2011

Marymoor Park Master Tree Plan

WASHINGTON STATE DEPARTMENT OF Natural Resources

King County

Friends of Marymoor Park

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

Urban & Community Forestry

GAYNOR, INC.

EarthCorps
LOCAL RESTORATION · GLOBAL LEADERSHIP

Marymoor Park Master Tree Plan

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April, 2011

Acknowledgements

EarthCorps would like to thank the following people who have been instrumental in this project:

Friends of Marymoor Park, for initiating this project and for providing financial support, input and guidance to shape this plan

King County Parks and Recreation Division for their support of this project

Kym Foley for assisting with GIS data entry and creating maps for this report

Funding for this project was made available through a grant from the Washington State Department of Natural Resources, Community Forestry Assistance Grant.

Disclaimer

This report was prepared by EarthCorps for the Friends of Marymoor Park. The information and guidelines provided within this document do not represent any delineation studies and/or mitigated critical area within Marymoor Park. This document is intended to provide a forestry guideline only. Planting schemes and/or removal of invasive material within critical areas require the approval of federal, state and local governmental agencies.

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I. Introduction

Marymoor Park is King County's most visited park, located on the north end of Lake Sammamish in Redmond, Washington (Map 1). This 640 acre park contains numerous recreational opportunities for county residents and receives more than 3 million visitors annually. There are a number of fields for team sports such as baseball, soccer, rugby and cricket; a climbing wall; biking trails and a velodrome; a community garden; one of the most popular dog parks in the country; a model airplane field; and numerous passive recreational opportunities such as hiking, bird watching and rowing. In addition, the park hosts outdoor concerts, large attractions such as Cirque du Soleil, and many smaller community and hobby gatherings throughout the year.

The property has a long and interesting history, which has greatly influenced the character of the park. In 1964, a 6,000 year old archaeological site was located in the park, adjacent to the Sammamish River, with evidence showing use of the site through at least 1,000 B.C. (Wikipedia, 2011). Modern history of the area begins in 1876, when John Tosh homesteaded 78 acres of the present park site. The homestead was purchased in 1904 by James Clise, who built a hunting lodge on the land. He subsequently decided to develop a showplace farm named "Willowmoor" and expanded the farm to 350 acres. The Olmsted Brothers were hired to prepare plans for the farm in 1909, although the plans were not fully implemented. The Clise Mansion was placed on the National Register of Historic Places in 1973 (Jongejan et al. 1995)

In 1928, Clise sold the farm, which was renamed to Marymoor and expanded to 420 acres in size during the next 30 years. In 1959, the farm was purchased by an investment firm who wanted to develop the land. Opposition to development resulted in King County purchasing Marymoor to use as a regional park in 1963 (Jongejan et al. 1995).

Today, the park is loosely divided into four different management zones, which reflect four distinct sections of the park (Map 1). 1) The active management zone, located on the north side of NE Marymoor Way (a road that bisects the park) is approximately 136 acres in size. This zone contains the majority of the sports fields, the velodrome and the event area. 2) The historical area, in the western part of the park adjacent to the Sammamish River, is approximately 41 acres in size. The site of the historic "Willowmoor Farm", this zone is home to the Clise mansion and grounds, which were designed by the Olmsted Brothers. 3) The passive use area, located in the south central part of the park, is approximately 102 acres in size and contains the community garden and the dog park. 4) The natural area contains more than 350 acres with a rich diversity of habitats including wet prairie, scrub-shrub wetlands, emergent wetlands, forested wetlands and riparian forests.

Due to the distinct character of each management zone and the variety of management objectives, there is a considerable difference in the types and density of overstory and regenerating trees within each area. The active management zone has a very sparse overstory, with trees located along NE Marymoor Way, adjacent to parking lots and on the edges of sports fields. The historical zone contains a number of horticultural specimens and heritage trees located in a landscaped setting. The passive use area also has a limited overstory, with several hedgerows of trees adjoining sports fields and the community garden, along with a number of trees within the dog park. The natural areas within the park contain a mosaic of conditions

including riparian forests with considerable overstory cover where it is not too wet, thick stands of willows and other wetland shrubs, along with patches of emergent wetland.

Several Master Plans exist for Marymoor Park, with the latest Master Plan Update prepared by Jongejan, Gerrard, McNeal Landscape Architects in 1995. However, no Tree Master Plan or specific tree planting guides exist for the park. In 2009, EarthCorps was contacted by Friends of Marymoor Park to create a Master Tree Plan for the park. The group was concerned that the active, passive and historical management zones currently have low levels of natural tree regeneration due to their intensive management and landscaped character. Furthermore, there was the perception that few new trees or species not appropriate to the park character were being planted in these areas. The group wanted to prevent further decline in the overstory canopy due to mortality of mature trees and to create an official plan guiding the management of the tree resource within the park. Currently, there is no park-wide strategy in place to plan for advance replacement of trees and further augmentation of the canopy in these management zones.

The purpose of this project is to conduct a tree survey within the active, passive and historical management zones within the park. Specifically, the tree inventory provides information about:

1) The structural composition including species, diameters and heights of existing overstory trees
2) Species, diameters and heights of existing regenerating trees
3) Densities and distributions of native trees
4) Densities and distributions of non-native trees

This Tree Master Plan was created based on the results of the inventory and with input from the 1995 Marymoor Park Master Plan Update (Jongejan 1995).

II. Tree Assessment Methodology

The tree inventory was conducted during September and early October, 2010. A GIS shapefile was created marking the boundaries of the active, historical and passive zones within the park. Each tree within these zones was identified to species and assigned a unique number. For each tree, the species, height, diameter at breast height (DBH) and general health condition of the tree were recorded. Health was assessed using three categories: good, fair and poor. Dead trees were also measured and recorded as “snag”. Data were collected on a TDS Recon PDA and transferred to an Access database for analysis. The location of each tree was recorded using orthophotos and entered into a GIS. Each tree in GIS is linked to the collected data.

III. Results

A total of 3,903 trees were inventoried in the active, historical and passive zones within the park. Detailed information for each zone is presented below. Results are presented for overstory and regenerating trees. Trees greater than 5 inches DBH were considered to be overstory trees, while trees 5 inches or less DBH were considered regenerating.

3.1 Active Zone - Overstory

A total of 775 overstory trees representing 39 species were recorded in the Active Zone. Table 1 summarizes the collected data. Overall, trees in this zone are fairly well distributed by species. Lombardy poplar (*Populus nigra*) is the most prevalent tree, representing 19% of all trees in this zone. Lombardy poplar is used as a hedgerow, delineating the park border and is planted along the main road traversing the park. These trees have reached the end of their lifespan and many are declining, with more than 35% showing signs of poor health (Table 1).

Three species comprising 10% each in this zone include Scotch pine (*Pinus sylvestrus*), Douglas fir (*Pseudotsuga menziesii*) and London planetree (*Platanus* × *acerifolia*). Red maple (*Acer rubrum*) constitutes nearly 9% of all trees in this zone, with approximately 20% of the existing mature trees in this zone in decline (Table 1). Other common species in this zone include: white poplar (*Populus alba*) (5% of all trees), black cottonwood (*Populus balsamifera ssp. trichocarpa*) (4% of all trees), Norway maple (*Acer platanoides*) (4% of all trees), bitter cherry (*Prunus emarginata*) (4% of all trees) and giant sequoia (*Sequoiadendron giganteum*) (3% of all trees). A large proportion of the white poplar trees (35%) are in decline in this zone (Table 1).

Figure 1 shows the diameter distributions of overstory trees in the Active Zone. Only 35% of trees are larger than 10 inches in diameter, and a total of 30 trees are larger than 30 inches in diameter. The diameter distribution in this zone is strongly skewed towards small diameter trees.

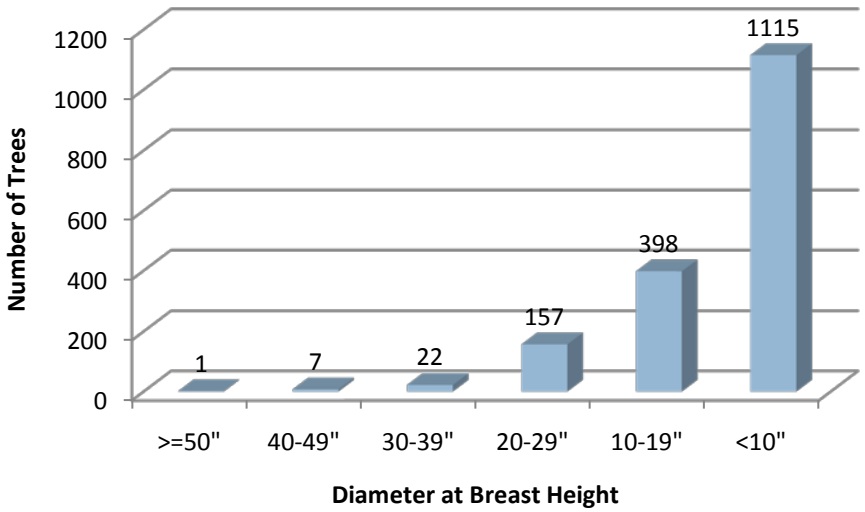
Table 1. Overstory trees recorded in the Active Zone in Marymoor Park in 2010.

