

City of Pacific Grove



Urban Forestry Standards

September 2012

Acknowledgements

City of Pacific Grove

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1. Introduction

The following Urban Forestry Standards (standards) are the Pacific Grove’s primary tool to provide for orderly protection of specified trees, to promote the health, safety, welfare, and quality of life for the residents of the city, to protect property values and to avoid significant negative impacts on adjacent properties. By ensuring preservation and protection through the following standards of care, these resources will remain significant contributions to the landscape, streets, and parks, and will continue to help define the unique character of the city.

These Urban Forestry Standards establish specific technical standards and specifications necessary to implement the city's tree ordinance (Municipal Code Title 12), and to achieve the city’s tree preservation goals. The City of Pacific Grove hereby establishes a 25-year city-wide canopy cover target to maintain the existing canopy cover with the goal of a total canopy cover of 33%. Programs shall maximize opportunities for the planting of Public Trees. These goals are intended to provide consistent care and serve as benchmark indicators to measure achievement in the following areas:

- Ensure and promote preservation and restoration of the existing tree canopy cover within the city limits.
- Provide standards of maintenance required for protected and city-owned trees.
- Provide a standardized content for tree reports required by the city.
- Establish criteria for determining when tree risk exceeds community tolerance thresholds and management strategies need to be implemented in order to preserve public health, safety and welfare.
- Provide standards for the replacement of trees that are permitted to be removed.
- Increase the survivability of trees during and after construction events by providing protection standards and best management practices.
- Enforcement of these standards and associated regulations by authorized City staff and public safety personnel.

1.1 Required Practices

All of the standards described in this chapter are required practices unless noted otherwise (e.g. “recommended”). These required practices are to be implemented by the property owner, project applicant, contractor or designee - and are the minimum standards by which the care of a Protected Tree is to be administered. These Required Practices are considered reasonable measures that are consistent with best management practices in the tree care industry and are intended to promote healthy, structurally sound trees.

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In all such cases, the Community Development Department, Public Works or City Arborist, if justified by field conditions such as conflict with utilities or a public nuisance, has the discretion to modify or add to any condition, practice or standard mentioned within the standards.

1.2 Recommended Practices

The Recommended Practices identified in this chapter are not mandatory. It should be noted, however, that a recommended practice may be required if it is so specified within the 'conditions of approval' for a development project or mitigation for injury or disturbance.

In all cases, the Director of Public Works and Community Development or the City Arborist, if justified by changing field conditions such as conflict with utilities, has the discretion to modify, re-designate or add to any condition, practice or Standard mentioned within the standards.

1.3 Definitions

Certain terms that are unique to the arboricultural or construction industry are defined to provide a uniform understanding of the terms and concepts used and mentioned in this document and Title 12 of the Municipal Code.

"Building Coverage" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Community tree program fund" means a dedicated city fund comprising donations, moneys appropriated by the city council, fines, tree damage assessments, and in-lieu fees collected under the authority of this title and established by the city council in the city's master fee schedule. Community Tree Program Fund expenditures shall be used for the following purposes: 1) to provide additional trees elsewhere on a site; 2) to plant and maintain of Public trees; 3) to assess and mitigate high-risk trees; and 4) to execute tree replanting consistent with goals and strategies in urban forest management programs.

"Critical Root Zone" shall mean the area that should be protected during construction to minimize impacts to a tree. To prevent construction damage, fence off the critical root zone. Estimate the Critical Root Zone by measuring the diameter of the trunk at breast height (dbh) in inches, multiplying that number by 1.5, and using that number in feet as the radius of the protected area. For example, a ten-inch tree would need to have tree protection fencing located 15 feet away from the trunk; while a 20-inch tree would need to have tree protection fencing located 30 feet away from the trunk.

"Development" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Discretionary development approval" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Emergency" means a sudden, usually unexpected, occurrence requiring immediate action to protect life and property.

“Feasible” means capable of being implemented, taking into account such factors as safety of persons and property, the environment, aesthetics, and economic considerations.

“Hedge” means and includes any plant material, shrub or plant, when planted in a dense, continuous line or area, as to form a thicket or barrier.

“High-Risk Tree” means an imminent hazard or threat to the safety of persons or property, with a Potential Failure Rating of 9 or higher.

“Invasive Tree” means a Tree that is not Native to the Monterey Peninsula and that has the ability to thrive and spread aggressively on the Peninsula. They tend to disrupt the natural habitat, squeeze out native plants and animals, and reduce biodiversity.

“*Landscape Trees for Pacific Grove*” means the approved list of trees in the City of Pacific Grove, which may be updated and amended from time to time by resolution of the City Council.

“Lower Canopy Tree” means a tree of a species that tends to be less than 40 feet tall at maturity. Lower Canopy Trees tend to have leaves and needles larger and softer than those of Upper Canopy Trees, better able to catch the available light and with less need to defend against the buffeting of the wind and rain. Most Lower Canopy Trees, including the ornamentals and fruit trees, are not native to the Monterey peninsula.

“Native Tree” means a species that was common on the Monterey Peninsula prior to the arrival of Europeans. These Trees, such as the Monterey pine and Monterey cypress, co-evolved over a very long period with other plants, animals, fungi, and microbes, to form the complex network of mutually reliant relationships found in the Peninsula’s native ecosystems.

“Parks” means and includes all Parks to which names have been given by action of the city council.

“Person” and “Persons” means and includes any and all individuals, partnerships, firms, associations, corporations, governmental agencies, and other legal entities, and the agents, employees, and representatives thereof.

“Plant” means and includes all other plant material, non-woody, annual, or perennial in nature, not necessarily hardy.

“Protected Tree” means those Trees as defined in Municipal Code Chapter 12.30 and described in more detail in the Urban Forestry Standards.

“Prune” or “Pruning” means to Remove dead growth, tip live branches, thin live foliage, or a combination. Pruning does not include topping.

“Prune Substantially” or “Substantial Pruning” shall apply to both above-surface and underground cutting or Removal. With reference to branches, either term shall mean cutting or Removal of more than 25 percent of the live branches of the entire Tree within

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a 12-month period; or Removal of foliage so as to cause the unbalancing of a Tree; and/or cutting or Removal of any live limb with a diameter of 6 inches or greater or a circumference of 19 inches or greater at any point on such limb. With reference to roots, either term shall mean cutting or Removal of any root 4 inches or greater in diameter.

“Public property” means and includes all grounds owned by or leased to and under the control of the city of Pacific Grove or other governmental agency.

“Public Trees” means all Street Trees and all other Trees located on Public Property.

“Qualified Professional” means a Person who possesses the credentials, degrees, or qualifications that support the resource-specific skill required to adequately prepare and submit Tree Reports, including:

- A Person designated by the International Society of Arboriculture as a: Certified Arborist; Municipal Specialist; Board Certified Master Arborist; or Certified Tree Risk Assessor.
- A Person designated by the American Society of Consulting Arborists as a: Registered Consulting Arborist.
- A degreed Forest Ecologist.

