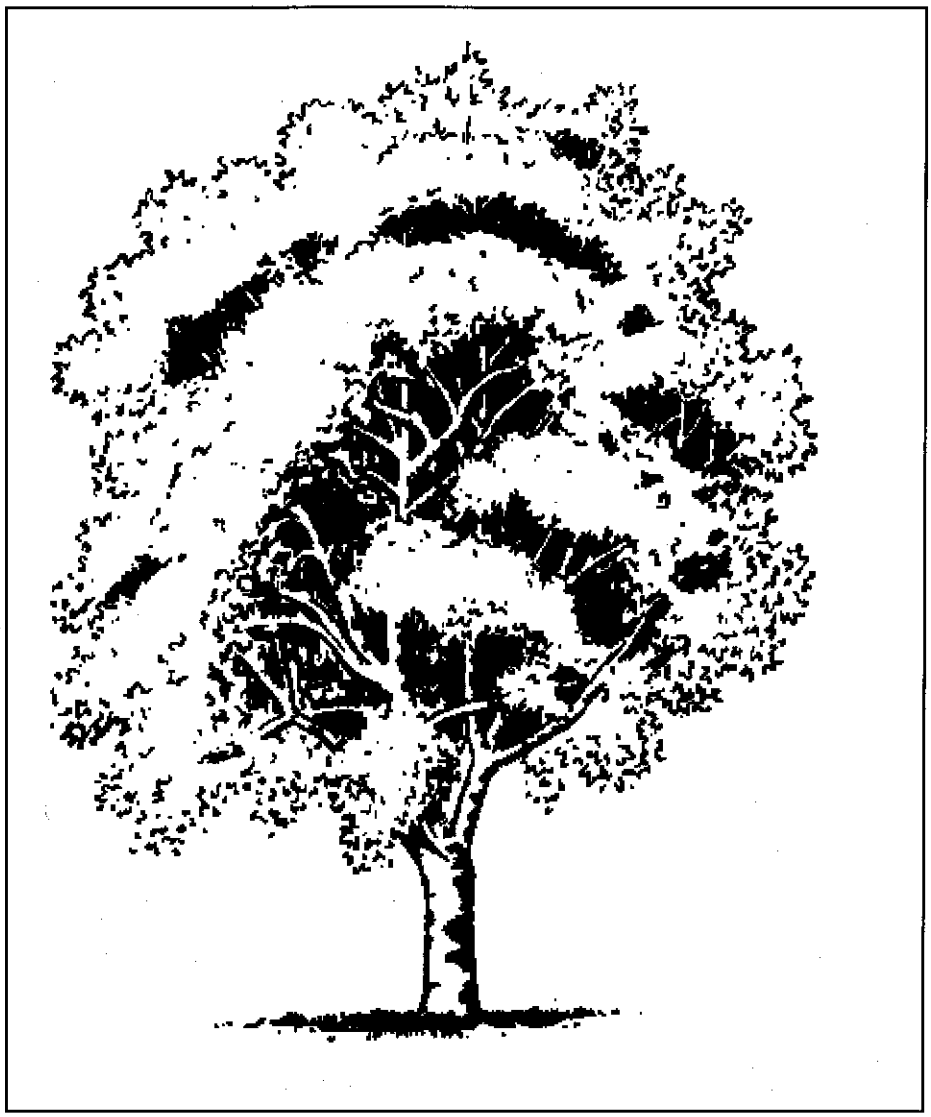
CITY OF MISSOULA PARKS AND RECREATION DEPARTMENT

APPENDIX TO MISSOULA MUNICIPAL CODE, CHAPTER 12.32.



STANDARDS AND SPECIFICATIONS

FORESTRY DIVISION

1997

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SECTION I: INTRODUCTION

A. Standards and Specifications Intent

1. Trees and shrubs on public and private property in Missoula constitute a valued and significant resource that markedly improves the quality of life for all residents and visitors to our city. In the spirit of preserving and enhancing our community forest, these standards and specifications have been developed by the City of Missoula Parks and Recreation Department, for the following purposes:

   ? to increase the chances of survival for planted trees and shrubs; and

   ? to ensure compliance with, through proper arboricultural care, the existing safety codes of the City of Missoula and the State of Montana; and

   ? to reduce and prevent potential hazards, liabilities and problems from tree breakage; and

   ? to reduce or eliminate breakage of sidewalks, curbs, and street pavement; and

   ? to reduce public and personal liability associated with right-of-way trees and shrubs; and

   ? to educate and encourage the public toward greater and proper use of trees and shrubs; and

   ? to inform Missoula property owners of both new and existing guidelines for dealing with the street and alley rights-of-way associated with their adjacent property. Missoula's streets and alleys have various right-of-way widths that were set during the original platting and development of Missoula's many building projects. Even though most residents incorporate street and alley frontage into their landscaping plans, a significant portion of that frontage is city-owned right-of-way subject to long existing codes for the safety of pedestrians, drivers, and vehicles. The City=s Engineering Division may be consulted for specific details of these right-of-ways.

2. Municipal Forestry Administration needs to be supported by legislation, standards, and specifications that clearly establish authority and provide for consistent management of trees on all public property. Missoula's street tree ordinance deals with trees and their maintenance within public rights of way, trees on private property, and also includes planning, and development guidelines that require preservation and planting of trees on private land.

B. ***Definitions***

1. Arboricultural Treatments: all services, treatments or operations involving trimming, pruning, spraying, injecting, fertilizing, cabling, surgery work, removal of and cutting above or below ground level of a tree.

2. Boulevard Trees : any tree which exists in an area of public right-of-way between the edge of the public roadway, whether curbed or not, and the private property line.

3. Class I Prune : removal of one or more branches in a localized area, as well as selective thinning to lessen wind resistance.

4. Class II Prune : removal of all dead, dying, broken or loose branches over 1 inch in diameter, or removal of branches that interfere with the trees strength or health.

5. Class III Prune : removal of all dead, dying, broken or loose branches 2 inches or more in diameter.

6. Class IV Prune : removal of perimeter branches at their lower junction in order to shorten branch structure.

7. Encroaching Woody Vegetation : any woody vegetation that grows or extends within the boundaries of the public right-of-way, which renders it dangerous for passage.

8. ISA Certified Arborist : an arborist who is currently certified through the International Society of Arboriculture, and who continues to educate themselves on the most recent and updated arboricultural practices.

9. MMC : Missoula Municipal Code

10. Notice : a verbal or written announcement to the abutting property owner.

11. Park Trees : all trees on city owned or leased land other than trees that

are in the public right-of-way.

12. Public Area : all public right-of-ways, public parks, and other land owned or leased by the city, unless the context of a specific provision expressly applies to other public lands as well.

13. Public Right-Of-Way : the entire width between the dedicated boundaries of all public streets, roads, boulevards, alleys and includes all sidewalks and public parking strips located within any such boundary.

14. Topping : the severe cutting back of limbs to stubs larger than 3 inches in diameter within the tree=s crown to such a degree so as to remove the normal tree canopy and disfigure the tree.

15. Tree Preservation Zone : an area around the tree which equals 1 foot radius for every 1 inch diameter of the tree.

16. Wildland/Urban Interface : an area where development and wildland fuels meet at a well-defined boundary.

17. Woody Vegetation : trees, shrubs, plants and any other vegetation with a woody stem.

Section II: Areas of Responsibility

A. Boulevard Trees:

* Street trees are the responsibility of the City Parks and Recreation Department for planting and management. All arterial streets and other streets with detached sidewalks are the first priority for planting. The cost of replacing a tree will be borne by the city only if action was authorized by the city and/or if reasons support a declaration of a public hazard as stated in Missoula Municipal Code (MMC) Section 15. 12.32. In all other cases, the cost of replacement will be borne by the party making the request. Cost-share programs are available for right-of-way plantings through the City Parks and Recreation Department.

B. Park Trees:

* Park trees are the responsibility of the City Parks and Recreation Department for planting and management.

C. **Private Property trees:**

* Private property trees are the responsibility of the private property owner. If woody vegetation from private property encroaches into the public right-of-way and in any way causes unsafe passage, City Parks and Recreation Department shall address the problem in a manner consistent with MMC Section 15. 12.32.150. Declaration of a Hazard.

Section III: General Requirements

These specifications are to serve as a standard for all plantings and treatments of public trees. They will apply whether work is performed contractually, by city forces or by private individuals. The Municipal Forestry Standards and Specifications Guide shall be adhered to at all times, but may be amended by the Missoula City Council at any time that experience, new research, or laws indicate improved methods, or whenever circumstances make it advisable. Exceptions to the Municipal Forestry Standards and Specifications must be made by written approval by the City Parks and Recreation Department.

A. **Public Requirements**

1. Public trees shall be managed by the City Parks and Recreation Department in such a manner as to promote their general health by providing fertilization, irrigation, staking, guying, wrapping, cabling, bracing, and pruning. Trees shall be maintained in such a manner as not to endanger, interfere, or otherwise conflict with requirements of safe public use of an area.

B. **Private and Business for Fee Requirements**

1. It is unlawful for any person, either for himself or another to plant, prune, remove, or treat any tree, shrub, or hedge in or upon the public right-of-way of any street, alley, sidewalk, or other public place without first obtaining a free permit from the City Parks and Recreation Department. No permits shall be required of any public electrical utility, their agents and contractors engaged in line clearanc maintenance. If accepted aboricultural practices are not followed, the City Parks and Recreation Department will immediately file a formal complaint with the state utility regulatory agency MMC Section 12.32.060.

2. It shall be unlawful for any person to engage in the business (for fee) of planting cutting, trimming, pruning, removing, spraying or otherwise treating trees, shrubs or vines within the city without first procuring business a license from the City. No license shall be required of any public electrical utility, their agents and contractors engaged in line clearance maintenance or city employee doing such work in the pursuit of their public service endeavors. Contact the City Treasurer=s office for license requirements and procedures MMC Section 12.32.080.

3. It shall be prohibited for any person to engage in the business (for fee) of planting, cutting, trimming, pruning, removing, spraying or otherwise treating trees, shrubs or vines within the city without retaining $300,000 minimum commercial liability insurance and adhering to state workers compensation regulations.

4. All motor vehicles and other major equipment used in conducting the licensed business will be identified with the name of the licensee.

5. All tree work (for fee) shall be performed according to the latest revision of the American National Standards Institute for Tree Care Operations Standard Z-133.1, Safety requirements for Pruning, Trimming, Repairing, Maintaining Trees, and for Cutting Brush, a copy of which is on file with the City Parks and Recreation Department. All private tree care companies are governed by Federal OSHA regulations and should abide by them.

6. Authorized tree work on or within the public right-of-way:

   a. Shall be performed properly and safely by competent personnel in a manner as to cause the least possible interference with or annoyance to others.

   b. An ISA Certified Arborist shall be on staff and should be present at all times when work is being performed. All other personnel utilized for work on or with trees or shrubs shall be trained to perform the work properly and safely.

   c. Any injury to persons or damages to any improvement, vehicle, tree, shrub, or structure while working with trees or shrubs shall be promptly reported to the City Parks and Recreation Department.

   d. Any use of tools or equipment in unsafe condition or any application of techniques or methods deemed unsafe to life, limb or property is forbidden.

   e. Pedestrian and vehicular traffic shall be allowed to pass through work areas **ONLY** under conditions of safety and with as little inconvenience and delay as possible.

f. Any tree work that impacts normal flow of traffic must have a pre-approved traffic plan from the City Public Works Department. Adequate barricades and warning devices shall be in position and flagmen will be stationed as necessary for the safety of persons and vehicles.

g. As required by the Missoula traffic control plan, manned or uniform traffic control devices and the traffic control devices handbook USDOT 1983 shall be in position at all times while work on public trees or shrubs is being performed.

h. Whenever electricity lines, telephone lines, gas lines, water lines or other improvements, public or private, upon a public area will be implicated or jeopardized by an authorized tree or shrub activity, the utility company or property owner involved shall be consulted prior to performing any work. All requested precautions by any such authority shall be complied with.

