

3.5.0 - DESIGN CRITERIA

The Land Development Code requires the protection of regulated trees during development as well as mitigation for their removal (LDC 25-8-603). Protection during development is necessary to prevent unpermitted removal of trees or damage that constitutes removal (LDC 25-8-602). This section addresses the requirements for both design around regulated trees and mitigation for their removal.

The City Arborist must make the initial determination whether trees have been adequately considered in the design process. This requires:

- The identification of significant trees;
- An assessment of conformance with minimum design criteria for tree preservation;
- An analysis of design constraints and alternatives; and
- The negotiation of mitigative measures when necessary.

A discussion of each of these aspects of plan review follows

3.5.1—Significant Tree Identification

The Land Development Code addresses tree preservation in terms of saving "protected or heritage" trees (Tree Ordinance, 1983), designing around "significant" trees and vegetation (Comprehensive Watersheds Ordinance, 1986) or preserving the "natural landscape character" (Landscape Ordinance, 1979) of an area. In order to provide a standard for defining a significant tree or group of trees an evaluation method has been provided below. Not all "protected" trees are significant due to such factors as their species or condition. Conversely, some smaller trees may have significance due to their rarity, screening potential or other factors.

A.—Tree Evaluation Method.

Whenever there is a question about which trees in a project area should be preserved, the tree evaluation method discussed below can be useful.

A designer can walk the project area with these criteria in mind and perform a rough analysis of the tree situation. Some groups of trees as well as individual trees can be identified as potential design constraints early in the process. In situations where it is necessary to choose between two (2) or more significant trees, a more detailed analysis can be performed by competent professionals in order to assign numerical values to each. These relative values can enhance the decision-making process.

In addition to the benefits described above, this tree evaluation method can be used as a "finding of fact." This can be submitted to the Planning Commission in the rare situation where no agreement can be reached over the removal of significant "protected" trees, or over the issue of whether the natural character of the site has been adequately preserved.

The method for evaluating trees for the purposes of this document is based on ten (10) factors: condition, type, size, aesthetics, energy conservation/heat abatement, safety, adjacent trees, water quality protection/soil conservation, wildlife habitat and historic significance. Each factor is graded on a scale from 1 to 4 (1 being low). Some of the factors are weighted to reflect greater importance in different situations. Weights which will be applied are as follows:

Sites – Aesthetics (2 x Score)

Waterway Alterations – Wildlife Habitat (2 x Score)

Utility Lines – Wildlife Habitat (2 x Score)

The sum of scores for all ten (10) factors determines the relative value of a tree or group of trees. Given the assigned weights, the range of possible scores is 11 to 44. To give some guidance to project designers and permit applicants, scores are categorized as follows:

11 to 22 – Low Value

23 to 32 – Medium Value

33 to 44 – High Value

A discussion of each factor follows:

1. — Condition. In assessing a tree's condition, the arborist considers trunk condition, growth rate, tree structure, insect and disease problems, crown development and life expectancy. A score is assigned as follows:

1 – Poor

2 – Fair

3 – Good

4 – Excellent

2. — Type.

The species of trees native to, naturalized in, adaptable to or frequently planted in the Austin area have been categorized based on overall quality. The chart in Appendix F indicates how each species fits in this general classification. A score is assigned as follows:

1 — Tree not included in Appendix F, 8 to 18.9 inches diameter

2 — Tree not included in Appendix F, 19 inches diameter and greater

3 — Tree included in Appendix F, 8 to 18.9 inches diameter

4 — Tree included in Appendix F, 19 inches diameter and greater

3. — Size of tree trunk.

Tree sizes are divided into four (4) categories. A score is assigned for each size category as follows:

1 – Less than 8 inches diameter

2 – 8 to 13.9 inches diameter

3 – 14 to 18.9 inches diameter

4 – 19 inches diameter and larger

4. — Aesthetics.

Trees located on the perimeters of a project area can serve to buffer or screen the project from roadways and adjacent tracts and therefore have a high aesthetic value. Trees may also score high in this category regardless of their location if they are in good condition.

and have exemplary form. Such trees should be preserved as aesthetic enhancements to the project. A score is assigned as follows:

1 = Poor

2 = Fair

3 = Good

4 = Excellent

5. Energy Conservation/Heat Abatement.

If a tree is shading a building, parking or pedestrian use area in its existing situation, it receives a high score under this category. The energy conservation/heat abatement potential is also considered even if there are no existing benefits. For example, large trees west of a buildable area will score high. A score is assigned as follows:

1 = Poor

2 = Fair

3 = Good

4 = Excellent

6. Safety.

If a tree is in a hazardous situation due to external factors related to man-made features (not inherent to the condition of the tree) such as its proximity to power lines, its location relative to a road intersection, etc., it receives a low score. Scores reflect the feasibility of mitigating the safety problems, and are assigned as follows:

1 = Hazardous; Low Mitigation Potential

2 = Hazardous; Medium Mitigation Potential

3 = Hazardous; High Mitigation Potential

4 = Not Hazardous

7. Adjacent Trees.

The proximity of other trees has a bearing on a tree's value. Everything else being equal, a lone tree has greater value than one (1) tree of many. The fate of other trees in the vicinity also affects this rating factor. A score is assigned as follows:

1 = Many trees; High Retention Potential of Adjacent Trees

2 = Many trees; Low Retention Potential of Adjacent Trees

3 = Few Adjacent Trees

4 = Lone Tree

8. Water Quality Protection/Soil Conservation.

Trees help reduce stormwater runoff and enhance ground water recharge by breaking the impact of raindrops and improving soil structure. A tree's effectiveness in this capacity is

correlated with the size of the crown and root zone area. Large trees with full crowns and unrestricted root zones score highest in this category. A score is assigned as follows:

1 = Poor

2 = Fair

3 = Good

4 = Excellent

9. Wildlife Habitat.

This factor is rated on the basis of the intrinsic value of the type of tree as a provider of food and forage and general wildlife cover characteristics, or on the basis of field observations of a particular tree, whichever is greater. The chart in Appendix F provides the intrinsic values for the major genera of trees in the Austin area.