“Remove” or “Removal” means any of the following:

- Complete Removal, such as cutting to the ground or extraction, of a Tree.
- Taking any action foreseeably leading to the death of a Tree or permanent damage to its health; including but not limited to excessive pruning, cutting, girdling, poisoning, overwatering, unauthorized relocation or transportation of a Tree, or trenching, excavating, altering the grade, or paving within the Critical Root Zone.

“Review Authority” means the city official or body responsible for reviewing and making decisions on permit requests, either initially or on appeal.

“Root Crown” means the zone of transition between the Tree trunk and supporting roots.

“Shrub” means and includes any woody perennial plant, normally low, several-stemmed, and capable of being shaped and pruned without injury, within the area planted.

“Snag” means a dead tree, generally ranging between 12 and 30 feet high, from which the top and a majority of the branches have been removed, in order to provide wildlife habitat.

“Street” means and includes all land lying between the boundaries of property abutting on all public Streets, boulevards, alleys and walks.

“Street Tree” means any Tree whose trunk is located all or primarily within the Street easement or on public property between the Street right of way and a Street-facing property.

“Substantial Pruning”—see “Prune substantially.”

“Suitable” shall mean appropriate to the situation, taking into account: safety of persons and property; environmental values such as wind break, soil erosion, and wildlife habitat; Tree density; Tree health; aesthetic results; and economic factors.

“Tree” means any woody plant that has a trunk six inches or more in diameter at four and one-half feet (54 inches) above natural grade level. For purposes of this title, a multi-trunk Tree shall be considered a single Tree and the circumference of that Tree shall be the sum of the circumferences of the trunks of that Tree.

“Tree Protection Zone” see “Critical Root Zone”.

“Tree Report” means a Tree assessment report meeting the standards specified in prepared by a Qualified Professional.

“Tree Service Contractor” means any Person providing tree trimming and removal services for a fee or other consideration.

“Upper Canopy Tree” means a Tree of a species that tends to be taller than 40 feet at maturity and is able to thrive (when mature) in circumstances providing greater direct exposure to the sun and wind. The leaves and needles of the upper canopy tree are often tough, to withstand drying without damage when moisture is less readily available. Upper Canopy Trees Native to the Monterey peninsula include Monterey pine, Monterey cypress, Monterey cypress, Monterey pine, and Torrey pine. Upper canopy trees provide shelter and shade for species lower in the canopy and on the ground.

“Urban Forestry Standards” means the standards issued to implement Municipal Code .

1.4 Coastal Zone Standards

The Local Coastal Program (LCP) Land Use Plan policies apply to tree management practices in the Coastal Zone. The LCP Land Use Plan is an element of the City's General Plan. Within the coastal zone area of the City, the LCP Land Use Plan shall take precedence over the General Plan and Urban Forestry Standards where policies are similar or conflict. All development projects must take into consideration the LCP Land Use Plan as well as these Urban Forestry Standards. If policies within this plan overlap or conflict, the policy that is the most protective of coastal resources shall take precedence.

The coastal zone of Pacific Grove contains several land habitats that are considered environmentally sensitive in the LCP Land Use Plan, including the shoreline pine forest/sand dune association and the pine/eucalyptus overwintering habitat of the Monarch butterfly. Policies in the LCP Land Use Plan that address the urban forest include, but are not limited to:

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- Designing new development in the Asilomar Dunes area (bounded by Asilomar Avenue, Lighthouse Avenue, and the boundary of Asilomar State Park) to protect existing and restorable native dune plant habitats, as well as the native oaks and pine forest which stabilize the inland edge of the high dunes along Asilomar Avenue southwards from the vicinity of its intersection with Pico Avenue.
- Designing new development within the scenic forest-front area along Asilomar Avenue to minimize loss of native Monterey pine and oak forest, and to retain public views towards the inland face of the high dunes.
- Retaining the scenic native forest within Asilomar Conference Grounds, along Asilomar Avenue, and within the abandoned railroad right-of-way, shall, to the maximum feasible degree. (note: although these lands are not under the jurisdiction of the City, the Coastal LCP applies to them)
- Protecting, or, when necessary, replanting, landscape trees which contribute to the scenic views in the City's coastal zone.

1.5 Assumptions and Limiting Conditions

- No responsibility is assumed by the City of Pacific Grove for matters legal in character regarding these standards. Any legal description that may be provided is assumed to be correct.
- Care has been taken to obtain reasonable information from reliable sources for these standards.
- Visual aids within the standards, such as sketches, diagrams, graphs, photos, are not necessarily to scale and should not be construed as engineered data for construction.
- These standards have been crafted to conform to current standards of care, best management practices, evaluation and appraisal procedures, diagnostic and reporting techniques and sound arboricultural practices.

2. Management Framework

This section assigns responsibility for the care and management of the urban forest resources and defines responsible parties/departments, assessment protocol and best management practices.

2.1 Standards of Care

Trees growing in the City of Pacific Grove require regular inspection to identify needs, assess condition, potential risk factors and provide a Due Standard of Care.

The City Arborist shall maintain all trees growing on public lands in order to provide a Due Standard of Care.

Private property owners should engage a Qualified Professional to assess the condition of trees growing on their property.

Tree removal or maintenance required on public or private lands shall be performed by a company with a valid Pacific Grove Urban Forest Tree Care license.

All trees in the City of Pacific Grove, public or private shall be maintained in adherence to the most current versions of the following industry standards and practices:

- American National Standards Institute (ANSI) A-300
- International Society of Arboriculture, Best Management Practices

2.1.1 City Arborist

The City shall retain a qualified professional City Arborist. Certification by the International Society of Arboriculture is the minimum qualification for this position. Preferred designations are:

- Certified Urban Forester, California Urban Forest Council
- Municipal Specialist, International Society of Arboriculture

The City Arborist is responsible for the implementation of the Urban Forestry Standards, including:

1. Promoting the value of trees within the community on both public and private properties.
2. Implementing the Tree Risk Management program and assessing and mitigating high-risk trees.
3. Consulting with constituents on tree related matters.
4. Resolving (or administering the resolution of) tree related conflicts within the community.

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5. Administration of the city Tree Ordinance.
6. Administer the tree permit process.
7. Maintaining all related records.
8. Producing reports when requested.
9. Giving presentations and submitting written reports to the City Manager, Natural Resources Commission and City Council.
10. Responding to tree related inquiries or requests for service.

2.1.3 Qualified Professional

The City Arborist shall compile and maintain a list of “Qualified Professionals” to review tree related issues and prepare and submit assessment reports when necessary.

The list of “Qualified Professionals” should be compiled through a review and screening process to determine experience, capability and demonstrated objective, unbiased behavior.

The “Qualified Professional” should possess resource specific skills and education to accurately opine on the issue at hand; if there is an assessment of a Native Monterey pine forest required, a forest ecologist may be the most “Qualified Professional.” If a risk assessment is required, an ISA Certified Arborist/Board Certified Master Arborist or an ASCA Registered Consulting Arborist may be the most “Qualified Professional.” If a timber harvest plan is required, a Registered Professional Forester is the most “Qualified Professional.”