Scientific Name*	Common Name	Total number	Percent of Total	Not healthy (# trees)
Abies procera	noble fir	2	0.3	
Acer macrophyllum	big-leaf maple	6	0.8	2
Acer platanoides	Norway maple	29	3.7	
Acer rubrum	red maple	67	8.6	14
Alnus rubra	red alder	17	2.2	1
Arbutus menziesii	Pacific madrone	1	0.1	
Betula pendula	European white birch	1	0.1	
Calocedrus decurrens	incense cedar	12	1.5	
Castanea dentata	American chestnut	5	0.6	
Chamaecyparis pisifera	sawara falsecypress	1	0.1	
Crataegus monogyna	one-seed hawthorn	5	0.6	
Frangula purshiana	cascara	1	0.1	
Fraxinus latifolia	Oregon ash	13	1.7	
Gleditsia triacanthos var.	honeylocust	13	1.7	

inermis				
Juglans nigra	black walnut	1	0.1	1
Larix occidentalis	western larch	2	0.3	
Malus domestica	domestic apple	5	0.6	
Malus sp.	horticultural apple species	13	1.7	2
Metasequoia glyptostroboides	dawn redwood	1	0.1	
Picea pungens	blue spruce	2	0.3	
Picea sitchensis	Sitka spruce	2	0.3	
Picea sp.	spruce	1	0.1	
Pinus nigra	Austrian pine	1	0.1	
Pinus sylvestrus	scotch pine	80	10.3	2
Platanus × acerifolia	London planetree	79	10.2	8
Populus alba	white poplar	39	5	14
Populus balsamifera ssp. trichocarpa	black cottonwood	33	4.3	1
Populus nigra	Lombardy poplar	147	19	54
Prunus cerasifera	cherry plum	4	0.5	1
Prunus emarginata	bitter cherry	28	3.6	2
Prunus sp.	horticultural cherry species	19	2.5	5
Pseudotsuga menziesii	Douglas fir	79	10.2	
Quercus kellogii	black oak	3	0.4	1
Quercus palustris	pin oak	6	0.8	
Quercus rubra	red oak	14	1.8	
Robinia pseudoacacia	black locust	1	0.1	
Sequoiadendron giganteum	giant sequoia	22	2.8	1
Thuja plicata	western red cedar	15	1.9	
Tsuga canadensis	Canadian hemlock	5	0.6	

* Trees in bold are considered to be invasive.

Figure 1. Diameter distributions of trees in the Active Zone in Marymoor Park in 2010



3.2 Active Zone - Regeneration

A total of 925 regenerating trees representing 32 species were inventoried in this zone in 2010. Regenerating trees in the active zone come from varied sources. In the landscaped areas, there are several large recent plantings of red maple and tulip trees (*Liriodendron tulipifera*). There is also natural regeneration of a number of trees, most notably dense patches of bitter cherry, present in the un-maintained northwest section of the zone. In addition, there are three habitat restoration areas in this zone (Map 1). The areas located in sub unit A1 were inventoried and the majority of native trees shown in Table 2 below are located in these areas. The large restoration area in sub unit A8 and extending into a portion of A9 below the soccer fields was not inventoried due to its size and the fact that the focus of this project is on landscaped areas and not natural areas. This area contributes hundreds of additional regenerating native trees to this zone.

As stated above, bitter cherry is the most common regenerating tree in the zone, comprising 20% of all regeneration. Native trees present in restoration areas in unit A1 make up the next largest category of regeneration: Douglas fir (12% of all trees), Oregon ash (*Fraxinus latifolia*), (11% of all trees), Sitka spruce (*Picea sitchensis*) (8% of all trees), western red cedar (*Thuja plicata*) and big-leaf maple (*Acer macrophyllum*) (7% of all trees). In addition, large plantings of red maples and tulip trees make up 9% and 5% of all trees respectively (Table 2). The vast majority of all trees inventoried in the zone (65%) are less than 10 inches in diameter, indicating that most of the trees in this zone are fairly young (Figure 1).

Table 2. Regenerating trees recorded in the Active Zone in Marymoor Park in 2010.

Scientific Name*	Common Name	Total number	Percent of Total	Not healthy (# trees)
Abies grandis	grand fir	1	0.1	
Abies sp.	fir	1	0.1	
Acer macrophyllum	big-leaf maple	61	6.6	4
Acer platanoides	Norway maple	25	2.7	5
Acer rubrum	red maple	79	8.5	8
Alnus rubra	red alder	7	0.8	
Betula pendula	European white birch	3	0.3	
Calocedrus decurrens	incense cedar	15	1.6	
Castanea dentata	American chestnut	3	0.3	
Crataegus monogyna	one-seed hawthorn	21	2.3	
Euonymus europaeus	common spindle tree	2	0.2	
Fagus sylvatica	European beech	4	0.4	
Frangula purshiana	cascara	27	2.9	9
Fraxinus latifolia	Oregon ash	100	10.8	4
Fraxinus sp.	ash	4	0.4	1
Ilex aquifolium	English holly	3	0.3	
Liriodendron tulipifera	tuliptree	42	4.5	12
Malus sp.	horticultural apple species	1	0.1	
Picea pungens	blue spruce	1	0.1	
Picea sitchensis	Sitka spruce	78	8.4	3
Pinus nigra	Austrian pine	1	0.1	
Pinus strobus	eastern white pine	1	0.1	
Pinus sylvestrus	scotch pine	6	0.6	
Platanus × acerifolia	London planetree	4	0.4	1
Populus balsamifera ssp. trichocarpa	black cottonwood	37	4	
Populus nigra	Lombardy poplar	3	0.3	
Prunus emarginata	bitter cherry	189	20.4	1
Prunus sp.	horticultural cherry species	11	1.2	1
Pseudotsuga menziesii	Douglas fir	112	12.1	11
Robinia pseudoacacia	black locust	6	0.6	
Thuja plicata	western red cedar	76	8.2	20
Tsuga sp.	hemlock	1	0.1	

* Trees in bold are considered to be invasive.

3.3 Historical Zone – Overstory

A total of 778 overstory trees representing 68 species were inventoried in the Historical Zone in 2010. This zone contains a number of exemplary specimens of mature trees, with 11 trees that have diameters at breast height of 50 inches or greater. The largest measured tree is a big-leaf maple with a diameter of 64 inches and a height of 95 feet. The tallest measured tree is a Douglas fir, with a diameter of 56 inches and a height of 165 feet. Of the trees that are at 50 inches in diameter or larger, four are big-leaf maples, six are Douglas firs and one is a magnificent tulip tree specimen. Figure 2 shows the diameter distributions of overstory trees in the Historical Zone. The largest proportion of trees consists of stems between 10-19" in diameter, which make up 38% of all trees in the zone, closely followed by 20-29" in diameter (28% of trees). These two categories make up the majority of trees in the zone.

The Historical Zone is dominated by Douglas fir trees, which make up 34% of trees in this zone (Table 3). The majority of these trees are located within two groves on the eastern side of the zone, just south of the maintenance barn. Incense cedars (*Calocedrus decurrens*) and western red cedars also make up a considerable proportion of trees in this zone (11% of all trees and 8% of all trees respectively). Other species present in smaller amounts include Norway maples (4.5% of all trees), big-leaf maples (4% of all trees) and horticultural cherry species (*Prunus sp.)* (3% of all trees), red maple (2% of all trees), English holly (*Ilex aquifolium*) (2% of all trees), horticultural apple species (*Malus sp.*) (2% of all trees) and scotch pine (2% of all trees) (Table 3).

A number of the overstory species in the zone are in decline, as evidenced by the high proportion of trees that are not healthy. More than half of the mature big-leaf maples in this zone are reaching the end of their lifespan. Most of these are significant trees that are 30" in diameter or greater. Of the six Pacific dogwoods (*Cornus nuttallii*) in this zone, four are not healthy. These are all small trees that are less than 15" in diameter. More than three-quarters of English holly trees in this zone are in decline. Likewise, more than 60% of horticultural apple trees are in fair or poor health. Almost all Lombardy poplars located in the zone have also reached the end of their lifespans. However, they are being replaced by red maples that have been recently planted beneath them. In addition, all Portugal laurel (*Prunus lusitanica*) trees recorded in the zone are in fair condition and are most likely reaching the end of their lifespans as well (Table 3).