Regarding field observations, an individual tree may rate higher than the assigned intrinsic value of the genus due to such things as the presence of food bearing parasites or epiphytes (e.g., mistletoe or grapes) or due to the potential for or actual presence of wildlife nesting cavities. A score is assigned as follows:

1 = Poor

2 = Fair

3 = Good

4 = Excellent

10. Historical Significance.

The highest rating in this category is reserved for trees which fit one of the following criteria:

- The tree is on a registry of significant trees.
- The tree has been documented as historically significant.
- The tree is rare in the Austin area.
- Due to its location and size, the tree serves as a significant landmark on the landscape.

Since historical significance is largely a function of age, the arborist's estimate of the age of the tree also has a bearing on this value. Scores are assigned as follows:

1 = Less than 40 Years Old

2 = 40 to 80 Years Old

3 = Greater than 80 Years Old

4 = Registered, Rare or Landmark Tree

B. Ecosystem Services Evaluation Methods for Heritage Trees.

LDC 25-8-642(C)(2) and 25-8-643(A)(2) state: "removal of the heritage tree is not based on a condition caused by the method chosen by the applicant to develop the property, unless removal of the heritage tree will result in a design that will allow for the maximum provision of

ecological service, historic, and cultural value of the trees on site." This code citation offers an option to applicants when attempting to demonstrate that a proposed development, which identifies removal of a heritage tree(s), results in a superior ecological service design. The following metrics establish ecological services to be measured. These metrics are not exhaustive, and additional metrics or methodologies will be considered by the City Arborist.

1. — air pollution loading reduction
2. — carbon storage and sequestration
3. — stormwater runoff and nutrient retention
4. — water quality
5. — biodiversity

These tools are intended to assess vegetative community values, though some can be applied to individual tree assessments. Acceptable methods are to use the Urban Forest Effects (UFORE) model or I-Tree ECO from the United States Forest Service or CITYgreen the ecosystem services analysis software from American Forest. Other acceptable methods can be submitted to the City Arborist for review.

Biodiversity can be measured by providing the tree diversity and relative abundance data for the proposed site. It is recommended that pre and post conditions are assessed and alternative land plan options are assessed for biodiversity retention.

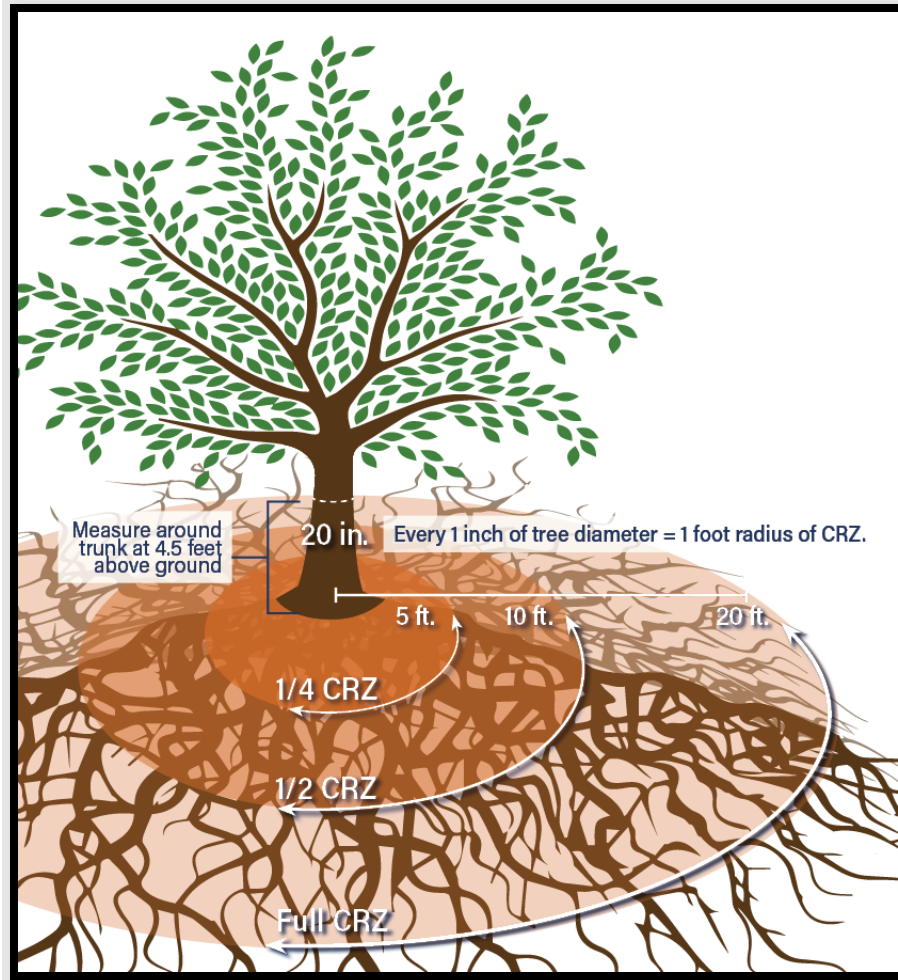
3.5.2 Preservation **Tree Preservation Criteria**

Tree removal is any "act that causes or may be reasonably expected to cause a tree to die," including damage to the root system or excessive pruning (LDC 25-8-602). This section identifies the requirements for work on or around regulated trees. When these requirements are not met the tree has not been preserved and is considered to have been removed.