A “Qualified Professional” shall possess credentials, degrees or qualifications that support the resource specific skill required to adequately prepare and submit assessment reports such as:

- International Society of Arboriculture
 - Certified Arborist
 - Municipal Specialist
 - Board Certified Master Arborist
 - Certified Tree Risk Assessor
- American Society of Consulting Arborists
 - Registered Consulting Arborist
- Register Professional Forester

“Qualified Professionals” shall not be a principal or employee of a tree service or other contract service provider that has a vested interest or conflict of interest in the subject project.

2.1.4 Pacific Grove Urban Forest Tree Care License

All companies performing tree related work that are not a governmental or non-profit organization conducting work in the City of Pacific Grove shall be licensed by the City to perform tree work for hire, including landscaping crews performing young tree pruning

and planting of trees. Personnel performing tree pruning shall be ISA certified arborists, certified tree workers or those with parallel professional designations/ registrations/ certifications. In order to obtain a Tree Care License, applicants shall pay the annual license fee and sign an agreement to perform work according to these Urban Forestry Standards. Licensees shall provide proof of appropriate consumer protection standards such as workers compensation and liability insurance, business license, state contractor's license and identification of company vehicles and other responsible practices for their constituency.

Pacific Grove Urban Forest Tree Care License shall be valid for 1 year (or more). The licensing fee and timeline shall be set by resolution of the City Council.

2.1.5 Public Tree Inventory

The City shall compile and maintain an inventory of individual trees on all public lands. The inventory should be cataloged at a minimum by street trees, park trees, and facility trees segment-able by land use. The inventory shall objectively evaluate tree resources to aid in decision making for maintenance, planting, and budgeting.

The inventory should include a land use specific canopy analysis identifying current coverage levels. This baseline data will be used to determine existing canopy coverage, available planting sites and measure success of tree-growing objectives.

The inventory should include all vacant available planting sites, and should provide the data needed to calculate the costs and benefits of the community's tree resources.

The inventory should be updated and managed with the most recent information each time a tree is inspected or maintained.

The inventory should be developed as an online resource with mapping features depicting locations and specific information; attributes, weaknesses, age class, risk rating and photos. This can be used a community engagement and educational tool.

2.2 Tree Risk Assessment

The City intends to meet or exceed all arboricultural industry standards including *American National Standards Institute A-300 (Part) 9 Draft 1 Version 1* Tree Risk Assessment a. *Tree Structural Assessment*.

The Pacific Grove Community Defined Risk Threshold is any tree with assigned Failure Potential Ratings of 9 or greater.

The City Arborist shall administer the Tree Risk Assessment Program and achieve a Due Standard of Care through the implementation of this policy as follows:

Qualified Professionals trained in tree risk assessment shall perform systematic inspections of all trees on City lands on a determined cycle.

2.2.1 Levels of Assessment

The level of assessment required for Tree Risk Rating shall be determined by prominence of weak structural conditions according to the following assessment criteria.

Level 1 assessment shall be a limited visual assessment of an individual tree or a population of trees near specified targets, such as along roadways or utility rights-of-way, to identify specified conditions or obvious defects. Assessment methodology shall be specified by the Qualified Professional.

Level 2 assessment shall include a 360-degree, ground-based visual inspection of the tree crown, trunk, trunk flare, above-ground roots, and site conditions around the tree in relation to targets. When sounding is specified, a mallet or equivalent tool should be used to detect large hollows and loose bark in the trunk, root collar, and above ground buttress roots. Use of hand tools, trowels, binoculars, or probes, shall not be precluded from a Level 2 assessment. An assessment should include the identification of conditions indicating the presence of structural defects.

Level 3 assessment shall include, but are not limited to, one or more of the following tree assessment methods:

- Aerial assessment of branch or stem defects;
- Drilling;
- Evaluation of target risk;
- Increment boring;
- Investigation of tree or site history related to possible or defined defects;
- Lean assessment;
- Probing;
- Pull testing;
- Radiation assessment (e. g. radar, x-ray, gamma ray);
- Resistance drilling;
- Sonic assessment;
- Sounding; and,
- Sub-surface root and/or soil assessment.

Risk levels shall be rated using the PNW International Society of Arboriculture (ISA) *Hazard Tree Evaluation* form following PNW ISA Tree Risk Assessment Program criteria. The *Hazard Tree Evaluation* rating system is based on three categories:

- | | |
|-------------------------------|---------------|
| a. Failure potential | 1 to 5 points |
| b. Size of the Defective Part | 1 to 3 points |
| c. Target Area | 1 to 4 points |

Inspection results shall be documented within the City Tree Inventory. Risk levels that meet or exceed the Community Defined Risk Threshold of 6 shall be pro-actively managed using the following table:

Table-1: Overall Risk Rating and Action Thresholds

The Overall Risk Rating and Action Thresholds

<i>Risk Rating</i>	<i>Risk Category</i>	<i>Interpretation and Implications</i>
3	Low 1	Insignificant - no concern at all.
4	Low 2	Insignificant - very minor issues.
5	Low 3	Insignificant - minor issues not of concern for many years yet.
6	Moderate 1	Some issues but nothing that is likely to cause any problems for another 10 years or more.
7	Moderate 2	Well defined issues - retain and monitor. Not expected to be a problem for at least another 5 - 10 years.
8	Moderate 3	Well defined issues - retain and monitor. Not expected to be a problem for at least another 1 - 5 years.
9	High 1	The assessed issues have now become very clear. The tree can still reasonably be retained as it is not likely to fall apart right away, but it must now be monitored annually. At this stage it may be reasonable for the risk manager/owner to hold public education sessions to inform people of the issues and prepare them for the reality that part or the entire tree has to be removed.
10	High 2	The assessed issues have now become very clear. The probability of failure is now getting serious, or the target rating and/or site context have changed such that mitigation measures should now be on a schedule with a clearly defined timeline for action. There may still be time to inform the public of the work being planned, but there is not enough time to protracted discussion about whether or not there are alternative options available.
11	High 3	The tree, or a part of it has reached a stage where it could fail at any time. Action to mitigate the risk is required within weeks rather than months. By this stage there is not time to hold public meetings to discuss the issue. Risk reduction is a clearly defined issue and although the owner may wish to inform the public of the planned work, he/she should get on with it to avoid clearly foreseeable liabilities.
12	Extreme	This tree, or a part of it, is in the process of failing. Immediate action is required. All other, less significant tree work should be suspended, and roads or work areas should be closed off, until the risk issues have been mitigated. This might be as simple as removing the critical part, drastically reducing overall tree height, or taking the tree down and cordoning off the area until final clean up, or complete removal can be accomplished. The immediate action required is to ensure that the clearly identified risk of harm is eliminated. For areas hit by severe storms, where many extreme risk trees can occur, drastic pruning and/or partial tree removals, followed by barriers to contain traffic, would be an acceptable first stage of risk reduction. There is no time to inform people or worry about public concerns. Clearly defined safety issues preclude further discussion.

The Table shown above outlines the interpretation and implications of the risk ratings and associated risk categories. This table is provided to inform the reader about these risk categories so that they can better understand any risk abatement recommendations made in the risk assessment report.