Table 3. Overstory trees recorded in the Historical Zone in Marymoor Park in 2010.

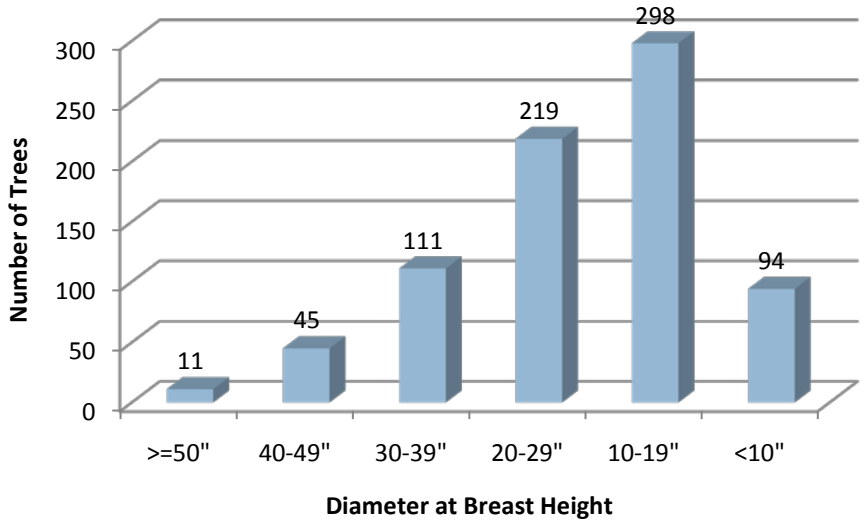
Scientific Name*	Common Name	Total number	Percent of Total	Not healthy (# trees)
Abies grandis	grand fir	3	0.4	1
Acer macrophyllum	big-leaf maple	28	3.6	15
Acer negundo	boxelder	3	0.4	
Acer palmatum	Japanese maple	8	1	2
Acer platanoides	Norway maple	35	4.5	4
Acer rubrum	red maple	16	2.1	1
Aesculus hippocastanum	horse chestnut	10	1.3	2
Betula nigra	river birch	1	0.1	
Betula pendula	European white birch	6	0.8	2

Calocedrus decurrens	incense cedar	84	10.8	1
Castanea dentata	American chestnut	1	0.1	
Catalpa bignonioides	southern catalpa	2	0.3	
Cercidiphyllum japonicum	katsura tree	3	0.4	
Cercis canadensis	eastern redbud	2	0.3	
Chamaecyparis lawsoniana	Port Orford cedar	1	0.1	
Chamaecyparis pisifera	sawara falsecypress	2	0.3	
Cornus nuttalli	Pacific dogwood	6	0.8	4
Cornus sp.	dogwood	1	0.1	
Crataegus monogyna	oneseed hawthorn	1	0.1	
Fagus sylvatica	European beech	6	0.8	
Fraxinus latifolia	Oregon ash	3	0.4	1
Halesia carolina	snowdrop tree	1	0.1	
Ilex aquifolium	English holly	18	2.3	14
Juglans nigra	black walnut	5	0.6	2
Liriodendron tulipifera	tuliptree	3	0.4	
Magnolia × loebneri	Loebner magnolia	1	0.1	
Magnolia acuminata	cucumber magnolia	1	0.1	1
Magnolia kobus	Kobus magnolia	3	0.4	
Magnolia tripetala	umbrella magnolia	6	0.8	1
Malus sp.	horticultural apple species	16	2.1	10
Metasequoia glyptostroboides	dawn redwood	1	0.1	
Oxydendrum arboreum	sourwood	1	0.1	
Picea pungens	blue spruce	1	0.1	
Picea sp.	spruce	1	0.1	
Pinus contorta	shore pine	11	1.4	2
Pinus monticola	western white pine	6	0.8	1
Pinus nigra	Austrian pine	5	0.6	
Pinus ponderosa	ponderosa pine	2	0.3	
Pinus sylvestrus	scotch pine	19	2.4	
Platanus × acerifolia	London planetree	1	0.1	
Populus balsamifera ssp. trichocarpa	black cottonwood	4	0.5	
Populus nigra	Lombardy poplar	12	1.5	11
Prunus avium	sweet cherry	1	0.1	
Prunus cerasifera	cherry plum	9	1.2	3
Prunus lusitanica	Portugal laurel	14	1.8	14
Prunus sp.	horticultural cherry species	20	2.6	7
Pseudotsuga menziesii	Douglas fir	268	34.4	9
Quercus kellogii	black oak	1	0.1	
Quercus myrsinifolia	Chinese evergreen oak	3	0.4	
Quercus palustris	pin oak	1	0.1	

Quercus rubra	red oak	6	0.8	
Robinia pseudoacacia	black locust	1	0.1	
Sassafras albidum	common sassafras	2	0.3	
Sequoia sempervirens	coast redwood	1	0.1	
Sequoiadendron giganteum	giant sequoia	7	0.9	
Sorbus aucuparia	European mountain ash	1	0.1	
Styrax japonicus	Japanese snowbell	1	0.1	
Taxus brevifolia	western yew	2	0.3	
Thuja occidentalis	American arborvitae	5	0.6	2
Thuja plicata	western red cedar	62	8	13
Thuja sp.	cedar	3	0.4	
Tilia americana	American linden	6	0.8	1
Tilia platyphyllos	large-leaved linden	4	0.5	1
Tsuga heterophylla	western hemlock	6	0.8	2
Ulmus americana	American elm	1	0.1	
Ulmus glabra 'Camperdownii'	Camperdown Scotch Elm	2	0.3	
Umbellularia californica	California bay	1	0.1	
x Cupressocyparis leylandii	leyland cypress	10	1.3	

* Trees in bold are considered to be invasive.

Figure 2. Diameter distributions of trees in the Historical Zone in Marymoor Park in 2010



3.4 Historical Zone – Regeneration

A total of 312 regenerating trees were recorded in the Historical Zone, representing 36 species. Regenerating trees in this zone originate from two sources: plantings and from natural regeneration. The majority of natural regeneration is present in the small natural area located directly to the east of the Clise Mansion. This natural area contains a number of large Douglas firs but is heavily colonized by invasive species. Almost all of the regenerating trees within the natural area are composed of species that are considered to be invasive such as English holly, Norway maple, one-seed hawthorn (*Crataegus monogyna*) and sweet cherry (*Prunus avium*). There are several other small pockets of naturally regenerating trees scattered throughout the zone, such as in the recently planted area to the north of the windmill.

Tree regeneration in this zone is dominated by Norway maples, which make up 30% of all regenerating trees. As stated above, the majority of these trees are located in the natural area to the east of the Clise Mansion. Other species present in smaller quantities include English holly (8% of all trees), black cottonwood (7% of all trees), incense cedar (6% of all trees), black locust (*Robinia pseudoacacia*) (6% of all trees), western red cedar (6% of all trees), one-seed hawthorn (5% of all trees) and horticultural cherry species (4.5% of all trees).

Table 4. Regenerating trees recorded in the Historical Zone in Marymoor Park in 2010.

Scientific Name*	Common Name	Total number	Percent of Total	Not healthy (# trees)
Acer griseum	paperbark maple	1	0.3	
Acer macrophyllum	big-leaf maple	1	0.3	1
Acer palmatum	Japanese maple	2	0.6	
Acer platanoides	Norway maple	93	29.8	3
Acer rubrum	red maple	6	1.9	1
Aesculus hippocastanum	horse chestnut	1	0.3	
Betula papyrifera	paperbark birch	3	1	
Betula pendula	European white birch	4	1.3	
Betula sp.	birch	1	0.3	
Calocedrus decurrens	incense cedar	18	5.8	
Castanea dentata	American chestnut	2	0.6	
Catalpa bignonioides	southern catalpa	3	1	
Cedrus deodara	Deodar cedar	2	0.6	1
Cornus florida	flowering dogwood	2	0.6	
Cornus sp.	dogwood	2	0.6	1
Crataegus douglasii	Pacific hawthorn	5	1.6	
Crataegus monogyna	one-seed hawthorn	15	4.8	
Frangula purshiana	cascara	1	0.3	
Ilex aquifolium	English holly	26	8.3	
Liriodendron tulipifera	tuliptree	1	0.3	
Malus sp.	horticultural apple species	5	1.6	2

Platanus × acerifolia	London planetree	2	0.6	
Populus balsamifera ssp. trichocarpa	black cottonwood	21	6.7	
Prunus avium	sweet cherry	7	2.2	
Prunus cerasifera	cherry plum	7	2.2	
Prunus lusitanica	Portugal laurel	10	3.2	
Prunus sp.	horticultural cherry species	14	4.5	2
Pseudotsuga menziesii	Douglas fir	5	1.6	1
Quercus garryana	Garry oak	2	0.6	
Robinia pseudoacacia	black locust	19	6.1	
Sassafras albidum	common sassafras	7	2.2	
Sequoia sempervirens	coast redwood	1	0.3	
Sorbus aucuparia	European mountain ash	1	0.3	
Styrax japonicus	Japanese snowbell	2	0.6	
Thuja plicata	western red cedar	19	6.1	
Thuja sp.	cedar	1	0.3	

* Trees in bold are considered to be invasive.

