Community Forest Best Management Practices Manual

2010

City of Bainbridge Island
Bainbridge Island, WA

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Revised – 2010 by Community Forestry Commission

Bainbridge Island Community Forestry Commission

Established By:
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Responsible Department:
Planning and Community Development

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BAINBRIDGE ISLAND COMMUNITY FOREST BEST MANAGEMENT PRACTICES

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INTRODUCTION

Bainbridge Island is endowed with abundant trees that give the landscape a special, forested character. This "Urban and Community Forest" is the sum total of trees in both our urbanized and suburban-rural "interface" areas, and its many benefits are well described in the 2006 **Community Forest Management Plan.** Our community forest is a source of pride and identity for Island residents. The State of Washington and the National Arbor Day Foundation has recognized Bainbridge Island as a **Tree City-USA**.

Our present challenge is to maintain enough healthy tree canopy to safeguard forest benefits for generations yet to come. Facing intense development pressure, our community is well served by making good use of every setting where trees can - or already do - grow. Tree losses may be inevitable as Bainbridge Island matures, but we still have abundant opportunities to fortify our common forest, where we live, shop, drive, play and exercise, worship, learn, commune with nature, and send our storm water. Available settings run the gamut from wild to urban. With commitment and foresight, we can accommodate trees almost anywhere.

Sustaining trees in Bainbridge Island's already-developed areas presents a great challenge, and entails careful planning and vigilant maintenance. Also, after more than a century of settlement, the vestiges of native island forest are increasingly rare and vulnerable. To meet these formidable challenges, the City and local citizen leaders serving on the Community Forestry Commission together have developed a **Community Forest Management Plan**. This plan has built the foundation for this **Community Forest Best Management Practices Manual**.

The BMP Manual **provides a toolbox** of standards needed in order to reach CFMP goals for tree preservation, management and replenishment for future generations. The goal of this document is to assemble the best available science and most widely accepted practical and professional techniques now in use in urban forestry. This BMP Manual should be reviewed and updated periodically, because, like trees, knowledge is dynamic.

CFMP and BMP Manual: What Is the difference?

Community Forest Management Plan (CFMP) 2006	Community Forest Best Management Practices (BMP) Manual 2007
Defined: A roadmap for maintaining the ecological function and benefit of Bainbridge Island's forest, while integrating trees as green infrastructure in the developing urban landscape.	**Defined:** A tool box of standards for achieving the Island goals described in the **CFMP** for tree preservation, tree management and planting new trees for future generations.
What? Current State of the Community Forest: • A mixed deciduous and coniferous forest with most trees on private land. • Island tree canopy cover was 72% in 2004, only 42% in Winslow and falling fast.	**What?** Tree Basics: • Structure & Growth - Roots, Trunk and Canopy • Spare that Tree! - How to protect what we have (root zone, soil health, construction impacts). • it's not just the trees; it's the forest as well.
When? Future Forest: Maintain a 70% canopy cover for the Island and 35% for Winslow.	**When?** Future Forest: Ongoing actions to ensure future canopy cover (Tree siting, planting & maintenance techniques, tree risk management).
How? Implement Plan Policies and Actions: • Protect and restore existing tree resources • Promote urban tree management • Enhance community awareness • Control invasive species destructive to forest health • Use the **BMPs** to make it all happen!	**How?** Provide and Maintain Trees for Specific Situations and Land Uses: • Urban Core • Streets & Roads / Parking lots • Residential settings • Institutional settings • Natural Areas, Green Belts and Environmentally-sensitive Areas.

This document is intended for builders, developers, landscape contractors, city planners, inspectors, engineers and operations crews, architects, landscape architects, garden designers, wetland and restoration specialists, heavy equipment, tree care & landscape maintenance operators, homeowners and do-it-yourself gardeners, community volunteers and civic leaders.

"Best management practices (BMPs)" means:
Conservation practices or systems of practices and management measures that:

a. Control soil loss and protect water quality from degradation caused by nutrients, animal waste, toxins, and sediment; and

b. Minimize adverse impacts to surface water and groundwater flow, and to the chemical, physical, and biological characteristics of critical areas." (from City of Bainbridge Island Code)

SECTION 1: TREE BASICS

Overview

Trees form an essential part of our infrastructure, just as do roads, schools and our water supply. Bainbridge Island's trees are a valuable asset, and unlike other types of infrastructure, appreciate in value over time. Trees perform essential biological, even psychological, functions that benefit the environment and all of us in substantial ways.

Trees perform hard labor by accomplishing the following:

- intercepting rainwater (100 mature trees catch ~250,000 gallons per year) and dispersing it more slowly into the ground
- cleansing the air by consuming carbon dioxide and producing oxygen (100 trees remove~ 5 tons of CO_2)
- buffering noise, dust, fumes, wind and glare
- sheltering wildlife and protecting native biodiversity
- creating calm settings to rejuvenate and relax
- creating a pleasant and safer sidewalk environment
- shading street pavement, increasing its useful life
- screening the view of parking lots and utility areas from public streets
- encouraging safe driving with street trees and planting islands
- building civic pride by enhancing the beauty of public thoroughfares
- increasing aesthetic and monetary value of property
- sheltering buildings from summer heat and winter chill, reducing electricity consumption
- buffering extremes of precipitation and heat accompanying climate change

Unlike other assets, trees are *living* things with biological requirements for survival and growth. "Operating Instructions" for trees aren't universally understood by everyone, whether homeowner, student, contractor, merchant, public servant, retiree or design professional. This chapter provides information to fill common knowledge gaps, about both individual trees and trees growing together as the urban forest.

Trees suffer abuse, especially where they come into contact with the human environment . Although damage is generally not intentional, it does represent a lack of understanding and respect. Because trees can absorb and adapt to some degree of mistreatment or neglect, we may not notice signs of decline. Eventually, cumulative stresses reach a tipping point, beyond which a vulnerable tree can't garner enough soil nutrients or sun energy to photosynthesize at a rate that will keep it alive.

If we understand ***how trees grow*** and how they function in the environment, we can prevent damage and manage them proactively. We must plan for growth ***with trees in mind****,* using the principles of "low impact development" in relation to our community forest, so we can improve the odds that future Islanders will enjoy the benefits of a healthy green canopy.

What Tree Biology teaches us:

Trees cannot run away – protect their roots or tops!
Trees need oxygen, water & light – please don't cut off supplies!
People and trees share space – think of BOTH before changing it.
There is strength in numbers– consider the forest and soil, not just the trees.

1.1 Individual Tree structure and growth

Understanding tree biology is the starting point for appreciating and using best management practices for planting, protecting, and maintaining trees.

Definition of a tree:
A woody plant that grows to 15 or more feet in height, usually with a single trunk, growing to more than 3 inches in diameter at maturity, and possessing an upright arrangement of branches and leaves.

Trees are commonly referred to by their size at maturity:

Small Trees: less than 25 feet tall
Medium Trees: 25 to 50 feet tall
Large Trees: more than 50 feet tall

Trees, like people, are complex organisms composed of many types of cells arranged into tissues and organs. New cells are produced in specialized structures called **meristems**. Those located at the ends of roots and shoots produce elongation, resulting in new growth, those near the periphery of stems increase a tree's girth.

Unlike people, trees are only generating systems: they cannot regenerate cells in the place of damaged or destroyed cells. This means that when a tree trunk is wounded, it can only "wall off" the damaged area and grow new wood around it. The damage itself cannot be mended.

Starting from the ground up, the three main parts of a tree are: roots, trunk and crown.

1.11 The Roots

The three most important things to know about tree roots are:

There are two basic types of roots: Woody and non-woody
85% of tree roots are located in the top 18 inches of soil
Tree roots spread far wider than the canopy edge…as much as 3 times

Tree roots grow out from the trunk a distance of 2 to 3 times the radius of the tree's crown. A tree that is 80 feet tall can have roots extending out in a 240 ft. diameter circle. Roots are located near the soil surface like a disk, to access needed nutrients, moisture and oxygen. Roots rarely penetrate deep into the earth.

Woody roots are the underground structures that **anchor** the tree. They are large, ropelike, and usually number from 4 to 11. They taper rapidly as they move away from the trunk. Woody roots develop in response the tree's particular environment, working together to keep it stable in wind and extreme weather.

Non-woody roots are many, small and fibrous. They absorb water and nutrients essential for tree survival and growth. On their fine root hairs grow beneficial fungi that form *mycorrhizae*,

structures that mutually benefit both the fungus and the tree. Mycorrhizae increase root surface area, thus maximizing the water and nutrient uptake passing into the water-transporting cells within the wood of the tree.

Xylem cells are microscopically-narrow pipes that connect the fine roots with the tree's twigs and leaves via the stem and branches. The upward movement of water is largely the result of the suction created by evaporation from leaf surfaces. Much of this transportation takes place in the most recently formed annual ring of the wood, although some also occurs in older rings.

What does this mean in the Practice?

Excavating a utility trench through a tree's root zone could sever one or more of the structural roots anchoring the tree. The tree could be destabilized and pose an increased risk of failure during an extreme weather event in the future.

When soil in the root zone is compacted for any reason (by, heavy equipment use, construction, vehicle parking, even heavy foot traffic) the air spaces (pours) that make soil porous and allow non-woody roots to function, are crushed. Without these pores, feeder roots die and the tree begins to starve.

Compacted soil leaves less space for water to seep down into the root zone. The results can be ponding and poor drainage, surface run-off and dry soil below.

Leveling of a site by the addition of fill can result in roots not being able to obtain enough oxygen.

1.12 The Trunk

The trunk is the main woody stem of the tree that supports the crown. While most trees have one stem or trunk, other trees, such as vine maples, are characteristically multi-stemmed. Carbohydrates and other substances necessary for tree growth are stored in the trunk, roots and other woody portions of the tree.

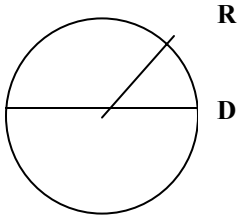
Beneath the bark—the outer protective layer that covers the trunk, limbs, branches, and roots—there is a very thin layer of specialized cells known as the **cambium layer**. This is where growth in trunk and root diameter takes place each year. It also functions as the nutrient transport system for the tree. Water is transported up through the trunk in vascular tissues **(xylem)** to other parts of the tree. Sugars produced in the leaves flow down through the trunk in other vascular tissues **(phloem)** servicing all parts of the tree including roots.

Every growing season, cambium cells divide repeatedly to form a new layer of phloem to the outside and an annual ring of new wood to the inside. The wood laid down in the early part of the growing season (early wood) contains more space for water conduction than the denser late wood that supplies more mechanical strength.

The annual rings produced by the cambium are not of uniform width or wood quality throughout the entire tree. Instead, the cambium responds to the prevailing load at any particular point by regulating the quantity and quality of new wood that it produces. By looking at a cut stump you can identify growth rings that are larger during rainy years, or asymmetrical where they have produced reaction wood to respond to a prevailing wind.

Measuring Trunk Diameter
Tree size is often measured as DBH or "diameter at breast height," which is at 4.5 feet above ground. You can calculate trunk diameter by measuring trunk circumference at 4.5 feet above the ground with a standard tape measure and dividing by pi or 3.14, a constant. A standard forester's tape converts a circumference measurement into diameter measurement.

Diameter = Circumference ÷ 3.14



What does this mean in the practice?

- When a backhoe clearing a building site removes a notch of the bark from a tree that is scheduled to be retained, its cambium layer has been damaged. Loss of this vascular life support system will make it more difficult for the tree to recover and thrive.
- Often, the diameter of the trunk is a better indicator of a tree's age than the height. –Some trees, by species characteristics are stouter per height than others. A crowded conifer forest will have tall trees reaching for light with narrow stems and a low live crown ratio.
- Trunks enlarge yearly but only become taller by adding new tissue at the top. Branches don't move upward as trees grow. Since a limb 4 feet above the ground stays at 4 feet, clearance beneath the canopy does not increase with time. Thus, a sweeping-branched Western red cedar does not make a great street tree in a tight location without surgical pruning.

1.13 The Canopy/ Crown

The crown is the woody and leafy component of the tree. It is composed of large, scaffold limbs that support smaller branches, twigs, leaves, and buds. The main function of the leaves is to capture energy from sunlight and convert it to energy stored in the form of sugars and starch. **This process is known as photosynthesis.**

The sugars are transported in solution to the parts of the tree where they are needed for growth or for storage--downward and inward through the stem and roots, and a short distance upward into the growing shoots.

New growth appears as meristematic cells divide at the tips of shoots and roots.

Tree crown size is measured in square feet, based on the diameter of the branches at their greatest reach. In urban areas, a very small canopy is 150 square feet . A large canopy ranges to 1600 square feet (40 x 40 feet) or more where favorably sited.

What does this mean in the Real World?

When planning new construction near a tree to be preserved, consider how upper building stories may impact tree branches. Branches can be temporarily roped back to avoid being torn off by equipment or placement of scaffolding. Buildings could have upper levels set back to accommodate wide canopy.

Pruning a tree too radically greatly reduces leaf area and the tree is unable to photosynthesize at its previous rate. This throws roots and shoots out of balance and may cause shock and decline.

Crown width indicates the "drip line", even though roots usually extend at least another crown width beyond that. The area below the drip line is known as the Critical Root Zone (CRZ) that needs protection to ensure tree survival.

If a tree planted below utility lines is a species that grows to great stature, it will require maintenance pruning indefinitely. This poses unnecessary hardship on the Public Works budget AND the tree. Remember to plant the "right tree in the right place."

1.2 What is the Community Forest?

Understanding how a single tree functions is vital to giving it the right care. It is equally vital to think of trees together in groves, stands, woodlots and remnant forests. Because tree groves provide exponentially greater public benefit in terms of storm water interception and porous soils, we should consider the forest, not just the trees.

The Community Forest Management Plan (CFMP) identifies the ***Community Forest*** *as* ***any individual trees, small stands of trees or forested areas, and associated understory plants, that are found growing in natural and built environments, and which contribute important ecological, social and/or economic benefits to the community.***

The CFMP discusses the ecosystem services that trees provide such as improved air quality, storm water interception, reduction of soil erosion and energy costs, and wildlife habitat…not to mention the general enhancement of our quality of life. In cities larger than Bainbridge this collective green infrastructure is also known as the **Urban Forest**.

Why does it need Managing?

There are often conflicts where people and trees coexist. As the Journal of Arboriculture stated in January 1997: "*We cannot separate sustainable urban forests from the people who live in and around them…Urban forests require active consistent, continuing management."*

The study and practice of community and urban forestry continues to evolve as municipalities recognize the huge value that trees provide. Increasingly, this value is being quantified and progressive communities like Bainbridge Island see their forests as necessities, not just amenities.

1.3 Managing for Climate Change

On December 14, 2006, a fierce wind and rainstorm hit the Puget Sound area, centering on central Seattle. It came on the heels of record November rains that saturated soils throughout the region. Major flooding, unprecedented power loss, sewage backups and failure of many large trees ensued. Tragically, four people lost their lives and more than 1,000 medical emergencies resulted from the storm.

Events like this may not be unusual in the future. In an article entitled *"This is What Climate Change Might Look Like."* in the journal Stormwater, author Laurel Funkhouser observes:

> *New road building and construction leave neighborhoods vulnerable to flooding, as less rainwater is intercepted and absorbed by non-compacted soils. Data indicate that even 10% impervious surface added to a watershed can greatly alter urban hydraulic systems. Cumulative deforestation, de-vegetation, and soil erosion degrade the function of natural streams and creeks we expect to absorb rainwater, at the same time that runoff grows.*
> *Modeling what happens to urban/suburban watersheds when tree canopy and ground vegetation are decreased reveals that even at incremental levels such as small house additions and new driveways, the effects of extreme weather events are compounded. Such events appear increasingly commonplace.*

Current development trends on Bainbridge feed directly into potential disaster scenarios, notably:

- "Mansionization" in which small houses on large lots are demolished and larger ones replace them, sacrificing surrounding mature canopy, root systems, and other vegetation in the process.
- Total lot clearing for multi-family and mixed-use projects, with little tree retention.

A promising tool for moving toward **sustainable infrastructure** is Low Impact Development (LID), an effective alternative to **disaster management**. Bainbridge Island has the timely opportunity at hand to embrace eco-friendly development as we absorb ever-greater population. Our community forest lies at the heart of maintaining a sustainable infrastructure and Island character while accommodating growth.

Low impact Development (LID) is a stormwater management strategy that emphasizes conservation and use of existing natural site features integrated with small-scale stormwater controls to more closely mimic natural hydrologic patterns. (Puget Sound Action Team & WSU)

SECTION 2: TREE PROTECTION

Overview

Like the physician's creed, "First, do no harm," we have chosen to place tree protection practices near the front of this BMP manual. To rephrase, **first save the best of the trees you have**. This option will *always* preserve greater ecological value, higher real estate value and probably cost less than waiting for newly planted landscape trees to mature. While not feasible in all cases, it is sensible to survey existing trees first and design for protection, rather than assume a new structure can be built right next to a prized tree without consequence.