2.2.2 Stumps, Snags and Slash Management

Stumps, snags (dead and topped trees with trunks remaining standing) and slash may provide food storage and nesting structures for wildlife.

Stumps, snags (dead and topped trees with trunks remaining standing) and slash should be left on public and open spaces if they do not increase fire hazard, create a risk to public safety or disturb view sheds.

Snags should be left no taller than the distance to of a target; use area, structure that would be struck in the event the snag fell.

Snags should be assessed at regular intervals to determine risk levels and managed when risk levels exceed 6, the Community defined Risk Tolerance Threshold.

2.2.4 Flammable Fuel Management

Fuel management is the planned manipulation or reduction of living or dead vegetation to prevent the ignition of wildland fires and to reduce the spread and intensity of any wildfire.

The Rip Van Winkle Open Space area and southern and eastern boundaries of the Del Monte park district are identified as Very High Fire Hazard Severity Zone VHFHSZ) by CalFire.

The City of Pacific Grove Urban Forestry Department and private property owners shall manage flammable fuel loads on their respective properties per the guidelines provided below and CalFire *General Guidelines for Creating Defensible Space*.

Grasses

1. Once annual grasses cure (beginning early to mid-June) they are to be maintained at or about 4 inches in length within the 100' fuel management zone.
2. Multiple grass mowing/cutting may be necessary following wet winters.
3. Technique used (mower v. weed eater) should be sensitive to slope and potential for erosion.

Trees

1. Within the 100' fuel management zone, remove from mature trees: all vines, dead branches and all live branches less than 3 inches to 8 feet above the ground.
2. Small trees and tree-form shrubs (to 15 feet) should be pruned-up 1/3 their height. The space between tree foliage and shrubs should be 3 times the height of the shrub. This can be accomplished by pruning the tree, shrub, or both.

Shrubs and Shrub Patches

1. Shrubs and shrub patches located under the canopy of trees should not exceed 18 inches in height.
2. Dead limbs should be removed from shrubs.
3. Individual shrubs and shrub patches outside of the canopy of trees should be managed to allow for adequate horizontal spacing. Individual shrubs or grouping of shrubs should be maintained in a form so their diameter does not exceed 2 times their height.
4. Whenever possible it is recommended that Scotch Broom (*Genesta sp*) Coyote bush and invasive species be removed during the fuel management process to promote the restoration of native plant communities.

Disposition of pruned vegetation

1. The preferred option should be to chip the native plant material on site and use for mulch in the landscape or distribute in the open in key erosion prone areas. Chipped material can also be spread within the landscaped areas where appropriate to reduce compaction and rebuild soil biota.
2. The alternative option should be to haul plant material off site and dispose of properly. This procedure is required for non-native, invasive and disease affected

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material. These materials should be hand loaded onto a truck and tightly covered with tarps for transport and disposal off-site.

3. Tree Reports

3.1 Introduction

A tree report is needed for development projects and tree removal permits. The report must be prepared by a certified arborist for the applicant and submitted to the city for the purpose of providing accurate information and opinion regarding the condition, welfare, maintenance, preservation or value of a protected or designated tree.

3.1.1 When a Written Report is Required

Generally, there are two circumstances in which tree reports are required: 1) When a tree removal permit is sought, and 2) To complete and verify a site plan, assess tree impacts and establish tree protection for property development when within the Critical Root Zone of a protected or designated tree.

3.1.2 Who May Prepare the Report

The tree report is to be prepared by a certified arborist retained by the applicant or property owner. This person shall possess a current ISA certification, be a member of the American Society of Consulting Arborists; or a member of good standing in another nationally recognized tree research, care, and preservation organization.

3.2 Types of Reports

There are four types of reports, each of which are discussed below, namely:

1. Letter Report
2. Tree Survey Report
3. Tree Protection and Preservation Report
4. Tree Appraisal

3.2.1 Letter Report

A brief format is acceptable for removal and development related activities (described below), and can generally be used for assessing one or two trees. The report is to be on letterhead stationery of the individual preparing the report, including their ISA Certification number.

Removal

For a tree removal, not in connection with a property development, the report shall provide information and determination whether the tree is dead, High risk or constitutes a nuisance under the Pacific Grove Municipal Code Chapter 12.40.

Development

For development on a single family residential lot (not a subdivision), the report shall also clearly indicate whether or not any Protected or Designated tree is so close to the

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building area or building footprint that it will be killed or permanently injured by disturbance. The report must make specific recommendations to protect and preserve the tree during the course of construction consistent with the specifications within these standards.

Submittal Requirements

Standard information

All letter reports shall contain the following information:

- Arborist name and certification number;
- Purpose of the report and for whom;
- Site address; date of the inspection(s);
- A to-scale diagram of the tree(s) location;
- Accurate size of the trunk diameter (measurement taken at 54-inches above natural grade);
- Perimeter of leaf canopy;
- Proximity to structures;
- Condition of the tree health (and/or decay presence);
- Condition of the tree structure;
- Imminent danger of failing (ISA Hazard Rating, see High risk Trees, above);
- Interface with utility services;
- Conclusion and recommendation(s);
- Photographs (encouraged); and,
- Tree protection instructions (if applicable).

Specific Situations

Other conditions may require the following additional information on an as needed basis if requested by the reviewing city staff: tree protection plans; appraised value (see Tree Appraisal, below); and any other supporting information, photographs, diagrams, etc. that may be necessary.

3.2.2 Tree Survey Report

A more extensive Tree Survey Report is required for all development projects except those identified above (Letter Report). The Tree Survey Report shall inventory all trees that are greater than 4-inches in diameter (measured at 12-inches above natural grade) on site, including trees to be removed, relocated and retained on the property (including trees on neighboring properties that overhang the project site) and all Public trees in the right-of-way within 30-feet of the project site. In addition to the information required in a Letter Report, the Tree Survey Report shall also include an inventory of the

trees, site plan, appraised value (see Appraisals, below) of the trees and any other information pertinent to the project.

Submittal Requirements

Items to include:

All Tree Survey Reports shall contain all items required for a Letter Report (identified above) as well as the following information:

- Cover letter;
- Title page;
- Table of contents (if necessary);
- Date of the inspection(s);
- Site plan (showing each tree location by number that correlates with the tree inventory on plans;
- A separate list of all Protected Trees with location numbers;
- Tree inventory data (include tree species, size, health, structure, etc. for all trees on the project site, including those to be removed (tables may be used);
- Condition of the trees (include information with respect to health, structure, decay, imminent danger of falling, existing property lines, structures and utility services);
- The monetary value that each tree contributes to the real estate value of the property shall be determined and listed separately. The formula used should be noted (see Tree Appraisal, below); and,
- Conclusion, recommendation(s) and ratings for suitability for preservation.

If necessary, other supporting information, photographs, diagrams, etc. may be required or provided.

3.2.3 Tree Protection and Preservation Plan

All Protected or Designated Trees to be retained on a development site shall be shown on approved sets of civil, building and landscape plans and shall be protected during the construction process. A Tree Protection and Preservation Plan submitted for review by the Community Development Department and the City Arborist is required when trees to be saved may be injured by disturbance.

