum interference with streets, sidewalks, and adjacent facilities by prompt removal of debris.

9.2 Stump Removal

Requirements for stump grinding vary based on the proximity to other living trees.

9.2a General Stump Grinding

Stump removal in general involves the grinding of stump and roots to a minimum depth of 18 inches. Large surface roots 12 inches from the outside circumference must be removed and backfilled with City approved topsoil to grade, the area tamped to settle the soil, and seeded with approved grass seed.

9.2b Stump Grinding Adjacent to Living Trees

Stumps to be removed within 36" of a living adjacent tree should be ground only to a depth of 2", to avoid impacting the anchor roots of the adjacent tree.

Appendices

Appendix A: How a Removal Application is Evaluated

Arborists issuing an approval for removal use a set of data, a site visit and evaluation rationale to determine whether a removal will be permitted.

Data Considered. Requests for public tree removals will be based on the following data:

- *Size.* The diameter of the tree trunk to be removed will be measured 4.5 feet above grade (Diameter at Standard Height, DSH) and expressed in inches.
- *Location.* The tree's location is evaluated by its ability to support the tree (vigor) and consideration of its placement within the surrounding landscape.
- *Condition.* The condition of a tree is assessed using the following factors:
 - Health: vigor, foliage size and color, leaf density, presence of absence of pests, twig growth rate, amount of twig or branch dieback, and wound closure
 - Structure: indicators of decay (cavities, wounds, cankers, etc), roots (exposed, uplifted, grade change, girdling, etc), trunk (deviation from vertical, co-dominant, cracks, seams, miss bark, etc), and crown (symmetry, multiple attachments, poor branch attachment, dieback, etc.)
 - Form: type (rounded, oval, columnar, pyramidal, vase, weeping, horizontal, irregular), shape, silhouette, atypical, aesthetic appeal
- *Species.* Tree species will be evaluated by considering the durability and prospective life span of the subject tree.

Evaluation Rationale. Because the ultimate goal is to preserve as many trees as possible, healthy public trees will typically not be approved for removal. However, at times, there will be

unavoidable impacts that make preservation unrealistic. A public tree may be approved for removal if a Forestry representative determines that:

- Tree is dead or dying, and poses a threat to public safety.
- Tree contains a structural problem (split trunk, split branching unions, poor branch attachments, etc.) that could result in failure and result in damage to adjacent properties or to residents.
- Necessary work/utility/roadway improvements required around the tree will kill the tree or render the tree hazardous.
- Tree is infested with an epidemic insect or disease where recommended control is not applicable and removal is necessary to prevent transmission of the insect or disease to other trees.
- The preservation of the tree, when adjacent property is developed, is not cost effective.

The site inspection results will provide a tree assessment and determine if removal is approved with required mitigation.

If a tree is determined to be dead, dying, seriously diseased, or otherwise represent a hazard to public safety through the site inspection, its removal will be approved and not result in any required tree mitigation.

Appendix B. Recommended Street Tree List - Revised November 2020

Recommended tree species and varieties (cultivars) for the public streets of Columbus. This list is not exclusive and other species, varieties or cultivars may be planted with the approval of Forestry. All Tree Plantings on public property require a permit from the City Forester. Weeping and multi-stem forms are not permitted as street trees.

B.1 Small-Sized Trees

Spacing: 20' between trees in general unless very small as noted. Any tree planted under overhead utilities must only reach a mature height of 25' or less.

Scientific Name	Trade / Common Name	Cultivar Name(s)	Mature Size (HxW)	Notes	Native	Under Wires	Minimum Tree Lawn Size
<i>Acer buergerianum</i>	Trident Maple		25' x 20'	Oval	No	Yes	4' x 4'
<i>Acer ginnala</i>	Flame Amur Maple Beethoven Amur Maple Mozart Amur Maple	'Flame' 'Betozam' 'Mozam'	20' x 20' 20' x 15' 20' x 15'	No multi-stem street trees	No	Yes	4' x 4'
<i>Acer grandidentatum</i>	Rocky Mountain Glow Big Tooth (Canyon) Maple	'Schmidt'	25' x 20'		North America	No	4' x 4'
<i>Acer tataricum</i>	Hot Wings Tatarian Maple Pattern Perfect Tatarian Maple Rugged Charm Tatarian Maple	'GarAnn' 'Patdell' 'JFS-KW2'	20' x 24' 25' x 20' 20' x 15'		No	Yes	4' x 4'
<i>Aesculus pavia</i>	Red Buckeye		20' x 20'		Ohio	Yes	4' x 4'
<i>Amelanchier arborea</i>	Cumulus Serviceberry	'Cumulus'	25' x 25'		North America	Yes	4' x 4'
<i>Amelanchier arborea</i>	Lustre Serviceberry	'Rogers'	20' x 15'	Use for tight space, with overhead lines	North America	Yes	4' x 4'
<i>Amelanchier arborea</i>	Spring Flurry Serviceberry	'JFS-Arb'	28' x 20'		Ohio	No	4' x 4'
<i>Carpinus betulus</i>	Columnar European Hornbeam Frans Fontaine Hornbeam Pyramidal European Hornbeam	'Fastigiata' 'Frans Fontaine' 'Columnare'	35' x 20' 35' x 15' 30' x 20'		No	No	4' x 4'
<i>Cercis canadensis</i>	Eastern Redbud		25' x 30'	Park use or, extra space needed due to pruning for street	Ohio	No	6' x 6'
<i>Cornus mas</i>	Golden Glory Corneliancherry Dogwood	'Golden Glory'	20' x 15'	No multi-stem street trees	No	Yes	4' x 4'

<i>Cornus kousa</i>	Kousa Chinese Dogwood		20' x 20'		No	Yes	4' x 4'
<i>Crataegus viridis</i>	Winter King Hawthorn	'Winter King'	20' x 25'	Wide	North America	Yes	6' x 6'
<i>Halesia carolina</i>	Wedding Bells Silverbell	'Wedding Bells'	20' x 15'	Upright / oval	North America	Yes	4' x 4'
<i>Heptacodium miconioides</i>	Seven-Son Flower Tree		25' x 15'		No	No	4' x 4'
<i>Maackia amurensis</i>	Amur Maackia		25' x 20'		No	No	4' x 4'
<i>Magnolia virginiana</i>	Henry Hicks Sweetbay Moonglow Sweetbay Magnolia	'Henry Hicks' 'Jim Wilson'	20' x 20' 30' x 15'	No multi-stem street trees	North America	North America	4' x 4'
<i>Magnolia x</i>	Galaxy Hybrid Magnolia	'Galaxy'	30' x 15'		No	No	4' x 4'
<i>Malus x</i>	Prairifire Crabapple	'Prairifire'	20' x 15'		No	Yes	4' x 4'
<i>Malus x</i>	Adirondack Crabapple	'Adirondack'	18' x 8'	Columnar	No	Yes	4' x 4'
<i>Malus x</i>	Red Jewel Crabapple	'Jewelcole'	25' x 15'		No	No	4' x 4'
<i>Malus x</i>	Golden Raindrops Crabapple	'Schmidcutleaf'	20' x 15'	Prone to Fireblight	No	Yes	4' x 4'
<i>Malus x</i>	Royal Raindrops Crabapple	'JFS-KW5'	20' x 15'		No	Yes	4' x 4'
<i>Parrotia persica</i>	Vanessa Persian Ironwood	'Vanessa'	28' x 15'		No	No	4' x 4'
<i>Prunus x</i>	Okame Flowering Cherry	'Okame'	25' x 25'		No	Yes	4' x 4'
<i>Prunus x</i>	Snow Goose Flowering Cherry	'Snow Goose'	25' x 20'		No	Yes	4' x 4'
<i>Prunus x</i>	First Lady Flowering Cherry	'First Lady'	27' x 14'		No	No	4' x 4'
<i>Prunus x</i>	First Blush Flowering Cherry	'JFS-KW14'	25' x 12'		No	No	4' x 4'
<i>Prunus x</i>	Newport Plum	'Newport'	20' x 20'		No	Yes	4' x 4'
<i>Prunus cerasifera</i>	Crimson Pointe Plum Krauter Vesuvius Plum	'Cripoizam' 'Krauter Vesuvius'	25' x 10' 20' x 15'		No	Yes	4' x 4'
<i>Prunus sargentii</i>	Columnar Sargent Cherry Pink Flair Cherry	'Columnaris' 'JFS-KW58'	35' x 15' 25' x 15'		No	No	4' x 4'
<i>Prunus serrulata</i>	Amanogawa Cherry Kwanzan Cherry	'Amanogawa' 'Kwanzan'	20' x 6' 25' x 20'		No	No	4' x 4'
<i>Prunus subhirtella</i>	Autumn-Flowering Cherry	'Autumnalis Rosea'	30' x 25'		No	No	4' x 4'
<i>Styrax japonicus</i>	Pink Chimes Snowbell Spring Showers Snowbell Snowcone Snowbell	'Pink Chimes' 'Spring Showers' 'JFS-D'	15' x 15' 20' x 15' 20' x 15'		No	Yes	4' x 4'
<i>Syringa reticulata</i>	Ivory Silk Japanese Tree Lilac	'Ivory Silk'	20' x 20'		No	Yes	4' x 4'

<i>Syringa pekinensis</i>	Beijing Gold Peking Lilac China Snow Peking Lilac Great Wall Peking lilac	'Zhang Zhiming', 'Morton' 'WFH2'	20' x 20' 20' x 20' 20' x 12'		No	Yes	4' x 4'
<i>Taxodium distichum</i>	Lindsey's Skyward Bald Cypress	'Skyward'	25' x 10'	Columnar	North America	No	4' x 4'

B.2 Medium-Sized Trees

Spacing: 30' between trees.