Section IV: Technical Requirements for Planting, Maintenance and Removals

A. Planting Standards

1. Public projects (i.e. parks, streets, medians, substations, treatment plants, plazas, and public buildings) shall include street and park tree planting as a part of the development and implementation process. The landscape plan for such projects shall be approved by the City Parks and Recreation Department and adhere to these standards and specifications.

2. Private projects shall provide for street tree planting as part of the development process. Street trees shall be located on the public right-of-way and adhere to the design objectives, spacing and location requirements of this document. Species selection shall be from the Missoula Desirable Tree List (Appendix). All tree planting on public right-of-way shall be approved by the City Parks and Recreation Department.

3. Existing public properties shall receive new infill plantings on an ongoing basis. All removed public trees shall be replaced with one or more new trees when space allows.

4. Site criteria to be evaluated in determining tree planting location.

   a. Visibility of site; Amount of public contact.

   b. Probability of long term survival; physical condition.

   c. Likelihood of private participation; funding.

   d. Benefit, both physical and psychological, to the surrounding communities.

5. No single tree specie should make up more than 10% of the street tree population. This is to prevent susceptible uniform disease and eventual uniform senescence.

6. No species other than those included in the Missoula Desirable Tree List may be planted as street trees without the permission of the City Parks and Recreation Department.

B. Planting and Maintaining Hedges and Shrubs:

1. Before planting any shrub or hedge on the public right-of-way, the property owner is required to obtain a free permit from the City Parks and Recreation Department.

2. No hedge planting is permitted in the parkway between the sidewalk and the curb. Shade trees of acceptable species may be planted in this area.

3. Where attached curb and sidewalk exist, no hedges may be planted closer than feet from the sidewalk.

4. Where curb and gutter exist but no sidewalk has been installed, no hedge shall be planted closer than 9 feet from such curb.

5. The planting or spreading of nuisance species which grow out and over designated pedestrian or vehicular right-of-way, thereby obstructing them, are not permitted. Property owners must prune to maintain spreading of the species.

C. Maintenance Standards

1. All public deciduous trees on improved properties should be pruned on a rotational basis of not more than ten (10) years. This involves a class II medium prune to be given to each City-owned deciduous tree at least once in this time period.

2. Public trees shall be managed in such a manner as to promote their general health by providing the necessary cultural practices which may include Integrated Pest Management, insect and disease controls, fertilization, irrigation, staking, guying, wrapping, cabling, bracing, and pruning.

3. **Any** tree, whether public or private, that becomes epidemic with insects or pathogens, (meaning it has infected over 50% of a certain tree species) will be treated to control the spread of the problem organism.

4. Any public tree which because of habit of growth, age, condition or disease becomes a hazard to public safety, obstructs a clear view of streets, signs, signals or intersections, shall be maintained in a manner that corrects the problem. Hanging limb and branch growth should be maintained 10 feet above sidewalks and 14 feet above streets, especially in designated truck routes.

5. Private land owners, whose trees overhang into the public right-of-way are responsible for pruning their trees to the minimum height clearance required by these standards and specifications. The city shall have the right to prune any tree or shrub on private property when it interferes with the safe use of the street or sidewalk or when it interferes with the visibility of any traffic control device or sign.

6. No solid hedge is permitted at the intersection of roadways within a 50 feet long boundary of each intersecting roadway. Individual shrubs within this area shall not exceed 30 inches in height. Property owners must prune to maintain the required maximum height (Figure 2, p.10).

D. <u>Tree Removal Standards</u> (Trees may be removed if:)

1. The tree is infected with an epidemic insect where the recommended control is not applicable and its removal is the recommended practice to prevent transmission.

2. The tree is creating an extreme nuisance, because of its species, size, location, or condition. The nuisance could be caused by fruit or seed drop, harboring of insects, root conflicts and excessive twig or limb breakage.

3. The tree is posing a severe safety hazard that cannot be corrected by pruning, transplanting, or other treatments.

4. The tree severely interferes with growth and development of a more desirable tree.

5. The tree's aesthetic value is so low that the site would be enhanced visually

by the removal of the tree.

6. Any construction, improvements or maintenance to be made around the tree would substantially interfere with the tree's natural growth and size or would damage or destroy it.

7. The tree has been topped thus producing an unsound branching structure conducive to severe storm damage, windthrow and accelerated death.

Section V: Street Tree and Parkway Design

A. Street Tree Design

1. Trees enhance visual quality, improve city air, reduce noise pollution and add increased value to both public and private property. Boulevard trees should be planted as to utilize these aesthetic, social and psychological and economic values.

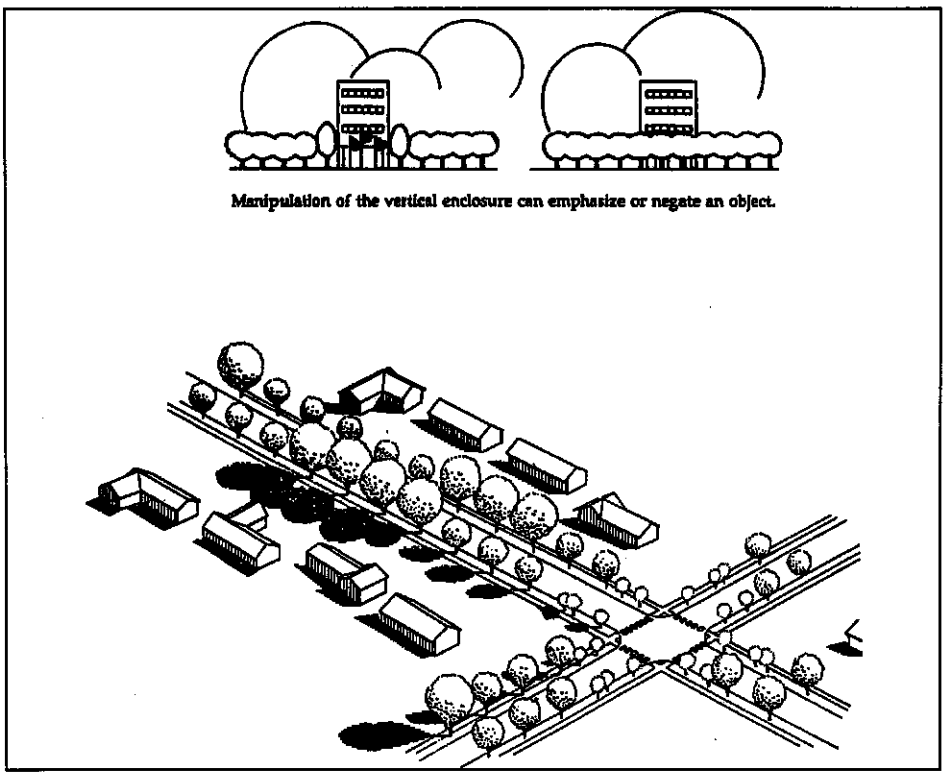
2. Street Trees should be used in an assertive architectural fashion to reinforce and connect the spaces and corridors created by buildings and other features. Tree planting schemes shall be on a grand public scale rather than intimate and private. Great numbers of large shade trees such as ash, maple and burr oak with high canopies spaced at 30-40' centers, in groves and alleys are favored over the individual ornamental tree. Large canopies should interconnect to enclose and unify space. Heavy pedestrian and vehicular traffic should continue below unhindered. To accomplish this objective, wide medians and parkways should be developed. (Figure 1).

B. Parkway Design

1. **Curbside Parkway**: Located between a detached sidewalk and curb. At least 3 feet is required if any tree is to be planted. Wider spaces are preferred and should be provided whenever possible.

2. **Boundary Parkway**: Located in back of a sidewalk between the property line and sidewalk. Trees should be planted 3-7 feet behind sidewalk.

3. **Sidewalk Parkway**: Located as part of the sidewalk where the walk extends from the curb to the building. The walk must be wide enough to allow the tree to be set back at least 30" from the face of the curb and five feet from the building.
4. **Undefined Parkway**: Located in areas that do not have a sidewalk. The future installation of a sidewalk shall be considered and trees shall be placed accordingly.



Manipulation of the vertical enclosure can emphasize or negate an object.

FIGURE 1

Section VI: Spacing and Location Requirements

1. At the intersection of roadways, no plant material with a mature height greater than 30 inches shall be planted within sight triangle measuring 50 feet along the boundary of each of the intersecting curb lines, except where engineering standards indicate otherwise. No tree shall be planted in such a location that it would create a conflict with sight obstacle triangle MMC Section 12.28.110 (Figure 2).

TRAFFIC VISIBILITY OBSTRUCTIONS
Section 2, 12.28.110 Missoula Municipal Code

2. No tree planting is permitted where the distance between a curb and detached sidewalk is less than 3 feet.

3. Trees will always be planted in the center of the planting strip when detached sidewalk is present or when sidewalk plans call for a detached sidewalk.

4. Whenever a sidewalk is attached to or abutting to the curb the tree must be at least 3 feet from the sidewalk.

5. Spacing of plantings shall be no closer than 20 feet for small height class, 30 feet for medium height class, and 40 feet for large height class; except for special plantings designed and/or approved by the City Parks and Recreation Department.

6. No tree or shrub shall be planted within 5 feet of any driveway or alley, within 15 feet of any street light, utility pole, or street sign and within 10 feet of any fire hydrant. When a tree exists near the potential placement of street signs, pedestrian lights etc., the sign location shall be evaluated as to lessen conflict with the growth of the tree.

7. Trees planted in a gutter/curb/sidewalk and building combination must have a minimum planter area of 16 square feet, and the planter edge may be no closer than 12 inches from the curb, unless permitted by the City Parks and Recreation Department.

8. No tree is to be planted within 5 feet of any building or structure.

9. No tree other than those designated as small category trees shall be planted under any overhead utility lines. If the utility line is less than 20 feet above ground no tree shall be planted at all.

10. Spacing of trees between curb and sidewalk depends on the size of the tree to be planted. A small tree requires a width of 3 feet or greater, a medium tree requires

a width of 7 feet or greater and a large tree requires a width of 10 feet or greater.

11. Trees may be planted in parkways holding existing sewers, **ONLY** if the sewer line is greater than 6 feet in depth **and** is made of PVC (poly vinyl chloride) material.