When contemplating new construction, paving or a building addition, a property owner should first obtain a site survey. The survey will locate accurately the edges of your property and the public right-of-way, as well as existing trees. Except in a single-family zone, local codes encourage saving a site's significant trees. Thoughtful site planning with trees in mind is the best first step, and buildings designed to allow retention of worthy trees have instant payback in amenity value.

This chapter includes information on maintaining healthy soils. The humble material beneath your feet is actually:

The basis for stable building foundations
The sponge that soaks up Northwest rains
A factory of organic decay and renewal
Home for vegetation that will provide returns well into the future.

If site soils are compacted into hardpan by heavy equipment, vehicles or stored materials, they will no longer be porous enough to absorb storm water or provide room for roots. What is done to soil cannot easily be undone, so it is wise to understand and protect soil before beginning construction. Protecting the soil also helps ensure a future for valuable site vegetation, especially trees.

2.1 Identification of Significant and Valuable Trees

*A "**significant tree**" on Bainbridge Island includes (BIMC 18.85)*

- *evergreen trees 10 inches in diameter or greater, measured four feet above existing grade;*
- *deciduous trees 12 inches in diameter or greater, measured four feet above existing grade;*
- *all trees located within a "critical area and/or buffer" as defined in BIMC Chapter 16.20.*

Revised Definition (Proposed Tree Ordinance – 2010)

Begin with an inventory of what you have. Assemble a list of trees, noting species, size and condition. A general rule of thumb is that groups of trees with associated understory plants are easier to protect and return greater value than single trees preserved in the center of a building site.

Although it is impractical to put time and money into saving a tree that is terminally flawed or diseased, it is equally important to understand the value that tree canopy provides to the overall ecological health of Bainbridge island. A Tree Professional should provide unbiased information on tree health and will not provide justification for tree removals, if none exist. They can also

help dispel fears of tree failure, which can lead to unnecessary removals of healthy and structurally sound trees.

Landscape buffers are often required for new subdivisions or commercial projects. On Bainbridge Island, these narrow strips of remnant forest more often than not include Douglas fir or other native conifers that are tall and slender with little canopy. Trees such as these, that begin their lives surrounded by forest, produce foliage at the top, where sunlight is abundant, while their lower branches often die back from light starvation. When site clearing creates a new woodland edge, these slim trees are exposed to a condition to which they are not adapted – standing alone. Blowdowns or breakage frequently result, and property owners understandably begin to fear tall trees.

This problem can be mitigated by planting smaller trees and shrubs that normally grow at the forest edge, removing conifers close enough to pose a risk to people or buildings and replanting young trees that can adapt to buffer conditions. The best solution is to preserve larger, less linear blocks of vegetation where space permits.

2.2 Protection and Conservation During Construction

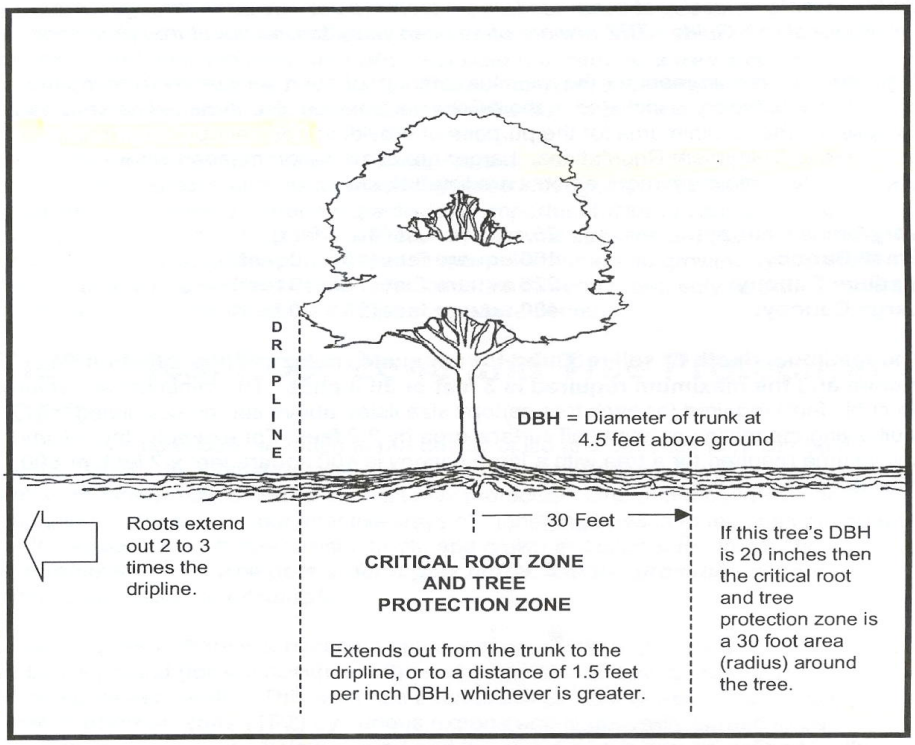
Please reference City code requirements, available from the City of Bainbridge Island Planning and Community Development Department, (206) 842-2552.

Property owners should meet with a City planner, architect, developer, and contractors to discuss tree protection issues and required permits before parties become invested in a particular site plan. This will save trees, money and headaches down the road.

2.21 Critical Root Zone (CRZ) and Tree Protection Zone (TPZ)

Most of a tree's roots lie within its dripline (or under-canopy area). Ninety-five percent of the roots of most trees grow in the top 12-18" of soil. Roots that supply nutrients and water concentrate just below the soil surface. Since fine feeder roots can only penetrate a thin layer of soil, they must spread far out from the tree to adequately supply it, well beyond the edge of the canopy above.

For existing trees, there is a minimum amount of space, above ground (for trunk and crown) and below ground (for soil health and the root system) needed to sustain a tree and preserve its health. The ground area is called the **Critical Root Zone** (**CRZ**). The CRZ is usually far smaller than a tree's entire root spread. Thus, protecting the CRZ saves a portion, but not all the roots. The greater the protected area, the better a tree's odds for survival. You can calculate the CRZ as illustrated and described below.



The CRZ falls within an imaginary circle on the ground with a radius of one foot to one & one half feet for every inch of tree diameter at 4.5 feet above the ground, (but never less than a six-foot radius). For example, a tree with a trunk diameter (dbh) of 20 inches has a CRZ of 20-30 feet (20 inches x 1 to 1.5) around the tree.

2.22 Activities Requiring TPZ Determination

The **Tree Protection Zone** (**TPZ**) is the area to be fenced around the CRZ, in this case having a 20- 30 foot radius, and a diameter of 40-60 feet. When this configuration is not practical, a Tree Professional, based on the location of a specific tree's structural roots and other site conditions, can establish a TPZ in the field.

A TPZ is a restricted activity zone where no soil disturbance is permitted. Site work planned near the critical root zone (CRZ) of a single tree or groups of trees to be preserved, requires a TPZ. TPZ fencing should be in place before undertaking any activities that might involve trenching or other disturbance to the tree's roots, such as:

- Access roads
- Staging, storage, and temporary parking areas
- Paving or other impervious surfaces
- Temporary utility lines
- Installation of pipe drainage, irrigation or other services
- Stormwater management devices
- Grading that requires cut and fill

2.23 Activities Prohibited within TPZ

Storage or parking of vehicles, building materials, refuse, excavated spoils or dumping of poisonous materials on or around trees and roots such as paint, petroleum products, concrete or stucco mix, dirty water

The use of tree trunks as a winch support, anchorage, as a temporary power pole, sign posts or other similar function.

Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches and other miscellaneous excavation

Soil disturbance or grade change

Drainage changes.

A site visit by a Tree Professional is needed if —advance planning fails and a trench must pass through the TPZ. Depending on specific site conditions, tree species, health, and position of any potential targets, trenching may be approved. If not, it could require risk mitigation and payment of a bond by the contractor. Alternative remedies can include tunneling or re-routing utilities, and relocating or re-engineering walls to avoid roots of important trees. Walls and pipes can be moved, but a damaged tree cannot be repaired or readily replaced.

2.24 Activities Permitted/Required within TPZ

Mulching. During construction, spread wood chips within the TPZ 4" to 6" deep, leaving the trunk itself clear. Mulching helps prevent inadvertent compaction and moisture loss from occurring. 2-inch unpainted, untreated wood chips or equivalent is recommended for mulch material.

Root Buffer. When areas under the tree canopy cannot be fenced, create a temporary buffer to cover the root zone (such as wood chips and plywood) that remain in place until final grading.

Irrigation, soil aeration with an air spade, fertilizing or other beneficial practices.

2.25 Protective Measures

Protective Measures for Retained Trees, Street Trees or Designated Trees

Tree protection fencing must achieve three primary goals:

- keep branches and foliage clear from contact by equipment, materials and activities;
- preserve roots and soil conditions from compaction;
- make it clear to all contractors on site that the tree protection zone (TPZ) cannot be violated.

Recommended fencing includes orange plastic or chain link fencing that is 4– 6 feet tall. For best results, use **chain link fence** on galvanized poles. After placement under supervision of a Tree Professional, this fencing will enclose the entire TPZ for the duration of the construction project.

To protect street trees, **a plywood box** that physically protects the trunk from gouging by nearby equipment is the best option.

Prune trees with branches that hang over into the building envelope zone before construction damages them. They may be temporarily roped back to allow for clearance during construction. A Tree Professional can perform this type of work in a way that will protect the tree.

Post a Sign
A brightly colored sign shall be posted on each fence and /or plywood box enclosure to clearly state: *WARNING - Tree Protection Zone*

Erosion Control
If a tree is adjacent to or near a steep slope or other critical area, approved erosion control or silt barriers may be necessary to prevent siltation and/or erosion within the TPZ. **Do not install silt fence within the Critical Root Zone, CRZ.** Far too often contractors trench through a tree's root zone to meet requirements for silt fence installation, causing more harm than good. Protective mulch (above) and permeable erosion control blankets can substantially reduce runoff within the CRZ.

Root Pruning
See Section 4.4 (Root Pruning) if damage to tree roots occurs during excavation on a building site. It is far better for the tree to avoid root damage in the first place.

2.3 Post-Construction Management
Once construction is complete and the site clean, the arborist should reassess the site and identify maintenance measures that may be required for retained trees. Factors to consider include:

Stress or damage to protected trees and associated vegetation/understory
Risk assessment
Odds for the trees to remain healthy in the altered landscape

A maintenance plan should help relieve tree stress from construction damage, including:

disruptions to drainage
restricting impervious surfaces or compacted soil
impacts of fill
impacts of root or canopy loss, or trunk damage
potential increased storm water runoff and erosion due to tree/vegetation loss
interference with, or impact on, surviving or neighboring trees

2.31 Maintenance and Monitoring Strategies
Successful tree protection does not end with construction, but continues with maintenance that takes place over a number of years. It requires a sustained stewardship commitment, fulfillment of after-care responsibilities, and may require that a landscape maintenance surety device be in place before granting a Certificate of Occupancy.

Regular site monitoring and weeding are of great importance following construction. Additional management includes mulching with compost or arborist's chips and summer irrigation for the first 3 years until retained trees have recovered from construction stress and new plants are well established. During the growing season, check at least monthly that weedy plants are controlled before smothering or setting seed, and that sufficient moisture is reaching plant roots to prevent wilting, browning or dieback.

IMPORTANT NOTE:
Avoid excessive or regular watering on or near the tree trunk and do not plant incompatible, water-loving plants within the tree's dripline. Combined with poorly-drained soil, these factors often activate normally dormant fungi to become opportunistic and infect the tree, causing the decline and eventual death of the tree. This decline can be slow and may not be evident for many years.

Performance Standards to track success of vegetation establishment (or restoration) should be clear. It is imperative to monitor tree and/or plant condition at the beginning and end of each growing season, relative to these standards. If problems arise, modify maintenance methods or frequency as needed. **Target success rates** should fall within the following guidelines:

- 95% survival of retained trees protected by approved plan
- 60-80% survival of new trees and plant material after 3 years
- Tree and shrub cover establishment resulting in 30-50% growth after 3 years
- After initial removal, invasive species grow-back should be limited to 10-30% a year through the first 3 years, and 5% thereafter
- Any dead plants should be replaced within 3 years of planting

2.4 Soil Health

Preserving soil health is essential to preserving tree root health. Construction is one of the main activities responsible for *sick* soil. While it appears that some trees will grow anywhere, most trees are particular about the soil conditions under which they will thrive. All roots need porosity in the soil to grow towards nutrients and water.

2.41 Soil Attributes

Native soils are highly complex systems that provide essential ecosystem services including bio-filtration of pollutants, nutrients for plant growth, and the storage and slow release of stormwater. The ability of soil to effectively store and slowly release water is dependent on soil texture, structure, depth, organic matter content, and biota (Washington Organic Recycling Council (WORC), 2003).

Soil fertility can be evaluated using standard tests that measure the amounts of phosphorous, potassium, calcium, magnesium, zinc, and manganese in a sample. Soil tests can determine the soil pH (acidity/alkalinity), concentration of key trace elements, and the amount of organic matter present by weight. The Kitsap County WSU Cooperative Extension Service provides soil sampling advice and soil sample analysis services. Special tests can determine the presence of soil pathogens affecting plant health.

2.42 Organic/Hydrologic Soil Balance

Organic matter is the critical component of a functioning soil system. Typically, native Puget Sound forest soils have an organic matter content of 4 to 6 percent and the sub-soils less than 1 percent.

Construction activity removes the upper layers of soil, and site equipment compacts exposed sub-soils low in organic matter. This alters the site's hydrologic characteristics by converting the predominantly subsurface flow regime of the pre-disturbance site to primarily overland flow (*Low Impact Development Technical Guidance Manual for Puget Sound*, 2005).

To restore the hydrologic and other environmental functions of disturbed soils on developed sites, added topsoil should have the following characteristics:

- A minimum organic matter content of 10 percent by dry weight for all planting beds and other landscaped areas (except turf requiring access during wet months)
- Organic matter content in turf areas that requires maintenance or supports foot traffic during the wet months should be 5 percent by dry weight

PH between 5.5 and 7.0 or a pH appropriate for installed plants – Some acid loving plant such as conifer require a pH of 4.0 to 5.7.
A minimum depth of 8 inches (except in TPZ)
Planting beds mulched with 2 to 4 inches of organic material
Subsoils below topsoil applications should be scarified to a depth of a least 4 inches and some topsoil material incorporated to prevent stratification

2.51 Soil maintenance: Enhancing Soil Composition

When beginning a construction project where retained trees will be protected:

Set Aside and Protect Native Soil and Vegetation Areas

The most effective and cost efficient method for providing the hydrologic benefits of healthy soil is to designate and protect native soil and vegetation areas that already exist on the site.

Stockpile Topsoil from Cleared and Graded Areas and Replace Prior to Planting

Strip and stockpile topsoil in approved locations. Cover with weed barrier or other breathable material that sheds moisture, yet allows for air transmission. Before replacing, test stockpiled material and if needed, amend with organic matter or topsoil to achieve required organic content to an 8-inch depth where redistributed. Replace stockpiled topsoil prior to planting.

If replaced topsoil plus compost or other organic material will amount to less than 12 inches, scarify or till subgrade to achieve 12 inches of loosened soil after topsoil and amendment are placed. The entire surface should be disturbed by scarification, and then dressed with the amendment. **Do not scarify (roughen) soil within drip-line or determined TPZ of existing trees to be retained.** To reduce damage to roots within 3 feet of tree drip-line or TPZ, incorporate amendment no deeper than 3 to 4 inches.

Import Topsoil that Satisfies Required Organic Matter Content Standards

If topsoil from the site is inadequate, bring in good quality organic compost and apply and incorporate as described above. Imported topsoil that is not blended into the subsoil layer can cause serious drainage and plant establishment problems.

2.52 Soil Stresses and Mitigation Measures

During development, compaction of the soil is the largest single factor responsible for the decline of older trees. Ninety percent of the damage to the upper eighteen inches of soil occurs with the first pass of heavy equipment – and **cannot be reversed**. Every effort must be made to avoid compaction of soil porosity within the TPZ. Correct placement of the TPZ fencing and strict adherence to the “no-fly” zone will prevent soil compaction. If, however, the completed development results in soil compaction near the trees that are to be protected, there are ways to help reduce impact injury.