Scientific Name	Trade / Common Name	Cultivar Name(s)	Mature Size (HxW)	Notes	Native	Under Wires	Minimum Tree Lawn Size
<i>Acer campestre</i>	Metro Gold Hedge Maple Queen Elizabeth Hedge Maple	'Panacek' 'Evelyn'	35' x 20' 35' x 35'		No	No	6' x 6'
<i>Acer x freemanii</i>	Armstrong Freeman maple	'Armstrong II'	45' x 15'	Columnar	Ohio	No	6' x 6'
<i>Acer truncatum x platinooides</i>	Crimson Sunset Maple Norwegian Sunset Maple Pacific Sunset Maple Urban Sunset Maple	'JFS-KW202' 'Keithsform' 'Warrenred' 'JFS-KW187'	35' x 25' 35' x 25' 30' x 25' 35' x 20'		No	No	6' x 6'
<i>Acer miyabei</i>	Rugged Ridge Maple State Street Maple	'JFS-KW3AMI' 'Morton'	50' x 40' 40' x 30'		No	No	6' x 6'
<i>Aesculus x carnea</i>	Briotii Red Horsechestnut Ft. McNair Red Horsechestnut	'Briotii' 'Ft. McNair'	30' x 35' 32' x 30'		No	No	6' x 6'
<i>Betula nigra</i>	Heritage River Birch	'Cully'	50' x 50'	No multi-stem street trees	Ohio	No	6' x 6'
<i>Carpinus betulus</i>	Emerald Avenue European Hornbeam	'JFS-KW1CB'	40' x 28'		No	No	6' x 6'
<i>Carpinus caroliniana</i>	Native Flame American Hornbeam	'JFS-KW6'	30' x 20'		Ohio	No	6' x 6'
<i>Carpinus caroliniana</i>	American Hornbeam		25' x 20'		Ohio	No	6' x 6'
<i>Cercidiphyllum japonicum</i>	Katsuratree		40' x 30'		No	No	6' x 6'
<i>Cladrastis kentukea</i>	American Yellowwood Perkins Pink	'Perkins Pink'	40' x 40' 30' x 30'		Ohio	No	6' x 6'
<i>Corylus colurna</i>	Turkish Filbert (Hazel)		45' x 35'		No	No	6' x 6'

<i>Eucommia ulmoides</i>	Hardy Rubbertree		45' x 45'		No	No	6' x 6'
<i>Koelreuteria paniculata</i>	Goldenraintree		30' x 30'		No	No	6' x 6'
<i>Maackia amurensis</i>	MaackNificent Amur Maackia	'JFS-Schichtel1'	30' x 25'		No	No	6' x 6'
<i>Magnolia x soulangiana</i>	Saucer magnolia	'Alexandrina'	30' x 25'	Park use only	No	No	6' x 6'
<i>Ostrya virginiana</i>	American Hophornbeam (Ironwood)		35' x 25'		Ohio	No	6' x 6'
<i>Ostrya virginiana</i>	Autumn Treasure American Hophornbeam	'JFS-KW5'	40' x 20'		Ohio	No	6' x 6'
<i>Quercus robur</i>	Skyrocket English Oak	'Fastigiata'	45' x 15'	Columnar	No	No	6' x 6'
<i>Ulmus x</i>	Frontier Elm	'Frontier'	40' x 30'		No	No	6' x 6'
<i>Ulmus x</i>	Triumph hybrid Elm	'Morton Glossy'	50' x 45'		No	No	6' x 6'
<i>Ulmus x</i>	Patriot hybrid Elm	'Patriot'	50' x 40'		No	No	6' x 6'
<i>Zelkova serrata</i>	Musashino Zelkova	'Musashino'	45' x 15'	Columnar	No	No	6' x 6'

B.3 Large-Sized Trees

Spacing: 40' between trees.

Scientific Name	Trade / Common Name	Cultivar Name(s)	Mature Size (Height / Width)	Notes	Native	Under Wires	Minimum Tree Lawn Size
<i>Acer x freemanii</i>	Autumn Blaze Freeman Maple Sienna Glen Freeman Maple	'Jeffersred' 'Sienna'	55' x 40' 50' x 35'	Surface rooting	Ohio	No	8' x 8'
<i>Acer nigrum</i>	Black Maple	'Greencolumn'	50' x 20'	Columnar	Ohio	No	8' x 8'
<i>Acer rubrum</i>	Autumn Flame Red maple Redpointe Red Maple Sun Valley Red Maple	'Autumn Flame' 'Frank Jr.' 'Sun Valley'	35' x 35' 45' x 30' 40' x 35'	Surface rooting	Ohio	No	8' x 8'
<i>Acer saccharum</i>	Sugar maple	'Endowment' 'Legacy' 'Commemoration' 'Green Mountain'	50' x 20' 50' x 35' 50' x 35' 50' x 40'	Columnar	Ohio	No	8' x 8'
<i>Celtis occidentalis</i>	Common Hackberry	'Prairie Pride' 'Magnifica'	45' x 45' 50' x 40'		Ohio	No	8' x 8'
<i>Fagus grandifolia</i>	American Beech		50' x 40'		Ohio	No	8' x 8'

<i>Fagus sylvatica</i>	European Beech Rivers Purple Beech	'Riversii'	50' x 40' 50' x 40'		No	No	8' x 8'
<i>Ginkgo biloba</i>	Autumn Gold Ginkgo Princeton Sentry Ginkgo	'Autumn Gold' 'Princeton Sentry'	45' x 35' 40' x 15'	Male cultivars only	No	No	8' x 8'
<i>Gleditsia triacanthos var. inermis</i>	Imperial Honeylocust Skyline Honeylocust Sunburst Honeylocust	'Impcole' 'Skycole' 'Suncole'	40' x 35' 45' x 35' 40' x 35'	Thornless varieties only	Ohio	No	8' x 8'
<i>Gymnocladus dioicus</i>	Espresso Coffeetree	'Espresso-JFS'	50' x 35'	Male cultivar, seedless	Ohio	No	8' x 8'
<i>Metasequoia glyptostroboides</i>	Dawn Redwood Gold Rush Dawn Redwood	'Ogon' or 'Gold Rush'	70' x 50' 50' x 20'		No	No	8' x 8'
<i>Platanus x acerifolia</i>	Bloodgood London Planetree Exclamation Planetree Columbia Planetree	'Bloodgood' 'Morton Circle' 'Columbia'	50' x 40' 55' x 35' 50' x 40'	Anthraxnose resistant	No	No	8' x 8'
<i>Quercus alba</i>	White Oak		60' x 60'		Ohio		8' x 8'
<i>Quercus bicolor</i>	Swamp White Oak (Bicolor)		50' x 50'		Ohio	No	8' x 8'
<i>Quercus imbricaria</i>	Shingle Oak		50' x 40'	Needs acidic soils	Ohio	No	8' x 8'
<i>Quercus lyrata</i>	Overcup Oak		50' x 50'	Needs acidic soils	Ohio	No	
<i>Quercus macrocarpa</i>	Bur Oak		50' x 50'		Ohio	No	8' x 8'
<i>Quercus phellos</i>	Willow Oak		50' x 35'	Zone 6	North America	No	8' x 8'
<i>Quercus rubra</i>	Northern Red Oak		75' x 75'		Ohio	No	8' x 8'
<i>Quercus shumardii</i>	Shumard Oak		50' x 45'		Ohio	No	8' x 8'
<i>Taxodium distichum</i>	Bald Cypress Shawnee Brave Bald Cypress	'Mickelson'	60' x 35' 55' x 20'	Columnar	North America	No	8' x 8'
<i>Tilia americana</i>	Boulevard American Linden Redmond Linden (Basswood)	'Boulevard' 'Redmond'	50' x 30' 35' x 25'		Ohio	No	8' x 8'
<i>Tilia cordata</i>	Corinthian Littleleaf Linden Greenspire Littleleaf Linden	'Corzam' 'Greenspire'	45' x 15' 45' x 30'		No	No	8' x 8'
<i>Tilia tomentosa</i>	Green Mountain Silver Linden Sterling Silver Linden	'PNI 6051' 'Sterling'	45' x 35' 45' x 35'		No	No	8' x 8'
<i>Ulmus americana</i>	Jefferson American Elm Valley Forge Am. Elm	'Jefferson' 'Valley Forge'	70' x 50' 70' x 70'		Ohio	No	8' x 8'
<i>Zelkova serrata</i>	Green Vase Japanese Zelkova	'Green Vase'	45' x 30'		No	No	8' x 8'

B.4 Specialty Class

To plant and track wherever site is most conducive. Small class: spacing: 20' between trees, Medium class spacing: 30' between trees, Large class: spacing: 40' between trees.

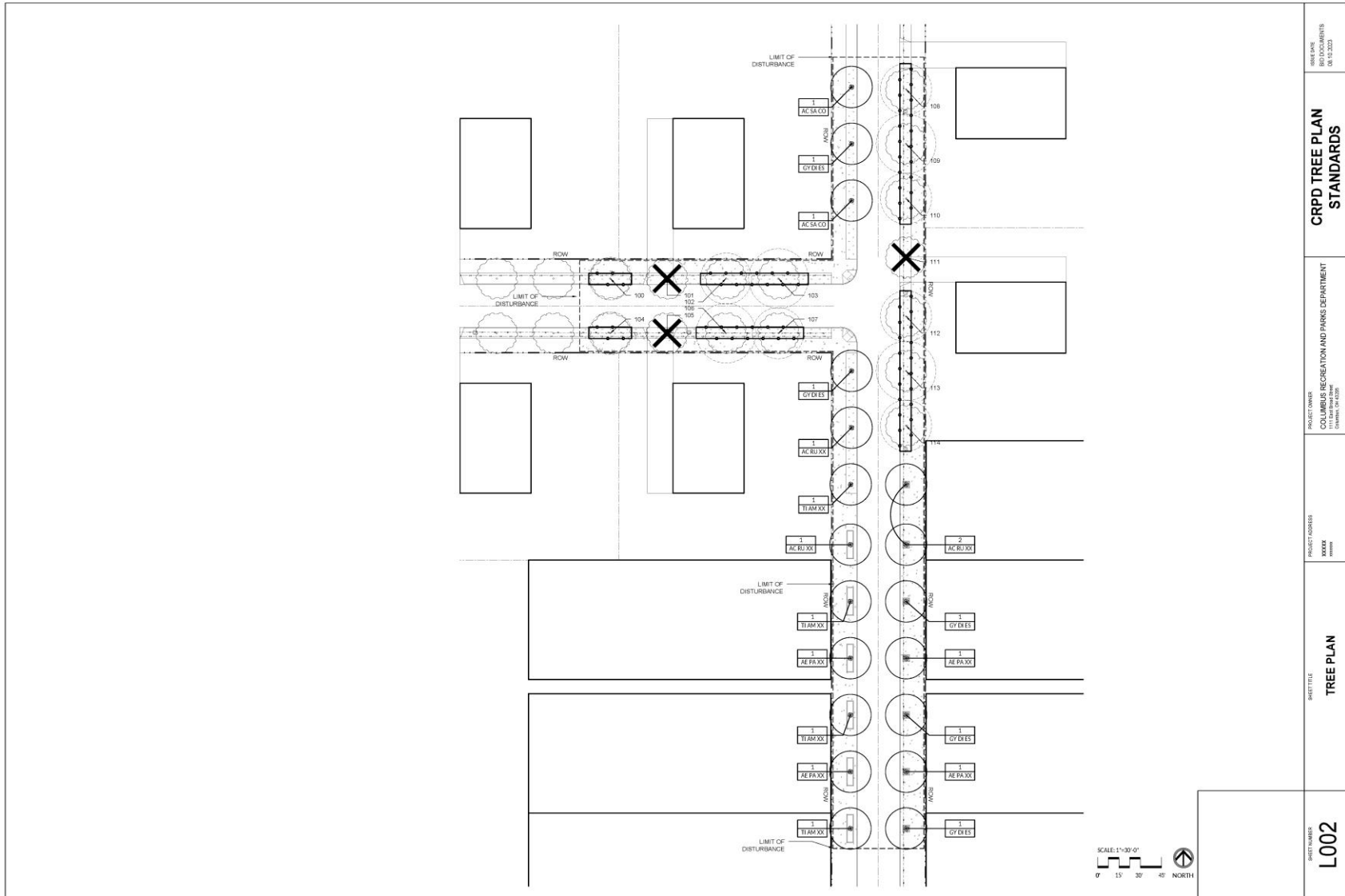
Scientific Name	Trade / Common Name	Cultivar Name(s)	Mature Size (HxW)	Notes	Native	Under Wires	Minimum Tree Lawn Size
<i>Celtis occidentalis</i>	Prairie Sentinel Hackberry	'JFS-KSU1'	45' x 12'	Columnar	Ohio	No	Per City Forester Approval
<i>Eucommia ulmoides</i>	Emerald Pointe Hardy Rubber Tree	'Empozam'	40' x 15'	Columnar	No	No	Per City Forester Approval
<i>Liquidambar styraciflua</i>	Slender Silhouette Sweetgum	'Slender Silhouette'	60' x 8'	Few to no seed pods; very columnar	Ohio	No	Per City Forester Approval
<i>Maclura pomifera</i>	White Shield Osage Orange	'White Shield'	35' x 35'	Male, no fruit or thorns	Ohio	No	Per City Forester Approval
<i>Quercus robur x Q. alba</i>	Skinny Genes hybrid Oak	'JFS-KW2QX'	45' x 10'	Columnar	No	No	Per City Forester Approval
<i>Quercus robur x Q. bicolor</i>	Streetspire hybrid Oak	'JFS-KW1QX'	45' x 14'	Columnar	No	No	Per City Forester Approval
<i>Quercus robur x Q. bicolor</i>	Regal Prince hybrid Oak	'Long'	45' x 8'	Very columnar	No	No	Per City Forester Approval
<i>Quercus robur x Q. bicolor</i>	Kindred Spirit hybrid Oak	'Nadler'	30' x 6'	Very columnar	No	No	Per City Forester Approval
<i>Quercus robur x Q. alba</i>	Crimson Spire hybrid Oak	'Crimsmidt'	45' x 15'	Columnar	No	No	Per City Forester Approval
<i>Quercus bicolor</i>	Beacon Oak	'Bonnie and Mike'	40' x 15'	Columnar	Ohio	No	Per City Forester Approval