3.5 Passive Zone – Overstory

A total of 317 overstory trees, representing 27 species were inventoried in the Passive Zone. This zone encompasses the community garden, the dog park and a number of natural areas, some of which have been restored. A large restoration area initiated by the Friends of Marymoor in 2003 spans the width of the zone, running from east to west on the north border of the community garden in sub unit P2 (Map 1). This restoration area, also called "Snag Row", contains hundreds of small, planted trees which were not inventoried during this survey. However, all overstory trees in this area were inventoried.

The majority of overstory trees in this zone appear to originate from natural sources, with a small number planted along the road. The overstory in this zone is very sparse, with the exception of a forested belt along the southern edge of the zone, a large stand of quaking aspens (*Populus tremuloides*) present on the western edge of the zone and a stand of hybrid bitter cherry (*Prunus x pugetensis*), adjacent to the dog park entrance on the eastern edge of the zone abutting Parking Lot G. The aspen stand was not inventoried, due to the large number of similarly sized stems in the stand. The majority of aspens in the grove are quite small, with the trees on the edges measuring between 1-3" in diameter and ones in the middle measuring 4-8" in diameter. The largest aspens are 11 inches in diameter and approximately 70 feet tall.

A large part of this zone can be characterized as wetland and riparian influenced habitat, which is evidenced by the tree species composition. Overstory trees in this zone are dominated by black cottonwoods, which make up 43% of all trees. Red alders (*Alnus rubra*), hybrid bitter cherry and Oregon ash (*Fraxinus latifolia*) are also common, making up 7%, 8% and 5% of all trees respectively. There is also an upland tree component in this zone within the drier areas away from the river. Norway maples, which make up 9% of overstory trees in this zone, are located

almost entirely within Snag Row. There are also a number of Douglas firs, which make up 4% of all trees and several one-seed hawthorns scattered throughout the dog park (3% of all trees) (Table 5).

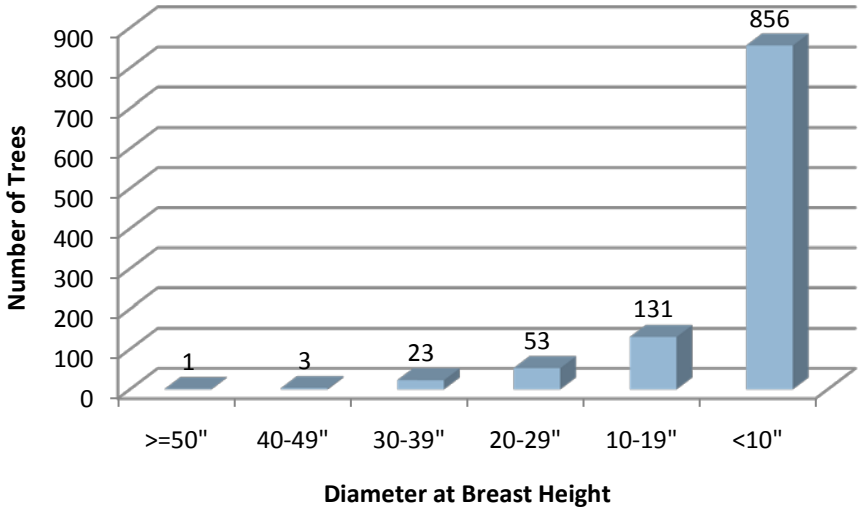
Figure 3 shows the diameter distributions of trees in the Passive Zone. The largest proportion of trees consists of stems less than 10" in diameter, which make up 80% of all trees in the zone. Trees between 10 and 19" in diameter make up an additional 12% of inventoried trees. Very few large trees are found in the zone, with only one tree, a black cottonwood, measuring greater than 50 inches in diameter.

Table 5. Overstory trees recorded in the Passive Zone in Marymoor Park in 2010.

Scientific Name*	Common Name	Total number	Percent of Total	Not healthy (# trees)
Abies grandis	grand fir	1	0.3	
Acer macrophyllum	big-leaf maple	1	0.3	
Acer platanoides	Norway maple	27	8.5	1
Acer rubrum	red maple	9	2.8	2
Acer saccharinum	Silver maple	1	0.3	
Aesculus hippocastanum	horse chestnut	1	0.3	
Alnus rubra	red alder	21	6.6	2
Betula pendula	European white birch	7	2.2	
Crataegus monogyna	one-seed hawthorn	8	2.5	
Fraxinus latifolia	Oregon ash	16	5	4
Gleditsia triacanthos var. inermis	honeylocust	2	0.6	
Larix occidentalis	western larch	4	1.3	
Malus domestica	domestic apple	7	2.2	
Malus sp.	horticultural apple species	2	0.6	1
Pinus contorta	shore pine	1	0.3	
Pinus sp.	pine	5	1.6	
Platanus × acerifolia	London planetree	6	1.9	
Populus balsamifera ssp. trichocarpa	black cottonwood	136	42.9	8
Populus tremuloides	aspen	9	2.8	1
Prunus avium	sweet cherry	2	0.6	2
Prunus emarginata	bitter cherry	1	0.3	
Prunus x pugetensis	hybrid bitter cherry	24	7.6	5
Pseudotsuga menziesii	Douglas fir	12	3.8	
Sequoia sempervirens	coast redwood	1	0.3	
Sequoiadendron giganteum	giant sequoia	5	1.6	
Thuja plicata	western red cedar	5	1.6	
Tsuga heterophylla	western hemlock	3	0.9	

* Trees in bold are considered to be invasive.

Figure 3. Diameter distributions of trees in the Passive Zone in Marymoor Park in 2010



3.6 Passive Zone – Regeneration

A total of 750 regenerating trees representing 27 species were recorded in the Passive Zone in 2010. The vast majority of these trees are naturally regenerating in forested areas within the zone. As was noted above, a large quaking aspen stand composed of small-diameter stems was not inventoried, along with regenerating trees in Snag Row. These areas would add hundreds of trees to the inventory total.

The vast majority of regenerating trees in this zone (42%) were hybrid bitter cherries inventoried within the hybrid bitter cherry grove, located on the southeast corner of parking lot G at the east entrance to the dog park. An additional 28% were one-seed hawthorns scattered throughout the dog park area and the natural areas. Trees present in smaller amounts included black cottonwood (14%), Oregon ash (3%) and Douglas fir (3%). As was mentioned in the overstory analysis, 80 percent of all trees inventoried in this zone are smaller than 10 inches in diameter (Figure 3).

Table 6. Regenerating trees recorded in the Passive Zone in Marymoor Park in 2010.

Scientific Name	Common Name	Total number	Percent of Total	Not healthy (# trees)
Abies grandis	grand fir	4	0.5	
Acer macrophyllum	big-leaf maple	4	0.5	
Acer rubrum	red maple	4	0.5	
Alnus rubra	red alder	2	0.3	
Betula papyrifera	paperbark birch	5	0.7	
Betula pendula	European white birch	1	0.1	
Cercidiphyllum japonicum	katsura tree	3	0.4	1
Chamaecyparis nootkatensis	Alaska yellow cedar	6	0.8	

Crataegus monogyna	one-seed hawthorn	212	28.3	17
Fagus sylvatica	European beech	1	0.1	
Fraxinus latifolia	Oregon ash	23	3.1	
Fraxinus sp.	ash	1	0.1	
Ilex aquifolium	English holly	7	0.9	
Laburnum anagyroides	golden chain tree	1	0.1	
Malus domestica	domestic apple	7	0.9	
Malus sp.	horticultural apple species	4	0.5	
Picea pungens	blue spruce	6	0.8	
Picea sitchensis	Sitka spruce	3	0.4	
Pinus ponderosa	ponderosa pine	1	0.1	
Pinus sp.	pine	2	0.3	
Populus balsamifera ssp. trichocarpa	black cottonwood	102	13.6	
Populus tremuloides	aspen	2	0.3	1
Prunus avium	sweet cherry	5	0.7	1
Prunus x pugetensis	hybrid bitter cherry	315	42	6
Pseudotsuga menziesii	Douglas fir	21	2.8	1
Pyrus sp.	ornamental pear	2	0.3	
Sorbus aucuparia	European mountain ash	6	0.8	1

* Trees in bold are considered to be invasive.