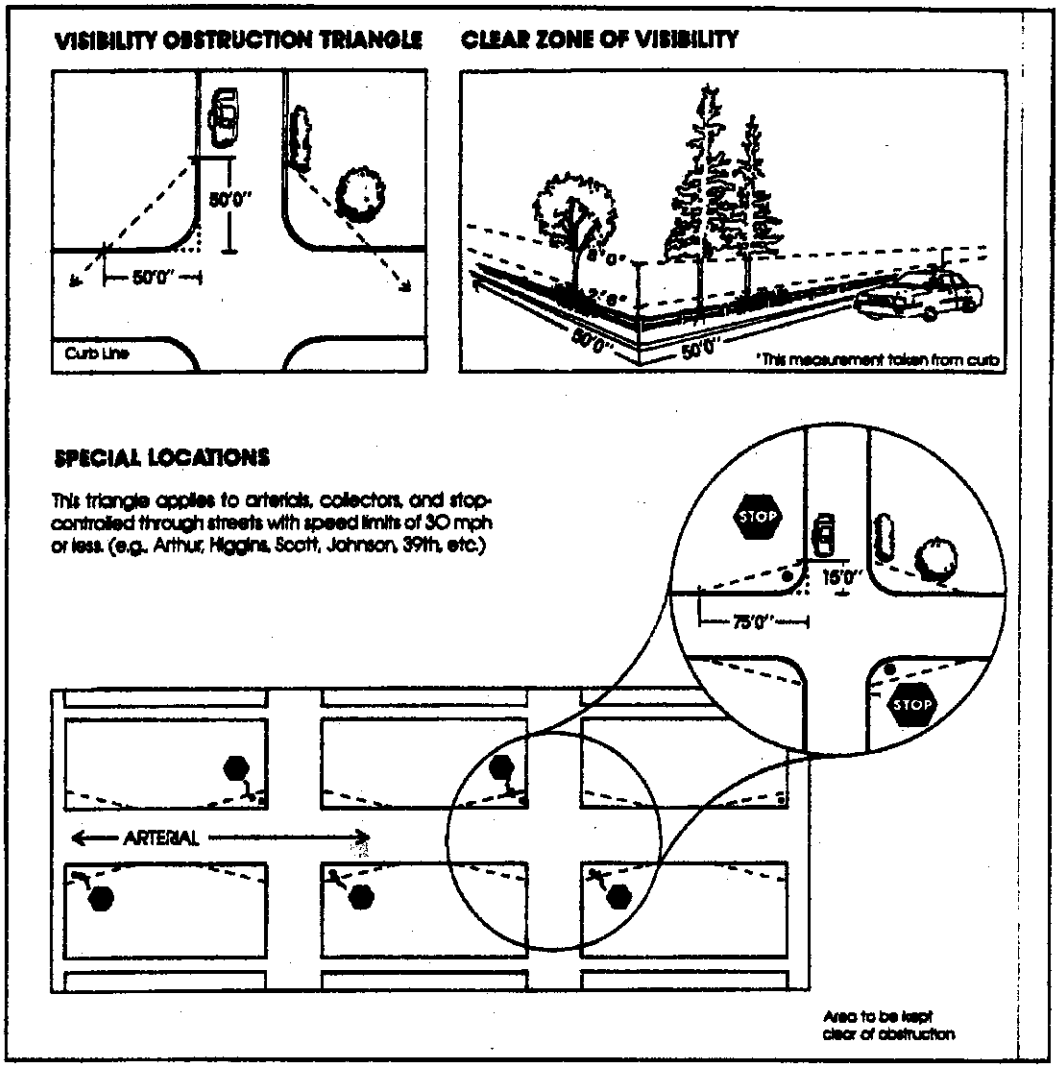


FIGURE 2

A. Plant Material

1. Newly planted right-of-way trees should not be less than 12 inches in diameter, measured 6 inches above the ground.

2. Plant material shall conform with procurement, transport and installation guidelines established by the International Society of Arboriculture and the American Nurserymans Association. The City Parks and Recreation Department reserves the right to reject any shipment of trees that do not meet minimum specifications of the plant material contract.

3. Plants shall have normal, well-developed branches and vigorous root systems. They shall be healthy, vigorous plants free from defects, decay, sun scald injuries, bark abrasions, insect pests, and all forms of infestations or objectionable disfigurements.

4. Balled and burlapped plants shall be dug with solid balls of adequate size. The root balls shall be securely wrapped with burlap or canvas, and tightly bound with rope or twine.

5. The minimum size for plants shall be specified on a planting permit or an approved landscape plan. Variances must be authorized by the City Parks and Recreation Department.

6. The City Parks and Recreation Department may inspect any tree or shrub before planting.

B. Planting Methods and Techniques

1. Installation of plant material: (Figure 3)

   a. Layout: All trees shall be located as designated in the field by the City Forester. Locations will be checked for **underground utilities** prior to any excavation. Where below ground obstructions are encountered, the tree locations shall be modified by the City Forester.

   b. Planting Holes: Circular holes shall be dug circular with a diameter 2 feet greater than the diameter of the ball (or root spread) of the tree. The depth shall be enough to accommodate the ball of the tree when the tree is set to finish grade, allowing for 6-12 inches of

pulverized and settled soil below the roots.

c. Setting of trees: Before setting the trees, and if determined necessary by the City, holes shall be backfilled with topsoil to a depth of 12-16 inches. The hole shall then be placed at such a level so that after settlement, the natural relationship between the original grade at which the plant grew, and the present one shall be the same.

d. Removal of binding material: All wires, twine, baskets, and other binding materials shall be cut and removed prior to backfilling.

e. Backfilling: Each hole shall be filled to% the total planting depth with the original soil from the planting hole (or pulverized topsoil where necessary), watered and settled. Burlap shall be pulled back from the top of the ball and cut away as close to the root ball as possible. The root ball and the surrounding soil shall be thoroughly saturated with water. The remaining 25% of the planting hole shall then be filled in with soil, watered and settled so the final planting level is as stated above.

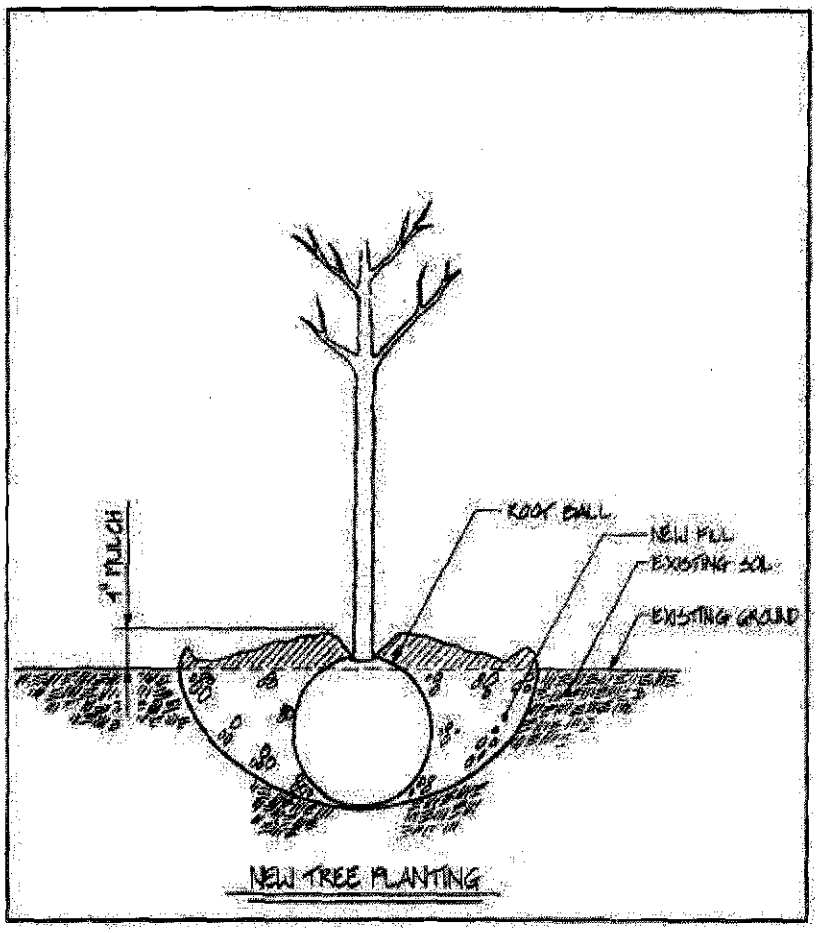
f. Watering Basin: A six inch high saucer shaped basin shall be formed a little larger than the diameter of the ball (or root spread) to receive and hold water. The basin shall be saturated at initial time of planting.

2. Pruning, Staking, and Mulching:

a. Pruning: The tree shall be pruned to preserve its natural form and character and in a manner appropriate to its particular species requirements. **In general, pruning shall be limited to the removal of dead, rubbing or damaged branches, and unwanted suckers. Under no circumstances shall any newly planted tree be headed back as to attempt to induce additional branching.**

b. Staking: All trees shall be staked with 2-7 foot long, 5/8 inch diameter rebar stakes, located approximately at the edge of the root ball. The rebar shall be attached to the tree stem by means of expandable rubber banding material. Material shall **not** be of any type that may constrict natural expansion of the stem through the initial growing season.

c. Mulching: The contractor is to install wood chips or other organic mulching material acceptable with the City Forester. This material



shall be laid 2-4 inches thick and in a diameter equal to the width of the root ball and/or the watering basin. All mulch shall be kept 2-4 inches away from the base of the stem so as not to induce rot, disease and insect problems.

FIGURE 3

C. Planting Standards and Workmanship

1. Trees should not be dug, balled and burlapped or moved during the active growth period, unless the ball is large enough to insure survival.

2. Plant material should be handled to allow the least amount of damage during planting.

3. Bare root stock shall never be left exposed except from the point of uncovering the roots to plant the tree. Roots shall be covered by a moist tarp or mulch.

4. Balled and burlapped and container grown plants shall always be handled by the soil ball as to minimize root and trunk damage and separation. Under no circumstances should they be dragged, pulled, or lifted by the trunk or branches in a manner that would loosen the roots in the ball.

5. On the job site, plants should be handled and secured to minimize damage. If a tree or trees are not to be planted the same day they are placed at the site, they should be watered, covered and stored in the shade to protect them from wind, dehydration, traffic, etc.

6. Any scars, abrasions and/or broken limbs, caused in the planting operation should be treated and/or corrected immediately. In cases where trees are apt to get damaged during planting operations, trees should be properly protected.

7. Qualified warning devices shall be used when excavated planting pits are left open during an extended period of time, and when work is not in progress.

8. Appropriate cleanup of soil, branches, twine, rope, wire baskets, or other debris resulting from any tree or shrub planting shall be promptly accomplished. The work area shall be kept safe at all times until the cleanup operation is completed. Under no circumstances shall debris remain as to cause a public hazard.

Section 8:

A. Requirements for Pruning of Trees

1. No tree shall be cut back in such a manner that its health will be impaired. An exception to this may occur in tree removal or in an emergency storm damage situation in which emergency relief to persons or property is urgent. Any emergency procedures shall be reported to the City Parks and

Recreation Department so that follow-up procedures can be approved.

2. Authority to prune street trees does not include the cutting back of sound, healthy tree branches in excess of 6 inches outside diameter, unless specifically described by the City Forester or if required by accepted arboricultural standards in the course of utility line clearance work. This must be approved by the City Forester.

3. When tree pruning cuts are made to a lateral branch, the remaining branch must possess a basal thickness of at least 2 diameter of the wound so affected. Such cuts shall be considered proper only when the remaining branch is vigorous enough to maintain adequate foliage to produce woody growth capable of healing the cut within a reasonable period of time.

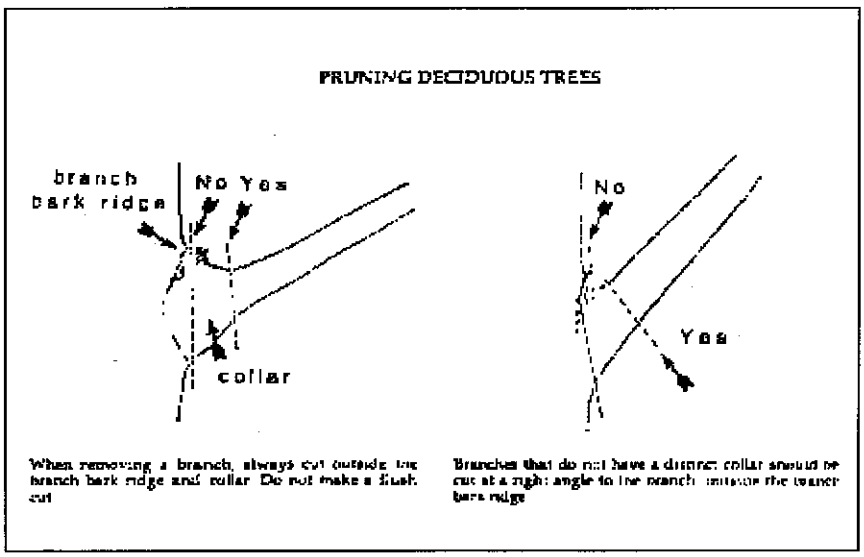
4. Any cutting of tree roots, other than when in the process of tree removal, shall give due consideration to future welfare of the tree. Proper action shall be taken as to protect, preserve or correct the root problem.