B.5 Prohibited and Restricted Species

The following species shall not be planted along the public streets. Columbus Recreation and Parks Forestry Section does not plant any invasive species on the official Ohio Department of Agriculture list and will not approve any public Tree Plantings of invasive trees.

Scientific Name	Trade / Common Name	Cultivar Name(s)	Mature Size (HxW)	Notes	Native	Under Wires	Minimum Tree Lawn Size
<i>Acer negundo</i>	Box Elder		Up to 50' x 40'	Weak structure, invasive tendencies, do not plant	Ohio	No	Do not plant
<i>Acer platanoides</i>	Norway Maple		Up to 60' x 40'	Do not plant	No; Invasive, do not plant	-	Do not plant
<i>Acer saccharinum</i>	Silver maple		Up to 80' x 50'	Weak structure, do not plant in ROW's or near structures and hard surfaces (aggressive roots)	Ohio	No	Requires extra large space, without active recreation, buildings or hard surfaces near
<i>Ailanthus altissima</i>	Tree of Heaven		Up to 75' x 50'	Weak structure, invasive	No	No	Do not plant
<i>Asimina triloba</i>	Paw Paw		Up to 20' x 20'	Do not plant on ROW's, for parks, colonizer for natural areas	Ohio	Yes	4' x 4' is a minimum
<i>Carya illinoensis</i>	Northern Pecan		Up to 100'x 70'or more	Do not plant on ROW's or near buildings, park use ok.	North America	No	
<i>Catalpa speciosa</i>	Northern Catalpa		Up to 60' x 40'	Do not plant on ROW's or near buildings, Park use ok.	Ohio	No	
<i>Diospyros virginiana</i>	Persimmon		50' x 30'	Do not plant on ROW's, colonizer for natural areas	Ohio	No	
<i>Fraxinus spp.</i>	Ash		Up to 80' x 50'	If EAB resistant hybrid is found; do not plant without City Forester permission	Most Ohio; some exotic	No	8'x8' is a minimum
<i>Ginkgo biloba</i>	Ginkgo (female)		Up to 50' x 35'	Do not plant	No	No	Do not plant

<i>Juglans nigra</i>	Black Walnut		Up to 100' x 80', but normal is 70' x 60'	Do not plant on ROW's or near buildings, park use ok.	Ohio	No	
<i>Liquidambar styraciflua</i>	Sweet Gum		Up to 60'	Do not plant on ROW's or near hard surfaces, unless fruitless, and tree lawn is at least 8'x8' (aggressive roots)	Ohio	No	8'x8' is a minimum
<i>Maclura pomifera</i>	Osage Orange		Up to 40' x 40'	Do not plant on ROW or near buildings (fruit)	Ohio	No	
<i>Morus alba</i>	White Mulberry		Up to 30' x 45'	Weak structure, invasive tendencies	No	No	Do not plant
<i>Morus rubra</i>	Red Mulberry		45' x 40'	Fruit issues, weak	Ohio	No	Do not plant
<i>Malus</i>	Apple	Edible fruit bearing varieties	Up to 25' x 25'	Do not plant on ROW's, for parks, requires City Forester permission only	Depends on variety	Yes	
<i>Pyrus</i>	Pear	Edible fruit bearing varieties	Up to 20' x 20'	Do not plant on ROW's, for parks, requires City Forester permission only	No	<i>Populus</i>	Poplars (Cottonwood)
<i>Pyrus calleryana</i>	Callery Pear	All cultivars	Up to 45'	Do not plant	No; Invasive, do not plant	-	Do not plant
<i>Prunus</i>	Peach	Edible fruit bearing varieties	Up to 25' x 20'	Do not plant on ROW's, for parks, requires City Forester permission only	No	Yes	
<i>Quercus acutissima</i>	Sawtooth Oak		Up to 45' x 50'	Do not plant on ROW's, messy fruit – and on watch list	No	No	8' x 8' is a minimum
<i>Salix sp</i>	Willow		Up to 70' x 70'	Aggressive roots, vision obstruction, special purpose trees	Some species are, some are not	No	
<i>Ulmus pumila</i>	Siberian elm		Up to 70' x 50'	Invasive; weak	No	No	Do not plant



DATE: 08/10/2020
 TIME: 10:00:00

CRPD TREE PLAN STANDARDS

PROJECT OWNER:
 COLUMBUS RECREATION AND PARKS DEPARTMENT
 COLUMBUS, OH 43229

PROJECT ADDRESS:
 XXXX
 XXXXX

TREE PLAN

SHEET NUMBER:
L002

EXISTING TREE DATA TABLE											
TAG NUMBER	ID NUMBER	BOTANICAL NAME	COMMON NAME	DBH (Diameter at Stand Height)	CONDITION	CRITICAL ROOT ZONE (RADIUS)	ACTION	MITIGATION REQUIRED (Y/N)	OTHER NOTES (Reason for Removal)	PROTECTION MEASURES	
Protected Trees											
100	###	Acer rubrum	Red Maple	10"	FAIR	15'-0"	DO NOT DISTURB	N		FENCING	
102	###	Quercus alba	White Oak	12"	GOOD	18'-0"	DO NOT DISTURB	N		FENCING	
103	###	Quercus alba	White Oak	14"	GOOD	21'-0"	DO NOT DISTURB	N		FENCING	
104	###	Quercus alba	White Oak	10"	POOR	15'-0"	DO NOT DISTURB	N		FENCING	
106	###	Pinus strobus	White Pine	14"	GOOD	21'-0"	DO NOT DISTURB	N		FENCING	
107	###	Pinus strobus	White Pine	12"	POOR	18'-0"	DO NOT DISTURB	N		FENCING	
108	###	Pinus strobus	White Pine	12"	GOOD	18'-0"	DO NOT DISTURB	N		FENCING	
109	###	Pinus strobus	White Pine	14"	GOOD	21'-0"	DO NOT DISTURB	N		FENCING	
110	###	Quercus alba	White Oak	12"	POOR	18'-0"	DO NOT DISTURB	N		FENCING	
112	###	Acer rubrum	Red Maple	12"	GOOD	18'-0"	DO NOT DISTURB	N		FENCING	
113	###	Acer rubrum	Red Maple	14"	GOOD	21'-0"	DO NOT DISTURB	N		FENCING	
114	###	Quercus rubrum	Red Oak	12"	POOR	18'-0"	DO NOT DISTURB	N		FENCING	
Removed Trees											
101	###	Acer rubrum	Red Maple	8"	DEAD	12'-0"	TO BE REMOVED	N	DEAD, DRIVEWAY INTERFERENCE		
105	###	Quercus alba	White Oak	8"	FAIR	12'-0"	TO BE REMOVED	Y	DRIVEWAY INTERFERENCE		
111	###	Quercus alba	White Oak	8"	POOR	12'-0"	TO BE REMOVED	Y	DRIVEWAY INTERFERENCE		
ITEM 1 - TOTAL REMOVED INCHES:				24"							
ITEM 2 - NUMBER OR TREES REPLANTED:				53"							
TREE FUND PAYMENT (Item 1 - Item2) \$260:				50							

PROPOSED TREE DATA TABLE						
KEY	QTY	SIZE	BOTANICAL NAME	COMMON NAME	STOCK	TOTAL INCHES
TREES						
AC SA CO	2	3" CALIPER	ACER SACCHARUM 'COMMEMORATION'	COMMEMORATION SUGAR MAPLE	B&B	6"
QY DI ES	5	3" CALIPER	GYMNOCALADUS DIOICUS 'ESPRESSO'	ESPRESSO KENTUCKY COFFEETREE	B&B	15"
AC RU XX	4	3" CALIPER	ACER RUBRUM	RED MAPLE	B&B	12"
TI AM XX	4	3" CALIPER	TIJA AMERICANA	AMERICAN LINDEN	B&B	12"
AE PA XX	4	2" CALIPER	AESCULUS PAVIA	RED BUCKEYE	B&B	8"
TOTAL:	19					INCHES REQUIRED: 24"
						INCHES PROVIDED: 53"