IV. Recommendations

Recommendations for preserving and augmenting overstory canopy cover and species diversity present within the park fall into three categories.

1. Preserve and augment existing overstory canopy in un-maintained forested areas
2. Begin a strategic planting program in maintained areas that do not currently have regenerating trees
3. Initiate additional tree plantings in identified areas that do not currently have trees present

Each of these categories is discussed below in more detail.

Priorities

The activities outlined below are wide-ranging and will take many years to implement. To assist the Friends of Marymoor and the Parks Department in prioritizing projects, the tasks have been divided into short-term, medium-term and long-term categories.

Short-term

1. Restore the natural area in zone H10 by removing invasive trees and shrubs and planting native shrubs
2. Begin replacing large trees (greater than 30 inches in diameter) in the Historical Zone identified in Map 3

3. Mulch and plant understory plants in Douglas-fir groves within the Historical Zone
4. Create a detailed planting plan for tree replacement within the Historical Zone
5. Continue maintaining existing restoration areas identified in section 4.1
6. Restore the natural areas in zone A1 and A5
7. Replace dying Lombardy poplars with groves of appropriate species based on the conceptual habitat types in Map 4

Medium-term

1. Restore the existing forested areas in Zone P4
2. Expand restoration efforts in Zone A1 to the remainder of the zone
3. Begin restoration efforts in forested patches in Zone P1
4. Continue conducting maintenance in existing restoration areas

Long-term

1. Focus on remaining habitat areas defined in Map 4

4. 1 Preserve and augment existing overstory canopy

The following recommendations concern natural areas within the Active, Passive and Historical Zones that are not formally maintained. There are a number of small forested patches with understory vegetation scattered throughout zones A1, A5, A9, H10, P1, P2 and P4 (Map 1). Many of these areas contain overstory trees but are invaded by invasive tree, shrub and groundcover species, which are compromising the health of these forested areas. Invasive species directly compete with native species for light, space and resources and can create thickets that prevent native species from growing, as well as threaten existing tree canopy.

To preserve the health of these forests, restoration activities should be undertaken to remove invasive species. In many cases, there are enough native plants present to re-colonize the area once the invasive species are removed. In other cases, native shrubs and trees should be planted to re-establish native communities. Plant palettes for different communities are available in Appendix B. A number of invasive species were identified during the tree survey. These species are discussed below and specific best management practices (BMPs) are available in Appendix A. Restoration activities should consist of removing existing invasive species using appropriate BMPs, planting native plants where necessary and conducting regular maintenance and monitoring over a number of years to ensure that invasive species are controlled.

In addition, three large restoration projects are already underway in the park (Map 1, Zones A1, A8 and P2). These areas contain hundreds of young trees and shrubs that have been planted over the past 10 years. It is important to maintain these areas and ensure that invasive species are controlled. It is recommended that regular maintenance occur in these areas twice a year.

Invasive trees

Twelve species of invasive trees were found during the park-wide tree survey in 2010. These species are listed in Table 7. Three of these species, one-seed hawthorn, English holly and European mountain ash have been designated King County Weeds of Concern by the King

County Noxious Weed Program (King County 2011). These are wide-spread species that impact and degrade natural habitat. Although control is not required for these plants, their removal is highly recommended and new plantings are discouraged. The remaining species have not been given a legal designation by the King County Noxious Weed Program but are deemed to be invasive by EarthCorps ecologists due to their prevalence in forests and natural areas throughout the region.

Table 7. Invasive trees recorded in Marymoor Park in 2010.

Scientific Name[1]	Common Name
Acer platanoides	Norway maple
Aesculus hippocastanum	horse chestnut
Betula pendula	European white birch
*Crataegus monogyna**	one-seed hawthorn
*Ilex aquifolium**	English holly
Laburnum anagyroides	golden chain tree
Populus alba	white poplar
Prunus avium	sweet cherry
Prunus cerasifera	cherry plum
Prunus lusitanica	Portugal laurel
Robinia pseudoacacia	black locust
*Sorbus aucuparia**	European mountain ash

[1]Species denoted by * are species which have been given a legal designation by the King County Noxious Weed Program (King County 2011).

These species of non-native trees are able to establish and reproduce in nearly any environment and can form very dense thickets, outcompeting native species for limited resources. Many species that have berries are bird dispersed and are easily spread by seed, making eradication of mature trees a priority. Other species in Marymoor Park were planted as part of the historical homestead and farm present on the site. Many of these species spread through stump sprouting and dispersing by seed into adjacent areas. Stems greater than one inch should either be frilled or cut and treated with glyphosate applied immediately to the wound or stem injected using an herbicide lance injector such as the EZ-Ject Lance. Smaller stems (less than one inch diameter) should either be removed manually by hand or weed wrench or should be cut at a height of one foot and receive an immediate glyphosate application on the cut stem. **These trees should never be cut without herbicide application as they will stump sprout and produce multiple stems which will be more difficult to remove.** See Appendix A for additional information and best management practices for treating invasive trees.

Invasive shrubs and vines

Himalayan blackberry (*Rubus discolor*) and English ivy (*Hedera helix*) are present in many of the natural areas in addition to the invasive trees identified above. Himalayan blackberry is a fast-growing shrub that forms extensive thickets and excludes all other species from the area. It spreads by bird seed and canes. Due to the presence of native vegetation in the natural areas,

manual removal of blackberry is recommended. Canes should be cut manually and roots dug out as completely as possible. Once the majority of the roots have been removed, cardboard and mulch can then be applied before or after planting with native tree and shrub species. Follow up maintenance and additional grubbing will be necessary for several years until native plants have sufficiently established to shade out the blackberry shrubs. Plants can be composted on site on top of a tarp, cardboard or an elevated platform.

English ivy is present in several of the natural areas, but in smaller amounts than Himalayan blackberry. This vine forms dense thickets on the forest floor, often excluding all other plants. In addition, it can climb into the canopy of trees where is adds weight to the tree, thus making it more susceptible to coming down in wind storms and suppresses photosynthesis by covering leaves. Initial restoration efforts should aim to sever all vines that are extending into the canopy of affected trees. This will help reduce the spread of this invasive plant by inhibiting fruiting and seed production which predominately occurs when the vines grow up a vertical surface. Vines should be cut and pried away from trunks creating "survival rings" as described in Appendix A. Once trees are cleared of ivy, ivy growing on the ground should be removed by pulling the whole plant with the roots. Plants can be composted on site on top of a tarp, cardboard or an elevated platform.

Areas cleared of English ivy should be covered with cardboard and six to eight inches of mulch to protect the soil and inhibit re-establishment of invasive species. Cleared areas should be mulched and planted immediately following ivy removal to inhibit ivy re-growth.

Invasive groundcovers

Reed canarygrass is the most dominant invasive groundcover present throughout the park. This tall perennial grass forms extensive monocultures in wetlands, preventing the establishment of all native vegetation. The rhizomatous roots form dense mats, up to two feet deep and are very difficult to dig out by hand. Covering the reed canarygrass for one to two years to kill the roots and prepare the site for planting is an effective approach for controlling this species. It is possible to cover small areas with four or five layers of cardboard and 8-12 inches of mulch over the cardboard. This technique is called sheetmulching. The cardboard and mulch will degrade within a year and allow planting into the soil. Monitoring the condition of the reed canarygrass after a year will determine whether another application of cardboard and mulch is necessary prior to planting. If reed canarygrass is sufficiently controlled prior to planting, installation of groundcovers in addition to shrubs and trees is recommended to provide shade and competition to the reed canarygrass. If a significant amount of reed canarygrass is still present on the site, an initial planting of shrubs and trees is recommended, followed with continued sheet mulching to reduce the amount of reed canarygrass as much as possible. Groundcovers can then be added to the site after reed canarygrass is controlled.

4.2 Begin a strategic planting program in maintained areas that do not currently have regenerating trees

Several issues have been identified in the park within landscaped areas that have been formally planted within the active, passive and historical zones. The following section contains recommendations for replacing existing senescing Lombardy poplars that were planted along the

park boundary, recommendations for infilling trees in available planting spaces, and specific recommendations for each management zone.