If a compaction event does occur to the upper 12-inch soil horizon, one or more of the following mitigation measures, performed under the supervision of a Tree Professional, can help:

Aeration system
Vertical mulching
Soil fracturing
Core venting
Radial trenching
Deep mulching
Other method recommended by a City-approved Arborist.

Mitigation for drought stress and excess soil moisture is covered in Chapter 4.2 Watering and Irrigation.

SECTION 3- TREE SELECTION AND PLANTING

Overview

Trees should be chosen carefully, since their value increases over decades, and is fully achieved only if growing site and species are well matched. Bainbridge Islanders can grow a wide variety of native and ornamental species, in a range of habitats. Site characteristics, aesthetics and habitat value should all be evaluated before deciding which tree fits best.

The tree itself should be of good quality, regardless of size. Flaws in nursery stock often cannot be corrected, and may prove weakening or even fatal over time. Quality matters. The City has developed an approved Landscape Materials Matrix (Appendix J), and can be used to select trees and shrubs. A few species should be avoided altogether, because of inherent lack of durability or invasiveness problems.

Northwest native species contribute special environmental and heritage value, and are highly recommended for all but Bainbridge's most urbanized settings.

3.1 Tree Selection Criteria

Potential trees need to work for the environments they will call home. A tree can't move; it can only try to adapt - or die trying. Species characteristics are genetically derived, based on habitat of origin. Since neither site nor species attributes are easily changed, both must be considered in advance to ensure a successful outcome.

Before buying a tree, investigate key planting site characteristics:

Light level (deep shade, open shade, partial shade, full sun, extreme exposure)
Soil type (sand, silt, clay, gravelly, glacial till, humus, loam, bedrock)
Availability of water (droughty or saturated soils, well-drained or moisture retentive soils, seasonal fluctuations, perched water table)
Size of intended planting area (above or below ground restrictions)

If a particular site presents multiple challenges based on this evaluation, another planting location might be a better choice. If your heart is set on a certain tree, seek out a more compatible spot if necessary. For multiple-tree planting areas, the same principles apply, and the match must work for all selected species.

With site constraints in mind, the next step is to choose a suitable species among the huge range of available options. It is at this point that landscape character and desired aesthetic or functional attributes come into play. A good plant list provides detailed information to help filter options:

Tree size (height & spread, ultimate stature, longevity & growth rate)
Environmental tolerances (light, water, pollution, soil type & pH, etc.)
Seasonal attributes (flower, fruit, bark, fall color, silhouette, etc.)
Functional attributes (screening, light shade, fragrance, wildlife value, etc.)

As a final selection step, you can seek out examples of good candidate species in a nursery, park or mature public or private garden such as the Island's own Bloedel Reserve. Looking at trees in actual landscapes is invaluable for envisioning a future tree's character and stature. Photos in books or on-line are also helpful. This deliberate process helps develop familiarity with both a tree and its landscape home, and provides the basis for wise decisions.

3.2 Tree Quality Standards

All trees planted on Bainbridge Island, as either street or landscape trees, should meet the standards defined in American Standard for Nursery Stock (ANSI Z60-1-1996). This standard specifies height, caliper, and rootball diameter for nursery stock. In addition, it provides standards for container tree stock and shrubs.

In addition to specifying that stock meet the ANSI standard, trees selected should:

Have strong central leaders for all but small or multi-stemmed, spreading trees
Have symmetrical canopy and evenly-spaced scaffold branches
Show evidence of cultural pruning by the nursery, including corrective pruning and crown raising but without extensive heading-back (which creates branch congestion),
Be free of damage from nursery lifting and shipping to site,
Be free of insects, diseases, and other pests
Have intact rootball, not broken from rough handling.
Have weed-free, non-desiccated rootball or container soil

3.3 Miscellaneous Material

3.31 Stakes

Not all new trees need staking. Trees planted in natural areas as part of restoration efforts, or those in protected areas do not need staking. Movement of the young tree's stem is important for developing trunk taper, which provides future strength. The use of planting stock with more substantial stem is preferable to staking.

In more urbanized settings like Winslow, where highly exposed to wind, or where there are close encounters with people and vehicles, new trees should be staked, but for **one year** only.

Install stakes and ties immediately after planting. Use stakes of sound, untreated wood, approximately 2 in. x 2 in. or 2 in. diameter, 6-8 feet long (depending on tree size), and pointed at one end. Use plastic chain-link ties to secure the tree to the stakes. Remove thin bamboo stakes and trunk-binding tape that come with some container-grown trees. Tape can girdle a tree as it adds growth rings, strangling or weakening it structurally to the point of failure.

Remember to remove all stakes after 1 year, except where necessary for trunk protection.

Do not drive a stake through a tree's root ball
Do not tie a tree directly to a stake (this immobilizes the trunk and inhibits proper growth)
Do not leave stakes – and especially ties – in place long-term (they can embed in bark)

3.32 Mulch

Mulch all trees, shrubs and other plantings with organic mulch previously approved by approve qualified tree professional. A mixture of composted wood chips and compost is ideal, but wood chips alone are usually sufficient. Avoid using peat moss or fine bark alone, since these actually shed water when dry, deflecting moisture from thirsty plants.

Place mulch 2 to 4 inches deep around trees and shrubs out to the edge of the drip line. Take care that no mulch touches the trunk itself, even on small plants.

Do not pile or mound mulch against tree trunks; This smothers roots and invites basal rot or insect attack.

3.33 Tree grates

Where sidewalk width is less than 8 feet and new trees are to be installed in tree wells, metal tree grates can successfully protect roots from soil compaction. Grates should be approved by Bainbridge Island Public Works Department, and should be at least 4' x 4', with breakouts to accommodate future trunk growth. Tree grates offer a good opportunity for integrating work of local artists in the Winslow core. Tree grate areas should be cleaned and re-mulched periodically, and inspected to be sure trunks have room to expand. Enlarge grate openings as needed.

3.4 Timing of Planting

Overall, Fall is the best time to plant in the Puget Sound region. Mild winters and rain favor root establishment before spring growth spurts. Exceptions are magnolias and a few other species, and conifers in landscape (not natural) areas; these survive better when planted in the spring. Here are guidelines for planting time:

Balled and Burlapped (B&B) trees and shrubs: October 20th to May 1st
Bare root trees and shrubs: January 1 to April 1st
Container-grown trees and shrubs: All year, but best October 20th to May 1st,

Alternatively, the best time to plant is right now, if irrigation and reliable monitoring of new plant material are available. Only frozen ground totally prevents planting.

Schedule plant purchase and delivery as close to planting time as possible after the site is prepared. Plants that cannot go in the ground immediately upon delivery should be held in a shady location, protected with wet wood chips and kept well watered. Plant within 4 days of delivery if possible.

3.5 Site Preparation

Call for utility locate service prior to digging a tree hole (800-424-5555, open 24/7).

A percolation test is required to ensure that there is adequate drainage for planting new trees. A minimum of one test per site shall be reviewed with the contractor and a City-approved landscape architect or arborist. Mitigation measures shall be applied to locations with poor drainage.

Planting site must be free of weeds, construction debris and spilled materials.

<u>For trees in a confined planter pit or sidewalk area</u>, dig the planting hole to a depth that establishes the top of the rootball 2-inches below the bottom of the tree grate. The width of the planting hole shall be at least 4-feet. Scarify (roughen) the sides of the pit.

<u>For trees in all other areas:</u>
The depth of the planting hole shall be no deeper than the height of the new tree's root ball. Trees shall be set at the same relationship to finish grade as they were to the ground from which they were dug. *Beware of excess soil piled up in the root ball or container – find the plant's root flare and remove any soil above this level before (and after) planting.* Excavate the hole a minimum of three times wider than the diameter of the root ball or container, and deep enough to allow the root ball or container to rest solidly on firm ground. If initially dug too deep,

refill the hole with mineral soil and tamp to bring root ball or container up to the correct level before proceeding with planting.

3.6 Tree Planting

1. Move the tree using only the root ball or container; avoid using the tree trunk as a 'handle' to move the tree.

2. Remove ropes, strings, and wrapping from the root ball after the tree has been set. Cut apart the wire basket and remove before backfilling.

3. Prune roots of bare root trees at the time of planting to remove damaged or undesirable roots (those likely to become a detriment to future growth of the roots system). Consult with the City-approved arborist prior to pruning. Bare root trees should have the roots spread to approximate the natural position of the roots and centered in the planting pit. Work planting soil backfill firmly into and around the roots, with care taken to fill in completely with no air pockets. Watering the back fill soil will aid in keeping roots moist and removing air pockets.

4. Trees must be plumb and braced in position until prepared backfill has been placed around the root ball.

5. Utilize the native soil from the planting hole for backfilling, unless specified otherwise. Studies have shown this is better for long term tree health than potting soil or other amendments.

6. Water twice during planting--once when the planting hole is half backfilled, and again thoroughly when full to eliminate air pockets. Soil in the hole should be moistened if necessary before setting the plant. Dry soil can kill fine roots on contact.

7. Mulch all trees, shrubs and other plantings as described elsewhere in this manual.

3.7 Recommended Species

Included in the BMP Manual Appendix is a matrix of plant materials recommended for use on Bainbridge Island. All commercial, industrial, and residential projects, whatever the scope, should use this list as the basis for plant selection.

Always select species based on site-specific conditions that affect plant growth: sun exposure, soil type, moisture availability, shoreline conditions, adjacent site improvements, and any particular constraints on space or function. If above- or below-ground utilities are present, plant selection must conform with utility company requirements to avoid conflicts. Otherwise, a promising tree may later suffer damaging root disturbance or disfiguring topping, compromising its longevity and landscape value.

Suggested landscape materials matrix—*please see APPENDIX J*

SECTION 4- TREE MANAGEMENT AND MAINTENANCE

Overview

Regardless of their location, all trees require some care, particularly in the early stages of life. The level of care generally increases with the level of human interaction a tree experiences. Established trees in large landscapes, buffers, riparian zones, and drainage areas require little more than periodic inspection and passive protection. Trees growing along road frontages, in parking lots, in plazas and downtown settings, in schoolyards and developed parklands and in some utility corridors require a much higher level of care since our interaction with them is frequent. People have direct impacts on trees, and trees on people. Tree maintenance and management are all about keeping people safe and trees healthy.

The recommended practices (BMPs) in this section describe basic tree care activities, and when or where to use them.

4.1 Mulching

Mulching is the application of organic material on top of the ground over a tree's root system, to enhance root and tree growth. The objective of mulching is to recreate the conditions found in undisturbed, natural woodlands. All trees should be mulched regularly unless nature provides it.

The main reasons for mulching are:

to improve soil moisture retention
to improve soil structure by reducing compaction and allowing aggregates to form
to enhance beneficial microbes and soil macro-fauna biodiversity (bugs & worms)
to protect roots from extreme heat and cold
to return nutrients to the soil for plant uptake
to reduce runoff and erosion

Guidelines:

1. Use organic materials such as aged wood chips, leaves, and compost; avoid grass clippings, fir bark, and inorganic materials like plastic and rocks.

2. For newly planted trees, mulch the area out to the dripline of the tree.

3. For established trees, mulch out to the drip line or as far out as practical. Completely remove underlying turf before mulching. This also can be accomplished by sheet-mulching. Sheet mulching is the practice of laying down "sheets" of cardboard, burlap, newspaper or any other material that will bio-degrade over time.

4. Spread mulch in an even layer, 2-4 inches in depth; avoid mounding the mulch around the tree trunk ("volcano" mulching).

5. Keep mulch at least 3 inches away from the tree trunk to avoid creating favorable conditions for disease and insect infestation.

6. Mulch twice per year if possible, in late spring and/or in fall as leaves drop.

7. Avoid using string weed trimmers around the base of trees to remove weeds within mulch beds. Trimmers damage bark and cambium at ground level, which diminishes tree health. Hand pull weeds. Avoid the use of contact herbicides.

4.2 Watering and Irrigation

In this era of diminishing resources, the ultimate goal for irrigation is to eliminate supplemental watering. The reality is that even the most drought tolerant species, well-mulched, require a period of watering to establish root systems and fend for themselves – typically 3 to 5 years. For a variety of reasons, we also sometimes use trees that aren't genetically adapted to our summer drought weather pattern. Without supplemental irrigation, such trees will either die or become stressed, stunted and susceptible to diseases and pests.

4.21 Basic Watering Practices

When watering is necessary, follow these basic guidelines:

- Water between 10 p.m. and 10 a.m. if possible. Early morning is best because winds are calmest and the sun will dry wet foliage.
- Water less often with more water, rather than more often with smaller amounts of water. This practice encourages deep rooting. Except trees in containers, no established tree should need watering more than twice weekly.
- Apply water evenly throughout the outermost 75% of the CRZ (drip line).
- Avoid directly spraying water on tree trunks.
- Apply water slowly to avoid losing it as runoff outside the CRZ.
- Mature trees need approximately 1 inch of water every 3 - 4 weeks. In extreme drought or heat waves, look for signs of distress and water deeply, more often if needed.
- Over-watering can cause as many problems as insufficient watering and symptoms may look the same: wilting, yellowing, dropping leaves, dieback.
- If you are unsure if your tree needs water, put your finger in the soil and see if it is dry deeper than 3 inches down. If so, water; if not, don't.
- Maintain mulch to retain moisture.

4.22 Newly Installed Trees

Newly installed trees, including drought tolerant and native species, are dependent upon supplemental irrigation until established, (3-5 years), but for a minimum of two years. Periods of extreme heat, wind or drought may require more or less water than recommended here. Amounts will vary, depending upon soil composition, heat, wind, rainfall, soil drainage characteristics, and type and extent of ground cover.

During the establishment period, water trees thoroughly to their full root depth as frequently as needed. Develop a schedule for dry months, prior to planting, as follows:

Tree Caliper (inches)	Gallons per Week
1	5
2	10
3	13
4	18
5	23

Alternatively, in the absence of adequate rainfall, apply 1 inch of water per week during the growing season, throughout the root zone of newly planted trees, damaged trees, or trees under stress. Brief or light rains add little usable moisture to the ground.

4.23 Mature Trees

Established and mature native vegetation should not require watering unless changes have occurred within the tree's CRZ. Root impacts such as construction damage, grade changes, compaction, root cutting, or other disturbances to the root zone may necessitate watering to improve or maintain the health of the tree. Mature trees could become stressed due to periods of drought and subsequently require watering to sustain them.

Water should be applied over a period of time to thoroughly moisten the soil to a depth of 18 inches or more.

The amount needed depends on several factors, including plant species, current soil moisture, soil texture (sand, loam, clay), and drainage. The amount of air in the soil is as important as moisture. These must be kept in balance to ensure continued plant health.

If soil texture is sandy, trees will need to be watered more frequently than in clay soil. Clay soils have a high water-holding capacity and may only need water during very dry periods. If your soil is compacted, it will be more difficult for water to penetrate the soil and aeration may be necessary.

To determine the amount of water to apply to a tree's root zone:

Calculate the radius of the CRZ
Calculate the number of seconds it takes to fill a 5-gallon bucket of water with the hose or water delivery system you are using
Match that time to the closest number of seconds listed in the following table
For tree's CRZ radius (Step 1) check under this Delivery Rate column to find total application time required to water the tree
These numbers assume that you are watering the outermost 75% of the CRZ
This can represent a huge amount of water, so take the time to figure accurately.

Approximate Watering Time to Apply One Inch of Water Across Critical Root Zone

Radius of CRZ (ft)	**Volume of Water (gals) to equal 1"**	**Total Application Time (minutes and hours) at a Delivery Rate of 5 Gallons Per x Seconds**				
	X =	**5 Sec**	**15 Sec**	**30 Sec**	**45 Sec**	**60 Sec**
10	147	3 min	7 min	15 min	22 min	30 min
15	330	6 min	17 min	33 min	50 min	1 hr
20	587	10 min	29 min	1hr	1 hr 30 min	2 hrs
25	917	15 min	46 min	1 hr 30 min	2 hrs 30 min	3 hrs
30	1,322	22 min	1 hr	2 hrs	3 hrs 30 min	4 hrs 30 min
35	1,799	30 min	1 hr 30 min	3 hrs	4 hrs 30 min	6 hrs
40	2,349	39 min	2 hrs	4 hrs	6 hrs	8 hrs
45	2,973	50 min	2 hr 30 min	5 hrs	7 hrs 30 min	10 hrs
50	3,670	1 hr	3 hrs	6 hrs	9 hrs	12 hrs

4.24 How and When to Water

A soaker hose is the best tool for properly watering trees. Position the hose at the drip-line and let it run for 1 - 1 1/2 hours at a slow drip so the water has a chance to penetrate the soil. A standard garden hose can be used in place of a soaker hose. Turn the hose on to a slow trickle and set it under the canopy for 2 - 4 hours. Water a minimum of four sites around the tree and out to at least the drip-line.