ISSUE DATE
B&B DOCUMENTS
08.10.2023

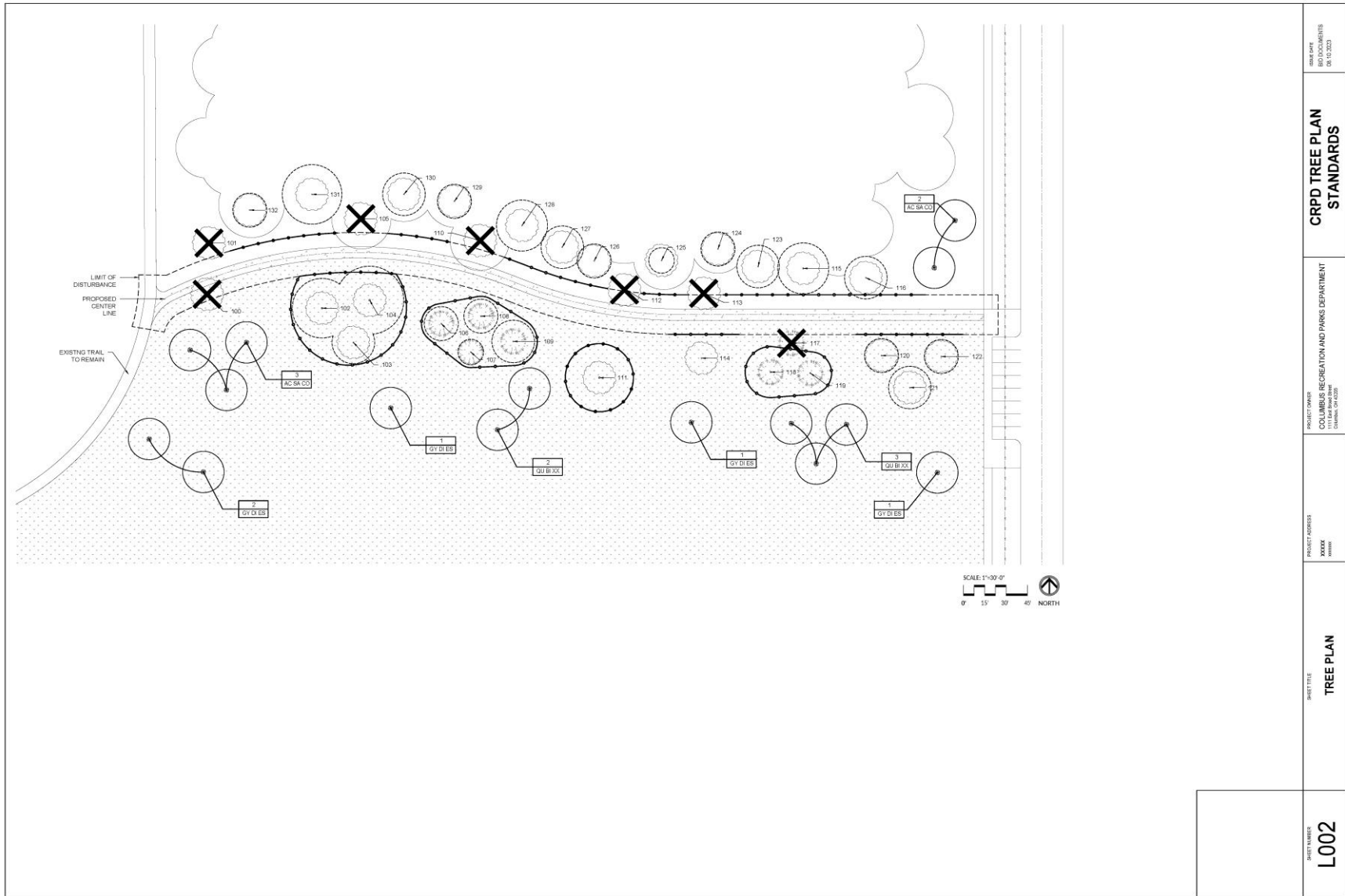
**CRPD TREE PLAN
STANDARDS**

PROJECT OWNER
COLUMBUS RECREATION AND PARKS DEPARTMENT
1111 East Broad Street
Columbus, GA 31906

PROJECT ADDRESS
XXXXX
XXXXXX

TREE DATA TABLE

SHEET NUMBER
L001



SHEET NUMBER L002	SHEET TITLE TREE PLAN	PROJECT ADDRESS XXXXX XXXXX	PROJECT OWNER COLUMBUS RECREATION AND PARKS DEPARTMENT COLUMBUS, OH 43208	CRPD TREE PLAN STANDARDS SHEET NUMBER OF SHEETS 02 OF 02
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EXISTING TREE DATA TABLE											
TAG NUMBER	ID NUMBER	BOTANICAL NAME	COMMON NAME	DBH (Diameter at Standard Height)	CONDITION	CRITICAL ROOT ZONE (Radius)	ACTION	MITIGATION REQUIRED (Y/N)	OTHER NOTES (Reason for Removal)	PROTECTION MEASURES	
Protected Trees											
102	###	Quercus alba	White Oak	14"	GOOD	21'	DO NOT DISTURB	N		FENCING	
103	###	Quercus alba	White Oak	15"	GOOD	15'	DO NOT DISTURB	N		FENCING	
104	###	Quercus alba	White Oak	18"	POOR	24'	DO NOT DISTURB	N		FENCING	
106	###	Pinus strobus	White Pine	8"	GOOD	12'	DO NOT DISTURB	N		FENCING	
107	###	Pinus strobus	White Pine	8"	POOR	9'	DO NOT DISTURB	N		FENCING	
108	###	Pinus strobus	White Pine	8"	GOOD	12'	DO NOT DISTURB	N		FENCING	
109	###	Pinus strobus	White Pine	10"	GOOD	16'	DO NOT DISTURB	N		FENCING	
111	###	Quercus alba	White Oak	18"	FAIR	24'	DO NOT DISTURB	N		FENCING	
114	###	Quercus rubrum	Red Oak	10"	POOR	15'	DO NOT DISTURB	N		FENCING	
115	###	Quercus rubrum	Red Oak	12"	FAIR	18'	DO NOT DISTURB	N		FENCING	
118	###	Quercus alba	White Oak	14"	GOOD	21'	DO NOT DISTURB	N		FENCING	
119	###	Pinus strobus	White Pine	8"	POOR	12'	DO NOT DISTURB	N		FENCING	
119	###	Pinus strobus	White Pine	12"	FAIR	18'	DO NOT DISTURB	N		FENCING	
120	###	Acer rubrum	Red Maple	10"	GOOD	15'	DO NOT DISTURB	N		FENCING	
121	###	Acer rubrum	Red Maple	8"	POOR	12'	DO NOT DISTURB	N		FENCING	
122	###	Acer rubrum	Red Maple	10"	GOOD	15'	DO NOT DISTURB	N		FENCING	
123	###	Acer rubrum	Red Maple	8"	GOOD	12'	DO NOT DISTURB	N		FENCING	
124	###	Ulmus americana	American Elm	8"	GOOD	12'	DO NOT DISTURB	N		FENCING	
125	###	Ulmus americana	American Elm	6"	GOOD	9'	DO NOT DISTURB	N		FENCING	
126	###	Acer rubrum	Red Maple	8"	FAIR	12'	DO NOT DISTURB	N		FENCING	
127	###	Quercus rubrum	Red Oak	10"	GOOD	15'	DO NOT DISTURB	N		FENCING	
128	###	Quercus rubrum	Red Oak	12"	FAIR	18'	DO NOT DISTURB	N		FENCING	
129	###	Quercus alba	White Oak	8"	GOOD	12'	DO NOT DISTURB	N		FENCING	
130	###	Quercus alba	White Oak	10"	GOOD	15'	DO NOT DISTURB	N		FENCING	
131	###	Ulmus americana	American Elm	14"	FAIR	21'	DO NOT DISTURB	N		FENCING	
132	###	Acer rubrum	Red Maple	8"	FAIR	12'	DO NOT DISTURB	N		FENCING	
Removed Trees											
100	###	Acer rubrum	Red Maple	8"	POOR	12'	TO BE REMOVED	Y	Less than fair condition and path interference		
101	###	Acer rubrum	Red Maple	8"	DEAD	9'	TO BE REMOVED	Y	Dead Tree and path interference		
105	###	Quercus alba	White Oak	6"	FAIR	9'	TO BE REMOVED	Y	Path interference		
110	###	Quercus alba	White Oak	8"	POOR	12'	TO BE REMOVED	Y	Less than fair condition and path interference		
112	###	Acer rubrum	Red Maple	6"	GOOD	9'	TO BE REMOVED	Y	Path interference		
113	###	Acer rubrum	Red Maple	8"	GOOD	12'	TO BE REMOVED	Y	Less than fair condition and path interference		
117	###	Acer rubrum	Tree of Heaven	10"	GOOD	15'	TO BE REMOVED	N	Invasive, path interference		
ITEM 1 - TOTAL REMOVED INCHES:				42"							
ITEM 2 - NUMBER OR TREES REPLANTED:				40"							
TREE FUND PAYMENT (Item 1 - Item2)*\$260:				\$620							

PROPOSED TREE DATA TABLE						
KEY	QTY	SIZE	BOTANICAL NAME	COMMON NAME	STOCK	TOTAL INCHES
TREES						
AC SA CD	5	3" CALIPER	m	COMMEMORATION SUGAR MAPLE	B&B	15"
GY DI EB	5	3" CALIPER	GYMNOCALADUS DIDIOLUS 'ESPRESSO'	ESPRESSO KENTUCKY COFFEE TREE	B&B	15"
QU BI XX	5	2" CALIPER	QUERCUS BICOLOR	SWAMP WHITE OAK	B&B	10"
TOTAL:	15					42"
					INCHES REQUIRED:	42"
					INCHES PROVIDED:	40"

SHEET DATE: 08/11/2020
 PROJECT OWNER: COLUMBUS RECREATION AND PARKS DEPARTMENT
 PROJECT ADDRESS: XXXXX
 SHEET TITLE: TREE DATA TABLE
 SHEET NUMBER: L001

Appendix D. Tree Protection Signage Example

The following shows an example of tree protection signage, referenced in Section 4.4.a.



Appendix E. Tree Valuation Formulas

The primary method of mitigation calculation is \$260/inch. However, Forestry has the ability to appraise trees instead of the fee-in-lieu. A Tree Plan preparer may request an appraisal, but it is up to the discretion of Forestry. If a tree appraisal is conducted, the City Forester will use one of the two methods below, based on each unique situation.