A. Standard Preservation Requirements

1. Critical Root Zone

While the full root system of the tree may extend three to four times the diameter of the dripline, the Critical Root Zone (CRZ) is an area surrounding the tree where root protection is important to tree survival. The CRZ is a circle centered on the tree where the radius of the circle is a number of feet equal to the diameter in inches of the tree. All ground within that circle is the CRZ. The Half Critical Root Zone and Quarter Critical Root Zone are also used by the City Arborist staff to evaluate the likelihood of tree survival. The Half CRZ is a smaller circle within the CRZ with a radius half that of the CRZ. The Quarter CRZ is a circle within the Half CRZ with a radius one quarter that of the CRZ. The figure below depicts the CRZ, Half CRZ, and Quarter CRZ.



Certain conditions may require a larger Critical Root Zone to expect tree survival. [The City Arborist Staff](#) may request a larger preserved area for species that are less resilient to the impacts of development, such as post oak (*Quercus stellata*), high value trees, rare trees, and trees in sensitive site conditions. This request could identify a CRZ $1\frac{1}{4}$ to $1\frac{1}{2}$ times larger than the minimum standard.

The actual root structure may not always be aligned within the regulated Critical Root Zone. Examples of this include encroachment of existing code-compliant structures; retaining walls which have historically altered the grade; and compacted surfaces (e.g. driveways, road surfaces, parking lots, etc.), all within the regulated CRZ. In these types of situations, staff can exercise their professional judgment to determine the likelihood of impacts to the root structure. Other factors which may assist with minimizing tree impacts include an assessment of the existing natural conditions, low impact construction methods, and remedial tree care.

Design constraints, such as site conditions, often dictate that trees slated for preservation have some root zone disturbance. Critical Root Zone impacts reduce a tree's likelihood of survival. Impacts include:

- a. Digging, trenching, or excavating;
- b. Soil compaction;
- c. Grade changes;

d. Chemical exposure and spills.

Most trees can tolerate some Critical Root Zone impacts. Impacts may be allowed as long as the following Preservation Criteria are met:

- a. At least fifty percent of the total area (square footage) of the Critical Root Zone must be preserved at natural grade, with natural ground cover.
- b. The entirety of the Half CRZ must be protected, with the exception that cut or fill of **four inches 4"** or less is allowed within the Half CRZ.
- c. No cut or fill is allowed within the Quarter CRZ.

~~This standard requires that construction impacts associated with various design features be considered. For example, the installation of a curb typically requires excavation of two (2) feet behind the back of curb. In such a case, the line of impact on the CRZ will be two (2) feet behind the curb line shown on the plan. If the curb is shown exactly at the Half CRZ line, or if the curb cut as drawn impacts exactly fifty percent of the total area of the CRZ, the scenario is not compliant with preservation standards. This is because in either case the actual impact from the required excavation goes beyond what is shown on the plans and exceeds the maximum allowable impacts.~~

2. Canopy

Pruning is to be in accordance with the most recent ANSI A300 pruning standard. Not more than **twenty-five 25** percent of the foliage ~~shall~~ **should** be removed within an annual growing season. The percentage and distribution of foliage to be removed shall be adjusted according to the plant's species, age, health, and site. In situations where removal of more than **twenty-five 25** percent of the live canopy is intended, a permit is required. The intent of crown preservation is **to ensure that sufficient foliage remains to allow for long term continuation of critical biological functions** ~~allow for an adequate foliage area to sapwood area ratio to ensure that physiological processes, such as photosynthesis and transpiration, and exchanges of gas, water, and energy continue without impairment.~~ The City Arborist will determine if the intent of crown preservation is met (insert LDC reference).

~~Structure design shall account for the location of significant branches to avoid canopy removal in excess of standard preservation requirements. Branch height and location may need to be verified to ensure that finished elevations do not require the removal of excess canopy. It is the responsibility of the applicant to ensure the accuracy of the plans with respect to proposed canopy impacts.~~

~~Construction methods must also be considered when implementing this design standard. For example, a building wall may only require the removal of 20 percent of the crown, but the scaffolding necessary to construct the building may require the removal of an additional 20 percent of the crown. This scenario is not compliant with preservation standards because the pruning required to construct the building, including the scaffolding needs, exceeds the twenty-five percent limit even though the pruning required to clear the line of the building wall does not.~~

B. Deviations From Standard Preservation Requirements ~~Deviations from Minimum Criteria.~~

~~Impacts that exceed the requirements of ECM 3.5.2.A may be allowed if all design alternatives have been proven unfeasible and measures to limit or remediate damage from excessive impacts are taken. Approval of alternative measures is at the discretion of the City Arborist.~~

~~These criteria represent minimum standards for determining whether or not a tree is "preserved". Greater impacts may be allowed, provided that all design alternatives have been proven~~

unfeasible and that some acceptable form of mitigation such as a remedial care program is negotiated (see Section 3.5.4 C). Conversely, some cases may require that a larger area of root zone be preserved to increase the survival potential of particularly significant trees.

These criteria are enforced in the field as well as on the plan. Plan adjustments made during construction must be reviewed by the City Arborist

1. Remedial Tree Care

A tree care plan shall be required when proposed impacts or unpermitted impacts during construction exceed what is allowed under ECM 3.5.2.A. The City Arborist shall review the remedial care plan to ensure that it will address impacts that exceed standard preservation requirements. Remedial tree care plans shall be documented in approved development plans. Any of the following components may be required as part of the plan:

- a. Initial inspection and assessment by a qualified arborist,
- b. Corrective pruning to address trunk or crown injuries or hazards,
- c. Monitoring of the site during construction to ensure compliance with required tree protection per ECM 3.6,
- d. Supplemental irrigation during or after construction as well as a monitoring program to ensure appropriate moisture levels,
- e. Decompaction of compacted soil within the Critical Root Zone using a supersonic air tool or other method approved by the City Arborist,
- f. Application of organic material, soil amendments, or fertilizer based on assessment of soil conditions,
- g. Post construction monitoring of tree condition.