Watering should take place during the dry months of the year, historically July-October. Annual weather variations or long-term climate change may alter this range.

4.25 Mitigation for Drought Stress

If for some reason watering doesn't occur when needed, make up the deficit as soon as possible by irrigating sufficiently to wet the soil within the CRZ (or on a construction site, the TPZ) to a depth of 18-inches or more. More aggressive options include: sub-surface irrigation at regular specified intervals by injecting on approximate 3-foot centers, 10-gallons of water per inch trunk diameter within the TPZ. Apply water slowly to avoid runoff outside of the CRZ Duration should be until October rains, unless specified otherwise by local authorities or a project arborist. Don't forget to mulch trees to reduce the volume of water required.

4.26 Mitigation for Excess Soil Moisture

Construction on- or off your property can result in excess surface moisture collecting around valued trees. Such changes can stress or put a tree into decline. More water is not always better, especially for long-established trees used to a particular environment. Take measures to prevent or alleviate excess water saturation and sedimentation within a retained tree(s) TPZ due to site construction activity. If a tree's adjacent grade exceeds 8% (23 degrees), silt barriers can be installed outside the TPZ to prevent excessive soil saturation, siltation and/or erosion within the TPZ. Divert water from low-lying areas of trees where it could pool for long periods and stifle roots. Some trees can survive periods of soil saturation, but others cannot. Acceptable levels of saturation vary with tree species, soil type, time of year and the pre-construction growing environment.

4.3 Fertilization

Do not apply fertilizer to newly planted trees. For established trees in managed landscapes, place 2 -3" of aged manure or compost to tree CRZ and on beds twice a year, in spring and fall. If finances limit this practice, omit the fall application. Unless soil tests indicate deficiencies, a tree should need no further supplemental fertilizer applications. In nature, trees recycle the nutrients they need through leaf and decaying wood returning nutrients to the soil.

When applying fertilizer based upon recommendations resulting from a soil test, use the following guidelines:

- Apply fertilizer when the roots are actively growing--late winter, early spring, and early summer
- Use slow release organic fertilizers with a salt index of less than 50
- Apply fertilizer to the CRZ of trees, from the trunk to the dripline
- Apply sub-surface applications of fertilizer where turf or groundcover exists, or where runoff is likely
- Make sub-surface applications of fertilizer 4-12 inches deep, in holes that are 2-4 inches in diameter and spaced 12 to 36 inches apart
- Do not use fertilizer injections and implants into the trunk for routine fertilization

Follow recommended application rates: more is not better, and may pollute the groundwater

4.4 Pruning

It is often said: "Pruning is for people, not for trees." Trees prune themselves in a natural setting. They might drop branches if they get too long, or get their tops blown out in a windstorm.

For trees in managed landscapes, the most compelling reason to prune is to develop a strong, safe framework and tree structure, or to correct significant defects or damage. Generally, no more than one fourth (25 percent) of the tree's functioning leaf and stem area should be removed within one calendar year. An arborist certified by the International Society of Arboriculture, or supervised by an ISA certified arborist should complete pruning. It should conform to the current American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning), ANSI A300 (2001).

Excessive Pruning (over 25%) is prohibited except for clearance pruning of overhead electrical utility lines, for traffic safety, or to abate a public nuisance

Topping is prohibited, unless approved by the City-approved arborist. There may be special cases when it is better to remove large portions of a tree rather than remove it totally. For example; screening adjacent property or providing habitat diversity for wildlife

4.41 Pruning Young Trees

Early structural pruning is a proven, cost-effective measure to improve life expectancy. Added benefits are safer trees with fewer branch failures. Prune newly planted and young trees as follows:

Newly planted trees should only receive minor pruning to remove dead wood and branches damaged during transport and planting

Prune in successive years to provide sidewalk and street clearance, improve the branch structure and maintain central leaders

No more than 25% of live foliage should be removed during any one growing season

4.42 Pruning Mature Trees

There are six types of pruning that may be required for use on mature trees. Prior to entering the tree, the tree worker is required to be familiar with these types of pruning as stated in the Performance Standards of the current ANSI A300 (2001). 'Species–specific pruning promotes the natural shape of the tree (*i.e.*, excurrent, decurrent, vase-shaped, fast-growing, etc.).

Types of pruning include:

Crown Cleaning: selective pruning to remove one or more of the following parts: dead, diseased, and/or broken branches

Crown Thinning: removal of watersprouts and dead, dying, diseased, crossing, and hazardous branches from a tree

Crown Raising: lower branches are removed, thus raising the overall height of the crown from the ground

Crown Restoration: restoring the natural growth habit of a tree that has been topped or damaged in any other way

Crown Reduction: reducing the height or spread of a tree by performing appropriate pruning cuts

Utility Pruning: pruning around or near utility facilities with the object of maintaining safe and reliable utility service

Re-trenchment pruning ("Veteranizing") is another way to maintain aging trees. (see Appendix)

Climbing and pruning practices should not injure the tree except for necessary pruning cuts; ascent into the canopy should be by rope. Climbing spikes (gaffs) should never be used unless the tree is identified for removal.

4.23 Root Pruning

Protecting tree roots during construction is a primary goal. If tree roots ***are*** exposed during excavation:

- They must be cut cleanly with sharp hand tools. Preserve the root bark ridge (similar in structure and function to branch bark ridge).
- Use hand pruners, loppers and/or an appropriate handsaw. **Do not** apply wound dressings, as this retains moisture and can encourage decay.
- Directional Root Pruning is the recommended technique, combined with hand excavation around tree roots. With Directional Root Pruning, objectionable and severely injured roots are properly cut to a lateral root that is growing downward or in a favorable direction.
- The project arborist or City-approved arborist should review the removal or cutting of roots greater than 2 inches in diameter. The recommended review ensures that the stability and health of the tree is assessed.
- If soil and or sub-grade material must be removed from the CRZ, complete by hand excavation, air spade, or water and suction device.
- If backhoe excavation is implemented, over-burden removal should be conducted with the bucket facing the tree(s) and soil removal should be pulled back toward the backhoe or small excavator.
- Don't leave the CRZ exposed overnight. If exposure is to occur, then wet burlap or mulch should be applied temporarily.

4.5 Plant Health Care

Generally, insect populations do not threaten tree health to the point of mortality. More often, when their populations become too great they create a nuisance. If a tree is stressed due to other circumstances, pests can defoliate and severely damage a tree. If action is warranted, **Integrated Pest Management (IPM)** suggests that the pest source be identified and targeted with a specific and timely treatment. To preserve an ailing tree, property owners should implement the following guidelines and treat the problem in a timely fashion to prevent further deterioration of the tree.

4.51 Insect Control

One of the most common and detrimental mistakes made by owners and landscape maintainers is the unwarranted use of pesticides and herbicides. Use the IPM method to diagnose and decide upon an appropriate response. If chemical controls are called for, consult a pest control operator licensed by the Washington State Department of Agriculture (Chapter 17.21 RCW). A licensed applicator should be employed. Nontoxic materials should be used whenever possible to control damaging insects.

4.52 Disease and Decay – above ground

Disease that erodes the health or weakens the structure of a protected or designated tree may compromise the safety of people or property. A Tree Professional should be contacted for diagnosis and remedy options. (See Section 5 for tree risk management.)

4.53 Disease – below ground

Soil borne diseases, such as root rot (*Phytophthora*, *Verticillium, Armillaria*, etc.) are present in this area's soils. Often, a poor landscape design encourages harmful, and often lethal, diseases in surrounding, old trees.

Avoid the following conditions that tend to favor a diseased root environment:

- compacting the soil within a tree's dripline
- adding fill dirt
- roto-tilling within the drip line
- trenching and removing soil from the tree root area
- excessive or regular watering on or near the tree trunk area
- planting incompatible water-loving plants within the tree's drip line

Combined with poorly-drained soil, these factors can activate normally dormant fungi that in turn may infect the tree, precipitating the decline and potential death of the tree. This decline can be slow and may not be evident for many years.

4.54 Diagnosing Health Issues; Biotic, Abiotic & Environmental

When planning landscaping around a protected or designated tree, an evaluation of the tree and soil should be performed to determine if a disease is present. If the tree is diseased and landscaping will contribute to decline, permanently damage, or render the tree hazardous, it is the obligation of the property owner to take reasonable measures to reduce or eliminate the conditions that may cause the decline of the protected or designated tree.

To identify cultural conditions that may lead to diseases such as *Verticillium* or *Phytophthora* or other soil borne fungi, consult with a plant health care specialist or Tree Professional.

Plants selected for use under established native trees should not need water more than once a month. Use a drip system to irrigate within the critical root zone of the established tree so that runoff does not flood the area. Procure plant material from a reputable source, to improve odds that new plants will be disease free. Sometimes landscape plants introduce serious pathogens that are hard to control, notably Phytophthora.

4.56 Diagnostic Techniques & Applications

The health and the safety of a tree are two distinct and separate functional characteristics. A vigorous and healthy tree may not necessarily be of sound wood or structure. To remove a protected or City-owned tree, it must first be evaluated and the tree determined to be "hazardous." This must be verified in writing by a Tree Professional with a completed current International Society of Arboriculture 'Tree Hazard Evaluation Form' (see CHAPTER 5 Tree Risk Management).

4.6 Invasive Plant and Weed Control

(see section 6.9: Invasive plant species)

SECTION 5: TREE RISK MANAGEMENT

Overview

The essence of good arboriculture is the conservation and sustainable management of individual trees and populations of trees. It is important to recognize that most trees, left to their own devices will spend less than half of their lifespan in infancy, juvenile to early maturity and full to late maturity (peak crown size, maximum seed capacity and onset of natural limb loss, etc.) The second and longer part of a tree's life is spent with a gradual decline in vitality that is accompanied by increased fungal activity, advanced activity by fauna and flora, more habitat capacity and eventual death…or not.

In fact, trees are capable of potential immortality, by reproducing themselves with new growth, even as they shed parts - especially if managed as "veterans." Most trees in urban settings never get this chance to age gracefully, because managers must anticipate potential risks of falling branches or whole tree failure to heavily peopled areas. (Adapted from Neville Fay. See Appendix D)

The assessment of **tree risk** has two primary goals:

- To ensure the safety of people and property
- To promote tree health through proper care to reduce future hazardous tree conditions

Tree risk assessment is a systematic process that reviews risk factors, ranks them into risk categories and makes recommendations for reducing the risk. When a qualified risk assessor identifies a 'hazard tree', that tree is no longer acceptable for retention in its present state. In this case, the sum of the risk factors equals or exceeds a predetermined threshold of risk.

The City of Bainbridge Island Municipal Code defines a Hazard Tree as:
"a tree with structural defects likely to cause failure of all or part of the tree, which could strike a "target." A target can be a building or a place where people gather such as a park bench, picnic table, street, or backyard."

The degree to which a tree is hazardous hinges on four factors:

- Its potential for failure;
- Its potential for striking a target in the event of failure;
- The potential that serious damage will result;
- The value of the potential target(s)

In short, hazard designation requires both a tree defect and a proximate target. A giant tree collapsing in a remote forest poses negligible risk, while a single limb dropping on a busy playground could cause tragedy. The level of potential risk depends on the size of the part likely to fail (whole tree or a part,) and the frequency that a target is present & occupied.

Three important things to keep in mind:

- There are many options for reducing tree risk to acceptable levels without removing the whole tree.
- Risk assessment should not be used as an excuse to remove trees that are healthy and 'safe'.
- All trees pose some degree of risk.

(Dunster, J.; Assessing Tree Risks in Urban Areas and the Urban-Rural Interface.)

5.1 Responsibility

On private property, the property owner bears responsibility to mitigate or abate a tree with a known hazardous condition. Trees on City property that may be a public safety hazard should be reported to the City of Bainbridge Island, Department of Public Works for an assessment of risk. Trees of concern on state property should be reported to the respective agency (WA DOT, Parks, etc.).

5.2 Recognizing Tree Risk

Determining whether a tree's defect constitutes a condition that makes it an imminent hazard requires a high degree of knowledge and expertise. In the case of a protected or designated tree, only a qualified tree professional who is familiar with tree physiology, can interpret external signs of weakness, can perform internal checks if necessary, and make recommendations for risk reduction should perform hazard assessment. (see Appendix: What is a Tree Professional?)

5.3. Managing Public Tree Risk

The City of Bainbridge manages thousands of trees in the public right of way and on City-owned property. The basic tools for proactive public tree management are:

A condition rating system
Guidelines for leaving or removing trees
Annual tree risk inventory

Creating and putting these tools to use requires a long-range commitment to public safety and community forest health.

5.4 Establishing a Baseline Tree Evaluation System

A baseline tree evaluation system should be developed in planning sessions before evaluations are conducted. The following represents a suggested approach toward developing a hazard tree detection and correction program for public property.

5.41 Stratify the Area into Risk Zones on a Map

Low risk areas such as woods, open fields or areas with trees and low foot traffic and no built structures, as well as roads leading into such areas.

Moderate risk areas, such as open space with trail systems, open picnic areas without fixed picnic tables, etc.

High risk areas, such as streets, arterials, developed parks, municipal facilities, and other structures, parking lots, bus stops, and any other places where people might congregate.

5.42 Annual Site Examinations

Timing and frequency of examinations may vary, but all developed sites should be evaluated for new evidence of hazardous trees at least annually. In addition to this minimum annual screening, sites should be examined after major storm occurrences and once the severe weather season has passed (also a sensible time for annual inspections).

Carry out annual site exams systematically. They normally consist of a walk-through examination of the zones, where each tree and all areas of the developed site are observed for new evidence of hazard or defect. Examine all trees within striking range of a target, either fixed (play structure) or transitory (swim beach).

Generally, only trees greater than 6 inches in diameter at breast height (DBH, 4.5' above grade) should be examined. Smaller trees cause little damage and are considerably less prone to failure under most conditions. Under certain circumstances, trees less than 6 inches in diameter may require periodic inspection if their proximity to a particularly sensitive target (a target that likely would be damaged by impact) suggests unacceptable hazard, but this is exceptional.

5.43 Guidelines for Tree Removal & Retention

When annual or storm-related site examination identifies trees of concern, these must be assessed individually for risk by a Tree Professional, using standard ISA or ASCA protocols . This evaluation provides the basis for "risk abatement" actions, which may entail removing defective part(s), moving a target, or partial or full tree removal. Proceed with risk assessment and prescribed remedies as promptly as possible to minimize liability and public endangerment. In the case of a high-value tree, a second professional evaluation may be warranted if removal has been recommended and time allows.

5.5 Risk Reduction

5.51 Pruning

When the primary objective is to reduce the danger to a specific target caused by visibly defined hazards in a tree, the property owner, manager and/or ISA-certified tree care contractor must choose an appropriate pruning type. Pruning for risk reduction should consist of one or more of the maintenance types described in the American National Standards Institute's Pruning standards: crown cleaning, crown raising, crown reduction, crown restoration. (See Section 4.4 Pruning for details)

5.52 Wildlife Snags

Creation of wildlife snags or "habitat trees" is another risk abatement option. If a tree is dead or dying, a habitat snag can be an excellent alternative to full removal. Choose an appropriate height for the site conditions and monitor the snag as it decays. Created snags add important habitat for microbes all the way up the food chain. While not suitable for developed, high use locations, Bainbridge Island offers many good locations for snag retention.
(see appendix; Wildlife Snag Specifications)

5.6 Tree Removal and Replacement

Limitations may exist on the removal or care of trees within certain regulated areas. For example, a regulated tree may not be removed without City review and approval, except if it is determined to be hazardous. Therefore, a first step would to verify that the removal is allowed under City law, by applying for a clearing permit and researching replacement requirements, and to prevent unnecessary tree removal. Trees removed in violation of City law must be replaced by the property owner or, in the case of street trees, the developer. (Removal and replacement standards for public trees are included in the Appendix.)

To remove a protected or designated tree that has been confirmed as hazardous, as defined by the City of Bainbridge Island Municipal Code, a letter addressing the condition of the tree is required from a Tree Professional. Submission of a replanting plan is also required, followed by review and concurrence by City staff. This approval document must be available on site before the tree is removed, unless emergency conditions exist.

5.7 Public Tree Replacement Criteria

When a public tree is removed, it should be replaced on a minimum 1:1 basis in the next available planting season, since canopy equivalent to that loss will take years to grow. This

ensures the continuation of the ecosystem service that the trees provide. Bainbridge Island's Community Forest Management Plan addresses expected population growth by establishing canopy cover goals by zone. In the Winslow Core and the MUTC where density is concentrated, the loss of even a single tree matters. Private citizens are also encouraged to replant or contribute time or funds toward tree replenishment on public sites instead. Contact the City Department of Planning and Community Development for suitable options.