E.1 Cost Approach - Trunk Formula Technique

The Trunk Formula Technique appraises larger trees in the landscape within the Cost Approach. Used by professional appraisers, this technique extrapolates costs to purchase the largest commonly available nursery tree relative to the size of the appraised tree. The form used by city arborists is below, from the latest edition of the *Guide for Plant appraisal* released by the Council of Tree and Landscape Appraisers.

Reproduction Method Trunk Formula Technique

Client name _____	Date _____	Case # _____
Phone _____	E-mail _____	
Address _____		
Subject tree		
Species _____		
1. Trunk diameter* (D) _____ @ _____		
2. Cross-sectional area (line 1) ² × 0.7854	_____	in ²
3. Condition rating	_____	%
Health _____		
Structure _____		
Form _____		
4. Functional limitations _____		%
5. External limitations _____		%
Replacement tree		
Species _____		
6. Trunk diameter* (D) _____ @ _____		
7. Cross-sectional area (line 6) ² × 0.7854	_____	in ²
8. Replacement tree cost Source: _____	_____	\$
Calculations		
9. Unit tree cost (line 8 / line 7 or RPAC)	_____	\$
10. Basic reproduction cost (line 2 × line 9)	_____	\$
11. Depreciated reproduction cost [^] (line 10 × line 3 × line 4 × line 5)	_____	\$
Additional costs		
Cleanup _____	_____	\$
Replacement tree installation _____	_____	\$
Aftercare _____	_____	\$
12. Total additional costs	_____	\$
13. Total reproduction cost (line 11 + line 12)	_____	\$
14. Rounded	_____	\$

* Diameter and cross-sectional area may be replaced with plant area, volume, or height as appropriate.
[^] Apply depreciation if it is appropriate for the assignment.

E.2 Sales Comparison Approach – Market Value

The Market Value approach is used to compare the value of a damaged or destroyed property to similar properties, also referred to as the Sales Comparison Approach. The courts often consider this the most reliable estimate of the real value of property because it is based on what someone else was willing to pay for a similar property.

No two properties are ever exactly identical so adjustments are allowed with the market approach. This method uses property sales to compare the estimated contribution that plants and landscapes make to the actual value of property. Because of the complexity of this approach it should only be considered with the assistance of qualified, licensed real estate appraisers.

Appendix F. References to Construction & Materials Specifications.

The below items from the City of Columbus Construction & Materials Specifications are relevant to projects with public trees in the work limits.

<https://www.columbus.gov/utilities/contractors/Construction---Materials-Specifications/>

101.3 Definitions

105.11 Inspection of Work

107.11 Protection and Restoration of Property

107.12 Contractor's Use of the Project Right-of-Way or other City-owned Property

201 Clearing and Grubbing

655 Tree Protection

656 Public Tree Removal

657 Tree Well Construction

661 Planting Trees, Shrubs, and Vines

666 Pruning Existing Trees

Appendix G: Sidewalk Tools, Strategies, and Alternatives for Consideration

The below are intended to be a resource for project owners in the City. The items in this appendix are not required to be implemented.

G.1. Sidewalk Design

Full Sidewalk

Full sidewalks extend from the back of the curb to the edge of the right-of-way. Tree pits should be installed whenever possible on full sidewalks (Figure G1).



Figure G1. Full Sidewalks.

Photo Credit: Eric Fischer

([https://commons.wikimedia.org/wiki/File:Fence_and_trees_\(37977120831\).jpg](https://commons.wikimedia.org/wiki/File:Fence_and_trees_(37977120831).jpg)),

Tree Well/Pit

An area within a full sidewalk where the pavement has been removed to accommodate tree planting. (Figure G2).



Figure G2. Tree Pit/Well.

Photo Credit: Wll540, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

Full URL https://commons.wikimedia.org/wiki/File:06_19_2022_tree_pit_on_Park_Ave.jpg

Tree grates

Tree grates, often constructed of metal, are installed to cover the tree well and allow pedestrian access through the space (Figure G3).



Figure G3. Tree grate.

Photo Credit: Eric Fischer

([https://commons.wikimedia.org/wiki/File:Double_tree_grate_\(41077871680\).jpg](https://commons.wikimedia.org/wiki/File:Double_tree_grate_(41077871680).jpg))

Contiguous Open Tree and Landscape Beds

Contiguous tree and landscape beds are connected and have exposed soil and mulch that can help provide adequate soil volume and space for trees to grow (Figure G4). These planting beds can be curbed or at grade; curbed beds can provide some protection from snow and ice melting products and other elements that may damage trees.



Figure G4. Contiguous Open Tree & Landscape Bed

Photo: sfbetterstreets.org

Continuous Tree Lawns

A strip of grass or vegetation between the sidewalk and street, which features trees (Figure G5). To support tree planting in Columbus, the tree lawn must be a minimum of 4-foot wide.



Figure G5. Continuous Tree Lawns.

Photo Credit: Nyttend, Public domain, via Wikimedia Commons

Full URL:

(https://commons.wikimedia.org/wiki/File:Republic_offices_in_Columbus,_trees_along_sidewalk.jpg)

Bump Outs

A landscape bump-out/curb extension is a vegetated area that extends into the street, to provide a growing space for trees and plants (Figure G5). These spaces can be used to beautify a streetscape while providing greater stormwater retention and slowing traffic at the bump-out location. Bump outs should be marked in a way to alert drivers of vehicles and snow plows of its presence.



Figure G5. Bump out.

Photo Credit: Mds08011

(https://commons.wikimedia.org/wiki/File:Stormwater_planter_San_Diego.jpg),

Meandering/Reroute Sidewalk

A meandering sidewalk is strategically curved to provide more space between the tree and sidewalk (Figure G6).



Figure G6: Meandering sidewalk.
Photo Credit: Payton Chung from DCA, USA
([https://commons.wikimedia.org/wiki/File:Meander_\(2285176783\).jpg](https://commons.wikimedia.org/wiki/File:Meander_(2285176783).jpg))

Bridging

Bridging sidewalks over roots facilitates root growth by raising the sidewalk with concrete piers or a base layer for support (Figure G7).



Figure G7. Sidewalk bridging over tree roots.
Photo: Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida

Permanent planter

Decorative planters are containers of varying shapes and sizes that allow for trees and other vegetation to be planted on sites that cannot support trees in-ground (Figure G8). Planters must provide adequate soil volume for the root growth of a small tree species. Soil is the key buffering agent in insulating the trees' roots against winter temperatures, therefore the largest possible planter option should be considered.

Tree species will experience a wider range of temperature extremes being in above ground planters. Therefore, species selected for planters should be one-to-two USDA zones hardier (for Columbus, that would be hardiness zones 4 or 5) to increase winter survival potential. Selected species should also be tolerant of drought and restricted or limited soil volume.



Figure G8. Permanent tree planter
Source: New York City DOT - Street Design Manual
<https://www.nycstreetdesign.info/furniture/planter>

G.2. Soil Engineering & Alternative Materials

Soil Cell Systems

Soil cells are engineered systems that help transfer the weight and force of a sidewalk while creating areas of uncompacted soils for tree root growth (Figure G9). The cell systems can be interlocked (depending on manufacturer) and expanded to meet the specific needs of the project. To install soil cells, existing soils are excavated to the desired depth, the area is then compacted, and the soil cell units are installed, filled with uncompacted soil, and topped with the desired hardscape or pavement material. Due to the amount of excavation needed in order to make room for this system, soil cells are best suited for new construction areas or for areas where existing trees will not be impacted. Soil cells provide the greatest amount of un-compacted soil volume. Examples of soil cell systems include Silva Cells and Stratavault Soil Cells.



Figure G9. Stratavault Soil Cells. Photo: CityGreen.com

Pavement Suspension Systems

Pavement suspension systems were originally designed to suspend hardscape and pavement on soils that lacked the structural cohesion and qualities to support it. One adaptive and beneficial use for trees is in construction of new or expansion of roadways, walkways, and other pavement areas where trees currently exist. Instead of excavating areas to install beds of compaction-suitable material, pilings are driven in a systematic grid and topped with formwork where the desired pavement is installed. The pilings transfer the weight of the pavement down into the ground similar to piling foundations in building construction. The benefit of the system is that the pilings are driven into the ground with minimal disruption to existing tree root systems. An example of this system is the Cupolex system.



Figure G10. Cupolex Pavement Suspension System. Photo: Pontarolo Engineering

Structural Soil

Structural soils are a specific, usually patented, soil mix that combines clay loam soil with various sized crushed stones (aggregates) and a hydrogel (binding agent), that can be compacted under pavement to give structural support. The aggregates allow for compaction of the structural soil, while creating gaps between the aggregate material for the clay loam soil and tree roots to grow. While it does not create the most optimum conditions for tree growth (when compared to soil cells), structural soils are best suited for compacted areas beneath hardscape improvements that are completely surrounded by large amounts of un-compacted soils and pervious areas. An example of a structural soil manufacturer/provider is the patented structural soil mix patented by Cornell University, termed CU-Structural Soil.

Pervious concrete

Mixture of cement, coarse aggregate, and water, using little or no fine aggregate to leave voids that allow water to pass through.

Permeable interlocking concrete pavers

Pavers with voids at the joints that create openings for water to pass through (Figures G11 and G12).

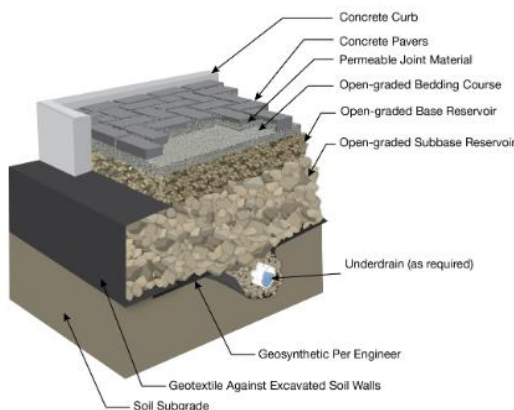


Figure G11. Permeable concrete paver detail
Photo: Portland Cement Association



Figure G12. Permeable Pavers around trees, Hoboken, NJ
Photo: Bruce Ferguson
https://wiki.sustainabletechnologies.ca/wiki/Permeable_pavements

Rubber/non-concrete sidewalks

Recycled materials can be used to accommodate tree root growth, frost heave, and foot and vehicular traffic without damage (Figure G13). Santa Monica, CA uses pervious and flexible rubber pavement produced from recycled tires for an ADA compliant walking surface over tree roots that have previously caused sidewalk damage.



Figure G13. Rubber sidewalk near tree. Source: Rubberway (rubberway.com)

G.3. Remedial Strategies to Address Existing Sidewalk Damage

Although proper planning is the key to avoiding sidewalk conflicts, there are methods of remediation that can be used to mitigate existing issues.