The Tree Protection and Preservation Plan shall assume compliance with the standards described below in the section on Tree Protection and Preservation During Development. In addition, the following submittal information must be included in the report:

REMOVAL, REPLACEMENT, AND PLANTING OF TREES

Submittal Requirements

Disclosure of All Trees On and Near the Site

The property owner or designee shall provide accurate information to the project arborist to develop the tree protection measures and to enable accurate recommendations to insure their survival. This site plan shall accurately show the surveyed location, species, size of trunk and leaf canopy; show the Critical Root Zone of any neighboring trees that may overhang the site and Public trees that are within 30 feet on each side of the project. Failure to show a tree on the plans and later determined to be affected by construction may require the work to stop until mitigation can be agreed upon by the property owner and the city.

Final Improvement Plans

In addition to the above information, final improvement plans shall include and show the following information: show the Critical Root Zone of any tree to be retained and the protective fencing around the protected zone of each tree or group of trees (to be clearly identified as such on all plans as a bold-dashed line); permeable paving located within the Critical Root Zone area; approved utility pathways; grade changes; surface and subsurface drainage and aeration systems to be used; walls, tree wells, retaining walls and grade change barriers, both temporary and permanent; landscaping and irrigation within Critical Root Zone of trees.

4. Tree Protection and Preservation during Development

4.1 Introduction

The objective of this section¹ is to preserve and protect existing trees by reducing negative construction impacts to a less than significant level. Trees vary in their ability to adapt to altered growing conditions. Mature trees have established stable biological systems in the preexisting physical environment. Disruption of this environment by construction activities interrupts the tree's physiological processes causing depletion of energy reserves and a decline in vigor, often resulting in the tree's death. Since construction impacts are cumulative and long term, this reaction may develop from one to twelve years or more after disruption. These standards define protocol to identify the condition of existing tree resources, distinguish trees suitable for preservation, inform design that retains and protects the maximum number of suitable trees, assess project impacts, preserve and protect trees during construction, maintain and monitor trees post construction.

These standards shall define criteria for tree protection to guide a construction project to insure that appropriate practices will be implemented in the field to eliminate negative impacts that may result from uninformed or careless acts, and preserve both trees and property values.

Typical negative impacts that may occur during construction include: mechanical injury to roots, trunk, or branches; soil compaction, which degrades the functioning roots, inhibits the development of new roots, and restricts drainage which desiccates roots and enables water mold fungi to develop; changes in existing grade which can cut or suffocate roots; alteration of the water table - either raising or lowering; microclimate change; exposing sheltered trees to sun or wind; and sterile soil conditions associated with stripping off topsoil. For these reasons it is imperative that the commitment to tree protection begins in the planning stages of a project.

These standards shall apply to all Protected Trees in the City of Pacific Grove. These standards do not apply to unprotected trees or trees previously approved for removal.

4.2 Assessment of the Tree Resources

1. During the conceptual stages of a development project, prior to project design and

¹ This section was adapted from City of Palo Alto Tree Technical Manual and Trees and Development, Adapted from County of Monterey Tree Report Requirements, City of Monterey Tree Protection Guidelines, James P. Allen & Associates and City of Scotts Valley Municipal Code Section 17.44.

TREE PROTECTION AND PRESERVATION DURING DEVELOPMENT

submittal of a permit application, a Tree Resource Assessment is recommended be performed by a Qualified Professional, and may be required by the City Arborist. This Qualified Professional will be designated the Project Arborist for the duration of the project, from planning stages through final inspection. The Project Arborist should be familiar with the tree species affected and experienced with procedures necessary to construct the project. In the event the Project Arborist is desired to be replaced by the property owner or the City, the replacement arborist shall be approved by the City prior to replacement. All costs associated with the Project Arborist shall to be borne by the applicant.

2. The initial Tree Resource Assessment should be completed during the conceptual planning stage to inform the project design, prior to submittal of a permit application.
3. Trees that are suitable for preservation, with Risk Ratings less than 5 and capability to tolerate moderate construction impacts, should be considered for incorporation into the final project design.
4. The project shall preserve, or mitigate for, the maximum number of suitable individual trees that exist on the site pre-development.
5. Tree Resource Assessment Report Requirements.
6. Numerically tag, map and identify the location of individual trees on a site plan.
7. Submit tree inventory table or spreadsheet, including the following information:
 - a) Assigned tree number, corresponding to mapped location
 - b) Common name
 - c) Botanical name
 - d) Tree Condition using an excellent/good/fair/poor rating system
 - e) Health
 - f) Structure
8. Preservation Suitability rating system evaluating tree health, structure, species characteristics, age and potential longevity.
 - a) Trees with a "good" rating have adequate health and structure with the ability to tolerate moderate impacts and thrive for their safe, useful life expectancy.
 - b) A "fair" rating indicates health or structural problems that have the ability to be corrected. They will require monitoring with an expectation that their lifespan will be shortened by construction impacts.
 - c) Trees with a "poor" rating possess health or structural defects that cannot be corrected through treatment. Trees with poor suitability can be expected to continue to decline regardless of remedies provided. Species characteristics may not be compatible with redefined use of the area. Species which are non-native and unusually aggressive are considered to have a poor suitability rating.
9. Factors to be considered or included:

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- a) Condition of root crown, base and roots.
 - b) Condition of trunk including decay, injury callusing or presence of fungus or spores.
 - c) Condition of limbs and twigs (identify) including strength of crotches, amount of deadwood, whether excessive weight is borne by limbs, and need for trimming.
 - d) Condition and growth rate history including pest damage and diseases.
 - e) Leaf appearance.
10. Describe the surrounding site, forest composition.
 11. Critical Root Zone (CRZ) extents will be determined and mapped - Individual tree root systems provide anchorage, absorption of water/minerals, storage of food reserves and synthesis of certain organic materials necessary for tree health and stability. The Critical Root Zone is the tree-specific amount of roots necessary to continue to supply these elements essential for this tree to stand upright and maintain vigor. This distance (CRZ) reflects the minimum measurement from the trunk required for the protection of the tree's root zone.
 12. Construction activities proposed within these CRZ areas are subject to specific review and the implementation of recommended special treatments.
 13. Canopy extents will be mapped.
 14. Risk Rating will be determined per the Management Framework discussion above.
 15. A summary report shall be submitted to the Planning Division of the Community Development Department to be used to determine where improvements and utilities can be positioned to preserve or minimize impacts to suitable trees.
 16. The Project Arborist shall work closely with the design team (architect, landscape architect, or project designer) prior to submittal of the permit application. Tree permits associated with development are reviewed and approved by the same Review Authority as for the related planning permit and processed concurrently.
 17. Disclosure of Information Regarding Existing Trees: Any application for discretionary development approval, or for a building or demolition permit where no discretionary development approval is required, shall be accompanied by a statement by the property owner or authorized agent which discloses whether any Protected Trees exist on the property which is the subject of the application, and describing each such tree, its species, size, Critical Root Zone, and location. This requirement shall be met by including the information on plans submitted in connection with the application.
 18. In addition, the location of all other trees on the site and in the adjacent public right-of-way which are within thirty feet of the area proposed for development, and trees located on adjacent property with canopies overhanging the project site, shall be shown on the plans, identified by species.
 19. The city may require submittal of such other information as is necessary to further the purposes of this chapter including but not limited to photographs, and condition

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of the trees (e.g. structural deficiencies, disease, infrastructure impacts, etc.), as determined by a certified arborist.