5.71 Public Tree Replacement Considerations

Budget: Develop a realistic budget covering the "life cycle cost" of added trees, including
- purchase of planting stock,
- site preparation (removal of existing trees, installation, landscape amenities such as grates)
- establishment care (watering, weeding, pruning, monitoring, etc.)
- ongoing maintenance (watering, fertilizer, mulch, pruning, etc.)
- administrative costs

Site Review & Planning: Review available growing space
- planting strip width, cut outs, behind sidewalk or curb, etc.
- underground utilities
- competition from existing plant roots
- suitability of soil (compaction, toxins, drainage issues, etc.)

Review above ground site constraints
- utility lines
- utility poles, traffic lights, street lights, security lights
- signs (public or private)
- awnings
- building structure (surrounding hardscape)
- vehicular and pedestrian clearance
- existing vegetation (trees and shrubs)

Standards Compliance
- ADA Standards,
- other City requirements and standards.

Site Design/Streetscape
- longterm viability or size at maturity
- stormwater mitigation potential and other ecological function
- suitability for "complete streets" that combine various functions including bicycles, pedestrian, utilities, etc.
- formal *allee* or informal groupings

Selection of tree species, placement, form, size, color, and texture in relation to:
- aesthetic design
- existing trees' condition and character
- site constraints
- attributes and limitations of the proposed new trees.

(Refer to the Winslow Area Civic and Street Tree Plan for specific recommendations.)

5.8 Designated Hazard Tree Forms

Many municipalities have traditionally used the (ISA) International Society of Arboriculture Tree Hazard Evaluation Form, completed by a Tree Professional, to provide a standard rating method for trees that pose some risk. The hazard rating is determined by adding assigned numbers to the failure potential + size of part + target rating.

In 2006, the Pacific Northwest Chapter of the ISA began a process of Tree Risk Assessment adapted from the United States Forest Service, and this approach is now considered the present Standard of Care. This method provides assessors a structured process, based on good science and arboriculture, to assign recommended thresholds for action for the purpose of informing risk managers. The PNWISA Tree Risk Assessment method requires assessor certification.

The method uses a 12 point system to rate the potential risk from a tree.

The **Probability of Failure** is rated at 1-5 points based on the judgment of the Assessor.

- 1 point = Low risk – The defect is not likely to lead to imminent failure and no further action is required. In many cases these defects might not even be recorded.
- 2 points = Moderate risk – One or more defects that are well established but would typically not lead to failure for several years. Corrective action might be useful to prevent future problems but only if time and money are available. Not the highest priority for action, these are the "retain and monitor" situations that can be used to inform budget and work schedules for subsequent years.
- 3 points = Moderately High risk – One or more defects areas well-established, but not yet deemed to be a high priority issue. Additional testing may be required or, the assessor may feel the problems are not serious enough to warrant immediate action, but do warrant placing the tree on a list of trees to be inspected more regularly. These are Retain and Monitor trees.
- 4 points = High risk – The defect is serious and imminent failure is likely and corrective action is required immediately. These cases require treatment within the next few days or weeks.
- 5 points = Extreme risk – The tree or component part is already failing. An emergency situation where treatment is required today.

The **Size of the Defective Part(s)** is rated 1-3 with 1 point for branches or stems up to 10cm (4 inches) in diameter, 2 points for branches or stems between 10-50cm (4-20 inches) in diameter and, 3 points for branches or stems over 50cm (20 inches) in diameter.

The **Target Area** is rated 1-4 based on the following target descriptions.

- 1= Low – Infrequently used, seldom for any great length of time. Workers pass through the area but do not stay within striking distance. No valuable buildings or other facilities within striking distance. *Examples = Back country roads or trails; seldom used or overflow or long term parking, industrial areas where workers drive machines (trucks fork lifts tractors) with substantial cab protection, natural or wilderness areas with limited access.*
- 2= Moderate – People move through the area regularly, but do not stay within striking range very long. Valuable buildings are at the edge of the striking distance and would not be seriously damaged even if the tree did fall down. *Examples = Moderate to low use school playgrounds, parks, pick-up and drop-off areas; parking lots with daily use; secondary roads and intersections, dispersed camping sites; moderate to high use trails; work and/or storage yards.*

3= Moderately High – The site has valuable buildings within the striking distance. People are within striking range more than 50% of the time span in any one day, week, or month, and their exposure time can be more than just passing by. Example include secondary roads, trails, and access points; less commonly used parking areas and trails within parks, trails alongside fairways, bus stops.

4= High – Frequent use by people, often for long periods of time, or high volumes of people coming and going within striking range. Valuable buildings or other structures within striking range that would suffer major damage in the event of failure. Busy roads. Power lines. *Examples = Short term parking constantly in use; pick-up and drop-off areas; emergency access routes and/or marshalling areas; handicap access areas; administrative buildings; high use camping areas, visitor centers or shelters; residential buildings; industrial areas where workers take outside breaks; development sites where work activity within striking range lasts more than a few hours at a time; main roads; high volume intersections.*

A rating of 12 is the most extreme possible and would represent imminent failure with catastrophic results.

5.81 Options for Mitigation of Risk Trees include

Remove the risk altogether if possible by cutting off one or more branches, removing dead wood, or possibly removing the entire tree. Extreme risk situations (10-12 points) should be closed off until the risk is abated.

Modify the risk of failure probability. In some cases it may be possible to reduce the probability of failure by adding mechanical support in the form of cables braces or props.

Modify the risk rating by moving the target. Risk ratings can sometimes be lowered by moving the target so that there is a much lower probability of the defective part striking anything. Moving the target should generally be seen as an interim measure.

Retain and monitor. This approach is used where some defects have been noted but they are not yet serious and the present risk level is only moderate.

CHAPTER 6- BMP's FOR SPECIFIC LAND USES & LANDSCAPE TYPES

Overview

In this section, we address several specific environments and discuss how to tap the opportunities each presents for preserving and adding trees. It is worth recounting that our *green infrastructure* accomplishes the following:

cleanses the air by consuming carbon dioxide and producing oxygen
buffers noise, dust, fumes, wind and glare
intercepts rainwater and dispersing it more slowly into the ground
shelters wildlife and protects native biodiversity
creates calm settings to rejuvenate and relax
creates a pleasant and comfortable sidewalk environment
shades street pavement, increasing its useful life
screens the view of parking lots and utility areas from public streets
encourages safe driving with street trees and planting islands
builds civic pride by enhancing the beauty of public thoroughfares
increases aesthetic and monetary value of property
shelters buildings from summer heat and winter chill
buffers extremes of precipitation and heat accompanying climate change

Tree care is the property owner's responsibility, including the city for trees within the right-of-way or on city-owned property. Most island residents are responsible for the care and protection of some portion of our community forest. Some willingly shoulder extra responsibility as community volunteers.

Common threads you will find running through these recommendations are to:

Save the best of what you have, evaluating existing trees, using careful site design, and following the principles of "Low Impact Development."
Understand specific characteristics and limitations of sites when choosing trees.
Take good care of trees, knowing and embracing the role(s) you play.

6.1 Parking Lots

Parking lots have long been recognized as thermal "hot spots", as well as collectors of significant storm-water runoff and associated pollutants. Trees growing in parking lots within commercial, industrial, and residential land use areas help to offset some of the many negative aspects of these sites. A parking lot is one of the few places where species with wide canopies can be allowed to grow and spread to full maturity.

Parking lots are not, however, a healthy environment for trees. Just picture how many times you have opened a car door onto the trunk of a struggling specimen tree or watched a busy shopper jam the grocery cart into a tree trunk. Successful conservation, planting and maintenance of trees in parking lots depends on providing adequate soil volume, water, nutrients and protection.

Tree species planted or retained in parking lots should be:

selected to provide abundant shade
tolerant of heat and pollution, and often, compaction and drought
effective at intercepting, evaporating, storing and conveying rainwater, enhancing infiltration and reducing erosion
free of structural, pest or disease problems, aggressive roots and fruits or nuts

protected to provide optimal opportunity for healthy growth

Certain design features are encouraged, where feasible:

- Continuous planting islands, to accommodate multiple tree and increase the soil volume available to roots
- Planting islands that serve double-duty by incorporating surface water runoff treatments such as bio-swales and rain gardens in their design
- The use of structural soil mixes, which increase rootable soil volume and reduce the potential for root invasion into parking lot paving. (See Appendix F)
- Incorporating understory plantings to shade and protect roots; prickly low shrubs discourage cut-through foot traffic better than groundcovers

6.11 Drainage / Water Quality Options

With early planning and design, it is possible for tree planting requirements to meet regulations for on-site treatment of stormwater. Trees planted within stormwater runoff areas should be limited to species adapted to heavy to moderate irrigation, such as riparian species (see Appendix).

6.12 Best Management Practices for Parking Lots

1. Integrate bio-retention into parking lot islands or planter strips distributed throughout the parking area in the forms of swales or linear shallow depressions
2. Utilize the opportunity to choose a species that will be big and spreading when mature. Plant one large canopy tree (>40') for every seven (7) parking spaces in parking lots
3. Select trees that can withstand the hot, dry microclimates and poor soil conditions of parking lots
4. Use Silva Cells (an underground frame) or a structural soil mix beneath pavement to increase the volume of soil available to tree roots
5. Group trees in islands so they can share rooting space.
6. Provide a required minimum open soil surface area for very small, small, medium, and large trees of 25, 100, 225, and 400 square feet respectively
7. Use pervious pavements to increase the moisture penetration and gas exchange for tree roots
8. The maximum distance between trees in linear tree islands should be 30 feet unless they are a species that will require more space.
9. Tree planting islands should have a minimum width of 12 feet
10. Maintain sight lines so motorists can see pedestrians and other vehicles, through proper tree selection and regular appropriate pruning
11. A clearing permit may be required from the City of Bainbridge Island to remove parking lot shade or ornamental trees if those trees had been required for retention through a land use permit. At this time, there is no cost associated with obtaining these permits
12. All pruning work shall be completed pursuant to the current International Society of Arboriculture (ISA) and American National Standards Institute (ANSI) standards

13. Removed trees must be replaced with healthy specimens of similar species and size
14. Maintain an 8-foot minimum height to branching for vehicular and pedestrian clearance
15. Provide curbs or wheel-stops around tree planting areas and plant trees at least 30-inches (2.5 feet) inside the curb or wheel-stop to avoid vehicle injury to the trees
16. Provide designated paths through planting areas that follow “desire lines” to prevent soil compaction by foot traffic.
17. Irrigate tree islands to ensure new tree survival and improve long-term tree health
18. Incorporate understory plantings to shade and protect roots, and prickly low shrubs to discourage cut-through foot traffic better than groundcovers

6.2 Plazas, Courtyards and Winslow Core Areas including Street Trees

Plazas, Courtyards and Core Areas are places where people gather to work, shop, eat, meet, and relax. They are found predominantly within commercial, institutional, and dense residential areas.

Growing space for trees in these areas is limited. The majority of trees are planted, as opposed to conserved, and usually grown as single trees. Trees are often arranged in a linear or rectangular grouping and planted in small tree wells (4 x 4 feet) or infrequently, larger landscape islands.

These settings are characterized by an abundance of impervious pavement, poor quality soil, inadequate soil volumes, close proximity to buildings and streets, air pollution, and high levels of human activity. They are also appropriate for the integration of ideas put forward in the Bainbridge Island Arts Plan.

6.21 Best Management Practices for Plazas, Courtyards and Winslow Core

1. Match the mature size of trees selected to the amount of available growing space
2. Select trees to enhance architectural design, without blocking important building or structural detailing
3. Plant trees where limbs will not impede access for delivery or emergency vehicles, pedestrian circulation, or sight lines
4. Don’t assume that site conditions are the same throughout a plaza; plazas can have dramatic changes in temperatures from one side to another due to microclimatic conditions created by surrounding buildings
5. Use alternative (permeable or open) paving systems that accommodate pedestrians and vehicles while increasing opportunities for moisture and air to reach tree roots
6. Use structural soils beneath the pavement and innovative design to increase the volume of soil available to tree roots
7. Locate trees where underground utilities and compacted soils won’t constrict the available area for tree roots

8. Look above for overhead utilities that will limit mature tree size
9. Protect trees from vandalism or other damage by pruning and protecting with sturdy fencing
10. Budget for increased tree maintenance costs in downtown "high contact" areas, to ensure new tree survival and long-term health; include irrigation and pruning to maintain pedestrian and vehicular clearance

6.22 Street Trees and Road Frontage Areas-- (Please refer to the "City of Bainbridge Island Civic and Street Tree Plan" for specific information)

Road Frontage Areas consist of public rights-of-way (including streets, alleyways, circles and medians) and immediately adjacent land in residential, commercial, institutional, industrial, and agricultural zones. Frontage areas include both street trees and adjoining yard trees that are part of a property's landscape design and function. These trees may be planted ornamentals, or pre-existing vegetation like native woods. Street trees are found growing both singly (most often) and in groups.

Removal and replacement of trees that damage city sidewalks or other city infrastructure shall be reviewed by a City-approved arborist prior to tree removal. The City encourages the use of creative alternatives that favor tree protection, such as "bumpouts" and rubber sidewalks that allow for tree root expansion.

6.23 Best Management Practices for Road Frontage Areas

1. Plant trees where there is adequate overhead and underground room to accommodate their mature size
2. Vary the spacing and species of trees along road right-of-ways to add interest and diversity to roadway plantings. In appropriate locations, evergreen trees should be considered in order to provide year-round foliage, as long as they comply with infrastructure and sight line restrictions
3. Maintain sight lines so drivers can see pedestrians and vehicles when pulling out of driveways or through intersections. Plant trees and hedges a minimum of 15 feet from driveways and 15 feet down each lot line on corner locations from road intersections for minor collectors. For major collectors and arterials, the distance will be greater to accommodate faster speeds
4. Provide 15 feet of vertical clearance for large vehicles along tree-lined streets and drives
5. Provide at least 8 feet of vertical clearance for pedestrians and bicycles, to avoid hazards created by low branches too close to sidewalks and drives
6. Avoid over-thinning natural stands of trees in or by road frontages, to reduce susceptibility to wind damage and failure
7. Bump out planting strips or jog sidewalks to accommodate tree trunk and root growth where necessary
8. In order to avoid damaging tree roots, tunnel or bore instead of trenching during utility line installation
9. Allow special consideration for designated Heritage trees that may be in right of way areas

10. Avoid planting trees directly over property lines or corners
11. Tree lawns (Planting strips) – the planting area between the sidewalk and curb – should be a minimum of 5 feet wide
12. Install root barriers along sidewalks and curbs to prevent tree roots from heaving and breaking pavers, sidewalks curbs, and road pavement. Other alternatives include load-bearing soil (developed by Cornell University—see appendix), rubber sidewalks or other innovative material that does not crack from root growth
13. Where the sidewalk is directly adjacent or very close to the street, plant trees behind the sidewalk. If necessary utilize private property tree planting easements to provide growing space and vehicular and pedestrian clearance

6.3 Utility Corridors and Easements

Utility corridors are linear landscape areas that contain power, gas, water, or sewer service. These corridors can be as narrow as 20 feet or as wide as 150 feet. They often run parallel to roadways, and contain above and/or below ground lines. Within these corridors, vegetation must be managed to allow safe maintenance and repair of the utilities. These long, narrow bands create continuous vegetation 'edges' that actually can improve ecological function. Wildlife is attracted to forest edges for food, nesting and protective cover, as well as to adjacent open areas to forage. The down side of exposed edges is their vulnerability to invasive plants, which can move in from any side.

6.31 Best Management Practices for Utility Corridors

1. Avoid trees with aggressive or damaging root systems near underground water and sewer lines. (See Appendix for recommended trees list.)
2. Plant only small-maturing trees beneath overhead electrical lines to minimize "topping" needed for future line clearance.
3. Maintain adequate clearance from all overhead and underground utility lines to facilitate access for repairs and minimize impacts to tree canopies and roots.
4. Plant medium sized trees at least 20 feet off the centerline of overhead electrical distribution lines.
5. Plant large sized trees at least 40 feet off the centerline from overhead electrical distribution lines.
6. When trees are pruned within overhead utility line maintenance zones, adhere to Best Management Practices for Utility Pruning of Trees [companion publication to the current ANSI A300 Part 1. Shrub, and Other Woody Plant Maintenance-Standard Practices, (Pruning). Only specially-trained arborists should perform tree work near live electrical lines.
7. Employ crown reduction pruning rather than tree "topping" to reduce tree size beneath utility lines.
8. Tunnel instead of trenching beneath tree roots within the CRZ for installation or repair of cable, phone, electric, gas, water, or sewer lines.