Bridging

Raising the sidewalk with concrete piers or a base layer for support – see Section H.1.

Ramping

Adding asphalt, concrete, or an alternative material to smoothly join the lifted sidewalk with the original grade (Figure G14).

Grinding

Grinding down the edges of a sidewalk to lessen a lift.

Jacking up

Pumping grout into a sidewalk's sub-base can create a smooth transition between edges.

Expanding tree pits

Removing damaged sidewalk and increasing soil volume for the tree's roots to grow.

Tree Removal

Removing a tree causing sidewalk damage should always be considered the last possible option and should be weighed against the current condition of the tree, the value/benefit it provides to the community, the cost of remediation, and the view/opinion of adjacent property owners. See Appendix A for more on evaluation criteria for tree removal.



Figure G14. Ramping. Photo: Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida

G.4. Preventative Strategies to Avoid Sidewalk Damage

Strategic sidewalk design along with the use of engineered soils and alternate materials should be coupled with simple planning approaches – most of which have little or no associated costs.

Choosing appropriate species

Some species have more aggressive root systems than others. Choosing the appropriate species based on the site conditions and available space can help reduce hardscape conflicts.

Root barriers

Root barriers can be used alongside hardscapes to deflect roots and direct them to grow deeper into the soil. They are made from plastic, fabric, or any impermeable durable material that can withstand burial in soil for an extended period of time; materials are sometimes infused with herbicides. Root barriers must be at least 18” deep, and the top must be above soil grade to be effective. In compacted soils, and soils with a high water table, roots may grow under the barrier and up the other side, but in well-drained soil, roots may remain at deeper depths longer.

Setback plantings

Setback trees are planted beyond the public Right of Way (BROW) on private property. BROW plantings may be the best or only option depending on the sidewalk or site’s condition. This approach requires coordination with property owners, as the City only performs work within the public ROW.

Incentives for private property

Providing an option for residents to plant a tree on their property for a subsidized, low, or no cost may increase their level of participation.

G.5 Using an Air Spade

Air spading is a method used in arboriculture to excavate soil around a tree without damaging its roots. The process uses compressed air to break up and remove soil, allowing arborists, landscapers, or other professionals to access the tree's root system without the risk of cutting or tearing the roots, as might happen with traditional digging tools. An air spade is a specialized tool that directs a high-velocity stream of air into the soil. It looks somewhat like a large, metal wand connected to a compressor.

Examples of when and air spade may be used:

- **Soil Excavation:** The air spade is used to blow soil away from the roots, breaking up compacted soil without harming the delicate root structures.
- **Root Inspection:** Air spading is often used when there's a need to inspect a tree's roots for disease, damage, or other issues. By removing the soil, arborists can get a clear view of the root system.

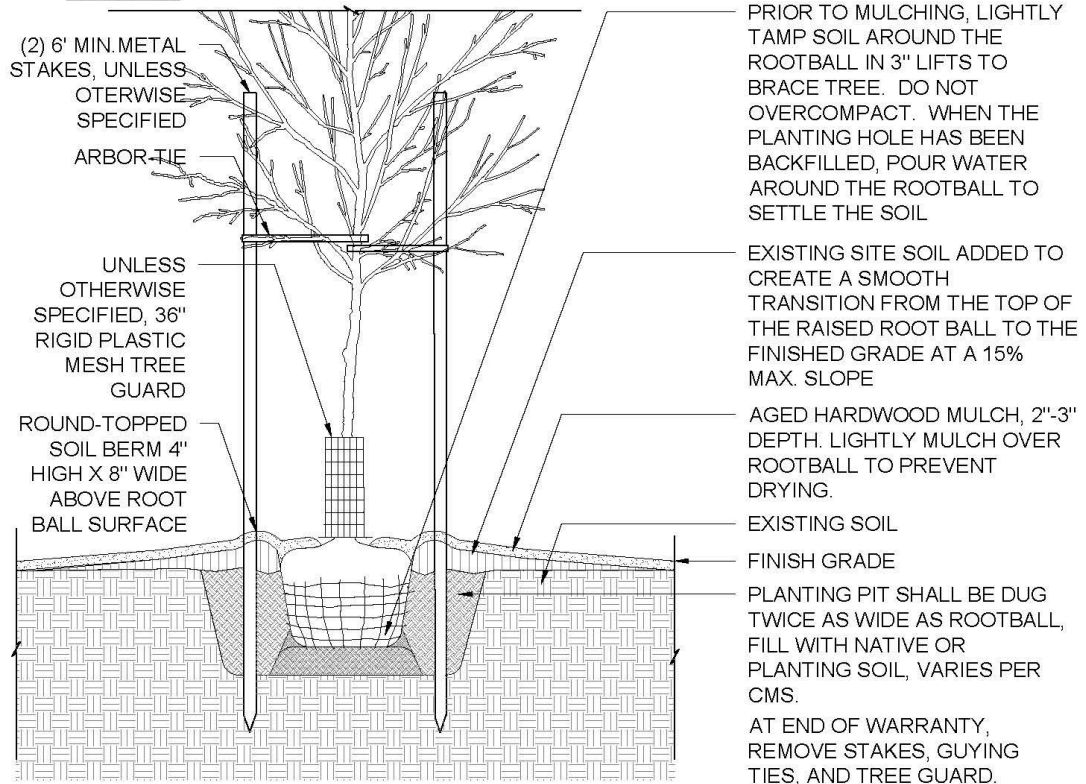
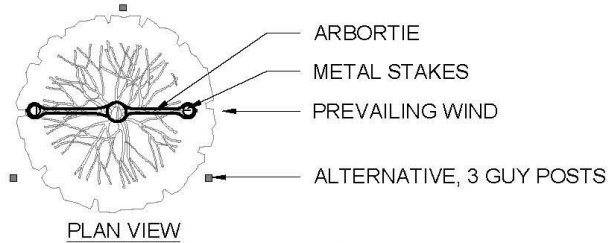
- **Root Pruning:** If damaged or diseased roots are found, they can be pruned without further excavation. The air spade allows for precise access.
- **Soil Aeration:** Compacted soil can be detrimental to tree health, limiting access to water, nutrients, and oxygen. Air spading can break up compacted soil, improving conditions for the tree.
- **Transplanting:** If a tree needs to be moved, air spading can be used to free the root system with minimal damage, making transplantation more successful.
- **Adding Soil Amendments:** After inspecting and possibly pruning the roots, soil amendments can be added to improve soil quality, and then the soil can be replaced.
- **Utility Work:** Sometimes, air spading is used in urban environments to access utilities that are near trees, allowing workers to reach pipes or cables without damaging nearby trees.

Air spading is considered a best practice in situations where root access is needed, as it minimizes stress and damage to the tree. The use of an air spade requires specialized equipment and professional expertise, and is typically done by trained arborists or other tree care professionals.

Appendix H: Standard Drawings

GENERAL NOTES:

1. REMOVE DEAD AND BROKEN BRANCHES AND ALL SUCKER GROWTH. DO NOT DAMAGE OR REMOVE CENTRAL LEADER.
2. THE TYPE OF TREES TO BE USED SHALL BE SELECTED FROM AN APPROVED LIST PROVIDED BY THE CITY, REFERENCE TREE MANUAL.



1 TREE PLANTING

SECTION

NTS

STANDARD DRAWINGS



PLANTING

DRAFT
TREE PLANTING

DATE DRAWN

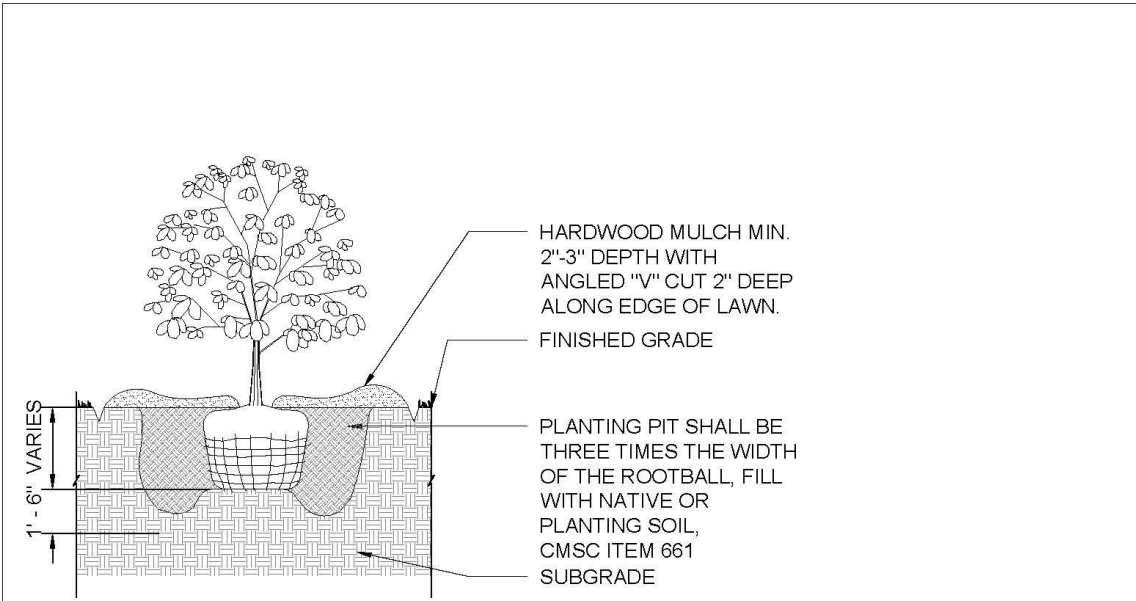
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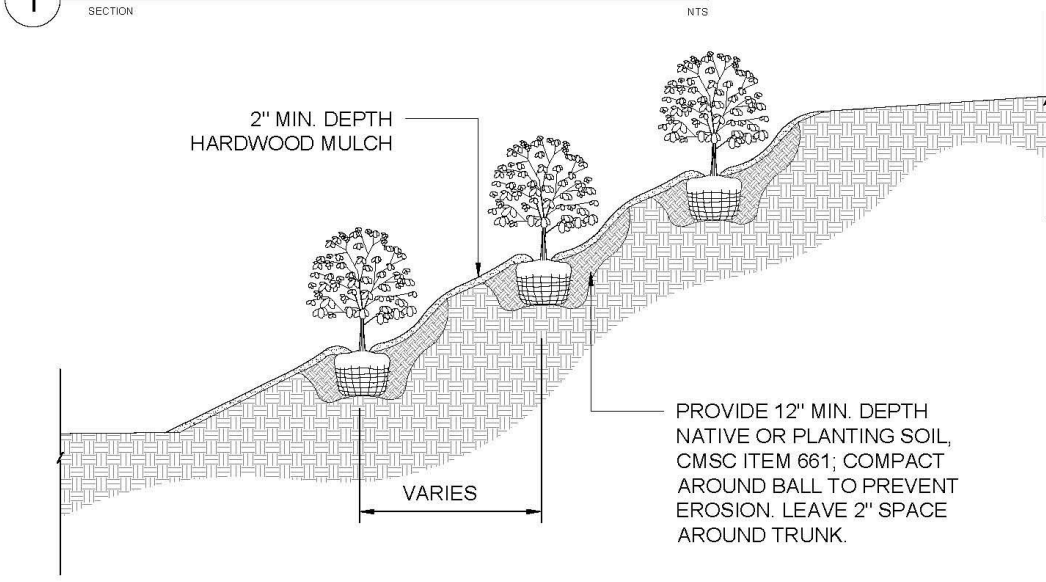
1 OF 1