Lombardy poplars

Lombardy poplars were planted along the park boundary as a hedgerow and along NE Marymoor Way, early in the history of the park. These large trees are now reaching the end of their lifespan and many are in poor health or dying. Lombardy poplars have been known to drop limbs suddenly and are considered to be a public safety hazard in many municipalities. Marymoor Park contains more than 150 Lombardy poplars, many of which are in poor health. The largest concentration is located in the Active Zone (see Maps 2B). It is recommended that these trees are replaced when they die by other species, using species appropriate to the habitat types shown on Map 4. Appendix B shows the plant species list for each habitat type along with information about plant spacing. The replacement trees should be planted in groves as opposed to the straight lines they are replacing. This will create a less abrupt edge and a more natural feel along the park boundary and allow the new trees to blend in with other forested areas, particularly along the eastern and western edge of the Active Zone where there are existing tree plantings.

Parking lots

Trees within parking lots have been placed in the oak savannah habitat type (Map 4). A full list of all species appropriate for this plant community is available in Appendix B. The vision for these areas is to have large, attractive, long-lived and drought tolerant trees such as conifers and oaks. Tree planting spaces in the parking lots are limited and constrained within the raised planting beds, which contain trees and mowed grass. Replacement trees from the appropriate plant palette identified in Appendix B can be planted in available growing spaces. Large trees identified in the palette can be placed into larger growing spaces that are 20 feet or more from the curb.

Parking lots that do not have existing curbs, such as the western side of Lot K and parts of Lot D, can convert existing vegetated areas into vegetation swales. Existing lawn or other vegetated areas level with the parking spaces can be planted with herbaceous wetland plants to capture stormwater runoff and provide drainage on-site. Aside from stormwater retention and treatment, swales can have great esthetic appeal, reduce mowing and maintenance, and provide water year-round for trees growing within the swales as well as protecting the tree roots from compaction and disturbance caused by mowing. Appendix D contains an FAQ about creating parking lot swales, created by the City of Seattle.

Entry Boulevard

NE Marymoor Way frames the main entrance and provides a thoroughfare through the park. This grand boulevard contains a large center median and a row of street trees on either side of the road. Currently, the central median contains an assortment of trees including large dying Lombardy poplars, big-leaf maples, Scotch pines, red maples, London planetrees, horticultural apples species, horticultural cherry species and others. The vision for this area is to create a more unified plant palette and slowly transition away from short-lived species such as horticultural cherries and apples to an oak savannah habitat type with groves of longer lived

conifers, big-leaf maples and oaks, including the native Garry oak (*Quercus garryana*). Although Garry oaks grow slowly, they can be beautiful and striking trees when mature. In addition, Garry oaks and native conifers within this habitat type provide important wildlife habitat for native insects, birds and mammals. It is recommended that available planting spots within the median are replaced with plants from the oak savannah palette in Appendix B. When possible, trees should be planted in groves of three-five trees of the same species to create more distinct stands.

The rows of street trees on either side of the boulevard are mostly composed of red maples. These maples should be maintained to preserve the forested character of the road. However, additional opportunities should be pursued to add groves of trees behind the row of street trees, within the adjacent natural areas of the park. These additional plantings should reflect the habitat areas present within the natural areas (Map 4) and should use trees from the palettes in Appendix B appropriate for those habitat types. Adding additional groves of trees near the road will create a more forested feel for visitors walking and driving through the park. It is important to be aware that certain areas along the road corridor should be preserved as viewpoints that allow for expansive views from the road. These viewpoints are identified in Map 4.

Active Zone

As was indicated in the results section, 65% of all trees inventoried in the Active Zone are less than 10 inches in diameter, indicating that most of the trees in this zone are fairly young (Figure 1). A total of 30 trees are larger than 30 inches in diameter. Since this zone is composed primarily of small-diameter or young trees, the focus in this zone should be to preserve and maintain the existing plantings over the long-term so they can grow and mature. A key recommendation in landscaped areas where trees are surrounded by mowed lawn is to create mulch rings around the trees to avoid compaction of the roots by constant mowing.

Passive Zone

The Passive Zone does not contain many landscaped areas where trees are located. The majority of this zone consists of natural areas that are not formally maintained. The only landscaped trees are the row of red maples on the south side of NE Marymoor Way and the plantings within the pet cemetery. These plantings should be maintained in a similar manner to those in the Active Zone, with mulch rings created around trees where necessary to avoid root compaction and damage from mowing.

Historical Zone

The Historical Zone contains the majority of the large trees within the park and the largest number of horticultural specimens in the park. Due to the zone's historical significance as an arboretum and the fact that most of the zone is formally landscaped, placement of new trees within this zone must be done carefully and thoughtfully. A detailed planting plan for the zone detailing all existing trees and all proposed new trees is outside the scope of this project. However, it is recommended that such a document be created as a Phase II of the planting plan to facilitate placement of new plantings.

A total of 167 trees with diameters greater than 30 inches at breast height were recorded in the historical zone during the 2010 survey (Figure 2 and Map 3). Of those trees, 101 are Douglas

firs, located within the many groves scattered throughout the zone. The majority of these trees are surrounded by smaller and younger Douglas fir trees. The key recommendation for protecting and extending the lives of these long-lived conifer trees is to prevent root compaction and trunk damage from mowing and driving over the tree roots. It is recommended that the forest floor in these groves is mulched and underplanted with low-growing native shrub species such as sword fern (*Polystichum munitum*), salal (*Gaultheria shallon*), and Oregon grape (*Mahonia nervosa*). As a guideline, the canopy dripline can be used as a border between the mulched and mown sections. The dripline is the outermost extent of the tree canopy.

The remaining large trees greater than 30" in diameter are composed of 18 different species. Two of these species are considered to be invasive, specifically, Norway maple and horse chestnut (*Aesculus hippocastanum*). It is recommended that these trees be allowed to live out their remaining lives but that they are replaced with non-invasive species with similar character. Norway maple should be replaced with big-leaf maple and horse chestnut should be replaced with oak trees.

Of the remaining large trees, eight species already have replacements planted within the zone. However, there are eight species with none or insufficient regeneration within the Historical Zone. These trees are shown on Map 3and include: big-leaf maples, river birch (*Betula nigra),* European beech (*Fagus sylvatica*), tulip tree (*Liriodendron tulipifera*), Western white pine (*Pinus monticola*), American linden (*Tilia americana*), large-leaved linden (*Tilia platyphyllos)* and American elm (*Ulmus americana*). Some of these trees such as many of the big-leaf maples are reaching the end of their lifespans. Other trees such as the European beech and Western white pine are longer lived. However, since there are no replacements for these large trees, a priority action within the Historical Zone should be to plant replacements for all of these species, with the exception of the American elm. The American elm is highly susceptible to Dutch Elm disease and should be replanted with a disease-resistant variety. Trees should be planted in a 2:1 replacement, approximately 25 feet apart and in groves to provide sufficient space for these trees to develop a large canopy similar to the trees they are replacing. If space is available near the original trees, the new trees will provide a continuation of the original grove. If space is not available, these trees will have to be planted elsewhere within the zone.

The eastern edge of the historical zone is currently devoid of trees and is mostly open mowed lawn. The concept plan (Map 4) shows two potential new Douglas-fir groves that could be placed within the mowed area, providing shade and picnic tables to park visitors. These trees should be planted between 15 and 25 feet apart, with slightly uneven spacing to resemble a natural forested stand. Some open spaces can be left for cedars, which can be underplanted in groups of two or three in approximately 20 years once the Douglas firs have created shade on the site. The lawn underneath the new groves should be mulched and low native groundcovers planted to create a natural forested setting.

4.3 Initiate additional tree plantings in identified areas that do not currently have trees present

As part of the master tree planning process, EarthCorps partnered with Gaynor, Inc. to create a conceptual plan for additional tree plantings within available areas in the Active, Historical and Passive Zones. A survey of the park identified a total of 99 acres within these zones that are not currently used for athletic or recreational activities (see Map 4). These areas include existing forested stands, current restoration areas as well as areas currently dominated by reed canarygrass and other invasive species which are not being restored or maintained at present. Map 4 shows the locations and habitat types assigned to these areas. Approximately 71 acres encompass areas without existing tree cover and currently covered with reed canarygrass, Himalayan blackberry and other invasive species. These are areas displayed in solid colors on Map 4. An additional 28 acres have some existing tree canopy but need to be enhanced with additional tree plantings and invasive species removal. These areas are displayed using striped colors on Map 4.