5. Tree branches shall be removed and controlled in such a manner as not to cause damage to other parts of the tree or to other plants and property.

6. All tools used on a tree known to contain an infectious tree disease shall be properly disinfected immediately after work is completed.

7. All cutting tools and saws used in pruning shall be kept adequately sharpened so as to retain smooth surfaces and secure bark on all cuts.

8. Excessively deep flush cuts are prohibited. All pruning cuts shall be made just outside of the branch bark ridge (Figure 4).



9. Pruning cuts to be made on branches too large to hold with one hand while cutting, will use a three cut method to relieve the weight of the branch before making a final cut, and to reduce the tendency of the branch to tear (Figure 5).

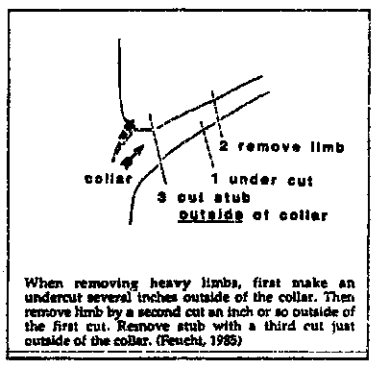


FIGURE 5

10. If a codominant stem must be removed, cut at an angle outside of the bark ridge as shown in figure 3. After the weight of the branch is removed, the remaining stub shall be cut on the outside edge of branch bark ridge (Figure 6).

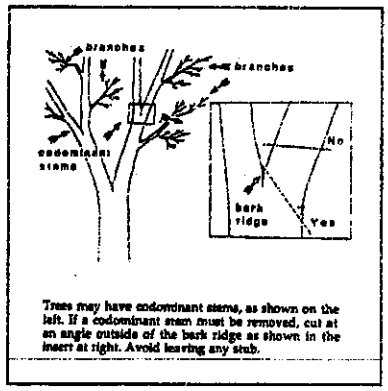


FIGURE 6

B. <u>Standards of Workmanship for Pruning and Removals</u>

1. Cleanup of branches, logs, or any other debris resulting from a tree pruning or removal shall be promptly and properly accomplished. The work area shall be kept safe at all times until the cleanup operation is completed. Under no condition shall the accumulation of brush, branches, logs, or other debris be allowed upon a public property in such a manner as to cause a public hazard.

2. The use of climbing spurs or spike shoes while engaging in the act of pruning is <u>prohibited</u>.

3. Under <u>no</u> condition shall it be considered proper to leave any severed or partially cut branches in the upper portion of any tree when the tree workers leave the scene of the operation.

4. Large tree sections being cut from a treetop that may endanger the public or property, shall be secured by ropes and lowered safely in a controlled manner.

5. Unless the tree work area is totally barricaded or otherwise kept safe while pruning or removing trees, at least one responsible tree worker shall serve to coordinate safe operations on the ground while work operations are in progress.

6. All removal of public trees shall be done in a manner so that the remaining stumps will be at least 8 inches below ground level. Exceptions may be

granted by the City Forester.

7. Excavations resulting from a tree or shrub removal must be promptly filled in to normal ground level. The soil fill shall be properly compacted and free of debris.

8. When removing a tree, or cutting tree roots, leaving the work scene with a standing tree having little or no support is prohibited.

C. Authorized Types of Pruning

1. **Spot or fine prune (Class I):** This operation of tree pruning shall consist of the removal of one or more branches localized in a particular area as well as selective thinning to lessen wind resistance.

   SPECIFICATIONS:

   a. Trees shall be pruned in such a manner as to prevent branch and foliage interference with requirements of safe public passage. Street clearance shall be kept to a minimum of at least 14 feet above the paved surface of the street and at least 10 feet above the surface of the public sidewalk or pedestrian walkway.

   b. Sprout or sucker growth shall be removed to a minimum height of 8 feet above the ground level. Exceptions are allowed for a young tree which would be irreparably damaged by such pruning action.

   c. Individual or scattered, dead and broken limbs shall be promptly and properly removed without performing other work not immediately urgent for the protection of the public or property, or the health of the tree.

2. **Medium Prune (Class II):** This operation of tree pruning shall consist of the total removal of those dead or living branches that affect the future health, strength and attractiveness of the tree.

   SPECIFICATIONS:

   a. Properly remove all dead and dying branches over 1" in diameter.

   b. Remove all broken or loose branches lodged in the tree.

   c. Remove all dead and live stubs of previously broken or pruned branches.

   d. Remove any live branches that interfere with the tree's structural strength and healthy development, which may include the following:

(1) Branches that rub and abrade a more important branch.

(2) Branches of weak structure that are not essential to the framework of the tree.

(3) Branches that, if allowed to grow, would wedge apart the junction of more important branches.

(4) Branches with twigs and foliage obstructing the development of more important branches.

(5) Branches forming multiple leaders in a single leader type tree.

(6) Branches near the end of a limb which will produce more weight or offer more resistance to wind than the limb is likely to support.

(7) Undesirable sucker and sprout growth.

(8) Selective removal to one or more developing leaders where multiple branch growth exists near the end of broken or stubbed limbs.

(9) Removal of branches that project to far outward beyond an otherwise symmetrical form.

(10) Removal or severing of any exposed roots that restrict, girdle or prevent proper expansion and growth of other major roots or restrict the base of the tree trunk.

e. All final cuts shall be made just outside of the branch collar. Extremely deep cuts which produce excessively wide wounds or weaken the tree are prohibited.

3. **Coarse Prune (Class III):** This operation of tree trimming shall consist of the minimum performance necessary to correct one or more extreme and undesirable conditions existing within a tree which may be hazardous to persons or property.

SPECIFICATIONS:

a. Remove all dead and dying branches of 2 inches or more in diameter.

b. Remove all broken or loose branches 2 inches or more in diameter.

c. Reduce the length of branches which extend excessively beyond the perimeter of an otherwise symmetrical form.

d. Cut back ends of branches and reduce weight where excessive overburden appears likely to result in breakage of supporting limbs. Such cutting back shall not include the removal of any live, healthy branch in excess of 6 inches in diameter.

4. **Drop crotching/Construction prune (Class IV):** This operation shall be done by means of a method used to shorten branch structure and thereby limits the extent of the foliage canopy to a natural appearing margin. This action consists of removing perimeter branches at their lower junction with shorter side branches.

SPECIFICATIONS:

a. No cuts on living branches shall be made in excess of 6 inches in diameter without first securing specific consent of the City Parks and Recreation Department.

b. Extended perimeter branches shall be properly cut at their junction with lower branches having a basal diameter of at least 1/3 of the diameter of the cut so affected.

c. The remaining lower branches shall be retained intact to form a reduced foliage perimeter at a specific height and/or spread.

d. This technique of tree pruning shall be applied only when larger growing trees endanger overhead utility lines, the loss of roots would lead to extreme decline in the crown, or where excessive growth of trees interferes with adjacent structures or otherwise creates a specific hazard to persons or property.

e. Drop crotch prune should not be used if the metabolism of a tree would be seriously unbalanced by the use of this technique or where the structure of the tree would be weakened by such action.

Section IX: Development Within Forested Areas

A. Introduction

1. Any development taking place within Wildland/Urban Interface and Wildland/Urban Intermix areas shall adhere to National Fire Protection Association, INC. Standards 299. NFPA provides criteria for fire agencies, land use planners, architects, developers, and local government for fire safe development in areas that may be threatened by wildfire. NFPA Standard

299 is available at the Missoula City Fire Department.

B. General Specifications

1. All new developments shall have a minimum 30' radius of defensible space, to protect structures from approaching wildfire as well as to reduce the potential of a structure fire spreading to wildland (Figure 7).

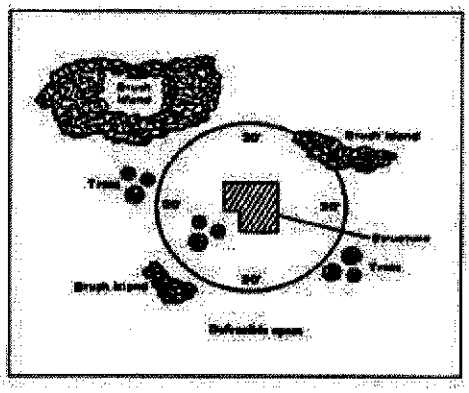


FIGURE 7

2. All new development should be constructed of as much noncombustible materials as possible.

3. All developments shall have more than one access route. The design of access routes shall consider traffic circulation and employ looped road networks.

4. Care should be given to direction of local air currents, adjacent slopes and past fire history of the area.

Section X: Protection and Preservation Specifications

1. Authorization must be given by the City Parks and Recreation Department before any excavation is done within the tree preservation zone - TPZ (1 foot radius for every 1 inch diameter of tree). (Figure 8).

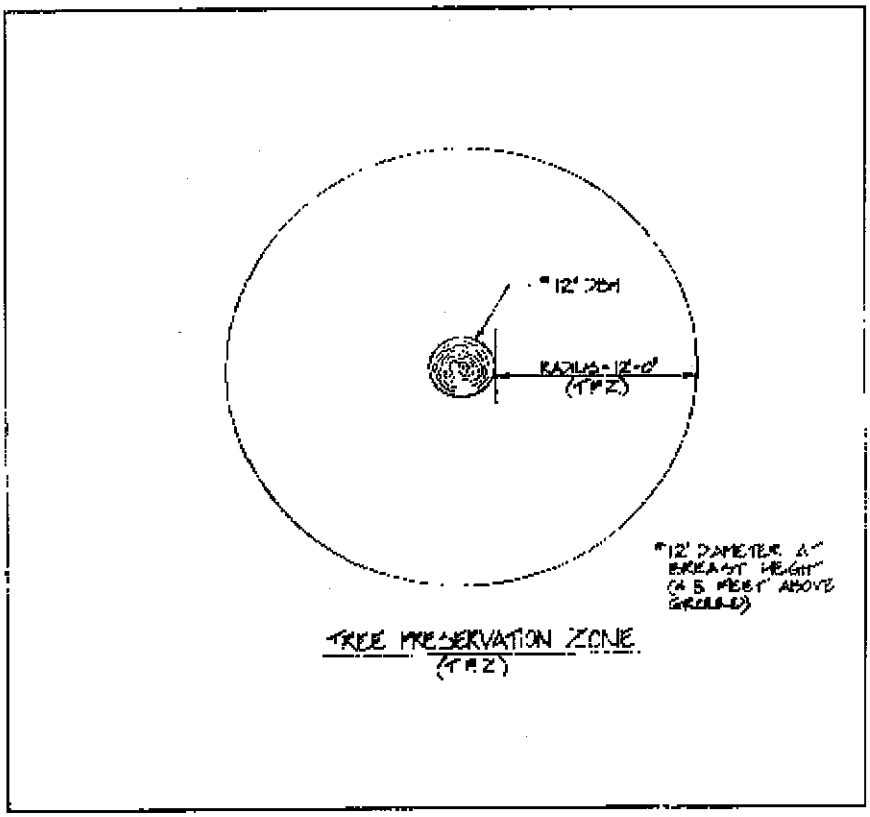


FIGURE 8

2. All site or landscape plans involving public lands must include the City Parks and Recreation Department in the review process. Every effort should be made to preserve desirable trees.