STANDARD DRAWING

600-601



1 SHRUB PLANTING

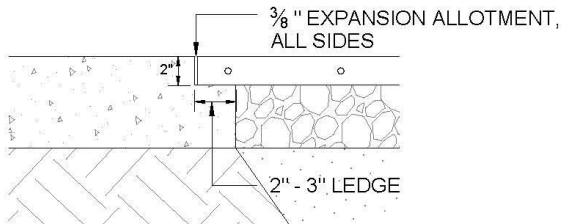


2 SLOPED SHRUB PLANTING

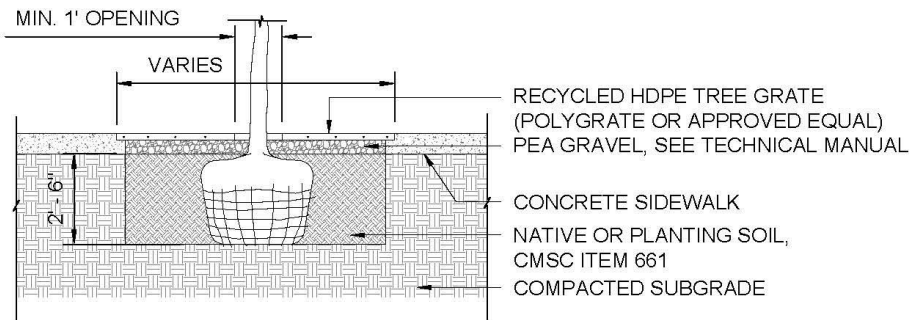
STANDARD DRAWINGS  THE CITY OF COLUMBUS RECREATION AND PARKS	PLANTING DRAFT SHRUB PLANTING	DATE DRAWN	SHEET
		08/2023	1 OF 1
		STANDARD DRAWING	
		600-602	

GENERAL NOTES:

1. ALTERNATIVES FROM THE POLYGRATE MUST BE APPROVED BY COLUMBUS RECREATION AND PARKS FORESTRY DEPARTMENT.
2. FOLLOW MANUFACTURER'S SPECIFICATIONS FOR INSTALLATION. GRATE HALVES SHALL BE BOLTED TOGETHER WITH TAMPER RESISTANT BOLTS.
3. CONCRETE LEDGE SHALL BE CAST IN SIZE AND CONFIGURATION OF SPECIFIED TREE GRATE MODEL PLUS $\frac{3}{8}$ " EXPANSION ALLOTMENT. LEDGE SHALL BE 2 INCHES BELOW CONCRETE OR TILED SURFACE AND EXTEND INWARD 2 TO 3 INCHES. LEDGE MUST BE LEVEL AND FREE OF BULGES AND SLAG.
4. RECYCLED HDPE TREE GRATE SHALL BE BLACK.
5. RECYCLED HDPE TREE GRATE SHALL BE ASSEMBLED WITH TAMPER-RESISTANT BOLTS.
6. SUPPLY TO CRPD 1 REMOVAL/INSTALLATION TOOL FOR TAMPER RESISTANT BOLTS PER 6 TREE GRATES.
7. SUPPLY TO COLUMBUS RECREATION AND PARKS 1 EXTRA COMPLETE SET OF MATCHING TREE GRATES PER SIZE INSTALLED, PER EVERY 8 SETS, MINIMUM 1 SET.



1 TREE GRATE ENLARGEMENT
SECTION NTS

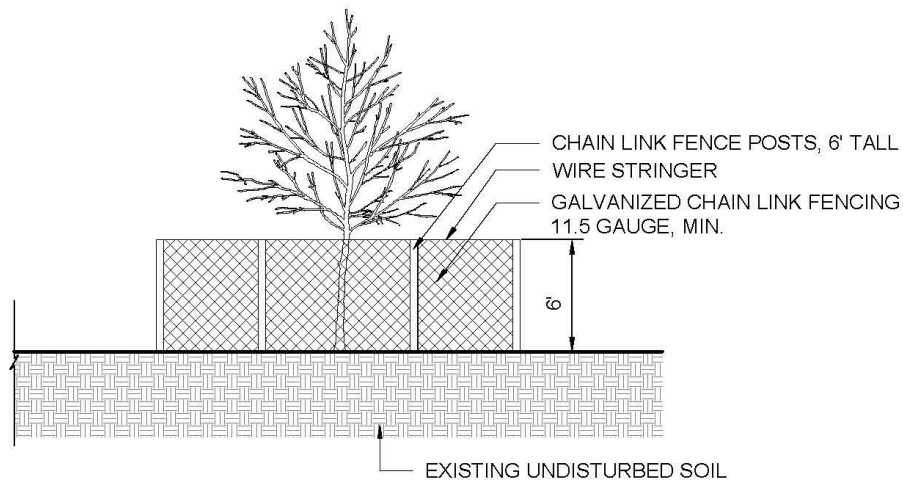
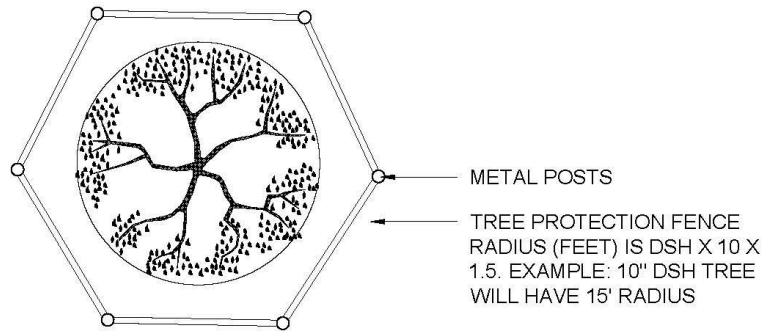


2 TREE GRATE PLANTING
SECTION NTS

STANDARD DRAWINGS  THE CITY OF COLUMBUS RECREATION AND PARKS	PLANTING DRAFT TREE GRATE	DATE DRAWN 08/2023	SHEET 1 OF 1
		STANDARD DRAWING 600-603	

GENERAL NOTES:

1. FOR GROUPS OF TREES PLACE BARRICADES BETWEEN TREES AND CONSTRUCTION ACTIVITY AT THE EDGE OF THE TREES CRITICAL ROOT ZONE.
2. TREE PROTECTION IS REQUIRED WHEN CONSTRUCTION ACTIVITY ENCLOSES ON THE CRITICAL ROOT ZONE OF A TREE.
3. SEE COLUMBUS TREE TECHNICAL MANUAL FOR ADDITIONAL TREE PROTECTION REQUIREMENTS.