Remedial tree care plans shall conform to the current ANSI A300 standard for tree care. The tree care plan shall be included in approved materials. When the tree care plan will continue beyond the completion of the project a signed service contract shall be reviewed and approved by the City Arborist prior to final inspection or release of the project.

2. Low-Impact Excavation

Excavation that exceeds impacts allowed in ECM 3.5.2.A may be permitted if the work is performed by a qualified arborist with a supersonic air tool or other approved low impact method. Low impact excavation may be used to locate significant roots within areas of restricted root zone. Low impact excavation methods must allow for the excavation of soil without damage to significant roots. Roots with a diameter of 1 ½ inches or greater are considered significant. The City Arborist may authorize removal of significant roots if this will not result in damage to the tree that constitutes removal of the tree.

Boring or tunneling under the root zone may be allowed at a sufficient depth to avoid roots. Access pits for boring or tunnelling must be compliant with ECM 3.5.2.A.

Elevated foundations are an impact that may be allowed in excess of standard preservation requirements at the discretion of the City Arborist. Elevated foundations may be used to allow the foundation footprint to overlap the Half CRZ or sections of the CRZ in excess of standard preservation requirements. Elevated foundations may not be used within the Quarter CRZ. Elevated foundation types include pier and beam, cantilevered

slab, or any other design that spans the Half CRZ. Elevated foundations shall meet the following requirements:

1. Elevated foundations shall provide an air gap or void with a minimum height of six inches between the bottom of the foundation and the soil.
2. The soil in void spaces shall be protected from impacts at all times (see ECM 3.6.1) and shall be preserved at natural grade.
3. Design and construction shall allow for the direct inspection and verification of the void space.
4. Piers may be allowed within the Half CRZ if low impact excavation methods are used and significant roots are not damaged except as approved by the City Arborist.
5. When concrete is poured within the Half CRZ the hole shall be lined with a six mil plastic barrier prior to pour to prevent leaching into the surrounding soil.
6. Elevated concrete slabs poured within the Half CRZ shall use a removable form to fill the void space during the pour.
7. A remedial tree care plan including soil decompaction (see ECM 3.5.2.B.1) shall be required as a condition of approval.

3. Transplanting

Transplanting trees may be an option for preservation at the discretion of the City Arborist. Transplanting trees has a significant risk for tree mortality if it is not performed with a high level of technical expertise. Not all trees are good candidates for transplant. Due to the inherent difficulties of this type of operation, a comprehensive feasibility report prepared by a qualified arborist with proven experience transplanting large trees must accompany such a request.

Transplant proposals shall include:

- a. Condition and suitability of trees proposed for transplant;
- b. Excavation and root ball stabilization method;
- c. Transport method;
- d. Transplant schedule;
- e. Tree storage methods.

Additional information may be required for approval. Transplanted trees require a remedial tree care plan and fiscal surety posted with the City.

C. Design Considerations

1. Construction Impacts

Planners should consider construction impacts as well as the impacts of finished structures in their design. Construction impacts shall not exceed the requirements of ECM 3.5.2. Construction impacts are any impacts necessary to build what is shown on plans. Examples include site access, material staging, scaffolding locations, concrete form bracing, over excavation, post holes for fences, and necessary grade changes. When the installation of permeable ground cover such as permeable pavement or artificial turf requires grading, excavation, or compaction these are also considered

impacts.

For example, the installation of a curb typically requires excavation of two feet behind the back of curb. In such a case, the line of impact on the CRZ will be two feet behind the curb line shown on the plan. If the curb is shown exactly at the Half CRZ line, or if the curb cut as drawn impacts exactly fifty percent of the total area of the CRZ, the scenario is not compliant with preservation standards. This is because in either case the actual impact from the required excavation goes beyond what is shown on the plans and exceeds the maximum allowable impacts.

Similarly, scaffolding may require pruning beyond what is necessary for a building envelope. A building wall may only require the removal of twenty percent of the crown, but the scaffolding necessary to construct the building may require the removal of an additional twenty percent. This scenario is not compliant with preservation standards because the pruning required to construct the building, including the scaffolding needs, exceeds the twenty-five percent limit even though the pruning required to clear the line of the building wall does not.

2. Existing Conditions

New impacts in the Half or Quarter CRZ that exceed ECM 3.5.2 requirements may be allowed within the footprint of previous impacts if no damage to the tree will occur as a result of the new impacts. For example, if a slab foundation is present within the Half CRZ a new slab may be allowed in exactly the same location, provided no excavation deeper or wider than what is already present is required. ~~Staff can exercise their professional judgment to determine the likelihood of impacts to the root structure.~~ Approval of exceptions to the requirements of ECM 3.5.2 due to existing conditions is at the discretion of the City Arborist.

3.5.3 - RESERVED

3.5.4 - Mitigation

Mitigation for the removal of regulated trees is required by ~~under~~ LDC 25-8-624(D), 25-8-642(D), and 25-8-643(B). Planting new trees or preservation of unregulated trees are the primary forms of mitigation. Alternative mitigation may be approved by the City Arborist when these are not feasible. Proposals that benefit the urban forest may be considered for mitigation credit on a ~~case-by-case~~ basis.

A. Calculating Mitigation

1. Mitigation Rates

Mitigation is expressed as the total caliper inches of required replacement trees. Mitigation shall be calculated by multiplying the diameter of the tree removed by the percentage in the table below according to the tree's diameter and species calculation replacement trees shall be measured in accordance with ECM 3.5.4.B.1. Existing trees shall be measured in accordance with ECM 3.3.2.A.2. Mitigation requirements may be modified for trees in categories marked with asterisks if the City Arborist determines they are in poor condition.