Each area is assigned to one or more of five habitat types that are present within the park. These habitat types are dependent on the proximity of the site to groundwater and range from wet meadow for the wettest sites to oak savannah for the driest areas. Specific information about each habitat type is presented below:

Wet Meadow

The wet meadow habitat type consists of wetland shrub and emergent species that grow in wetland conditions which remain moist throughout most of the year, although the area may dry out during the summer months for short periods of time. These areas tend to be too wet for tree establishment. Wetland areas dominated by shrubs and emergent vegetation provide vital wildlife habitat to amphibians, birds and other wildlife. If restored to a native condition, these are some of the most biologically diverse habitats, hosting many different plant and animal species. The wet meadow habitat is appropriate for sites where the water table is near the surface, as well as sites that stay completely submerged year-round, usually in areas that are less than two feet in elevation above the water table. Figure 4 shows a typical cross-section of elevation above the water table and the appropriate location for the wet meadow habitat type, as well as a sample planting layout. Most of these sites are heavily invaded with reed canarygrass and will require soil preparation prior to planting (see Figure 5). Shrubs can be planted between 8-20 feet apart, depending on the density desired on the site. If the site was previously covered with reed canarygrass, a dense planting of both shrubs and emergents is recommended to shade out the reed canarygrass. Appendix B provides a list of plants appropriate to this habitat type. Additional native species can be used where appropriate.

Deciduous Wetland

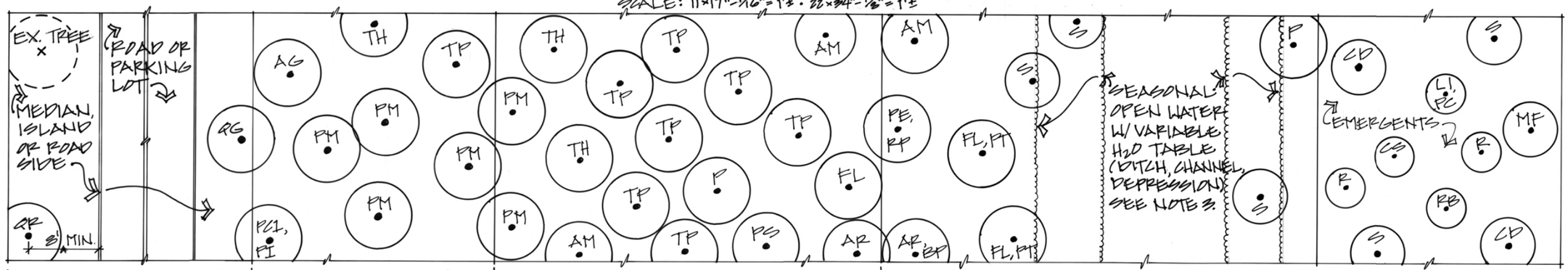
The deciduous wetland habitat type is dominated by moisture-loving deciduous trees and shrubs. This community is often found in areas where the water level is variable throughout the year, specifically in areas that have standing water in the winter and dry out in the summer such as ditches, channels and other depressions. These areas tend to be too wet for most conifer trees, but can support a wide diversity of willows and other deciduous trees and shrubs. This habitat type is appropriate for areas where standing water is present in the winter, but which are

approximately 2-4 feet above the water table during the summer. Figure 4 shows a typical cross-section of elevation above the water table and the appropriate location for the deciduous wetland habitat type, as well as a sample planting layout. Most of these sites are heavily invaded with reed canarygrass and will require soil preparation prior to planting (see Figure 5). Trees can be planted between 12-40 feet apart, depending on the density desired on the site. A small number of conifer trees can be added to the site 10 years after the initial planting, primarily on the banks and high spots on the site. If the site was previously covered with reed canarygrass, a dense planting of both trees and shrubs is recommended to shade out the reed canarygrass. Appendix B provides a list of plants appropriate to this habitat type. Additional native species can be used where appropriate.

FIGURE 4

SAMPLE PLANS

SCALE: 11×17"-1/16" = 1'± · 22×34"-1/8" = 1'±



- 80% OAKS AT 20-50' APART
- 5% BIGLF MAPLE AT 25-50' APART & 20' FROM PAVEMENT
- OPEN GROVES OF CONIFERS WHERE SPACE ALLOWS

OAK SAVANNAH

- 100% CONIFERS AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- OCCASIONAL DECIDUOUS & BROADLF EVERGREEN

UPLAND FOREST

- 75% CONIFERS AT 12-25' APART
- 25% DECIDUOUS AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- UNDERSTORY/LARGE SHRUBS OPTIONAL OR AS 2ND PHASE; AT 8-25' APART

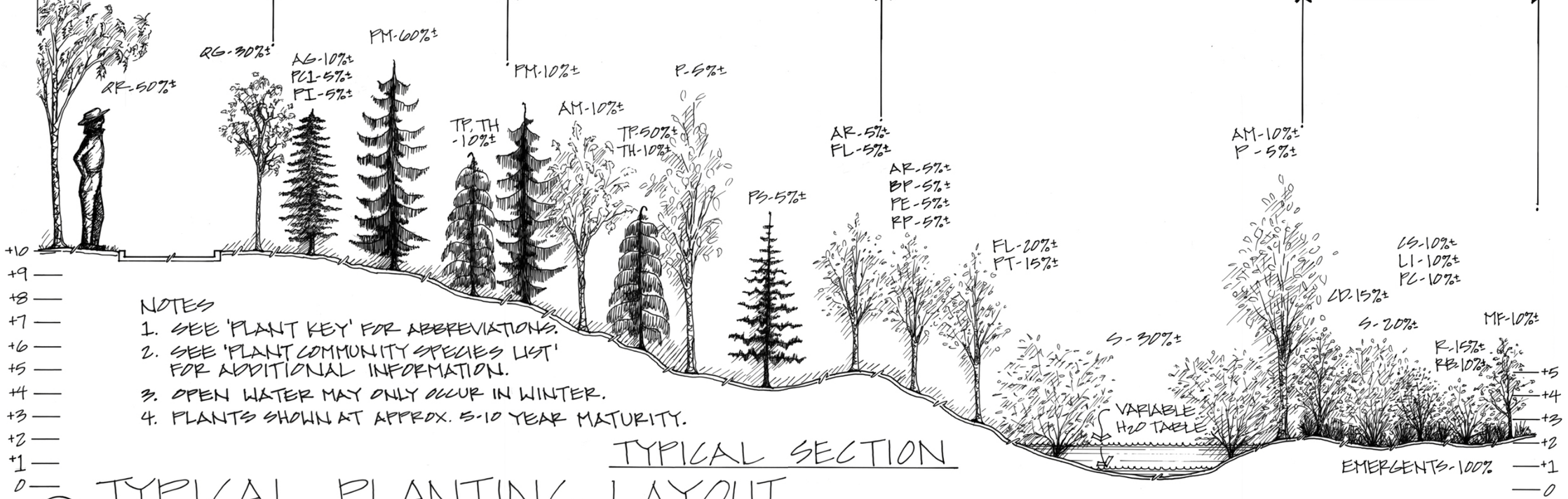
CONIFER WETLAND

- 100% DECIDUOUS TREES AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- UNDERPLANT W/ LARGE SHRUBS OPTIONAL OR AS 2ND PHASE. EXCEPTION: OFF-LEASH AREA-PLANT BORDER OF BARRIER SHRUBS

DECIDUOUS WETLAND

- 100% LARGE SHRUBS AT 8-20' APART
- APPROX. 5-15 SHRUBS/1000 S.F.
- UNDERPLANT 100% W/ EMERGENTS

WET MEADOW



NOTES
1. SEE 'PLANT KEY' FOR ABBREVIATIONS.
2. SEE 'PLANT COMMUNITY SPECIES LIST' FOR ADDITIONAL INFORMATION.
3. OPEN WATER MAY ONLY OCCUR IN WINTER.
4. PLANTS SHOWN AT APPROX. 5-10 YEAR MATURITY.

TYPICAL SECTION

VARIED SCALE

① TYPICAL PLANTING LAYOUT

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

Conifer wetland

The conifer wetland habitat is slightly higher in elevation than the deciduous wetland. This is a wetland habitat dominated by conifer trees, with a smaller deciduous tree component and a dense shrub layer. This community is found on moist sites, approximately 4-6 feet above the water table. Figure 4 shows a typical cross-section of elevation above the water table and the appropriate location for the conifer wetland habitat type, as well as a sample planting layout. Most of these sites are heavily invaded with reed canarygrass and will require soil preparation prior to planting (see Figure 5). Trees can be planted between 12-25 feet apart, depending on the density desired on the site. A small number of deciduous trees and a shrub layer can be added to the site 10 years after the initial planting. If the site was previously covered with reed canarygrass, a dense planting of both trees and shrubs is recommended to shade out the reed canarygrass. Appendix B provides a list of plants appropriate to this habitat type. Additional native species can be used where appropriate.