3. Trees to be preserved during construction should have their TPZ clearly barricaded protecting all roots within it.

4. Heavy equipment and construction materials should not be allowed inside the TPZ.

5. Curb cuts shall not be allowed to penetrate the TPZ.

6. A porous area is needed for any newly paved or asphalted areas that converge into the TPZ.

7. When grade change is required, a retaining wall or dry well, for drainage must be established at existing grade. The City Parks and Recreation Department has guidelines on file.

8. Avoid cutting surface roots wherever possible. Sidewalks and paving levels should

be contoured sufficiently to avoid such cutting. Tunneling shall always be picked over trenching when tree roots are encountered.

9. Excavation involving root cuts should be done rapidly. Make smooth, flush cuts on tree roots. Backfill before the roots have a chance to dry out, and water tree immediately. If tree roots are to remain out for any extended period of time, they must be covered with burlap and kept moist at all times.

10. If many roots have to be pruned, the drop crotch or construction pruning method MUST be incorporated to restore a proper root to shoot balance.

Section XI: Spray applications Specifications

The following pertains to all public and private applicators who solicit the spraying of fertilizers or pesticides to the above ground portions of trees.

1. Persons applying pesticides must have an up to date commercial pesticide applicators license.

2. Ineffectual control, damage, injury or death of plant being treated shall be the responsibility of the licensed operator.

3. Spray machines should be able to cover all portions of infected tree or it shall be considered inadequate for operation.

4. Spray equipment shall be kept clean and in good working order. The City Forester or department designee may inspect and/or sample spray materials being applied.

5. Operation with dirty tanks or equipment or unsanitary, unsafe, methods of washing out or draining of the same in public sewers and gutters is prohibited.

6. No spray application shall be carried out when the temperature is outside of 40-88 degrees F. and when the wind velocity is greater than 4-5 mph.

7. All spray machines other than hand-pump sprayers must have agitators capable of maintaining a uniform spray suspension at all times when spray application is in progress.

8. Adequate precautions should be taken in all phases of spray application concerning factors of toxicity, phytotoxicity, chemical reaction or residual action pertaining to spray materials used.

9. Applicators applying pesticides to trees shall adhere to all state and federal regulations pertaining to pesticides and their applications.

10. Pesticide application must remain consistent with any requirements, i.e. public notification, regulations, use etc., of any pesticide ordinance adopted by the City of Missoula.

APPROVED STREET TREES FOR MISSOULA

Street Trees for Missoula
and a Guide to Their Selection,
Planting, and Long Term Care

Prepared by
City of Missoula Parks and Recreation Department
June 10, 2014

Recommended
by the
Parks and Recreation Board
June 10, 2014

Adopted by
City Council Resolution No. 7891
July 28, 2014

APPROVED STREET TREES FOR MISSOULA, MONTANA
JULY 28, 2014

Introduction

This list is established to provide a quick reference of allowable street trees for use by homeowners, business owners, developers, engineers, and landscape architects.

Using the List

The list is divided into three height groups, Class I-Small trees, Class II-Medium trees, and Class-III-Large trees. Each group lists the trees by common name and botanical name. Where a cultivated variety, or cultivar, is available, the cultivar is listed below the species.

The characteristics of each specie or cultivar are listed to the right of the common name. When selecting a tree, determine the limitations of the planting site. Look for trees that are suitable for your site based upon the site limitations.

Where a cultivar has characteristics different from the parent species, such as height or spread, those characteristics will be identified separately. Where the cultivar characteristics are similar to the parent species, such as rooting depth or growth rate, the box will be blank.

On sites where shading is needed, the amount of shade cast by the tree is located in the shading column. The approximate square footage of shade cast by a tree is calculated by the shadow of a 15 year old tree at noon on the first day of Summer. Actual shade production with be determined by the growth rate of a tree on a particular site.

When a proposed tree is not on the list of approved trees, consult with the City Forester before planting the tree.

Selection

The master list of recommended trees for Missoula contains a general description of each tree and the appropriate use for the tree. For ease of use, the list is divided into Class I-Small, Class II-Medium, and Class III-Large trees. Class I-Small trees are generally 30 feet in height or less at maturity. Class II-Medium sized trees are generally 30 feet to 60 feet in height at maturity. And finally, Class III-Large trees are generally 60 feet in height or taller at maturity.

All of the trees on this list have characteristics which make them desirable. Most of the trees on this list are suitable for locations other than along city streets. Though there are no pest free trees, the trees listed in this document have been selected for their resistance to injurious insects or diseases. The information accompanying each tree species is meant to be used as a guide for decision making purposes.

The height and spread figures are given for trees at maturity. Trees with rapid growth rate can be expected to grow at least two feet per year when young. Those with moderate growth rates will grow between one and two feet per year when young. Slower growing trees will generally grow less than one foot per year when young. Please remember, growth rates are considered in general terms. Soil conditions and water availability will greatly influence the actual growth rate of a tree.

For purposes of calculating the approximate shading area provided by a particular tree species or cultivar, shading square footages are provided. The square footage area is based upon the shadow of a 15 year old tree on June 21 at noon. The shadow is based upon the growth of the tree under normal landscape conditions. In *Manual of Woody Landscape Plants – Their Identification, Ornamental Characteristics, Culture, Propagation and Uses* 6th Ed., Dr. Michael Dirr provides growth estimates based upon field observation throughout North America.

Root growth is listed as shallow, medium or deep. These are relative terms and describe the root system in its natural setting. The majority of a trees root system is typically within the upper three feet of soil. However, actual soil conditions on site, as well as irrigation patterns, will ultimately determine the depth of rooting of a tree.

Spacing recommendations are based upon future growth estimates. These minimum spacing distances provide for adequate canopy growth, while still providing for aesthetics. Planting trees too close together for initial effect will typically result in poor performance as the trees grow and mature.

The planter width column provides a minimum planter size for each tree. The widths are based upon typical rooting patterns in a natural setting, and the mature size of the tree. Specific site conditions may require a wider planter than that recommended. Planting a tree in too small of a planter will typically lead to poor tree performance, infrastructure damage, or both.

The comments section provides helpful insight into special characteristics of a particular tree. Specific comments are noted for those species that have limiting characteristics. General pruning requirements are also included.

Users of this list should keep in mind that no tree species is perfect and no one species will meet all the needs of a particular area. It is important that a selected tree species or cultivar be adaptable to the space available, laterally, horizontally and vertically, while meeting the aesthetic needs of the area.

The final consideration is the availability of trees on the list. Every effort is made to list trees that are commercially available, and to work with local nurseries to ensure they are stocked. If the tree is not in stock at a local nursery, ask the salesperson to order the tree and have it shipped in. When a particular tree is not available at the grower, a substitute with similar characteristics maybe selected from the list.

Questions regarding street tree characteristics may be called into the Missoula City Forester at 406-552-6270.

Planting

Heavily compacted soils, or soils with high clay content, typically limit the movement of oxygen to within only a few inches of the surface. To minimize the potential impact to curbs and sidewalks, adequate soil preparation is essential. Proper soil preparation not only fosters deeper root systems, it provides adequate growing conditions that ultimately lead to healthier trees. Where possible, till the soil within the entire boulevard to a depth non-compacted soil is reached.

Landscape Detail PR-101 provides directions for proper tree planting of Balled and Burlap tree stock. Proper planting will ensure the tree thrives for many years. The detail is included in this document for your reference. Improperly planted trees will not attain their full potential, and will be adversely affect by pest problems. Place the root crown of the tree at or slightly above finish grade. The top of root ball is not always the top of root crown. Trees are typically planted deep in the container, and in the field. You will need to remove excess soil and girdling roots before planting the tree.

Plastic root barriers provide a measure of protection for curbing and sidewalk. However, they do not guarantee damage prevention. To provide the greatest level of protection, root barriers must be installed properly, with at least ½-inch of barrier above final grade, mulch, or turf thatch layer. Failure to install the root barrier properly will result in roots growing over the top of the barrier, rendering it ineffective.

Turf at the base of a young sapling can inhibit the production of new roots, stunting the trees growth. Chemicals secreted by the roots of turfgrass act as a growth regulator for tree roots. Further, string trimmers and mowers used to maintain the turf will damage the trunk of the tree. The easiest way to solve this problem is to create and maintain a turf ring around the tree. The Missoula tree planting detail shows a minimum tree ring diameter of three feet.

Apply a three to four-inch thick layer of composted mulch within the tree ring. Mulch keeps the soil cooler for new roots, reduces water loss, and reduces the growth of weeds. The mulch also provides a visual barrier for weed eaters and lawn mowers. Make sure the mulch is kept from the base of the tree. Do not form mulch "volcanoes" around the base of the tree. Not only are the "volcanoes" unsightly, they damage the trunk of the young tree.

Maintenance

Proper irrigation is essential to good tree growth. Do not over water the tree! Over watering removes oxygen from the soil. Inadequate oxygen in the soil leads to root death and shallow rooting. In turn, shallow rooting causes damage to turf, maintenance equipment, sidewalks, buildings, and other landscape improvements. In either case, the tree is often removed prematurely. Water trees, shrubs, groundcovers, and turf based upon need, not time! Less water needs to be applied in the Spring and Fall than in the Summer. The typical water need is 0.32 inches of water per day in the middle of July, but only a tenth of that in early Spring or late Fall! Increase water applications as the need increases. Begin to decrease the water application as the season cools and the days shorten. Apply water more infrequently, but to a greater depth. A good rule of thumb for newly planted trees is to slowly apply 5 to 10 gallons of water per week to the rootball for every inch in diameter. Proper irrigation saves money and fosters good plant growth!

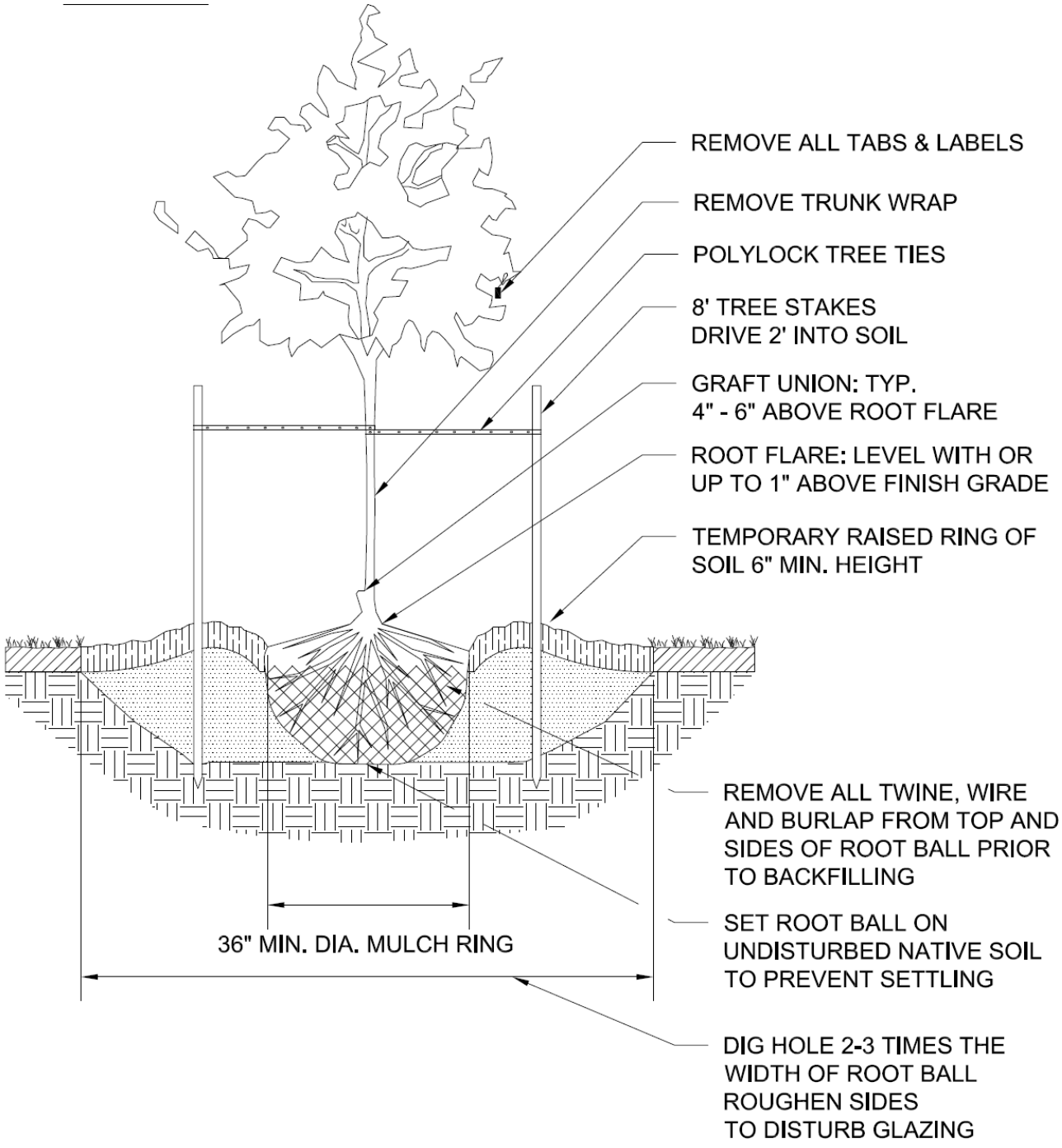
Maintain a turf free tree ring around each tree. The ring will provide basic protection from string trimmers and lawn mowers. Increase the ring size as the tree grows. Apply additional mulch as the old mulch decays. Do not allow weeds or turf to overgrow the tree ring!