1 TREE PROTECTION
SECTION

NTS

STANDARD DRAWINGS
 THE CITY OF COLUMBUS
 RECREATION AND PARKS

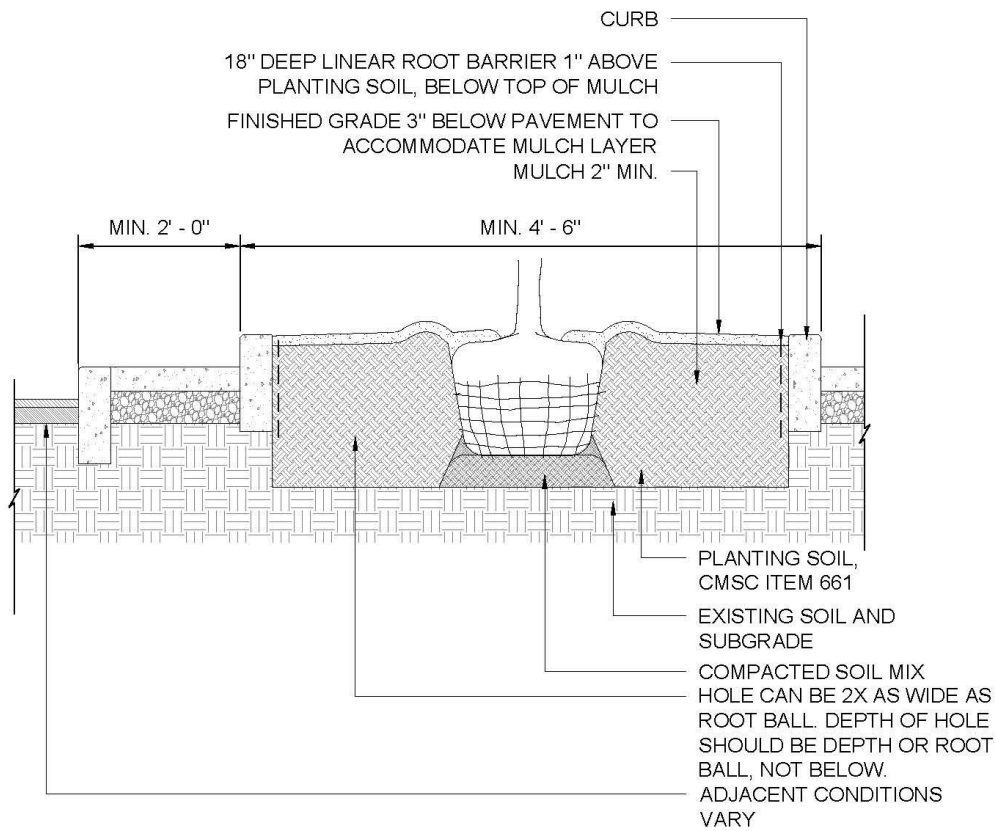
PLANTING **DRAFT**
TREE PROTECTION

DATE DRAWN
 08/2023

SHEET
 1 OF 1

STANDARD DRAWING

600-604



1 CURBED PLANTER PLANTING

SECTION

NTS

STANDARD DRAWINGS
 THE CITY OF COLUMBUS
 RECREATION AND PARKS

PLANTING **DRAFT**
 CURBED PLANTER

DATE DRAWN
 08/2023

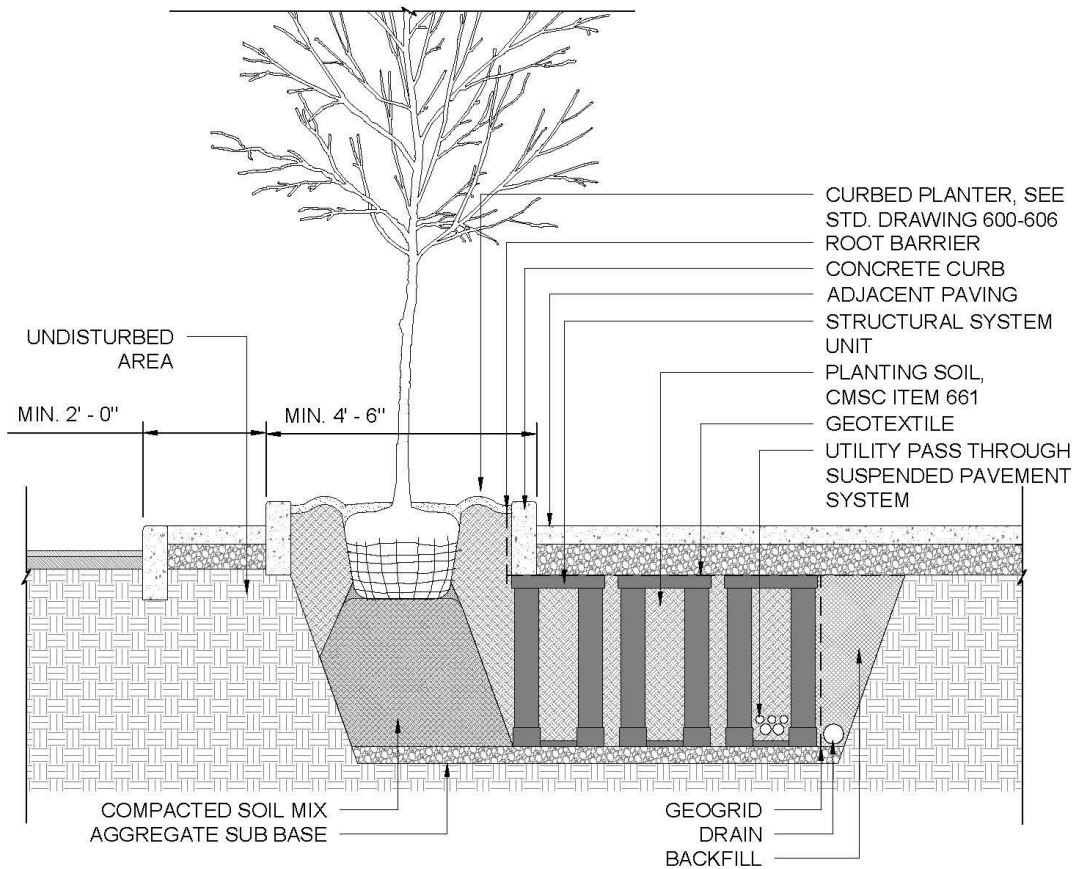
SHEET
 1 OF 1

STANDARD DRAWING

600-605

GENERAL NOTES:

1. UTILIZE RECOMMENDED SUSPENDED PAVEMENT SYSTEM TO PROVIDE REQUIRED SOIL VOLUME IF OPEN PLANTER DOES NOT MEET SOIL VOLUME REQUIREMENTS.
2. FOR TWO OR MORE TREES, PROVIDE A MINIMUM SOIL VOLUME OF 750 CUBIC FEET PER TREE.
3. FOR A SINGLE TREE, PROVIDE A MINIMUM SOIL VOLUME OF 1,000 CUBIC FEET.

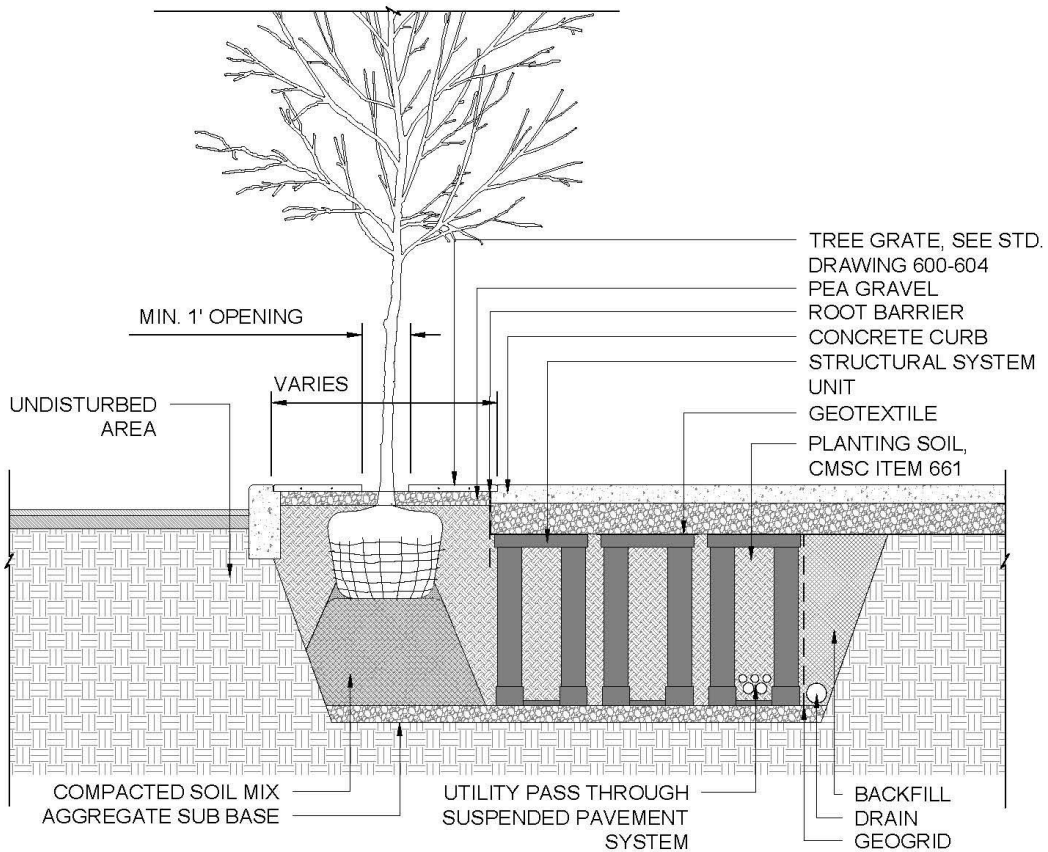


1 CURBED PLANTER AND SUSPENDED PAVEMENT SYSTEM NTS

STANDARD DRAWINGS  THE CITY OF COLUMBUS RECREATION AND PARKS	PLANTING DRAFT CURBED PLANTER AND SUSPENDED PAVEMENT	DATE DRAWN	SHEET
		08/2023	1 OF 1
		STANDARD DRAWING	
		600-606	

GENERAL NOTES:

1. UTILIZE SUSPENDED PAVEMENT SYSTEM TO PROVIDE REQUIRED SOIL VOLUME IF OPEN PLANTER DOES NOT MEET SOIL VOLUME REQUIREMENTS.
2. FOR TWO OR MORE TREES, PROVIDE A MINIMUM SOIL VOLUME OF 750 CUBIC FEET PER TREE.
3. FOR A SINGLE TREE, PROVIDE A MINIMUM SOIL VOLUME OF 1,000 CUBIC FEET.
4. SEE COLUMBUS TREE TECHNICAL MANUAL FOR ADDITIONAL INFORMATION.
5. IF TREE NEEDS GUYING, TIE THE ARBORTIE TO GRATE.



1 TREE GRATE AND SUSPENDED PAVEMENT SYSTEM
SECTION

STANDARD DRAWINGS  THE CITY OF COLUMBUS RECREATION AND PARKS	PLANTING DRAFT TREE GRATE AND SUSPENDED PAVEMENT	DATE DRAWN	SHEET
		08/2023	1 OF 1
		STANDARD DRAWING	
		600-607	

Appendix I: Forestry Permit



TREE MAINTENANCE/REMOVAL/PLANTING PERMIT

in City Right of Way, Park or Public Place

Permit/Work Order #: _____

Work on behalf of: City Agency Private Property Owner Private Utility Co Public Utility Co

Property owners or volunteers are not permitted to use power equipment or chemicals in parks or the street R.O.W.)

Name of City Agency/Private Utility/Private Owner: _____

Tree Contractor (bonded/insured): _____

Tree Contractor Contact: _____

Tree Contractor ISA Certification #: _____

Tree Contractor Address: _____

Phone: _____ Email: _____

Work Location Address: _____

Property Owner: _____ Owner Phone: _____

Type of Task: Maintenance Removal Planting

Species of Tree(s): _____ DBH of Tree(s): _____

Quantity of Tree(s): _____ Tree ID(s): _____

Inspector/Arborist: _____

In making this maintenance/removal/planting application, I acknowledge that trees growing on city rights-of-way/park/public place fall under jurisdiction of the City of Columbus, Recreation and Parks Department, per City Code 912 and I agree to perform work according to the conditions listed at the bottom of this form:

This application for a permit to maintain city trees has been reviewed and approved as noted with any revisions.

Signature Date

Steve Hoeft City Forester
 Columbus Recreation & Parks Department
 1533 Alum Industrial Drive W Columbus, OH 43209
 sjhoeft@columbus.gov
 Date

Description of Work

To prevent the spread of Oak Wilt, the City of Columbus follows Ohio Department of Natural Resources guidelines of pruning Oak trees November 1 to March 1 only.

Any permits from ODNR/USFW pertaining to the Indiana Brown Bat habitat and the Migratory Bird law is the responsibility of the permit holder, not the City of Columbus.

- All city, state and federal safety standards shall be followed.
- All industry safety and professional standards shall be followed (ANSI Z133.1 and ANSI A300).
- Permittee is responsible for proper traffic control including required permits.
- Permittee is responsible for the disposal of any and all wood waste generated from the pruning and/or removal of trees.
- Site clean-up is required.
- Permittee is responsible for contacting all applicable utilities – OUPS at 811.
- Permittee will provide routine maintenance (watering, mulching, basic pruning) to the tree at the time of planting.
- Work to be completed by - _____
- If work is not completed by above completion date, this permit is null and void. An extension or new permit must be obtained from the City.
- Failure to comply with these conditions shall render this permit null and void and no future permits will be issued.
- Permittee agrees to release, hold harmless and indemnify City from all injuries and damages that may incur relating to the work done pursuant this permit.