9. Never use spikes to climb trees during overhead utility line maintenance, installation or repair. Exemptions include tree removal or emergency situations, such as storm work and worker rescue situations.
10. Annually monitor edges for invasive plant infestations and remove or limit encroachments before they penetrate to interior of corridor

6.4 Residential Lots

Although the potential for large canopied trees is limited in urban core areas, trees remain an important part of residential landscapes. Their value as "green infrastructure" is so great from a storm water management standpoint, that many communities credit homeowners on utility bills for choosing tree canopy rather than increased impervious surface.

In suburban and rural lots, especially where new houses are built on wooded tracts of land, property owners should embrace the opportunity to practice enlightened site design early in the planning process. Consideration of tree protection and healthy soils can result in the preservation of promising young and mature native trees, that buffer roads, provide screening and habitat value, and reduce the visual intrusiveness of large new buildings. Rainwater mitigated on site can reduce the costs of below-grade storm water drainage systems.

6.41 Best Management Practices for Residential Lots

Assess the existing vegetation and plan new construction or additions to save as many high quality existing trees as possible.

1. Evaluate your yard for above- and below-ground conflicts: utilities, soil type, buildings, view, shade, sun, other trees, and safety
2. Plant trees only where there is adequate room both overhead and underground for the mature size of the tree you are planting
3. Avoid planting trees directly over, or too close to, property lines or corners.
4. Identify tree priorities—whether for beauty, wildlife habitat, shade, windscreen or a visual buffer
5. Consider the maintenance needs of the tree you choose by matching the preferences of the tree (i.e., drought tolerant, likes "wet feet") with the site conditions.. Can the tree prosper in our Pacific Northwest climate without extensive care throughout its life?
6. Plant native species, which, if chosen wisely and sited appropriately for their microclimate, can reduce the need for ongoing care (i.e. irrigation) after establishment
7. Where room allows, install an informal hedgerow to replace a fence or laurel hedge. Hedgerows are mixed plantings that create habitat for birds, reduce hedge-pruning chores, and add seasonal interest – all while providing screening. A hedgerow should be at least 6 feet wide, but is much more valuable to wildlife if it is wider. Mixed hardwoods and conifers add significantly to the diversity of wildlife that will use the hedgerow. Plant shrubs and trees about 3 feet on center. Try to avoid breaks or openings in the hedgerow — these spaces are hazardous for many hedgerow dwellers, allowing easier access for larger predators. Native hedgerow species may include:

Red alder	Oregon grape	Elderberry
Douglas fir	Salal	Nootka rose
Western red cedar	Snowberry	Serviceberry
Vine maple	Ceanothus	Blueberry
Bigleaf maple	Red osier dogwood	Huckleberry
Willow	Red flowering currant	Salmonberry
Oregon white oak		

6.5 Institutional Campuses

Typical examples of institutional campuses found across the island are schools, churches, and health facilities. Larger tracts of land associated with institutions provide valuable opportunities for tree planting and preservation. By virtue of their size, they can preserve remnant forests that provide a link to Bainbridge Island's wooded past. They also allow for planting of large new specimen trees and groves of trees and understory.

The Bainbridge City Hall, Bainbridge Performing Arts Center and Island History Museum located between Madison and Erickson Avenues make up the main downtown Civic Complex. A Tree Management Plan was completed for this campus in 2006, and is available at City Hall. Private developments may also lend themselves to landscape-level planning for vegetation retention and planting.

6.51 Best Management Practices for Institutional Campuses

1. Inventory and assess the site's existing critical areas, flora and fauna to identify areas to protect and enhance as part of development or landscape improvements
2. Conduct a risk assessment of major trees every 5 years and after major storm events
3. Utilize native species in layered arrangements that echo the Island's forest communities
4. Create surface storm water handling systems such as rain gardens and swales
5. Configure pedestrian circulation to invite visual contact between people and plants, while protecting them from physical damage and disturbance
6. Concentrate buildings and associated pavement, to maximize green area on site
7. Select a wide variety of trees to maximize biodiversity; include unusual species to pique public interest and test out tree performance
8. Choose tree species offering ease of upkeep, durability and a range of seasonal effects

6.6 Open Spaces, Parks and Natural Areas

Open spaces and Natural areas include forests, large gardens, parks, agricultural areas, pasture land, lake and stream margins, beaches and natural preserves. These fulfill many positive and fundamental functions on Bainbridge Island. They provide large areas of un-compacted soil that absorb stormwater, greater tree canopy for intercepting and distributing rain, and provide habitat and movement corridors for wildlife. Furthermore, they offer opportunities for sports, recreation, education and other individual and social activities. Well-

managed open spaces are a positive contributor to quality of life in developed areas of the Island.

6.61 Best Management Practices for Parks, Open Spaces and Natural Areas

1. Assess and inventory individual sites related to critical areas, flora and fauna
2. Determine specific site uses and contributions, and reinforce the positive contributions
3. Maintain or reclaim optimal ecological health of the site
4. Establish a maintenance management system for Open Spaces, Parks and Natural Areas

6.62 Maintenance Recommendations

Remove or prune trees if they pose undue risk to people or property
Remove invasive species of plants
Replant areas with non-invasive, mostly native species
Create wildlife snags and retain fallen woody debris to improve wildlife habitat
Develop way-finding and artist-designed interpretive signs
Build volunteer stewardship partnerships with local civic, religious, school, youth, neighborhood and social organizations, or budget for private contracted maintenance
Cooperate with municipal, county, and state government agencies for permitting and technical advice

6.63 Suggested Maintenance Management System

The following basic steps are recommended to maintain environmental diversity, health, and recreational use within Island open spaces and natural areas.

1. Familiarize stakeholders with BMP's and any applications before the Planning Department or other agencies. Gather comment on management concerns and opportunities.
2. Conduct onsite evaluation to define vegetative zones.
3. Determine management priorities.
4. Plan for restoration and ongoing maintenance according to vegetative zone:
   - Determine and rank restoration and maintenance needs
   - Determine and comply with permitting and regulations relating to work within open space and natural areas
   - Remove exotic and invasive plant species in accord with recommended vegetation management techniques (see Section 6.9 and Appendices/References)
   - Replant areas of disturbance and set up maintenance programs for newly established areas
   - Monitor and record replanting survival rates and invasive plant resurgence; replace lost plants and remove invasive weeds promptly
   - Monitor and record trees with significant defects located within striking distance of persons or property, annually and after severe storms
   - Monitor and record erosion or other significant changes to landscape features
   - Monitor and record health of vegetation annually; budgeting resources to take timely corrective action when monitoring indicates a threshold of need
5. Monitor security issues

Increase volunteer presence for trail and vegetation maintenance projects,
Add trail patrols
Encourage recreational user awareness, appropriate use and communication
Tap “eyes and ears” of property owners adjacent to public open space/ parks

6.7 Buffers and GreenBelts

Buffers are the linear areas that border roadways, adjacent properties, or dissimilar land uses. Critical Area Buffers are vegetated areas that protect fragile landscape elements in accordance with the State-mandated Critical Area Ordinance. These areas include steep slopes, , shorelines, slide zones, wetlands, and streams. Trees provide very effective buffers, either alone or with other vegetation. They may be planted in either groups or rows, and spaced uniformly or in irregular patterns. On Bainbridge Island, many buffers contain natural woodlands or remnant forest areas. Plantings that combine overstory trees, understory canopy, shrub, and herbaceous layers make effective buffers. Wherever possible, buffers should be designed and/or enhanced to provide multiple vegetative layers.

In some cases, buffers may be limited in width and therefore in the amount of growing space available for trees. In most cases, however, trees in buffer areas remain relatively undisturbed after they are established and usually have an ample amount of growing space.

6.71 Best Management Practices for Landscape Perimeter and Park and Conservation Land Buffers

1. Select low branching or multi-trunk species to provide visual and physical screening to the ground
2. Plant a variety of tree species and mature tree sizes
3. Include all vegetative layers in buffer planting. Consider creating mixed-species hedgerows as compact, wildlife-rich buffers
3. Incorporate trees with dense, evergreen foliage to provide screening year-round (especially native coniferous trees)
4. Select trees for their suitability to the existing topography, soils, infrastructure (utilities, roads), light, moisture conditions, and vegetation
5. Conserve existing undisturbed woodlands with understory trees and shrubs for high quality buffers where width allows – preferably 50 feet or more. Create woodland buffers where there is room to create a “feathered” canopy edge with lower foreground trees to help tame and deflect wind.
6. Be aware of the remnant forest ‘New Edge’ effect on wind firmness of retained trees. Newly exposed interior trees are at risk for windthrow or failure due to soil saturation from redirected drainage water. A too narrow buffer of slender, interior-stand trees within striking distance of frequently-occupied targets (homes, parking lots, playgrounds, etc.) may pose a risk. If necessary, consider enhancing the existing buffer or planting a new buffer that will mature into a multi-layered canopy with site-adapted, stable trees
7. Leave the soil, organic litter layer, and native groundcovers undisturbed
8. Plant trees in a staggered, naturalistic pattern, rather than in linear rows
9. Conserve at least the minimum undisturbed width of buffer required by the City Municipal Code

6.8 Riparian Zones and Drainage Areas

These areas are associated with streams, rivers, shorelines, and surface drainage-ways. They are characterized by wetlands, alluvial soils, high water tables, and periodic flooding. In many riparian zones, the topography includes a substantial slope from upland to lowland areas.

6.81 Best Management Practices for Riparian Zones and Drainage Areas

1. Review the City's Critical Areas Ordinance (BIMC 16.20), Shoreline Management Master Program (BIMC 16.12) and related State and Federal Codes
2. Retain, to the extent possible, existing woodlands with undisturbed understory trees, shrubs, herbaceous plants, leaf litter, and soil
3. Plant and conserve trees in mixed groups and stands
4. Select species that are adaptable to local soil conditions, whose root systems help prevent erosion (fibrous, non shallow-rooting habit)
5. Manage areas containing young trees to ensure development of valuable mature tree stands over time
6. Do not plant exotic species, as many are aggressive or have the ability to be transmitted easily along riparian corridors or shorelines
7. Plant trees and associated vegetation that can tolerate variable lowland or high water table conditions
8. Refer to Washington Department of Ecology manuals available on line that address vegetation management for steep slopes and stream corridors (see References)

6.9 Invasive Plant INFESTATIONS

Our community must be ever vigilant to the risks posed by noxious weeds and invasive exotic plants. These "thug" plants threaten the general ecological health and diversity of our native ecosystems on public and private lands throughout Bainbridge Island, including forests, parks, agricultural land, waterways, and developed landscapes. Guidance for protecting such areas may be found in Washington state noxious weed law, which acts to protect wildlife, property values, and public health and safety from the adverse impacts of invasive plant species. Kitsap County Weed Control Program provides monitoring and advice on controlling listed plants.

The key tools for noxious weed and invasive species management are: prevention, eradication and containment. For control, all three must be put to use. By definition, such plants respect no boundaries, so coordinated public and private efforts are essential to successfully dealing with this constant threat to our environment.

*An **invasive plant** is one that has the ability to thrive and spread aggressively outside its natural range.*
*A **noxious weed** is an invasive, often herbaceous plant traditionally designated as a threat to farmland, pasture or wetlands. Some of our most serious invasive forest species are not official noxious weeds: English laurel, English holly, English ivy, and knotweed.*

6.91 Best Management Practices for Invasive Plant Infestations

1. Properly identify the existence, extent and species of invasive plants within your site

2. Contact the Kitsap County Weed Control Program for direction on invasive control methods or when dealing with a Class A noxious species, mandatory eradication (contact information: http://kitsap.wsu.edu/noxious_weed/index.htm)
3. Determine the type or combination of control methods that apply to your situation and site and from this information develop a specific Maintenance Plan. Control options include biocontrol (using selected insects and pathogens), weeding, grazing, smothering (with sheet mulch), herbicides, and mechanical removal. Always select the most environmentally-friendly alternative you can, within the constraints of the situation
4. Use techniques developed through experience by others. See Appendix H (References) for excellent resources to help Bainbridge Island win the war against invasives, one infestation at a time
5. "An ounce of prevention" is key to invasive and noxious weed management. Protect desirable vegetation by monitoring, and weed out invaders as soon as they appear. Don't waste energy attacking the worst first – instead save valuable, intact plant communities
6. Embrace the adage "prevention begins at home." Engage local nurseries, landscapers, garden clubs, schools, service organizations, park managers, permitting agencies and realtors to raise public awareness about invasive plants
7. Encourage the use of non-invasive ornamental species in public and private landscapes. Eliminate them from civic landscapes and in their place demonstrate vigorous, attractive alternatives to popular invasive ornamentals like holly, laurel, ivy, butterfly bush and broom

Note on Ivy Removal:
In addition to hurting trunks and killing canopies, English ivy weighs down our Northwest trees and can cause them to fail in whole or in part, during storms. It is important to control ivy growth into trees by removing as much as possible. A qualified professional can climb the tree and remove ivy from high in the canopy.

An effective way to control ivy is to cut vine stems at the base of the trunk and 4 feet up. Strip away cut sections while leaving vines higher in the tree to die on their own without pulling them down, which can be dangerous, fruitless or damaging to a tree's protective bark. For large vines, a crowbar or pruning saw may be needed to cut the vines, and a screwdriver to pry them off. The goal is to delay return growth and keep the tree healthy even if it inhabits a sea of ivy. For long-term control, remove ivy roots and replant with sword fern or other native ground covers. To discourage erosion, cleared slopes should be replanted in the fall before winter rains set in.

APPENDICES

The Appendices that follow are intended to provide more specific information for managing Bainbridge Island's important Community Forest resource.

APPENDIX A -- Defining an Arborist

ISA Certified Arborist
A certified Arborist has at least 3 years experience in tree care industry and has passed an exam demonstrating knowledge in all areas of arboriculture. Continued Education credits are required for recertification every 3 years. www.isa-arbor.com.

ASCA Registered Consulting Arborist
This is the highest certification a consulting arborist can earn; RCAs are considered experts of the field. They must have extensive technical experience in landscape planning and development, tree preservation, hazard tree assessment, legal matters, tree appraisal and damage assessment. They must meet and maintain requirements for membership in ASCA, including Continuing Education requirements. They must have completed ASCA's rigorous Consulting Academy and passed a qualifying exam. They must also demonstrate extensive report writing competence through reports submitted for peer review. There are currently only 6 arborists in the State of Washington with this designation.
http://asca-consultants.org/join_rca.html

For the purposes of this manual, we are recommending the use of the term "Qualified Professional."

Tree Professional
An individual with relevant education and training in arboriculture or urban forestry. The individual must be an arborist certified by the International Society of Arboriculture or a registered consulting arborist from the American Society of Consulting Arborists or have equivalent training from an organization such as Tree Care Industry Association and for Forest Management Plans may be a certified forester by the Society of American Foresters. A Tree Professional must possess the ability to perform tree risk assessments and prescribe appropriate measures necessary for the preservation of trees during land development. For Forest Management Plans, the qualified professional must have the ability to assess wooded sites and prescribe measures for forest health and safety.

What is Urban Forestry?

Urban forestry is the care and management of urban forests, i.e., tree populations in urban settings for the purpose of improving the urban environment. Urban forestry advocates the role of trees as a critical part of the urban infrastructure. Urban forestry is practiced by municipal and commercial arborists, municipal and utility foresters, environmental policymakers, city planners, consultants, educators, researchers and community activists. (Wikipedia)
There is no officially certified title of "Urban Forester" at this time, that we know of.

Selecting an Arborist

Hiring a tree care provider deserves careful consideration and caution. A mistake can be expensive and long-lasting, while the right choice can assure health, beauty and longer life for your trees and landscape.

First decide if you need a diagnosis of a suspected problem, or a tree service company to perform work that has been prescribed

Beware of *door-knockers* who may show up just after storms when there is an opportunity to earn quick money. These may not be professionals and may not have the skills or proper equipment to do the work safely

Hire an arborist or tree worker who has been certified through a program of the International Society of Arboriculture (ISA) and has a business license

Ask the arborist for a client or reference list so that you can assess their workmanship

Check the phone directory, usually under trees or tree care service. Listings in the directory should indicate some degree of permanence. Look for professional membership affiliations. Membership does not guarantee quality, but a lack of it may cast doubt on the company's commitment to professionalism

Check with the COBI Planning and Community Development Department for a list of approved arborists

Get copies of proof of liability, personal insurance, property damage insurance and worker's compensation. Don't stop there – call the insurance company to verify that the policy is current

Obtain more than one written estimate that clearly states their scope of work, but don't expect an arborist to lower a bid to match another's

A good arborist will not use climbing spikes unless the tree is going to be removed

Beware of an arborist who is too eager to remove a living tree, but keep in mind that living is not always equal to healthy or structurally sound

The Contract for Services

A contract should protect you and the tree professional. Most companies will provide their own contract and should include the following basics:

Dates that work will begin and end.