Prune the trees only as necessary, removing no more than one-quarter of the canopy at any one time. Early developmental pruning will establish the long-term structure of a tree. Reference the comment section for information on the developmental pruning needs. Some species or cultivars require more aggressive developmental pruning than others. "Bleeding" trees, such as maple or birch, should be pruned in late-Summer or Fall. For more pruning information, please reference the current ANSI A300 Pruning Standards and the Best Management Practices for Pruning Manual.

Do not top trees. This practice destroys the natural defense mechanisms of a tree, and allows wood decay to progress unimpeded. Plant a smaller tree if space is limited.

City of Missoula Planting Detail

SECTION



1. Plant material must meet the minimum acceptable standard set by the American Association of Nurserymen's American Standard of Nursery Stock: ANSI Z60.1. Broken, damaged, diseased, or substandard stock are prohibited from being planted in the public right-of-way and will be rejected.
2. Only class I (small growing) trees are permitted to be planted under or within fifteen (15') of overhead utility lines.
3. Prune only broken or damaged branches. Do not apply fertilizer at time of planting.
4. The root flare is the point where the top most structural root emerges from the trunk. The depth of the root ball shall be measured from the root flare to the bottom of the root ball. Handle B&B plants carefully when transferring to planting hole. Lift or carry by holding the root ball, not the trunk.
5. Remove any excess soil from the top of the root ball to expose the root flare. Place tree in planting hole with root flare level with or up to 1" above finish grade.
6. Remove all wire baskets and rope from root ball. Be careful to keep the root ball intact.
7. Remove all burlap from the root ball. Be careful to keep root ball intact.
8. Straighten, cut and remove any circling roots.
9. Backfill planting hole 2/3 full with existing soil, settle with water, continue to fill with soil, water again. Water thoroughly after installation to eliminate air pockets.
10. Construct a temporary raised ring of soil at edge of root ball to contain water. Remove or breach before winter.
11. Construct mulch ring with a minimum 36" diameter to a depth of 2" - 4"; leave 3" bare ground between mulch and tree trunk.
12. Set stakes parallel to prevailing wind and outside of root ball. Ties must be 1" wide minimum, flexible belt-like strapping. Do not use rope or wire. Do not over-tighten around tree. Ties should be tight enough to support the tree while allowing it to sway. Remove stakes and ties within one year after installation.
13. Trees benefit when irrigated separately from turf. Water new trees during summer months to a depth of 12" - 18" once per week (about 5 gallons of water per caliper inch) for the first 3 growing seasons. During periods of drought, new trees my need more frequent watering.

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Class I – Small Stature Trees – Less Than 30 Feet

Common Name Scientific Name	Height	Spread	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Trident maple *Acer buergerianum*	25’ – 30’	25'	Moderate	Medium	4'	20' - 25'	No	A small shade tree with a round shaped crown and small, 3-lobed leaves. The leaves are glossy green turning yellow to red in the fall. This tree must be properly pruned to grow more upright and provide needed pedestrian and vehicular clearance. Somewhat drought tolerant.
Rocky Mtn. Glow maple *Acer grandidentatum* ‘Schmidt’	30'	20' - 25'	Slow	Deep	3'	20' - 25'	No	Small round headed shade tree for areas of restricted space. Iridescent reddish orange fall color. Drought tolerant when established.
Apollo maple *Acer sacharrum* ‘Barrett Cole’	25’	10’	Slow	Medium	4’	10’ – 15’	No	Small, columnar canopy. Needs fertile, well-drained soil. Fall colors are yellow to red. Needs developmental pruning.
‘Crescendo’ sugar maple *Acer* saccharum ‘Morton’	25’ – 30’	25’ – 30’	Slow	Medium	5’	25’	No	Excellent heat and drought tolerance. Good branch structure. Prefers well draining soils for optimal growth. Good Fall color.
Tartarian maple *Acer tartaricum*	15’ – 25’	20’ – 25’	Slow – Moderate	Medium	4’	20’	No	This tree needs drier rooting conditions. Somewhat drought tolerant when established. Yellow and red fall color.
Saskatoon serviceberry *Amelanchier alnifolia*	15’	10’	Moderate	Deep	4’	10’	No	This is a small multi-stem tree. Limited use as a street tree in boulevards. Use in areas where sight lines are not a concern.
Snow Cloud serviceberry *Amelanchier laevis*	15’ – 25’	15’ – 20’	Moderate	Deep	3’	15’ – 20’	No	Snow white flowers in late spring. Purple-bronze summer leaf color. Needs developmental pruning. Sometimes questionable under unfavorable growing conditions. All cultivars share these traits.
‘Cumulus’	20’ – 25’	15’ – 20’						
‘Majestic’	20’ – 25’	15’ – 20’						
‘Snowcloud'	20’ – 25’	15’ – 20’						
Constellation dogwood *Cornus florida X kousa* ‘Rutcan’	20’ – 25’	20’	Moderate	Deep	4’	20’	No	White flowers in the late Spring. Resistant to dogwood anthracnose. Erect tree with wide branch angles. More vigorous than Korean dogwood.
Stellar Pink dogwood *Cornus florida X kousa* ‘Rutgan’	20	20’	Moderate	Deep	4’	20’	No	Pink flowers in the late Spring. Resistant to dogwood anthracnose. Erect tree with wide branch angles. More vigorous than Korean dogwood.

Class I – Small Stature Trees – Less Than 30 Feet

Common Name Scientific Name	Height	Spread	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Thornless cockspur hawthorn *Crataegus crus-galli* var. *inermis*	20' – 30'	20 – 35'	Slow – Medium	Medium	3'	25' – 30'	Yes	Thornless cultivar of hawthorn. Can be used in swales if they drain well, otherwise plant just above the swale bottom. Hawthorns can be subject to many diseases, especially when stressed.
English hawthorn *Crataegus laevigata*	15' – 20'	15' – 20'	Slow	Medium	3'	15'	Yes	This hawthorn has thorns. Can be used in swales if they drain well. Because of its small size, use only where space is very limited. May be subject to many diseases when stressed.
Snowbird hawthorn *Crataegus x mordenensis* 'Snowbird'	20' – 25'	20'	Slow	Medium	3'	20'	Yes	This hawthorn has thorns. Can be used if swales drain well. Double petal flowers. May be subject to diseases when stressed.
Washington hawthorn *Crataegus phaenopyrum*	25' – 30'	20' – 25'	Slow	Medium	4'	20' – 25'	No	Use 'Princeton Sentry' when available, it is nearly thornless. May be subject to diseases when stressed. Very showy fruit.
Green hawthorn *Crataegus viridis* 'Winter King'	20' – 35'	25' – 35'	Medium	Medium	4'	20' – 25'		Silver bark and few thorns. Less susceptible to cedar-hawthorn rust
Prairifire crabapple *Malus* 'Prairifire'	20'	20'	Moderate	Medium	5'	20'	Yes	One of the best crabapple cultivars. Resistant to all typical crabapple diseases. Can sucker if apple rootstock is used. Swales must drain well.
Robinson crabapple *Malus* 'Robinson'	25'	25'	Moderate	Medium	5'	20' – 25'	Yes	Small ornamental tree for restricted areas. Disease resistant. Birds eat the fruit. Yellow-red fall color. Can sucker if apple rootstock is used. Swales must drain well.
Spring Snow crabapple *Malus* 'Spring Snow'	20' – 25'	15'- 20'	Moderate	Medium	5'	20'	Yes	Small ornamental tree for restricted areas. Highly susceptible to apple scab. Very little fruit. Yellow-red fall color. Can sucker if apple rootstock is used. Swales must drain well.
Sugar Tyme crabapple *Malus* ' Sugar Tyme'	15' – 20'	15'	Moderate	Medium	5'	15'	Yes	Small ornamental tree for restricted areas. Due to its small size, use only where space is very limited. Disease resistant. Birds eat the fruit. Yellow-red fall color. Can sucker if apple rootstock is used. Swales must drain well.