Trunk Diameter	Appendix F Species	Not Appendix F Species
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8 - 18.9 inches	50%	25%
19 inches and greater	100%*	50%
Heritage	300%*	N/A

2. Exemptions from Mitigation Requirements

A permit is required for the removal of or impact to any regulated tree, including those exempted from mitigation requirements.

a. Dead, Diseased, and Imminent Hazard

Per LDC 25-8-x, no mitigation shall be required for the removal of any regulated tree determined by the City Arborist to be dead, diseased beyond rehabilitation, or constitute an imminent hazard.

b. Mitigation Exempt Species

No mitigation shall be required for removal of one of the following species:

Arizona ash (<i>Fraxinus velutina</i>)	Chinaberry (<i>Melia azedarach</i>)	Chinese Parasol (<i>Firmiana simplex</i>)
Chinese Pistache (<i>Pistacia chinensis</i>)	Chinese Tallow (<i>Triadica sebifera</i>)	Golden Rain Tree (<i>Koelreuteria paniculata</i>)
Ligustrum (<i>Ligustrum spp.</i>)	Mimosa (<i>Albizia julibrissin</i>)	Mulberry, Paper (<i>Broussonetia papyrifera</i>)
Mulberry, White (<i>Morus alba</i>)	Photinia (<i>Photinia spp.</i>)	Salt Cedar (<i>Tamarix spp.</i>)
Siberian Elm (<i>Ulmus pumila</i>)	Tree of Heaven (<i>Ailanthus altissima</i>)	Vitex (<i>Vitex agnus-castus</i>)

B. Forms of Mitigation

1. Replacement Trees

Replacement trees are the preferred method of mitigation.

a. Measuring Replacement Trees

Replacement trees shall be measured at six inches above the soil level. If this measurement is greater than four inches they should be remeasured at twelve inches above soil level and the second measurement used. On trees with

multiple stems only those stems with a caliper of at least one inch shall count towards mitigation. Full credit shall be given for the largest qualifying stem and half credit for all other qualifying stems.

b. Qualifying Species

Eligible replacement tree species are listed in ECM Appendix F. The City Arborist may approve species not listed in Appendix F for mitigation credit. At least seventy five percent of the total caliper of all replacement trees shall be from species designated Significant Shade Providers in Appendix F. The remaining twenty-five percent may be of any Appendix F species.

Replacement trees shall be of a species suited to the particular site where they are planted. To encourage diversity of species in the urban forest, when twenty or more inches of replacement trees are planted on a site they must be selected from at least two species. When one hundred or more inches of replacement trees are planted on a site they must be selected from at least five species, with no single species representing more than fifty percent of the total caliper of the required mitigation.

c. Planting Requirements

The spacing of replacement trees shall be appropriate to their species and to the site. Replacement trees adjacent to Austin Energy lines or other infrastructure shall comply with all Austin Energy requirements and recommendations.

Replacement trees shall be planted on the site where the mitigated tree was located unless an alternate planting location is approved by the City Arborist. ~~Alternative planting locations should be in close proximity to the original site. The applicant is responsible for any additional authorizations and permits required for offsite planting.~~

d.c. Quality Stock

Replacement trees shall be planted in accordance with the ANSI 300 standard for tree care. Replacement trees shall be free of pests, disease, and significant damage or structural defects. They shall have a visible root flare at the soil line and be planted at the proper depth.

e.d. Irrigation

Replacement trees shall be provided with automatic irrigation for their establishment. When added to an existing irrigation system they shall have their own zone so that they can be watered at a frequency and rate appropriate to newly planted trees. Where installation of automatic irrigation is not feasible a water truck may be used instead. If a water truck is used for irrigation it must be approved prior to planting and an executed contact with a water truck service included with approved materials.

f.e. Hill Country Roadway Replacement Trees

Replacement trees for Hill Country Roadway projects shall be of a species listed on the approved list of Hill Country trees in Appendix F.

2. Preservation of Unregulated Trees and Natural Areas

Mitigation requirements may also be met through the preservation of unregulated trees or natural areas which that would otherwise be damaged or removed during development.

a. Qualifying Trees

To receive mitigation credit for their preservation trees shall:

1. have a diameter less than the minimum regulated size for the site;
2. be of a species listed in ECM Appendix F;
3. be without significant damage or structural defects;
4. be located on the site in an area that is otherwise developable.

b. Preservation Guidelines

Unregulated trees preserved for mitigation credit shall conform to all rules for regulated trees in this Section at all stages of design and construction. Failure to meet preservation standards shall result in the loss of mitigation credit and will require a plan revision to address mitigation requirements through other methods. Unregulated trees which are not indicated for preservation during the design phase shall not be eligible for mitigation credit during or after construction.

c. Calculating Mitigation Credit

One inch of mitigation credit shall be given for each diameter inch of trees preserved in this category.

3. Alternative Mitigation

On some sites the amount of required mitigation may exceed the space available for replacement trees. When the City Arborist determines that a site is unsuitable for the required planting, payment to the Urban Forest Replenishment Fund (UFRF) shall be made as an alternative form of mitigation. When a site can support some but not all of the required mitigation as many replacement trees as are feasible shall be planted and the balance of mitigation addressed through payment into the UFRF.

a. Qualifying Criteria

Criteria which may qualify a site for alternative mitigation include:

1. Planting the required mitigation would require exceeding the understory species limits in 3.5.4.B.1.b;
2. The required mitigation would require denser spacing of replacement trees than is appropriate to the site;
3. The soil in available planting locations is of a volume or quality such that long term survival of the trees is unlikely and remediation is not practicable;
4. Expected future development or site conditions make the long term survival or preservation of the trees unlikely.

b. Payment rate

When approved as alternative mitigation, payment into the UFRF shall be made at a rate of \$200 per inch of required mitigation, or \$75 for certified affordable developments. Payments into the UFRF may be used for off-site tree planting and maintenance, promoting tree care and preservation, urban forest conservation, and enforcement of City tree protection and mitigation regulations.

Applicants who wish to claim a mitigation credit under Texas Local Government Code Section 212.905 should indicate this on their application.