Specific Scope of Work

Cleanup procedures should be listed and whether firewood will need to be cut (and into what lengths)

Clarify if a tree removal includes grinding the stump and surface roots and if so, how deep? Will they remove grindings and backfill the hole?

The total dollar amount you will be charged and how: (a) as a single price for the job, or (b) on an hourly basis plus materials "…but not to exceed…".

APPENDIX B-- Tree Protection Specifications (General Guidelines)

1. This specification must be followed for all trees that are in close proximity to any clearing and grading limits.
2. After the site has been surveyed, and clearing and grading stakes are in place, the Tree Professional will visit the site to determine the actual placement of tree protection measures based on the potential impact to tree root systems. Final adjustment of clearing limits will be made on site.
3. Tree Protection Zone (TPZ) fencing or other barriers shall be installed along all clearing limits to protect the Critical Root Zones (CRZ) of trees that are to be preserved. Optimal CRZ areas should be calculated at 1 foot radius for every 1 inch of tree diameter. Work required for removal of unwanted vegetation within the CRZ areas will be **hand work only**. TPZ fencing shall be 4' tall orange plastic fencing anchored with steel stakes or 6' chain link fence, depending on local code requirements. The Tree Professional may also require plywood boxing around trees in certain high traffic areas, and will meet on site with the contractor to determine the specific types of fencing, placement, and specific clearing instructions for areas near preserved trees. Adjustment of the initial TPZ lay out may be required as construction progresses.
4. Within the TPZ areas no parking, materials storage, dumping, or burning is allowed.
5. When removing trees outside of the TPZ determined to be unacceptable for retention, use methods such as directional felling to avoid damage to trees and other valuable vegetation that is being retained. Small trees and other native vegetation in these areas should be carefully preserved.
6. Where the consulting arborist has determined that roots of a preserved tree may be encountered during excavation or grading, a Tree Professional shall be on site to supervise any root pruning and to assess the potential impact of such pruning. Any root greater than 1.5" diameter that is encountered shall be carefully cut with a sharp tool. Roots cut shall be immediately covered with soil or mulch and kept moist.
7. Where access for machinery or any vehicle is required within the CRZ or TPZ of any preserved tree, the soil should be protected from compaction. Acceptable methods include 18" of wood chips or hog fuel, plywood, or steel sheets.
8. TPZ fencing shall not be moved without authorization from the Tree Professional or the site supervisor. All fencing is to be left in place until the completion of the project. Tree protection signage shall be attached to fencing only.
9. Landscaping specified within the TPZ areas shall be designed to limit disturbance of surface soils and preserved vegetation. No root pruning is permitted. New plants added in these areas should be of the smallest size possible to minimize disturbance.
10. Where backfill is required within a CRZ or TPZ area, the Tree Professional the shall determine the amount and type of fill material to be used.
11. Any trees adjacent to high traffic areas or building envelopes shall be pruned by the owner. The Tree Professional will provide a recommendation using ANSI A30 American Standards for Pruning to remove dead wood, provide clearance, and cabling or bracing. Use of an International Society of Arboriculture Certified Arborist to perform the recommended work is strongly recommended.
12. Supplemental irrigation for all protected trees is required during the summer months or prolonged periods of dry weather. THIS IS MOST IMPORTANT FOR SUCESSFUL TREE RETENTION.
13. Monitoring of all trees, especially those exposed to new environmental conditions such as exposure to wind, sun, or deep shade, shall occur annually to check for adverse changes to the tree health or stability.

APPENDIX C-- Tree Removal Criteria

Trees may be removed in accordance with the BIMC. See sections 16.22.050- Vegetation management permit, and 16.22.060 Vegetation management standards.

Public Tree Removal Considerations include:

- Vandalism
- Casualty/Accident
- Sight Line Obstruction (traffic lights, signs, view safety)
- Outgrew it's site (various reasons)
- Capital Improvement (street widening, new entrances, sidewalk installation, etc.)
- Natural Disaster (storms, wind, landslide, fire, etc.)
- Disease
- Risk consideration (over mature, structural problems)
- Utility Conflicts (buckling paving and sidewalks, growing into overhead power lines)
- Maintenance
- Development (loss of 30% or more critical root area)

APPENDIX D-- Alternatives to Tree Removal

Create a Wildlife Snag

The object of creating a snag is to preserve as large a portion of a defective tree as the location permits, so it can serve as habitat for birds and insects and to blend in with the landscape. The cuts made by chainsaw should be disguised to look like a natural break

The height of a snag is dependent on the site. It is important to remember the tree will slowly decay and fall apart. In busy locations, it is best to choose a height that will not put anything at risk. Based on management concerns and budget, long-lived snag species may be monitored and reduced in height again as they break down.

Long lasting snags = 15 years or more

Douglas fir (*Pseudotsuga menziesii*),
Western red cedar (*Thuja plicata*)
Bigleaf maples (*Acer macrophyllum)*
Other maple species (*Acer spp.*)
Oak species (Quercus spp.)

Short lived snags = Less than 15 years

Western hemlock (Tsuga heterophylla)
Red Alder (Alnus rubra)
Bitter cherry (Prunus emarginata)
Black cottonwood (Populus trichocarpa)

Snag Creation techniques:

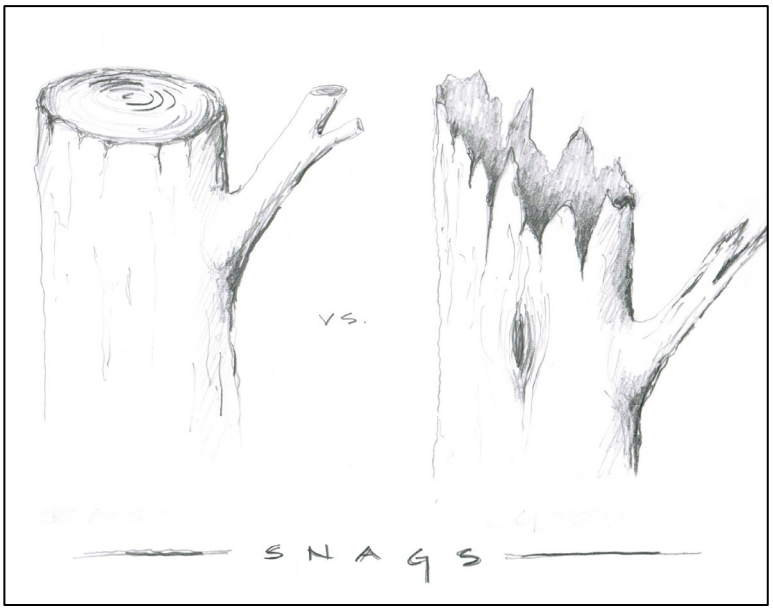
Birds love a perch, and so, it is important not to strip a snag tree of the lower branches.
Branches can be cut back, but stubs should be left to serve as perches and to mimic nature.
Ragged cuts at the end of branches will look best when the tree is finished.
The cut at the top is important to the look of the final project.

- Try to mimic the way trees that break naturally look.
- Many small slits in the edge of the trunk works well.
- Use a small sledgehammer to break and bend the smaller pieces created with saw cuts.

Installing bird holes and bat slits:

Bird holes form as stumps decay and woodpeckers begin to work on the decayed wood. Bats often use narrow cracks or loose pieces of bark to roost in. This process can be speeded up by cutting in a birdhouse or bat slit in the created snag. *CAUTION; these techniques require advanced chainsaw skills. Use a small, sharp saw and extreme care.*

- Bore a triangular “pie’ shaped piece from the trunk. Use a crowbar to pop the piece loose.
- Send the piece to the ground and cut the back off, leaving a 1-2” thick slab of wood with the bark.
- Drill an appropriately sized hole. Two northwest species that use trees are chickadee (1”) and Flicker (2.5“)
- Deepen and enlarge the hole using the tip of the saw bar
- Send the piece back up into the snag and screw or nail it back in place.
- For bats, make a shallow cut upwards into the trunk of the tree; use the saw to widen the cut to about ½”.



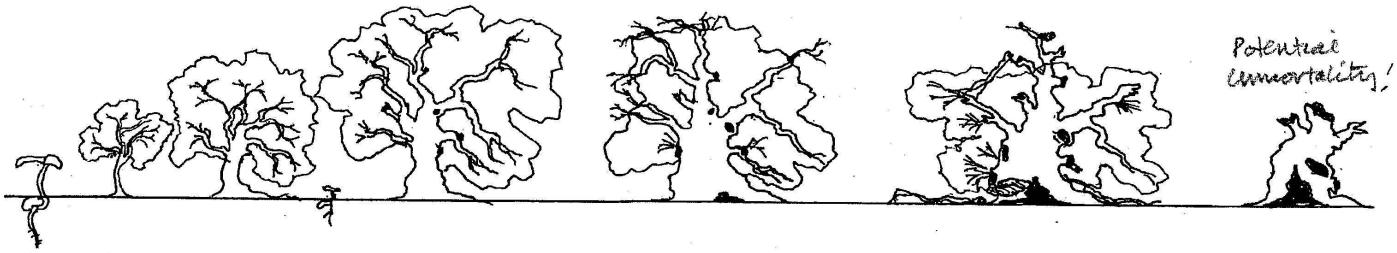
Veteranizing an Old Tree

"Veteranizing" – or re-trenchment pruning, is the current European practice of allowing mature and senescent trees to be managed to reduce risk, but stay as elder members of the Community Forest so they can continue to provide ecological value for a wide range of organisms. Through the work of Neville Fay, a respected British professional who has conducted two recent workshops here, this knowledge is becoming more widespread here in the Northwest.

Fay, Neville, (2002) Environmental Arboriculture, Tree Ecology and Veteran Tree Management. The Arboricultural Journal, 26 (3) 213-238.

The Ageing Process: From Infancy to Death

By Neville Fay of Treework Environmental Consultancy, designer Christine Kirkley



A	B	C	D	E	F	G
Stages				*Annual Rings*	*Ideal Natural State : Optimum Growth*	
				Increase in size	**Germination**	
Formative	**A - B**	Infancy pre-sexual maturity:	Young tree, high vitality Growth enhanced by mycorrhizal root associates			
	B - C	Juvenile to early maturity:	Continued fast growth Net increase in annual increment Low volume of dysfunctional tissue		Low habitat contribution	High vitality
Full to late maturity	**C - D**	Full to late maturity:	Growth to peak crown size Colonisation by saproxylic (deadwood) invertebrates Maximum pollination and seed capacity Onset of natural limb loss Increase of dysfunctional tissue Accelerated fungal colonization and activity	Tend to constant size		
Ancient	**D - E**	Early ancient stage:	Retrenchment of crown: reduction in net annual increment Contraction of live crown Increased vegetative vitality in lower crown Increased fungal activity and wood decay Increased colonization by flora and saproxylic fauna	Begin to decrease Gradual decrease in ring size		
	E - F	Late ancient stage:	Advanced retrenchment Decline in crown size and annual increment Extensive hollowing Crown collapse Declining vitality Advanced heartwood decay and hollowing Advanced activity by fauna and flora	Annual rings become discontinuous in circumference	Increasing nutrient status of tree for colonizers Increasing habitat capacity of tree	Gradual decline in vitality
	F - G	Senescent stage:	Terminal decline: Tree death Continuing fungal activity Peak of saproxylic activity Nutrient recycling			**Death** or not.

APPENDIX E-- Best Management Practices for Utility Pruning of Trees

Companion publication to the current ANSI A300 Part 1. Shrub and Other Woody Plant Maintenance-Standard Practices. The complete list of standards appears below:

ANSI A300 – 2001 (American National Standards Institute) for Tree Care Operations: Pruning Standards

ANSI A300 (Part 2) – 2004 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Fertilization). New York: Tree Care Industry Association, 2004.

ANSI A300 (Part 3) – 2006 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Supplemental Support Systems). New York: Tree Care Industry Association, 2006.

ANSI A300 (Part 4) – 2002 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Lightning Protection Systems). New York: Tree Care Industry Association, 2002.

ANSI A300 (Part 5) – 2005 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Management of Trees and Shrubs During Site Planning, Site Development, and Construction). New York: Tree Care Industry Association, 2005.

ANSI A300 (Part 6) – 2005 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Transplanting). New York: Tree Care Industry Association, 2005.

ANSI A300 (Part 7) – 2006 IVM American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Integrated vegetation Management a. Electric Utility Rights-of-way). New York: Tree Care Industry Association, 2006.

TCIA, *the Tree Care Industry Association*, is a good resource for these standards. To order a copy visit the below URL:

http://www.natlarb.com/Public/gov_standards_a300.htm

APPENDIX F – Providing Space for Urban Trees

Overview of Alternatives
Evaluate streetscape alternatives to the classic street profiles (following in Appendix G) that incorporate some common sense technologies and research. The following list is a brief overview of ways to provide space for tree roots while reducing infrastructure damage.

Planting Space
Match tree species with available space. When possible, allow between 10 and 15 feet for large growing species, and take advantage of the added benefits of the increased canopy cover they provide.

Curving Sidewalks
Create additional space for trees by replacing existing sidewalks with ones that curve away from the tree. Build a new section or narrow the existing one to a minimum of 39 inches (for wheelchair access.)

Pop-Outs
Remove a section of curb and extend the planting space into the street, taking care to maintain water drainage. Combine with curved sidewalks to maximize tree space.

Tree Islands
Plant trees in groups, so they can share root space. This technique can be useful in non-linear settings, and they can double as traffic-calming devices.

Narrower Streets
Make more space for trees and people by widening sidewalks and planting spaces, and reducing the width of streets in appropriate locations. This has been shown to lower the number of accidents by slowing traffic. This will become more practical as cars get smaller and their numbers decrease in the coming decades.

Structural Soil
A structural soil mix, sometimes called an engineered or load-bearing soil, offers an alternative medium for planting in pits and under sidewalks. A formula developed by Cornell University researchers, consists of approximately 80 percent small triangular stones mixed with about 20 percent loam, along with a small amount of water retention material that also helps to keep the pore spaces open. The mixture helps prevent soil compaction, preserve large air spaces, and help ensure oxygen supply to the roots. When used under a sidewalk, there is promising evidence that this mix will support the pavement and keep it from lifting. Structural soil mix used under sidewalks can also expand the rooting space to extend under the pavement. It can be used to connect existing tree pits and increase available rooting space on the most congested urban thoroughfare.

Super Planting Pits
Where new construction is proposed, design large, unsealed surfaces (130 sq.ft.) in combination with deep soil loosening, providing at least 525 cubic ft. of soil for each tree. A typical profile might be 24” topsoil, 24-32” exchanged mineral base soil, and 32-48” loosened original soil.

Root Barriers
Material installed vertically, directly adjacent to the paving should extend above the soil and mulch line. This will keep roots from rowing over the top of the barrier. Ribbed material is more effective in directing roots downward and horizontally, instead of under sidewalks.

Rubber Sidewalks/ vaulted sidewalks
A modular sidewalk system made of recycled tires is relatively simple to install over existing tree roots. The material allows some flexibility of movement, and the modularity allows removal of specific portions for periodic inspection of tree roots. It also keeps tires out of landfills.

Appendix F is compiled from:

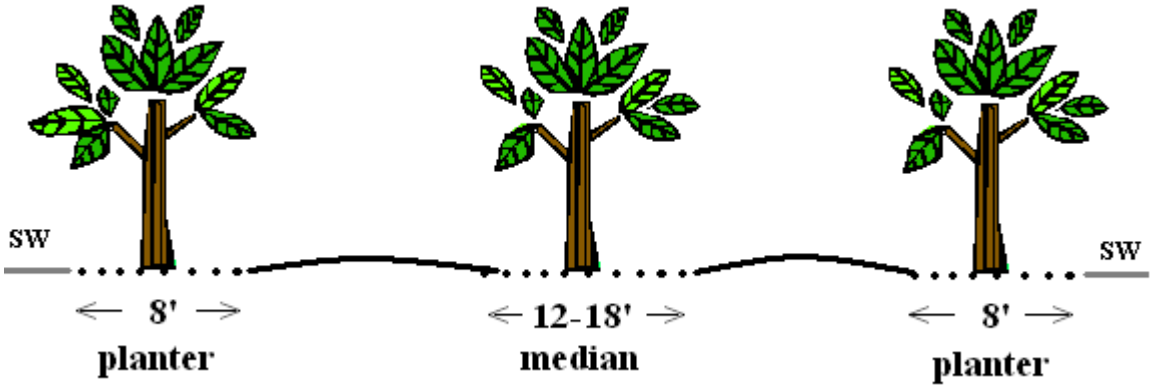
Buhler, Kristofferson & Larsen. *Growth of Street Trees in Copenhagen*, Scientific Journal of the ISA, Vol. 33, No.5. Sept. 2007.