20. Disclosure of information pursuant to this section shall not be required when the development for which the approval or permit is sought does not involve any change in building footprint nor any grading or paving.
21. Removal or substantial pruning of a tree(s) is considered development activity when it is for the purposes of: (1) erecting or adding to a structure, including, but not limited to, fences, sheds, decks and retaining walls, (2) providing parking, (3) grading, trenching, or lot clearance, or (4) any other activity requiring a building permit or any discretionary land use entitlement.

4.3 Construction Impact Analysis

1. Prior to issuance of a planning or building permit, the Project Arborist must review grading, drainage, utility, building and landscape plans to determine impacts to individual trees.
2. Recommendations for alternative construction methods and preconstruction treatments shall be made.
3. Tree protection and preservation specifications including a protection-fencing plan shall be completed.
4. Mitigation requirements for trees removed due to construction impacts shall be determined.
5. The appraised value of trees to be preserved shall be calculated.
6. A Construction Impact Assessment Report, accompanied by a Tree Location Map/Preservation Plan, may be required to be submitted to the Planning or Building Division of the Community Development Department, depending on the permits required, and reviewed by the City Arborist.
7. All procedures recommended by the Project Arborist through review of planning or building permits shall be Conditions of Project Approval or delineated on construction drawings for the Building Permit.

4.4 Minimum Tree Protection Standards during Construction

1. All development projects shall adhere to the most current version of the "American National Standards Institute A-300 (Part 5) Management of Trees and Shrubs During Site Planning, Site Development and Construction".
2. To avoid beetle infestation, the lower six feet of Monterey pine trees scheduled for preservation shall be sprayed with an appropriate pesticide as recommended by a licensed pest control adviser.
3. All improvement plans for the project shall include accurate trunk locations, Critical Root Zones (CRZ), and Canopy Extents of all trees, or groups of trees, to be preserved within the development area. Tree Protection measures, fencing

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locations, and Special Treatment Areas are to be clearly defined on approved architectural/site plans to be used in the field and to be on file with the Community Development Department.

4. The Project Arborist shall verify, in writing with photo verification, that all preconstruction conditions have been met (tree fencing, erosion control, pruning, pre-construction treatments, etc.) and is in place. Written verification shall be submitted to, and approved by, the Building Division of the Community Development Department prior to any demolition, grading or building permit issuance.
5. The demolition, grading, and underground contractors, construction superintendent, and other pertinent personnel are required to meet with the Project Arborist at the site prior to beginning work to review procedures, tree protection measures, and to establish haul routes, staging areas, contacts, watering requirements, etc.
6. All tree protection measures recommended in the Tree Resource Evaluation/Construction Impact Analysis are to be clearly presented in the building plans.
7. The City Arborist will inspect project specific Tree Protection measures as installed.

5. Growth and Development of the Pacific Grove Urban Forest²

In order to develop trees that grow, reach maturity and provide maximum benefits, a comprehensive growing plan is necessary. The following sections provide guidance for site selection, species selection, nursery stock selection, tree planting, and addressing conflicts between trees and infrastructure.

All tree growing elements in the City of Pacific Grove should adhere to the most current versions of *ANSI A-300 Standards and Landscape Trees for Pacific Grove, A Guide to Selection, Planting and Care*.

5.1 Site Selection

A thorough site analysis should be performed for all proposed plantings on public and private lands.

1. Adequate below and above-ground space should be required for the space to be identified as an appropriate planting site. If there is insufficient space to allow the tree to grow to full size, a different site or a smaller growing tree species should be chosen.
2. Tree planting sites should allow adequate distance between the tree trunk and hardscape elements that may be damaged by root development. A general distance to maintain is 10 to 20 feet for mature trees.
3. Tree planting sites should contain adequate soil volumes to allow tree root growth. Below ground space requirements should be twice the area of the above ground canopy coverage extents.
4. Soils shall have sufficient drainage capabilities as verified by a simple percolation test; dig a hole 24 inches in depth, fill with water, and monitor the time it takes for the water to drain. If water moves from the hole into the surrounding soil at a rate less than two inches per hour or pools at the bottom of the whole, drainage capabilities are poor.
5. Trees planting sites in poorly draining soils shall be dug shallow, to a depth that equals two-thirds to one-half the height of the container. This results in a "mounded" type-planting site.

² This section includes materials adapted from *Up by the Roots*, James Urban.

6. Irrigation water supply should be tested to ensure there are no toxic elements or high salt concentrations.

5.2 Species Selection

Species planted in the City of Pacific Grove shall be selected from the list of appropriate landscape trees for Pacific Grove.

The Natural Resources Commission in partnership with the City Arborist, and knowledgeable community members shall update the list of appropriate landscape trees for Pacific Grove as needed.

Tree species selected shall respect land use and rebuild native systems where space allows. Native Monterey pine shall be the species of choice for reforesting Rip Van Winkle Open Space and some sections of George Washington Park.

5.3 Nursery Stock Selection

The selection and procurement of high quality, nursery grown trees is of paramount importance in Growing the Urban Forest.

All nursery grown trees planted in the City of Pacific Grove shall adhere to criteria defined in *Guideline Specifications for Nursery Tree Quality* authored by The Urban Tree Foundation.

5.4 Tree Planting

Trees planted in the City shall adhere to the most current version of *American National Standards Institute (ANSI) A-300 (Part 6) Transplanting* (Tree Planting Cue card by the Urban Tree Foundation) and the list of appropriate landscape trees for Pacific Grove.

5.4.1 Selecting quality trees

Planting quality trees begins by choosing vigorous, structurally sound trees from the nursery. Strong trees have straight roots, a thick trunk, and one central dominant leader growing straight to the top. The root collar (the uppermost roots) should be in the top 2 inches of the root ball.

5.4.2 Digging the hole

A firm flat-bottomed hole will prevent trees from sinking. Dig the hole only deep enough to position the root collar even with the landscape soil surface. Use the rototiller or shovel to loosen soil in an area three times the size of the root ball. This loose soil promotes rapid root growth and quick establishment.

5.4.3 Installing the tree

Remove soil and roots from the top of the root ball to expose the root collar; cut away any roots that grow over the collar (see Appendix C, Figure 3). Also cut any roots that circle or mat along the sides and bottom of the root ball (see Appendix C, Figure 4). The root collar should be even with the landscape soil after planting (see Appendix C,

Figure 3). Backfill with soil removed from the hole. Minimize air pockets by applying water and packing gently. Build a berm 4 inches tall around the planting hole to help force water through the root ball.

5.4.4 Staking

Staking holds trees erect and allows the root ball to anchor. Secure the trunk at the point where the tree stands straight. A second stake tied directly to the trunk made of bamboo may be required to straighten the upper trunk.