3.5.3 Design Constraints and Alternatives

In addition to the preservation of significant trees, other factors which affect plan design in Austin include such things as restrictions on building on steep slopes, in floodplains and near critical environmental features; cut and fill limitations; access and egress restrictions; parking requirements; landscape area requirements; building height limitations; and impervious cover limitations. Tree preservation is intrinsically less definitive than most of these restrictions, and requires that those constraints, as well as other issues such as public health and safety and reasonable and lawful use of the property, be considered in an evaluation of whether a project meets tree preservation requirements of the Land Development Code.

In order to best provide for the preservation of significant trees, the project designer should carefully consider different design alternatives in the initial planning of the project. Meeting with the City arborist in a preliminary consultation prior to submitting plans for review is advised when there appear to be conflicts between design constraints. Early resolution of such conflicts during the design phase is usually advantageous.

In the review of a proposed project, the first indicator of how well trees have been incorporated in the design process is, how will the proposal impact the medium to high valued "protected" trees (19 inch diameter and larger). These trees are considered on an individual basis and a proposal to remove any of them is carefully scrutinized. Removals which are not adequately justified may require major plan alterations.

Another indicator is, how will the proposal impact smaller, significant trees (less than 19 inch diameter). These trees are typically considered in mass as they relate to the overall preservation of the natural character of the site. Individual trees are examined to see whether minimum design criteria have been met, but recommendations for major plan alterations are reserved for cases where large numbers of these trees are to be adversely impacted without adequate justification.

An example of a major plan change might be to notch a proposed building in a manner which would result in a loss of the building's square footage. A less restrictive change might be to alter the configuration of the building, but maintain the same square footage.

The following sections include text and illustrations describing some design alternatives which can be used to preserve significant trees.

A. Parking and Vehicular Use Areas

A few examples of ways to achieve the standards or otherwise preserve significant trees adjacent to parking areas are as follows:

- Use compact car parking space allotments in a manner which allows an expansion of peninsula or median sizes.

- Use minimum allowable dimensions of parking spaces.
- Reduce the number of parking spaces to the minimum required.
- Use angled parking to minimize parking aisle widths and expand peninsulas and medians.
- Consolidate nearby landscaped peninsulas and apply for alternative compliance to the 50-foot spacing requirement.
- Realign or alter sizes of drives to avoid trees.
- Shift parking medians.
- Reduce building sizes or change uses to reduce the number of required parking spaces.

1. Permeable Paving

Another design alternative which may be considered in some situations is the use of permeable paving. This alternative is less preferable than leaving 50 percent of the root zone natural. The qualities that make a good paving surface are in direct conflict with the qualities necessary to save tree roots. Permeable paving is permitted, however, provided the installation meets City of Austin Standards and City of Austin Standard Specifications and the following design criteria:

- Finished grade of the permeable paving surface must be a minimum of six (6) inches and a maximum of 18 inches above existing grade to provide room for base and paving material without cutting.
- A minimum distance of three (3) feet must be maintained between curb and tree to minimize potential for trunk scarring by vehicles.
- Minimum of 25 percent of the CRZ must remain at natural grade with a natural ground cover.
- The combined area of permeable paving and natural cover around a tree must be at least 75 percent of the CRZ.
- Permeable paving is only permitted in parking spaces and low traffic drives. It is not permitted in areas that are likely to be staging areas for fire ladder trucks.

These design criteria, as well as the construction specifications must be observed in the field. Deviations may be considered code violations.

B. Buildings.

Some alternatives to preserve significant trees are as follows:

- Provide a pier and beam foundation.
- Provide finished floor elevations which minimize required cut or fill.
- Notch buildings around significant trees.
- Design building to fit under crowns of adjacent trees.

To comply with the design criterion requiring preservation of a tree's crown, consideration must be given to the following:

- Providing adequate work space during construction;

- Providing a safe distance between limbs and walls (especially glass), eaves, roofs, etc.; and,
- Applying proper pruning techniques (see City of Austin Standard Specifications).

C. — Sidewalks and Pedestrian Use Areas.

Sidewalks often appear innocuous on plans, but can be very detrimental to trees due to grading requirements. Some design alternatives which should be considered are:

- Move sidewalk as far from tree trunks as possible.
- Provide a finished grade above existing grade for sidewalks required in close proximity to a tree trunk.
- Route drainage under sidewalks where elevated grade is required.
- Reduce width of sidewalk (minimum of four (4) feet when adjacent to a street curb or three (3) feet otherwise).

D. — Grading.

Tree preservation and grading requirements are two (2) design constraints which are most often in conflict. A grade change of a few inches can be detrimental to a tree, yet most sites require extensive cut and fill in order to manage drainage flow. Some design alternatives which can be used to preserve significant trees are as follows:

- Use berms or retaining walls instead of cutting to provide detention.
- Design detention ponds around significant trees, adding depth to minimize width where possible.
- Provide tree well and/or aeration systems for trees in fill areas (see City of Austin Standard Specifications and City of Austin Standards).
- Provide retaining walls to mitigate cuts and fills.
- Erosion and sedimentation controls shall be installed and maintained to not cause impacts that exceed preservation criteria.

E. — Utilities.

Underground water and wastewater lines, storm sewers, irrigation lines and both underground and overhead electric and telephone lines have considerable impact on trees.

Some typical design alternatives which should be considered are as follows:

- Establish the utility easement where it will have the least impact on trees, if possible.
- Stack underground utility lines to reduce the number of trenches required.
- Bore or tunnel under trees to minimize root impacts.
- Prescribe methods to mitigate impacts on trees during construction not addressed in standard specifications and details (e.g., lifting lines over significant trees during stringing of power poles).

3.5.4 — Mitigation Measures

The emphasis on preserving existing trees is due in part to the adverse or unique growing conditions in the Austin area. In general, native trees have adapted to stresses associated with the physical, climatic, and biological conditions of the Austin area, thus making preservation more critical in order to mitigate the long-term impacts of tree removal.