Costello & Jones. *Designer Sidewalks*, ISA Arborist News Vo.l 14, No 5. Oct. 2005
Rubber Sidewalks, Inc. **www.Rubbersidewalks.com**

Urban, James, Up By Roots. ISA, 2008.

APPENDIX G-- Classic Street Profiles for Trees

The ideal street profile to create a tree-lined street with canopy forming trees would include 8' planter strips plus 12-18' wide medians. Future designs of major and minor arterials should consider this type of design where right-of-ways permit. This design provides adequate space above and below ground for trees, minimizing damage to curbs, sidewalks and streets. These guidelines enhance the driving, bike riding, jogging and walking experiences on these types of streets.

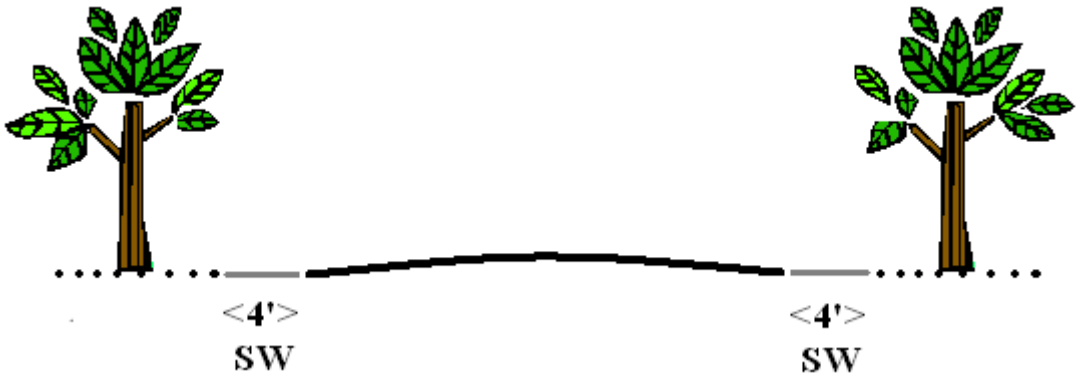


This is the ideal street design for development of maximum canopy, while providing separation between streets and sidewalks.

When space does not allow the development of a full median, 8' planter strips will offer enough room for large, canopy forming trees to be planted.

Planter strips should not be less than 6' wide. These narrow widths will only accommodate plantings of small to medium sized trees that will not produce the canopy effect.

Street designs that incorporate a 4' planter should not be planted with trees due to the limited above and below ground space. If trees are required as part of the street development or frontage improvement, then the trees should be planted at a minimum 4' behind the outside edge of the sidewalk if adequate space and rights-of-way are available.



Street trees are planted behind the sidewalk within public rights-of-way.

APPENDIX H--Additional References and Resources

The following websites provide related information and additional links.

Bainbridge Island Land Trust – www.bi-landtrust.org

City of Bainbridge Island – www.ci.bainbridge-isl.wa.us

City of Bainbridge Island Community Forest Management Plan

Matheny and Clark, Trees and Development: A Technical Guide to Preservation of Trees During Land Development

Kitsap County Extension (Washington State University) – http://kitsap.wsu.edu/

The National Arbor Day Foundation – www.arborday.org

Pacific Northwest Chapter – International Society of Arboriculture – www.pnwisa.org

Tree Care Industry Association- TCIA - www.tcia.org

Trees Are Good http://www.treesaregood.com/

Trees for Green Streets, Portland Metro – www.metro-region.org

APPENDIX J- Suggested Landscape Matrix

This matrix provides a list of suggested plant materials recommended for use on Bainbridge Island. Additional plants may be added to this list as deemed appropriate by the department. Plants shall be selected based upon site-specific conditions which may affect plant growth such as sun exposure, soil types, shoreline conditions, adjacent site improvements, etc. Plant material selection shall be coordinated with utility company requirements to avoid conflicts.

		Parking lot trees	Landscape buffer areas	Critical areas – Uplands	Critical areas – Wetlands/streams	Native species	Drought resistant	Shoreline	Trees near util. lines
Large deciduous trees									
Acer macrophyllum	Bigleaf Maple	·	·	✠	✠	✠	·	·	·
Acer rubrum species	Red Maple variety	✠	✠	·	·	·	·	✠	·
Acer saccharum	Sugar Maple	✠	✠	·	·	·	·	·	·
Alnus oregona	Red Alder	·	·	✠	✠	✠	✠	·	·
Fagus sylvatica	European Beech	·	✠	·	·	·	✠	✠	·
Fraxinus latifolia	Oregon Ash	·	·	✠	✠	✠	·	·	·
Gingko biloba 'Sentry'	Columnar Maidenhair	·	✠	·	·	·	✠	·	·
Liquidambar styraciflua	American Sweet Gum	✠	✠	·	·	·	✠	✠	·
Liriodendron tulipifera	Tulip Tree	·	✠	·	·	·	·	·	·
Platanus x acerifolia	London Plane	·	✠	·	·	·	·	·	·
Populus trichocarpa	Black Cottonwood	·	·	·	✠	✠	·	·	·
Quercus species	Oak variety	·	✠	·	·	·	✠	·	·
Quercus robur 'Fastigiata'	Upright English Oak	·	✠	·	·	·	✠	✠	·
Quercus rubra species	Eastern Red Oak	·	✠	·	·	·	✠	·	·
Salix species	Willow variety	·	·	·	✠	✠	·	✠	·
Tilia cordata	Littleleaf Linden	✠	✠	·	·	·	·	✠	·
Medium deciduous trees									
Acer campestre	Hedge Maple	✠	·	·	·	·	✠	·	✠
Betula species	Birch variety	✠	✠	·	·	·	·	·	·
Carpinus betulus	European Hornbeam	✠	✠	·	·	·	✠	✠	·
Cercidiphyllum japonicum	Katsura Tree	·	✠	·	·	·	·	·	·

		Parking lot trees	Landscape buffer areas	Critical areas – Uplands	Critical areas – Wetlands/streams	Native species	Drought resistant	Shoreline	Trees near util. lines
Cornus species	Dogwood variety	·	·	✠	·	✠	✠	·	·
Fraxinus pennsylvanica 'Marshall'	Marshall's Seedless Ash	✠	✠	·	·	·	✠	·	·
Populus tremuloides	Quaking Aspen	·	·	·	✠	✠	·	·	·
Prunus species	Flowering Cherry variety	✠	✠	·	·	·	✠	✠	·
Pyrus calleryana species	Flowering Pear variety	✠	✠	·	·	·	✠	·	·
Zelkova serrata 'Village Green'	Sawleaf Zelkova	✠	✠	·	·	·	·	·	·
Small deciduous trees		·	·	·	·	·	·	·	·
Acer circinatum	Vine Maple	·	✠	✠	✠	✠	·	·	✠
Acer davidii	David Maple	·	✠	·	·	·	·	·	·
Acer ginnala	Amur Maple	✠	✠	·	·	·	·	✠	✠
Acer palmatum	Japanese Maple	·	✠	·	·	·	·	·	✠
Amelanchier species	Serviceberry variety	·	✠	✠	✠	✠	·	·	✠
Carpinus species	Hornbeam variety	✠	✠	·	·	·	✠	✠	·
Cornus florida	Eastern Dogwood	·	✠	·	·	·	·	·	✠
Cornus kousa	Kousa Dogwood	✠	✠	·	·	·	·	·	✠
Crataegus species	Hawthorn variety	·	✠	✠	·	✠	✠	✠	✠
Magnolia species	Magnolia variety	✠	✠	·	·	·	·	✠	✠
Malus species	Flowering Crabapple	·	✠	·	·	·	·	·	✠
Prunus species	Flowering Cherry Plum	·	✠	·	·	·	✠	✠	✠
Rhus typhina	Staghorn Sumac	·	✠	✠	·	✠	✠	·	✠
Styrax japonica	Japanese Snowball	·	✠	·	·	·	·	·	✠
Evergreen trees		·	·	·	·	·	·	·	·
Abies grandis	Grand Fir	·	✠	✠	·	✠	·	·	·
Cedrus deodara	Deodar Cedar	·	✠	·	·	·	✠	✠	·
Chamaecyparis lawsoniana	Port Orford Cedar	·	✠	✠	·	✠	✠	✠	·
Chamaecyparis nootkatensis	Alaska Cedar	·	✠	✠	·	✠	✠	✠	·
Calocedrus decurrens	Incense Cedar	·	✠	·	·	·	·	·	·
Picea sitchensis	Sitka Spruce	·	✠	·	✠	✠	·	✠	·
Pinus contorta	Shore Pine	✠	✠	✠	·	✠	✠	✠	·
Pinus contorta latifolia	Lodgepole Pine	·	✠	·	·	·	✠	✠	·

		Parking lot trees	Landscape buffer areas	Critical areas – Uplands	Critical areas – Wetlands/streams	Native species	Drought resistant	Shoreline	Trees near util. lines
Pinus densiflora	Japanese Red Pine	·	✠	·	·	·	✠	·	·
Pinus monticola	Western White Pine	·	✠	✠	·	✠	✠	·	·
Pinus nigra	Austrian Black Pine	·	✠	·	·	·	✠	✠	·
Pinus ponderosa	Ponderosa Pine	·	✠	·	·	·	✠	·	·
Pinus sylvestris	Scotch Pine	✠	✠	·	·	·	✠	✠	·
Pinus thunbergii	Japanese Black Pine	·	✠	·	·	·	✠	✠	·
Pseudotsuga menziesii	Douglas Fir	·	✠	✠	·	✠	✠	✠	·
Sequoidendron sempervirens	Coastal Sequoia	·	✠	·	·	·	·	✠	·
Taxus brevifolia	Western Yew	·	✠	·	✠	✠	·	✠	·
Thuja plicata	Western Red Cedar	·	✠	·	✠	✠	·	·	·
Tsuga heterophylla	Western Hemlock	·	✠	·	✠	✠	·	·	·

Deciduous shrubs

Amelanchier alnifolia	Western Serviceberry	·	✠	✠	✠	✠	·	✠	·
Callicarpa japonica	Japanese Beautyberry	·	✠	·	·	·	·	·	·
Cornus stolonifera	Red-Osier Dogwood	·	✠	✠	✠	✠	·	✠	·
Corylus cornuta californica	Western Hazelnut	·	✠	✠	·	✠	✠	·	✠
Enkianthus campanulatus	Red-Veined Enkianthus	·	✠	·	·	·	·	·	·
Elaegnus species	Elaeagnus variety	·	✠	·	·	·	✠	✠	·
Euonymus alata 'Compacta'	Winged Eunymus	·	✠	·	·	·	✠	✠	·
Hamamelis mollis	Chinese Witch Hazel	·	✠	·	·	·	·	·	·
Holodiscus discolor	Ocean Spray	·	·	✠	✠	✠	✠	✠	·
Hydrangea lacecap varieties	Lacecap Hydrangea	·	✠	·	·	·	·	·	·
Potentilla fruticosa	Potentilla	·	✠	·	·	·	✠	✠	·
Physocarpus capitatus	Pacific Ninebark	·	·	·	✠	✠	·	·	·
Rhamnus purshiana	Cascara Sagrada	·	·	✠	✠	✠	·	·	·
Ribes sanguineum	Red-Flowering Currant	·	✠	✠	✠	✠	·	·	·
Rosa nutkana	Nootka Rose	·	·	✠	✠	✠	·	✠	·
Rosa rugosa	Rugosa Rose	·	✠	·	·	·	✠	✠	·
Rubus parviflorus	Thimbleberry	·	✠	✠	✠	✠	·	·	·
Rubus spectabilis	Salmonberry	·	✠	✠	✠	✠	·	✠	·
Salix species	Willow variety	·	·	·	✠	✠	·	✠	·
Sambucus racemosa	Red Elderberry	·	·	✠	✠	✠	·	✠	·

		Parking lot trees	Landscape buffer areas	Critical areas – Uplands	Critical areas – Wetlands/streams	Native species	Drought resistant	Shoreline	Trees near util. lines
Spiraea species	Spiraea variety	·	✠	·	✠	✠	✠	✠	·
Symphoricarpos albus	Snowberry	·	✠	✠	·	✠	✠	·	·
Syringa vulgaris cultivars	Lilacs	·	✠	·	·	·	·	✠	·
Vaccinium parvifolium	Red Huckleberry	·	·	·	✠	✠	·	·	·
Viburnum x burkwoodii	Burkwood Viburnum	·	✠	·	·	·	·	✠	·
Evergreen shrubs		·	·	·	·	·	·	·	·
Arbutus unedo	Strawberry Tree	·	✠	·	·	·	✠	✠	✠
Cotoneaster species	Cotoneaster variety	·	✠	·	·	·	✠	✠	·
Gaultheria shallon	Salal	·	✠	✠	✠	✠	✠	✠	·
Ilex crenata	Japanese Holly	·	✠	·	·	·	·	·	·
Kalmia latifolia	Mountain Laurel	·	✠	·	·	·	·	·	·
Ligustrum japonicum	Japanese Privet	·	✠	·	·	·	·	·	·
Myrica californica	Pacific Wax Myrtle	·	✠	✠	✠	✠	✠	✠	·
Umbellularia californica	California Bay Laurel	✠	✠	·	·	·	✠	✠	✠
Osmarea x burkwoodii	Burkwood Osmarea	·	✠	·	·	·	✠	·	·
Osmanthus delavayi	Delavay Osmanthus	·	✠	·	·	·	✠	✠	·
Photinia frazeri	Japanese Photinia	·	✠	·	·	·	✠	✠	·
Pieris floribunda	Mountain Pieris	·	✠	·	·	·	·	✠	·
Pieris japonica	Japanese Pieris	·	✠	·	·	·	·	✠	·
Prunus lusitanica	Portuguese Laurel	·	✠	·	·	·	✠	·	·
Pinus mugo	Mugho Pine	·	✠	·	·	·	✠	✠	·
Rhododendron spp./ hybrids	Rhododendrons / Azaleas	·	✠	✠	·	✠	·	✠	·
Vaccinium ovatum	Evergreen Huckleberry	·	✠	✠	✠	✠	·	✠	·
Viburnum sinus species	Laurustinus variety	·	✠	·	·	·	✠	✠	·
Groundcovers		·	·	·	·	·	·	·	·
Arctostaphylos uva-ursi	Kinnikinnick	·	✠	✠	·	✠	✠	✠	·
Berberis nervosa	Cascade Mahonia	·	✠	✠	·	✠	✠	·	·
Calluna vulgaris	Scotch Heather	·	✠	·	·	·	·	✠	·
Ceanothus gloriosus	Point Reyes Ceanothus	·	✠	·	·	·	✠	✠	·
Cotoneaster microphyllus 'Cochleatus'	Rockspray Cotoneaster	·	✠	·	·	·	✠	✠	·
Erica carnea	Winter Heath	·	✠	·	·	·	·	✠	·

		Parking lot trees	Landscape buffer areas	Critical areas – Uplands	Critical areas – Wetlands/streams	Native species	Drought resistant	Shoreline	Trees near util. lines
Erica x darleyensis	Mediterranean Heather	·	✠	·	·	·	·	·	·
Euonymus fortuei	Winter Creeper Euonymus	·	✠	·	·	·	·	✠	·
Hypericum calycinum	St Johnswart	·	✠	·	·	·	·	✠	·
Ilex crenata varieties & cultivars	Japanese Holly	·	✠	·	·	·	·	·	·
Mahonia species	Mahonia variety	·	✠	·	·	·	·	✠	·
Pachysandra terminalis	Japanese Spurge	·	✠	·	·	·	✠	·	·
Sarcococca hookerana	Sarcococca	·	✠	·	·	·	·	·	·

Source: Hough, Beck & Baird Inc. revised by CFC - 2010

Additional Natives for the Landscape Matrix
Community Forest BMP Appendix J

Large deciduous trees

Cornus nutallii Pacific Dogwood buf, n
Quercus garryana Garry Oak buf, n, dt

Small deciduous trees

Prunus emerginata Bitter Cherry buf, n, drt, shr, utl

Deciduous shrubs

Menziesia ferrugina False azalea buf, w, n
Omeleria cerasiformis Indian Plum buf, w, n
Oplopanax horridus Devils Club buf, w, n
Sorbus sitchensis Sitka Mountain Ash buf, up, n, drt
Spiraea douglasii Hardhack Spiraea buf, w, n
Viburnum edule Highbush Cranberry buf, up, n, shr

Evergreen shrubs

Polystichum munitum Sword Fern buf, up, n, drt
Rhododendron macrophyllum Pacific Rhododendron buf, up, n, shr

Groundcover

Blechnum spicant Deer fern buf, w, n
Gaultheria ovatifolia Tea Berry buf, w, n, shr