Class I – Small Stature Trees – Less Than 30 Feet

Common Name Scientific Name	Height	Spread	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Thunderchild crabapple *Malus* 'Thunderchild'	20'	20'	Moderate	Medium	5'	15' – 20'	Yes	Small ornamental tree for restricted areas. Susceptible to apple scab. Dark red, ½" fruit. Deep purple leaf color. Can sucker if apple rootstock is used. Swales must drain well
Accolade Cherry *Prunus sargentii* 'Accolade'	20' – 25'	20' – 30'	Moderate	Medium	5'	25'	No	Semi-double deep rose pink blossoms. Smaller cultivar of parent for use under power lines. Needs well draining soil.
Chokecherry *Prunus virginiana*	25'	20'	Fast	Medium	5'	20'	No	Short lived multi-stem tree. Select single trunk standards for street trees. Needs well draining soil. Produces large quantities of 3/8" fruit with red fleshy skin. Susceptible to black knot.
Canada red chokecherry *Prunus virginiana* 'Canada Red'	30'	20' – 25'	Moderate - Fast	Medium	5'	25'	No	Burgundy colored leaves during the growing season. Needs well draining soil. May produce some fruit. Susceptible to black knot
Red Cascade mountainash *Sorbus americana* 'Dwarfcrown'	15' – 20'	20'	Slow	Shallow – Medium	4'	25'	Yes	Small ornamental tree for restricted areas. Due to its small size, use only where space is very limited. Needs training to maintain a central leader. Well draining swales are best for this tree.
Japanese Tree Lilac *Syringa reticulata*	20' – 30'	15' – 25'	Moderate	Shallow – Medium	4'	20'	No	Small tree. Best in more acidic soils. Prefers cooler planting locations. Many insect pests. Flowers have a somewhat offensive odor.
'Ivory Silk'	20' – 25'	15'				15'		One of the best forms. Dense form with deep green leaves.
'Regent' (PNI 5723)	20' – 25'	10'				10'		Vigorous upright growth.
'Summer Snow'	20'	15'				15'		Flowers fragrant. Cherry like bark.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Sub-alpine fir *Abies lasiocarpa*	50’ – 70’	25’ – 30’	50 SF	Very Slow	Shallow – Medium	6’	25'	No	Evergreen conifer. This tree grows very slowly. The typical height over many years is approximately 50’ in our area. Under ideal conditions, this tree can grow over 100’ tall.
Hedge maple *Acer campestre*	30’ – 45’	30’ – 35’	154 SF	Slow	Medium	6’	25’ – 35’	No	A relatively disease and pest free tree. It tolerates poor soil conditions. Developmental pruning is required to maintain good form.
Freeman maple *Acer X freemanii*	40’ – 60’			Moderate – Fast	Shallow – Medium	8’		Yes	This tree is a cross between red maple (*Acer rubrum*) and silver maple (*Acer saccharinum*). Growth rate is faster than red maple. Structure is better than silver maple. Developmental pruning is a must when the tree is young. While it tolerates wet soils, this hybrid does better in soils that drain.
‘Autumn Fantasy’ (‘DTR 102’)	40’ – 50’	40’	452 SF				40’		Better than ‘Autumn Blaze’, but with wider branch angles. Fast grower with a broad canopy. Developmental pruning is needed to minimize included bark. Susceptible to freeze damage on young twigs in cold pockets..
‘Celebration’ (‘Celzam’)	45’	20’ – 25’	79 SF				25’		Similar to Armstrong, but with wider branch angles. Shorter than most cultivars. Use in areas of limited canopy space. Developmental pruning is required to maintain good form.
‘Morgan’ (‘Indian Summer’)	45’ – 50’	40’	491 SF				40’		Good branch angle attachment. Brilliant fall color. Very fast growing. Due to its rapid growth, developmental pruning is critical to establishing good structure.
‘Scarlet Sentinel’ (‘Scarsen’)	45’	25’ – 30’	154 SF				25’		Broadly columnar canopy. Good branch angles. Use in areas of limited canopy space. Developmental pruning is important to maintaining good form.
Red maple *Acer rubrum*	40’ – 60’	35’ – 45’		Moderate – Fast	Shallow – Medium	8’		Yes	A broadly pyramidal tree, with several cultivars. As a species, red maples will tolerate wet soils, but prefers adequate drained soils. Use only the cultivars listed below, as cultivars developed in the southern end of the range are not cold hardy here. Developmental training is a must when the tree is young.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
'Northwood'		35'	452 SF				35'		Good cold tolerance. Better branch structure. Developmental pruning needed to maintain a good branch structure. Excellent Fall color.
Red Sunset ('Franksred')	45' – 50'	35' – 40'	706 SF				35'		Good cold tolerance. Good branch structure. Excellent Fall coloration. Can show manganese deficiencies, which causes Summer leaf scorching.
'Schlesingeri'	60' – 70'	35' – 50'	615 SF			10'	40'		One of the oldest, and largest, red maple cultivars. Earliest of the Fall coloring maples.
Pacific Sunset maple *Acer truncatum X plantanoides* 'Warrensred'	30'	25'	115 SF	Slow – Moderate	Medium	6'	25'	Yes	Similar to Norwegian Sunset maple. However, the wider branch structure makes this the better of the two cultivars. This tree can be used under taller power lines.
Red horsechestnut *Aesculus X carnea* 'Briotii'	30' – 40'	30' – 35'	176 SF	Slow – Moderate	Medium	6'	30'	No	A good substitute for common horsechestnut. Less susceptible to leaf scorch and mildew. Brilliant red flowers in the Spring.
River birch *Betula nigra*	40' – 70'	30' – 50'	706 SF	Fast – Moderate	Shallow – Medium	10'	30' – 35'	Yes	This species is resistant to bronze birch borer. While river birch tolerates wet conditions, they also tolerate dry Summer conditions. Very interesting bark. Aphids can be a problem at times. Like black alder, the wood can be brittle, requiring periodic pruning to maintain canopy structure.
'Dura-Heat' ('BNMTF')	35' – 50'		615 SF				35'		Best cultivar for high heat conditions. Cold tolerant. Moderate aphid resistance.
'Heritage' ('Cully')	40' – 60'		706 SF				40'		Consistent salmon bark coloration. Cold tolerant. Heat tolerant.
European hornbeam *Carpinus betulus*	40' – 60'	30' – 40'	491 SF	Slow – Moderate	Medium	8'	35'	No	This species will tolerate wet soil if they drain well, otherwise drier soils are preferred. Developmental pruning will aid in developing a good branch structure. For maximum shade, do not use the common cultivar 'Fastigiata'.
Prairie Pride Hackberry *Celtis occidentalis* 'Prairie Pride'	40' – 60'	40' – 50'	452 SF	Moderate	Medium	8' – 10'	40'	Yes	Tolerates drought and alkaline soils. Tolerates wet draining soils. Lighter fruit crops. Susceptible to nipple gall, powdery mildew and leaf spots.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Magnifica hackberry *Celtis occidentalis X laevigata* 'Magnifica'	50'	40'	706 SF	Moderate	Shallow – Medium	10'	35'	Yes	This hybrid species is better adapted to street tree use than its parents, common hackberry (*Celtis occidentalis*) and sugarberry (*Celtis laevigata*). It can be used in swales. Salt tolerant.
Katsura tree *Cercidiphyllum japonicum*	40' – 60'	25' – 45'	706 SF	Moderate – Fast	Shallow – Medium	10'	35'	Yes	Will tolerate periodic flooding, provided the soil eventually drains. Tree needs supplemental watering when young. Requires developmental pruning to establish a good form, and periodic pruning to maintain good form. Do not over-thin the canopy – it will sunburn.
Yellowwood *Cladrastus kentukea (lutea)*	30' – 50'	40' – 55'	452 SF	Moderate	Medium	8'	35' – 40'	No	Can tolerate moist, well-drained soils. Requires developmental pruning to establish a good form. Otherwise, the tree is prone to splitting. Prune only in the Summer – this tree is a profuse bleeder!
Turkish Filbert *Corylus colurna*	40' – 50'	35' – 40'	452 SF	Moderate	Medium	8'	35'	No	Cold and heat tolerate tree. Supplemental water needed the first few summers to reestablish the root system. After that, it is drought tolerant. Soils may be moist, must drain. Developmental pruning needed when young.
European beech *Fagus sylvatica*	50' – 60'	35' – 45'		Slow – Moderate	Shallow	10' – 12'	35'	No	Species will not tolerate wet, low oxygen soils. Will not tolerate salt. Makes a fine, strong canopied tree. Prune tree in the late summer to avoid bleeding.
'Purple' ('Riversii')	45' – 55'	35' – 45'	254 SF				35'		Very deep purple color in Spring. Developmental pruning needed to establish a good branch structure. Spring, changing to purple-green in the Summer.
Ginkgo *Ginkgo biloba*	50' – 80'	30' – 50'		Slow – Moderate	Medium	8'		No	This species is an ancient, living transition tree between conifers and hardwoods. It is classified with conifers, such as pines, but it grows like a hardwood. NEVER plant field seedlings! It could be a female with rancid smelling fruit. ALWAYS select a named male cultivar!
'Autumn Gold'	50'	30' – 35'	254 SF				30' – 35'		Brilliant yellow Fall color, almost iridescent. Needs developmental pruning to prevent narrow branch angles and included bark.
'Fairmount'	45' – 60'	30'	176 SF				30'		Narrow canopy tree with good branch angles. Good Fall coloration. The tree can grow tall.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
'Halka'	45' – 50'	40'	314 SF				35' – 40'		Broader canopy than most ginkgo cultivars, and will produce large amounts of shade with age.
'Princeton Sentry' ('PNI 2720')	45' – 60'	25'	113 SF				20' – 25'		Very narrow canopy for constricted areas. Good branch angles for such a narrow tree. Developmental pruning will prevent included bark.
'Saratoga'	40' – 45'	30'	176 SF				30'		Smaller scale ginkgo with very distinctive foliage, and a distinct central leader.
Thornless Honeylocust *Gleditsia triacanthos inermis*	30' – 70'	30' – 70'		Fast	Medium	8'		Yes	Extremely variable in height and width. Very salt tolerant. The species and cultivars tolerate wet conditions. Use named cultivars. Species and cultivars are susceptible to pod gall midge.
'Halka' ('Christie')	40' – 45'	40' – 45'	452 SF				35' – 40'		Broad oval canopy with good branching. Developmental pruning will ensure good branch structure. May periodically produce sterile seed pods.
'Moraine'	40' – 50'	40' – 45'	452 SF				35' – 40'		One of the earliest and best thornless cultivars. Larger canopy for good shade. Developmental pruning needed to establish good branch structure.
'Shademaster'	40' – 45'	40' – 45'	452 SF				35' – 40'		Like 'Moraine', but with ascending branches. Developmental pruning is needed to establish a good branch structure.
'Skyline' ('Skycole')	40' – 45'	30' – 35'	314 SF				30' – 35'		Pyramidal form. Best resistance to pod gall midge. Developmental pruning needed.
'True Shade'	40'	35'	314 SF				30' – 35'		Broad oval canopy with 45 degree branch angles. Fast growing shade tree. Developmental pruning will be necessary to establish good branch structure.
Espresso Kentucky Coffeetree *Gymnocladus dioicus* 'Espresso'	45' – 55'	30' – 35'	254 SF	Slow – Moderate	Medium	8'	30' – 35'	No	Vase shaped canopy like American elm. Seedless cultivar. Prune in Winter. Wood can be brittle. Developmental pruning needed to establish and maintain a good branch structure. Cold tolerant.
American hophornbeam *Ostrya virginiana*	25' – 40'	25' – 30'	176 SF	Slow	Medium – Deep	6'	25'	No	Transplant this tree in the Spring or early Summer. Graceful, lacey branch form. Few pest problems. Soils can be moist, but must drain.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Macho Amur corktree *Phellodendron amurense* 'Macho'	30' – 45'	35' 45'	452 SF	Moderate	Shallow	10' – 12'	35'	No	Male cultivar. DO NOT plant female trees. Better branch structure than species. Tends to have a shallow fibrous root system. Dark green feathery leaves.
White spruce *Picea glauca*	40' – 60'	20'	113 SF	Moderate	Shallow – Medium	10' – 12'	15' – 20'	No	Narrow canopied conifer for restricted sites. However, the root system needs adequate space. Needles are a whitish-gray color. Low branches can cause visibility problems. Susceptible to root rots in wet soils.
Scotch pine *Pinus sylvestris*	30' – 60'	30' – 40'	314 SF	Moderate	Shallow – Medium	10' – 12'	25' – 30'	No	While this tree has its benefits, it is susceptible to a number of pest problems. Roots will rot in wet soils. Use only on dry sites.
Sargent cherry *Prunus sargentii*	40' – 50'	35' – 45'	452 SF	Moderate	Shallow – Medium	10' – 12'	35'	No	Beautiful Spring blossoms, followed by small purple drupe in early Summer. Developmental pruning needed to establish a good branch structure. Use where the drupe fruit will not cause problems. Will not tolerate wet soils.
Callery pear *Pyrus calleryana*	30' – 60'	35' – 45'		Very Fast	Medium	8' – 10'		Yes	The species is a very fast growing tree, but is not readily available. DO NOT plant the cultivar 'Bradford', it self destructs after about 15 years.
'Trinity'	30' – 35'	25' – 30'	254 SF				25'		Broad oval canopy, with a flatter branch structure. Developmental pruning is still needed. Heavy blossom production. Very little fruit.
Prairie Gem pear *Pyrus ussuriensis* 'Mordak'	35' – 45'	35' – 45'	452 SF	Moderate	Medium	8'	30' – 35'	Yes	Very cold tolerant. Resistant to fire blight. Produces 1-1/2" fruit if cross pollinated. Developmental pruning needed.
English oak *Quercus robur*	40' – 60'	40' – 60'	314 SF	Slow – Moderate	Medium	8'	35' – 40'	No	The species is susceptible to powdery mildew. Large stature in the landscape. Prefers well drained soils. Does produce acorns.
'Regal Prince Oak' ('Long')		10' – 15'				8' – 10'	10' – 15'	No	Very narrow cultivar, producing very little shade. Resistant to powdery mildew.
'Rosehill Oak' ('Asjes')		20' – 25'	78 SF			8' – 10'	20' – 25'	No	Wider branched cultivar producing some shade. Resistant to powdery mildew.
Westminster Globe oak 'Michround'	40' – 55'	40' – 50'	254 SF	Slow – Moderate	Medium	10' – 12'	35' – 40'	No	Smaller sized oak is a cultivar of English oak. Very cold tolerant. May have problems with mildew. Produces an acorn crop every other year. Needs good