Mitigation is required when removal is authorized under 25-8-624(D), 25-8-642(D), or 25-8-643(B). The City Arborist shall recommend an appropriate mitigation program. A typical program would include one or more of the following mitigation measures:

- Planting replacement trees;
- Preserve or restore natural areas, ecosystems, or plant communities;
- Providing a maintenance program for trees to be retained; See C.O.A. "Remedial Tree Care Notes"- Appendix P-6.
- Requiring special construction techniques; and,
- Transplanting existing trees.
- Alternative mitigation proposals for enhancement of the urban forest (e.g. payment into a tree fund)

In considering the above mitigation measures, proposals which will enhance any aspect of the city's urban forest will be considered by the City Arborist. Proposals should be submitted in writing. When all feasible mitigation efforts have been exhausted, and upon approval of the City Arborist, funds may be provided to the Urban Forest Replenishment Fund (UFRF) as part of the mitigation requirements and managed in accordance with the most current City of Austin fiscal policies and procedures. Payments into the UFRF may be used for:

- (1) off-site tree planting and maintenance;
- (2) promoting tree care and preservation;
- (3) urban forest conservation;
- (4) enforcement of City tree protection and mitigation regulations.

A standard formula of one-caliper inch of replacement value is equivalent to \$200.00, or \$75 for certified affordable developments and placed into the UFRF. (NOTE: This option is not intended to facilitate the excessive removal of trees.) Trees have varying values based upon numerous tree and site conditions (see ECM 3.5.1). The following mitigation rates apply for medium-valued trees; however the City Arborist may raise or reduce these rates for high or low valued trees:

- Heritage – 300%
- greater than 19 inches diameter and located in Appendix F – 100%
- 8 to 18.9 diameter inches and located in Appendix F – 50%
- greater than 19 inches diameter and greater and not located in Appendix F – 50%
- 8 to 18.9 inches diameter and not located in Appendix F – 25%
- Sizes smaller than 8 diameter inches found in Appendix F (for example: development in Parks under ECM Section 5.3.0 and Hill Country Roadways under ECM Section 2.7.0) – 50%
- Sizes smaller than 8 diameter inches and not found in Appendix F (for example: development in Parks under ECM Section 5.3.0 and Hill Country Roadways under ECM Section 2.7.0) – 25%

• The following trees may require a permit but do not require mitigation in order to meet the objectives of the non-native, invasive species management efforts of the City of Austin:

Common Name	Latin Name
Tree of heaven	<i>Ailanthus altissima</i>
Mimosa	<i>Albizia julibrissin</i>
Paper Mulberry	<i>Broussonetia papyrifera</i>
White Mulberry	<i>Morus alba</i>
Russian Olive	<i>Elaeagnus angustifolia</i>
Chinese Parasol	<i>Firmiana simplex</i>
Golden Rain Tree	<i>Koelreuteria paniculata</i>
Ligustrum	<i>Ligustrum spp.</i>
Chinaberry	<i>Melia azedarach</i>
Nandina	<i>Nandina domestica</i>
Photinia	<i>Photinia spp.</i>
Chinese Pistache	<i>Pistacia chinensis</i>
Pyracantha	<i>Pyracantha coccinea</i>
Salt Cedar	<i>Tamarix spp.</i>
Chinese Tallow	<i>Triadica sebifera</i>
Siberian Elm	<i>Ulmus pumila</i>
Lilac-chaste	<i>Vitex agnus-castus</i>

Non-compliant tree impact or removal may necessitate more extensive mitigation. This may include an assessment of the tree or situation which would identify a monetary and community value based upon replacement cost, trunk formula method, or cost of repair (see the most recent edition of the Guide for Plant Appraisal, Council of Tree and Landscape Appraisers). These mitigation measures may also be associated with fines, penalties, and time delays associated with corrective measures.

Mitigation measures are not intended to supplant good site analysis, or planning and design practices that consider all elements of the site, including existing trees and ecological features. In view of the emphasis on tree preservation requirements discussed above, mitigation for tree removals will be considered only after all feasible design alternatives to preserve trees have been exhausted. A discussion of each measure follows.

A.—Replacement Trees.

The most common measure used to mitigate tree removals is the planting of replacement trees. The following factors affect tree replacement:

- The available planting area;
- The anticipated rate of survival of trees planted;
- The quantity of trees to be planted; and
- The types of trees proposed.

1.— Available Planting Area.

Replacement trees should be planted on the site or easement from which existing trees are to be removed. If this is not feasible, a person may initiate a proposal to plant trees off-site. This may be acceptable if the planting site is in reasonable proximity to the project area.

2.— Survival Potential.

Before agreeing to any replacement option, the City arborist will assess the probability that trees planted will survive. This typically requires that some type of irrigation capability be implemented for a minimum two (2) year period. Irrigation may not be required if it can be adequately demonstrated that, given the size and type of trees planted, the planting site and the time of year the trees are planted, the mortality rate is likely to be low.

3.— Quantities of Replacement Trees.

Replacement tree values will be expressed in terms of caliper inches. For example, a plan must identify when a 20 inch diameter tree is allowed to be removed, and the required caliper inch replacement.

After completion of the tree evaluation, the City Arborist will determine if the tree mitigation plan is appropriate. The size of replacement trees are typically between one (1) and four (4) caliper inches. Trees greater than four (4) caliper inches may be permitted if the feasibility is adequately documented.

As an example, if the site in question could only support a few trees, and there was good irrigation available, then five (5) trees with a minimum caliper of four (4) inches would be acceptable. If there was ample planting space and minimal irrigation potential, then 20, one (1) inch caliper trees would be more acceptable.