5.4.5 Mulching

A layer of organic mulch, such as leaf litter, shredded bark, or wood chips, helps protect tree roots from temperature extremes and conserves soil moisture. Mulch also helps prevent grass from competing with the tree for water and nutrients. The mulched area makes it easier to operate mowers and weed eaters without hitting the trunk and compacting soil. Apply mulch to a depth of 3 to 4 inches (slightly thinner on top of the root ball).

5.4.6 Irrigating

Consistent irrigation is critical for establishment. 1. Apply about 3 gallons irrigation per inch of trunk diameter to the root ball 2 or 3 times a week for the first growing season. 2. Increase volume and decrease frequency as the tree becomes established. 3. Weekly irrigation the second year and bimonthly irrigation the third year should be sufficient for establishment. 4. Once established irrigation requirements depend on species, climate and soil conditions. 5. Irrigation devises should be regularly checked for breaks and leaks.

5.4.2 After Planting Care

Aftercare is essential to ensure new plantings succeed and grow. Newly planted trees shall be monitored weekly for the first three months, monthly during the next year's growth and then at six (6) month intervals for a period of five years or until they acclimate to their new environment.

5.4.7 Pruning

Training young trees promotes structurally sound growth and overall tree health. Cut back or remove codominant stems (stems that compete with the central leader) to encourage growth in the central leader (below).

5.4.3 Early Training Pruning

1. Directing the growth of young trees is essential if mature trees are to perform properly in the landscape. Early training pruning will establish proper structure and form.
2. Shade trees that grow to be large should have one relatively straight central leader. Heading the tree is acceptable provided the central lead is retrained.

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3. Main branches should be well distributed along the central leader, not clustered together. They should form a balance crown appropriate for the cultivar or species.
4. The diameter of branches that grow from the central leader, or trunk, should be no larger than two-thirds (one-half is preferred) the diameter of the trunk measured just above the branch.
5. The largest branches should be free of bark that extends into the branch union, known as included bark (see A and B).
6. Temporary branches should be present along the lower trunk below the lowest main branch. These branches should be no larger than 3/8 inch in diameter. The trunk should be free of wounds, sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, or lesions. Properly made recent pruning cuts are acceptable.
7. The trunk caliper (thickness) and taper should be sufficient so that the tree remains vertical without a stake.
8. The root collar (the uppermost roots) should be within the upper 2 inches of the solid media (substrate). The root collar and the inside portion of the root ball should be free of defects, including circling, kinked, and stem grinding roots. You may need to remove soil near the root collar to inspect for root defects.
9. The tree should be well rooted in the soil media. Roots should be uniformly distributed throughout the container. The tree's structure and growth should be appropriate for the species or cultivar. When the container is removed, the root ball should remain intact. When the trunk is lifted, both the trunk and root system should move as one.
10. The root ball should be moist throughout at the time of inspection and delivery. The roots should show no signs of excess soil moisture as indicated by poor root growth, root discoloration, distortion, death, or foul odor. The crown should show no signs of moisture stressed as indicated by wilted, shriveled, or dead leaves or branch dieback.

5.5 Tree Maintenance

Tree Maintenance in the City of Pacific Grove shall be performed to specifications written in accordance with American National Standards Institute (ANSI) A300 (Part 1) Tree Management Standards in accordance with International Society of Arboriculture Best management Practices.

Trees on Public Property and within the city right-of-way shall be pruned by the Urban Forestry Department to maintain a Due Standard of Care. Vertical clearance shall be maintained at a minimum height of 13'6" for all roads, streets throughways etc. Tree with a Risk Rating of 6 or greater shall be managed.

Trees on Private Property shall be pruned to maintain a Due Standard of Care at the expense of the Property owner.

5.6 Trees and Infrastructure³

5.6.1 Introduction

Trees and hardscape/infrastructure elements are often in conflict when tree roots damage curbs, gutters, sidewalks, utility/drainage lines, foundations and retaining walls on both public and private properties. The most effective long-term planning strategy to avoid these conflicts is to dedicate larger planting sites for tree planting. Since a mature tree requires a minimum distance of 10 to 20 feet between the trunk and hardscape elements, this distance is impossible to maintain in streetscape settings and near structural foundations. Soil conditions affect tree root trajectory and depth. The required compaction and site stabilization beneath roads and sidewalks creates a perfect environment for small roots to penetrate the concrete/asphalt and base material interface and grow to cause damage.

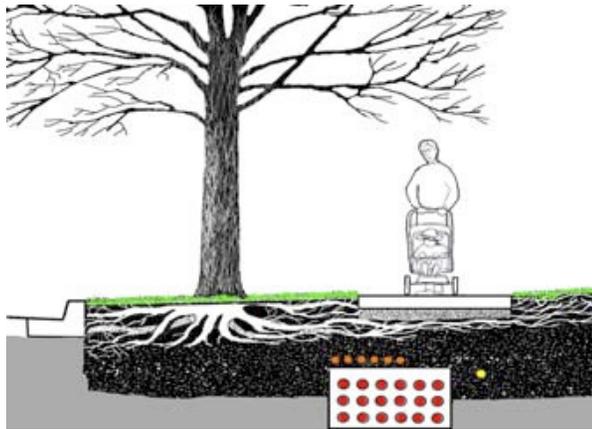
³ Adapted from work by Jim Urban, Nina Bassuk and Jason Grabowsky.

5.6.2 Locating Trees

Large scale trees planted on private property, public rights of way, in public parks and open space shall be positioned a proper distance from hardscape elements in order to decrease damage potential from root development.

A standard detail, depicted at the right will result in significant damage to the sidewalk, curb/gutter and street as the tree grows.

As the tree develops, roots grow toward and beneath the sidewalk and street.



Street tree and right-of-way plantings near infrastructure shall be placed in locations where root /soil volumes can be expanded below or to the side of infrastructure elements. Some of the methodologies available include planting in the easiest places first. Make use of the spaces that currently have the largest soil volumes.

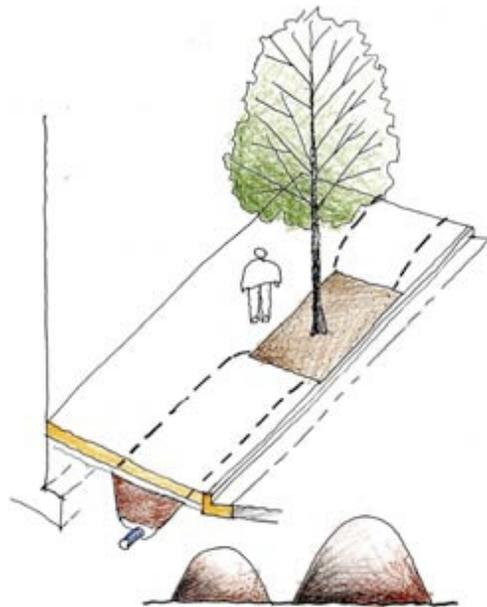
Expand “root paths” by extending and deepening the soil trench, creating more soil volume or root growth. This increases soil volume from 115 cubic feet to 365 cubic feet, two and one half times the volume

Soil trenches can be extended and connect street trees to further develop “root paths.”