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
									draining soil. Needs developmental pruning.
Korean mountainash *Sorbus alnifolia*	40’ – 50’	20’ – 40’	452 SF	Moderate – Fast	Shallow – Medium	10’ – 12’	30’ – 35’	No	Adaptable to many soil types. Simple leaves. The tree does produce clusters of fruit. Though more tolerant of pests than European mountainash, it is still susceptible to many. Maintain plant health to minimize pest problems. Do not over prune.
Oak-leaf mountainash *Sorbus X hybrida (thuringiaca)*	25’ – 35’	20’ – 30’	176 SF	Moderate – Fast	Shallow – Medium	10’ – 20’	25’	No	Leaves look like oak leaves. Keep tree healthy to minimize pest problems. Developmental pruning needed. Do not over prune.
American linden *Tilia americana*	60’ – 80’	35’ – 45’	706 SF	Moderate	Medium	8’ – 10’	40’	No	The species is a very large headed tree. Can tolerate moist soils if drained well. Large leaves. Cultivars are better suited for urban use. Can have problems with aphids.
‘American Sentry’	45’ – 55’	20’ – 25’	78 SF	Moderate	Medium	8’ – 10’	25’	No	Narrow canopy. Developmental pruning needed to minimize included bark. Medium green Summer foliage.
‘Legend’	40’ – 55’	30’ – 40’	314 SF	Moderate	Medium	8’	35’	No	Broadly pyramidal with a distinct central leader. Leaves hold green color all Summer. Developmental pruning needed to maintain the central leader.
‘Redmond’	40’ – 60’	25’ – 30’	254 SF	Slow – Moderate	Medium	8’	25’ – 30’	No	Pyramidal canopy with a distinct central leader. Developmental pruning needed to maintain the central leader.
Greenspire littleleaf linden *Tilia cordata* ‘Greenspire’	40’ – 50’	30’ – 35’	254 SF	Slow – Moderate	Medium	8’	35’	No	Broadly pyramidal with a distinct central leader. Leaves hold green color all Summer. Developmental pruning needed to maintain the central leader. Tougher than American linden. Can have aphid problems.
Silver linden *Tilia tomentosa*	50’ – 70’	30’ – 45’	452 SF	Moderate	Medium	8’ – 10’	40’	No	Large headed shade tree. Tolerates moist soil, if it drains. Silver underside of leaves shimmer in the wind.
‘Green Mountain’ (‘PNI 6051’)	45’ – 60’	40’	706 SF	Moderate – Fast		8’ – 10’	40’	No	Faster growing cultivar for rapid shade. Maintains a central leader. Developmental pruning needed to maintain good branch structure. Tolerates heat and drought.
‘Sterling’	50’	40’	452 SF	Moderate		8’ – 10’	40’	No	Similar to Green Mountain, but slower growing. Yellow Fall color.

Class II - Medium Stature Trees – 30 to 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Crimean linden *Tilia X euchlora*	40’ – 60’	20’ – 30’	176 SF	Moderate	Medium	8’ – 10’	25’	No	Hybrid with yellow Fall color. More resistant to aphids. Tolerates hot, dry conditions. Developmental pruning needed to maintain good branch structure.
Frontier elm *Ulmus* ‘Frontier’	40’ – 50’	30’ – 35’	452 SF	Fast	Shallow – Medium	10’	30’ – 35’	No	Vase shaped hybrid with red fall color. Moderate resistance to elm leaf beetle. Prefers moist soil. Developmental pruning needed to maintain a good branch structure. The vase shape may be a problem under heavy snow or ice loads.

Class III - Large Stature Trees – Over 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Freeman maple *Acer X freemanii*	40’ – 60’			Moderate – Fast	Shallow – Medium	8’ – 10’		Yes	This tree is a cross between red maple (*Acer rubrum*) and silver maple (*Acer saccharine*). Growth rate is faster than red maple. Structure is better than silver maple. Developmental pruning is a must when the tree is young. While it tolerates wet soils, this hybrid does better in soils that drain.
‘Marmo’	60’ – 70’	35’ – 40’	491 SF				35’		Broadly columnar canopy. Branches angles are wider than ‘Armstrong’. Developmental pruning is needed to ensure a good branch structure.
Sugar maple *Acer saccharum*	60’ – 70’	40’ – 55’		Slow – Moderate	Medium	8’ – 10’		No	Susceptible to salt damage. Does not like small planting spaces or restricted root zones. Prefers fertile, well draining soil.
‘Bonfire’	50’ – 65’	40’ – 50’	615 SF	Moderate – Fast			35’ – 40’		More tolerant of heat. Irregular branching pattern needs developmental pruning. Fall color listed at brilliant red.
‘Majesty’ (‘Flax Mill Majesty’)	60’ – 80’	40’ – 50’	615 SF	Fast			40’		Fast growing with egg-shaped canopy. Resists frost cracking and sunscald. Very cold tolerant. Very think branching habit. Developmental pruning is needed to establish good branch spacing.
‘Green Mountain’	65’ – 75’	40’ – 50’	452 SF	Moderate			35’ – 40’		This cultivar is listed for use in hot dry areas. Slower growth with leathery leaves.
‘Wright Brothers’	50’ – 75’	35’ – 40’	491 SF	Rapid			40’		Fast growing with cone-shaped canopy. Resists frost cracking and sunscald. Very cold tolerant. Very thick branching habit. Developmental pruning is needed to establish good branch spacing.
Western Larch *Larix occidentalis*	90’ – 120’	25’ – 40’	254 SF	Moderate – Fast	Medium	10’ – 12’	30’	No	Not tolerant of west soils. Prefers well draining soils. Very cold tolerant. This is a large tree; plant only where there is space!
Cucumbertree magnolia *Magnolia acuminata*	50’ – 80’	50’ – 60’	706 SF	Fast	Shallow – Medium	10’ – 12’	35’ – 40’	No	Prefers deep, well draining soils. Plant in the early Spring. Can produce fruit on some trees. Prune after blossom.
Black Spruce *Picea mariana*	40’ – 65’	10’ – 20’	78 SF	Moderate	Medium	10’ – 12’	10 – 20’	Yes	Prefers moist soil. Grows at the edge of streams, bogs and lakes. Will tolerate stagnant water, but prefers soils that drain. Use at the upper edge of a swale. The root system is typically very shallow.

Class III - Large Stature Trees – Over 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Serbian Spruce *Picea omorika*	50’ – 60’	20’ – 25’	78 SF	Slow – Moderate	Medium	8’ – 10’	20’	Yes	Tolerates moist soils that eventually drain. Cold tolerant. Subject to aphids and budworms.
Ponderosa Pine *Pinus ponderosa*	60’ – 100’	25’ – 35’	113 SF	Moderate	Medium	10’ – 12’	30’	No	Drought tolerant native. Prefers deep, well drained soils. Can be attacked by a number of pests if growing conditions are poor. Some tolerance to salts. Three-needle pine with a coarse appearance. Produces large cones!
Southwestern White Pine *Pinus strobiformis*	60’ – 100’	25’ – 35’	113 SF	Moderate	Medium	10’ – 12’	30’	No	Drought tolerant species from New Mexico. Prefers deep, well drained soils. Blister rust can be a problem. Five-needle pine with a fine appearance. Produces large cones.
Vanderwolf Pine *Pinus flexilis* ‘Vanderwolf’	30’ – 55’	15’ – 35’	113 SF	Moderate	Medium	8’ – 10’	25’	No	Faster growth rate than species. Fine textured five-needle pine with twisting, blue-green foliage. Blister rust can be a problem.
Sycamore *Platanus occidentalis*	50’ – 85’	35’ – 50’	491 SF	Moderate	Medium	10’ – 12’	40’	Yes	Tolerates wet conditions and salty run-off. Well draining soils needed. Anthracnose can be a problem. Debris can be a problem. Fuzz on leaves can make people sneeze.
Doug-Fir Pseudotsuga menzeisii	70’ – 100’	25’ – 35’	113 SF	Moderate – Fast	Medium	10’ – 12’	30’	No	Drought tolerant native. Does not like wet soils. Doug-fir will grow faster in the Inland Empire with periodic deep watering. Produces heavy cone crops.
White Oak *Quercus alba*	50’ – 80’	40’ – 70’	452 SF	Slow – Moderate	Medium – Deep	10’ – 12’	40’	No	Hardy oak species. Does not like to have its root system disturbed once established. Does not tolerate compacted soils. Prefers deep, well draining soils. Subject to aphid infestations. Produces a cyclical acorn crop.
Swamp white oak *Quercus bicolor*	50’ – 60’	50’ – 60’	491 SF	Slow – Moderate	Shallow – Medium	10’ – 12’	35’ – 45’	Yes	Very tolerant of wet soils, especially if they eventually drain. Needs an acid soil. Very broad canopy with horizontal limbs.
Scarlet Oak *Quercus coccinea*	70’ – 75’	40’ – 50’	706 SF	Moderate	Medium	10’ – 12’	40’	No	Best Fall color of all oaks. Leaves persist through the Winter as a juvenile tree. Prefers sandy soils. Produces an acorn crop every other year. Subject to aphid infestations. Developmental pruning is required to establish a good branch structure.
Bur Oak *Quercus macrocarpa*	70’ – 80’	70’ – 80’	314 SF	Slow – Moderate	Medium	10’ – 12’	40’	No	Very large oak tolerant of most urban conditions. Will tolerate wet soils in the Spring if they eventually drain. Produces an acorn crop every year. Acorns can be up to 1-inch in diameter and 1-1/2 inch long. Needs developmental pruning.

Class III - Large Stature Trees – Over 60 Feet

Common Name Scientific Name	Height	Spread	Shade Area at 15 Years	Growth Rate	Rooting Depth	Minimum Planter Width	Optimum Spacing	Swale Suitable	Description
Valley Forge American Elm *Ulmus americana* 'Valley Forge'	60' – 80'	60' – 80'	706 SF	Moderate – Fast	Shallow – Medium	10' – 12'	40' – 45'	Yes	Dutch elm Disease resistant cultivar. Tolerates wet soils, or soil under periodic flooding. Salt tolerant. Distinct V-shaped canopy. Developmental pruning needed to establish a good branch structure. Elm leaf beetle may be a problem.
Accolade elm *Ulmus japonica X wilsoniana* 'Morton'	65' – 75'	55' – 65'	706 SF	Moderate – Fast	Shallow – Medium	10' – 12'	40' – 45'	No	Dutch elm disease resistant hybrid. Resistant to elm leaf beetle feeding. Distinct V-shaped canopy. Developmental pruning needed to establish a good branch structure. Prefers well draining soils.
Sapporo Autumn Gold Elm *Ulmus* 'Sapporo Autumn Gold'	60' – 60'	40' – 45'	452 SF	Moderate	Shallow – Medium	10' – 12'	35' – 40'	No	High resistance to Dutch elm disease. Resistant to elm leaf beetle feeding. Distinct V-shaped canopy. Developmental pruning needed to establish a good branch structure. Prefers well-draining soils.