In determining the total caliper inches of replacement trees acceptable as compensation for trees removed, the City Arborist can use the evaluation results. For the highest valued trees (for example, 33 and greater), replacement may be more than 300 percent of the diameter of the tree in question and lesser valued trees may not require mitigation.

4.—Types of Replacement Trees.

In order to enhance the general quality of the urban forest in Austin, certain restrictions will be placed on the types of trees which will be allowed to serve as replacement for trees removed. Unless site conditions prohibit it, 75 percent of the total caliper inches of replacement trees required must be represented by significant shade trees located in Appendix F. The remaining 25 percent of total caliper inches may be represented by a mixture of Appendix F tree species. All trees selected must be suitable for the environment of the immediate planting site (see Appendix F for specific categorization such as tree, soil, site, or regulatory qualities). Further, replacement trees should be representative of the plant community that were present prior to development or species typically associated with the forest type found at or near the project location.

A minimum of five (5) different species of trees must be planted if more than 100 caliper inches of trees are required, not to exceed more than 50% of one species to be planted. A diversity of tree species is shown to reduce the chances of disease and pest epidemics.

5.—Hill Country Roadway Corridor Replacement Tree Provisions. In accordance with code requirements, replacement trees for Hill Country Roadway projects must come from the approved list of Hill Country trees found in Appendix F.

6.—Enforcement Criteria.

The location, size and type of all replacement trees must be shown on approved plans in a manner which will allow verification of their installation at the time of inspection for Certificate of Occupancy or project release.

Optimum planting times do not always correspond to project completion. For that reason, replacement tree plantings may take place after the project is released provided, that before project release, a person posts fiscal security in an amount for installed trees with a one (1) year guarantee, plus 15 percent to cover administrative costs.

In areas where no irrigation system is available, irrigation may be supplied by water truck. In such cases, prior to project release, a person must submit:

- A signed water truck service contract for review and approval by the City arborist; and,
- Fiscal security in an amount equal to the going rate for the approved service plus 15 percent to cover administrative costs.

B.—Natural Area Preservation.

Another form of mitigation for trees removed which may be considered is the preservation of areas containing significant trees and other vegetation which might normally be destroyed during the construction process. Examples are areas within the normal limits of construction such as parking medians, landscape areas adjacent to proposed buildings, etc. which contain trees and vegetation that are not required to be surveyed and are not normally subject to protective measures.

In order to qualify as a mitigative measure, these areas must be delineated on the plan in the same manner as any limit of construction (see Section 3.3.2 C). The area must also be protected in accordance with City of Austin Standard Specifications and City of Austin Standards for tree protection.

C.—Tree Maintenance.

This mitigation measure is most appropriate in cases where the minimum design criteria established in Section 3.5.2 cannot be met for individual trees. Deviations from these criteria

increase the chances of a tree's death or greatly reduced longevity. A remedial care program can increase the survival potential to an acceptable level in many cases.

A good maintenance program is beneficial for all trees subjected to changes in micro-climate conditions resulting from development activities even when all feasible design criteria and protective measures have been met. For this reason, a tree maintenance program for all remaining trees on a site may serve as mitigation for trees destroyed in lieu of replacement trees in some cases.

The City arborist must review the remedial care program to ensure that it will accomplish what is necessary to maintain the viability of any affected trees. A complete and effective remedial tree care program may include the following:

- 1) have a qualified arborist conduct an initial inspection and assessment;
- 2) treatment of any trunk or crown injuries;
- 3) monitoring plan for irrigation and drainage around trees;
- 4) ensure mulch is placed in appropriate locations and depths to maximize root zone protection;
- 5) improve aeration to tree root zones*;
- 6) assessment of nutrient limitations and amend soil for tree optimization*, and
- 7) monitor for decline and hazards.

*Appendix P-6 provides recommendations for aeration and soil amendments.

To ensure compliance, the program must be documented by a plan note at the time of plan approval. In addition, prior to release of the project, a person must submit:

- A signed service contract for review and approval by the City arborist; and,
- Fiscal security in an amount equal to the going rate for the approved service plus 15 percent to cover administrative costs.

These measures are necessary because the remedial care program must typically extend over a minimum 18-month period after completion of the project.

D. Special Construction Techniques.

In conjunction with remedial care, mitigation for trees removed may include special construction techniques not normally required in standard specifications. Some of these techniques include the following:

- Prior to excavation within tree driplines or the removal of trees adjacent to other trees that are to remain, make a clean cut between the disturbed and undisturbed root zones with a rock saw or similar equipment to minimize root damage.
- In critical root zone areas that cannot be protected during construction with fencing and where heavy vehicular traffic is anticipated, cover those areas with a minimum of 8 inches of organic mulch to minimize soil compaction. In areas with high soil plasticity Geotextile fabric, per standard specification 620S, should be placed under the mulch to prevent excessive mixing of the soil and mulch. Additionally, material such as plywood and metal sheets, could be required by the City Arborist to minimize root impacts from heavy equipment. Once the project is completed, all materials should be removed, and the mulch should be reduced to a depth of 3 inches.
- Perform all grading within Critical Root Zones by hand or with small equipment to minimize root damage.

• Water all trees most heavily impacted by construction activities deeply once a week during periods of hot, dry weather. Spray tree crowns with water periodically to reduce dust accumulation on the leaves.

• When installing concrete adjacent to the root zone of a tree, use a plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil.

E. Transplanting.

Another form of mitigation may be to transplant existing trees especially when anticipated development impacts cannot be alleviated. Due to the inherent difficulties of this type of operation, a comprehensive feasibility report prepared by a qualified arborist (and with proven experience with successful large tree transplanting) must accompany any such request.

The feasibility report must contain such things as:

- Suitability and condition of tree(s) proposed for transplanting;
- Digging and root ball stabilization method;
- Relocation sites;
- Method of transport;
- Time of year transplanting will take place;
- Storage methods (if any); and,
- Maintenance programs before and after transplanting