5.6.3 Structural Soils

CU-Structural Soil is a load-bearing soil under pavement that can be compacted to 100% dry density (proctor density or modified proctor density) to bear the load of a pavement while allowing tree roots to grow through it. Previously, soils compacted to meet engineering specifications for load bearing restricted tree root growth.

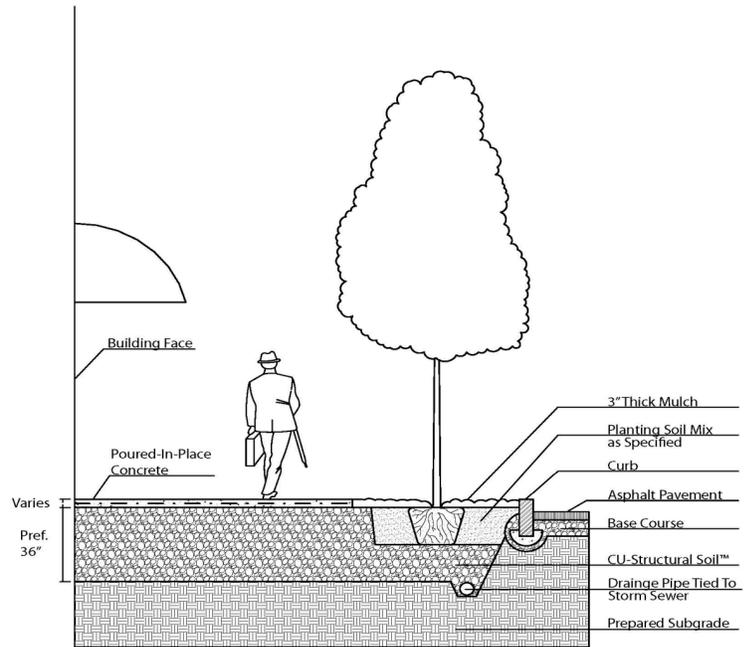
CU-Structural Soil is a mixture of crushed gravel and soil with a small amount of hydrogel to prevent the soil and stone from separating during the mixing and installation process. The keys to its success are the following: the gravel should consist of crushed stone approximately one inch in diameter, with no finer particles, to provide the greatest porosity. The soil needed to make structural soil should be loam to clay loam containing at least 20% clay to maximize water and nutrient holding capacity. The



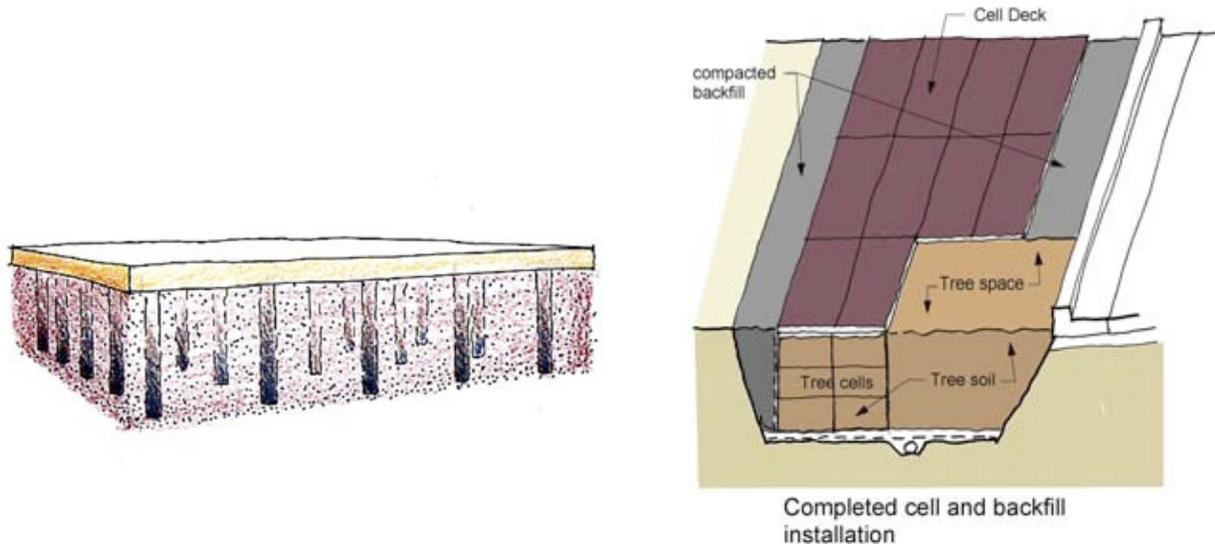
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proportion of soil to stone is approximately 80% stone to 20% soil by dry weight, with a small amount of hydrogel aiding in the uniform blending of the two materials. This proportion insures that each stone touches another stone, creating a rigid lattice or skeleton, while the soil fills the large pore spaces that are created between the stone. This way, when compacted, any compactive load would be borne from stone to stone, and the soil in between the stones would remain uncompacted.

CU- Structural Soil requires, approximately 2 cubic feet of soil for every square foot of envisioned crown diameter. A 36" soil depth is recommended although several projects have been successful using as shallow as 24". We would not recommend any less than 24". CU-Structural Soil has an available water holding capacity between 7% and 12% depending on the level of compaction. This is equivalent to a loamy sand or sandy loam. (See the table below for soil volume recommendations). Because of its well-drained nature, trees that prefer well-drained soils do best in CU- Structural Soil. Depending on the stone type used to make it, the pH of the soil may be affected (e.g. limestone vs. granite). Good tree selection practices and establishment procedures should be used with CU- Structural Soil as would be done with any tree installation. It is important to maximize the water infiltration through the pavement to replenish CU-Soil as with any soil. This feature serves a dual purpose to expand stormwater infiltration functions and decrease hardscape damage.



Another system is a structural cell configuration that is engineered to support above ground elements while increasing soil volume by 80%.



5.6.4 Strategies to Reduce Infrastructure Damage Potential⁴

Alternative design methods to reduce tree/infrastructure conflicts include:

1. Curving sidewalks
2. Pop-outs
3. Reconfigured sidewalk alignment
4. Monolithic sidewalks
5. Increasing Right of Way
6. Build root paths, narrow trenches installed in compacted sub-grade material filled with root friendly material to encourage rooting
7. Root channels, directing root growth to areas of larger soil volume
8. Elimination of Sidewalks
9. Narrower Streets
10. Tree Islands
11. Bridges and Ramps
12. Lowered sites
13. Gravel layer between roots and concrete
14. Concrete with extra reinforcement/Thicker slabs

⁴ Adapted from Strategies to Reduce Infrastructure Damage Potential, Costello and Jones.

15. Pervious concrete promotes deeper rooting
16. Recycled rubber sidewalk panels
17. Root control diversion barriers

5.6.5 Trees and Infrastructure, Remedial Treatments

Once damage to infrastructure elements occurs, there are alternatives to tree removal including:

1. Grinding pavement to eliminate uplifted that cause trip hazards
2. Root pruning and the installation of root control diversion barriers
3. Mudjacking, lifting and resetting concrete slabs

Alternative materials for walkways that are either: thinner, modular, re-usable, easily replaced, and don't require complete root removal beneath the material.