Upland forest

The upland forest type is dominated by conifer trees, with a small deciduous tree component. This habitat type is found in dryer, upland areas, at least six feet above the water table. Prior to European settlement, conifer forests covered the vast majority of the Puget Sound region and provided habitat for plants and wildlife in the region. Figure 4 shows a typical cross-section of elevation above the water table and the appropriate location for the upland forest habitat type, as well as a sample planting layout. Trees can be planted between 12-40 feet apart, depending on the density desired on the site. Appendix B provides a list of plants appropriate to this habitat type. Additional native species can be used where appropriate.

Oak savannah

Oak savannahs are found on dry, sunny spots with good drainage. In the context of Marymoor Park, this habitat type is appropriate for parking lots, road sides and road medians as these areas tend to be influenced by pavement and experience higher temperatures than forested areas. This habitat type contains a mixture of hardy oaks, deciduous and conifer trees. Figure 4 shows a typical cross-section of elevation above the water table and the appropriate location for the oak savannah habitat type, as well as a sample planting layout. Trees can be planted between 20-50 feet apart, depending on the density desired on the site and availability of planting spaces. Appendix B provides a list of plants appropriate to this habitat type.

Specific Zone Recommendations

Active Zone

The active zone contains a mosaic of all five of the habitat types described above (Map 4). The western section is predominantly a mosaic of conifer wetland, deciduous wetland and wet meadow areas surrounding the ball fields. Due to the varying topography and water features found in these areas, all three habitat types will form a mosaic within each area. The typical cross section in Figure 4 shows the locations of these habitat types in relation to the elevation of the water table.

A number of ditches are present within the western section of the Active Zone, adjacent to Lot K. The deciduous wetland habitat type is appropriate in these areas. The parking lots themselves have been placed in the oak savannah habitat type. There is also a small section of upland forest on the north side of Lot K as well as on the eastern side of the park boundary and along NE Marymoor Way to the east of Lot I (Map 4).

Additionally, a mosaic of upland forest and conifer wetland habitat types is appropriate on the northeastern edge of the Active Zone, adjacent to SR 520 (Map 4). The habitat in this area and other habitat areas along the north boundary of the park would create a park buffer offering a visual and noise screen for the freeway. Due to future plans for potentially constructing a Light Rail corridor along the northern edge of the park, major planting activities should be avoided within 100 feet of SR 520 until a concrete plan is finalized.

Historical Zone

The majority of the Historical Zone is located in the more upland section of the park. Due to the landscaped nature of this zone, there are only two small natural areas present, which are both upland forest. As was previously discussed, two additional conifer groves are suggested for the eastern boundary of the zone. These are also shown on Map 4. A full species list for the upland forest habitat type is available in Appendix B.

Passive Zone

The Passive Zone is wetter than the Historical Zone and extends down to the Sammamish River. The southern part of the zone is mostly a mosaic of conifer and deciduous wetland habitat types. A considerable part of the zone is already forested, but these natural areas are colonized by invasive species which need to be removed. The forested natural areas are delineated as "Enhanced" on Map 4. The off-leash dog area lies within this habitat type and will be discussed separately below.

The northern part of the Passive Zone contains a mix of the conifer wetland, deciduous wetland and wet meadow habitat types (Map 4). The placement of these habitat types depends on topography and existing ditches and water features. The typical cross section in Figure 4 shows the locations of these habitat types in relation to the elevation of the water table.

Off-Leash Dog Area

The off-leash dog area is located in the southeast section of the park and is composed of the conifer and deciduous wetland habitat types. There are a number of permanently fenced islands within the area protecting sections that have considerable natural vegetation or those that are too wet for use. These fenced sections present an opportunity for additional tree and shrub planting, enhancing the wildlife habitat within the off-leash dog area. Most of these areas are heavily invaded with reed canarygrass and will require soil preparation prior to planting (see Figure 5). In areas where the fence is not dog-proof, tree planting in the islands can be supplemented by a dense shrub border, which will create a living fence and will help to keep dogs out of these areas, giving them an opportunity to establish. The plant palette for the deciduous wetland habitat type in Appendix B lists shrub species appropriate for a living fence border.

4.4. Planting and Maintenance

Table 8 contains a planting and maintenance schedule for various activities identified within this plan. Invasive species removal can be conducted any time throughout the year, but clearing large new areas of Himalayan blackberry should be avoided between March 1st and July 1st due to the bird nesting season and the possibility of ground nesting birds using blackberry. The planting season in the Pacific Northwest is during the winter months, from October through February when there is enough rain for the plants to get established. Planting after February is not recommended due to the summer drought season, if the plants will not be irrigated during the summer. Potted plants can be installed throughout the growing season. However, bare-root plants such as the ones recommended in the plant palettes in Appendix B are often not available until December of January. Therefore, the appropriate time to plant bare root plants is in January and February. Maintenance of planted sites can be done all year. Detailed illustrations showing appropriate soil preparation and planting techniques for bareroot plants are shown in Figure 5.

Areas in restoration should be maintained at least two times per year for a minimum of five years. Maintenance should include removing invasive species and adding cardboard and mulch where necessary. New plantings should be kept clear of other vegetation to prevent competition until the trees and shrubs become established.

Trees planted in formally landscaped areas should have mulch rings at least one foot away from the tree, to prevent injury and compaction damage due to mowing. New trees within formally landscaped areas should be watered during the summer or provided with tree gators for at least three years, until they become established.

Table 8. Planting and maintenance schedule for Marymoor Park

Task	Month
Invasive species removal	January – December (except for large patches of Himalayan blackberry which should not be removed between March and June).
Planting potted plants	October - February
Planting bare root plants	January-February
Site maintenance	January - December

FIGURE 5.

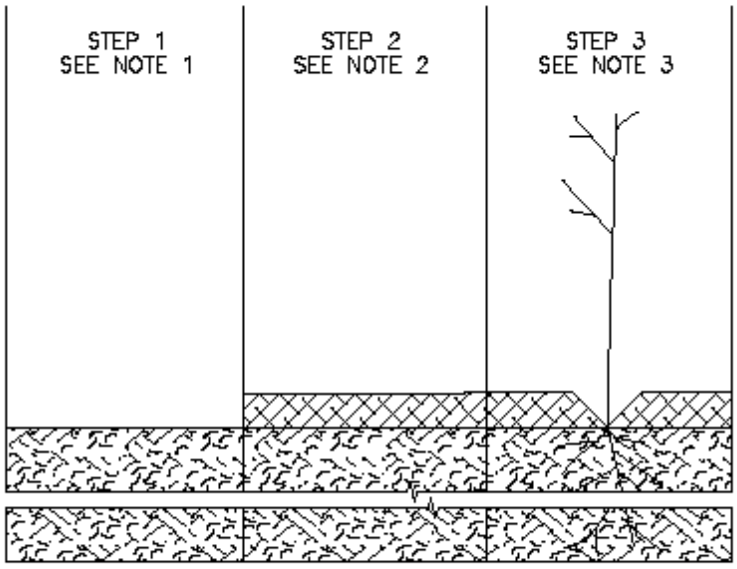
SOIL PREPARATION SEQUENCE

1. PLACE 4–5 LAYERS OF OVERLAPPING CARDBOARD TO SHEET MULCH ON TOP OF EXISTING SOIL AND/OR GRASS SPECIES (E.G. REED CANARY GRASS). SHRUBBY INVASIVES, SUCH AS HIMALAYAN BLACKBERRY, SHOULD BE MOWED DOWN AND PREFERABLY REMOVED PRIOR TO SHEET MULCHING.

2. PLACE WOOD CHIP MULCH TO 6–8 INCH MIN. DEPTH OVER CARDBOARD. INSTALL COCONUT FIBER OR JUTE MATTING ON TOP OF WOOD CHIP MULCH TO STABILIZE 2 1/2:1 OR STEEPER SLOPES.

3. AFTER 6–12 MONTHS, PLANT MULCHED AREA WITH NATIVE SPECIES. (SEE PLANTING DETAIL 3.) RESTORE WOOD CHIP MULCH TO 3–4 INCH MIN. DEPTH AFTER COMPLETION OF PLANTING. FOR RESTORING WOOD CHIP MULCH ON SLOPES 2 1/2:1 OR STEEPER, INSTALL WOOD CHIPS OVER COCONUT FIBER OR JUTE MATTING.

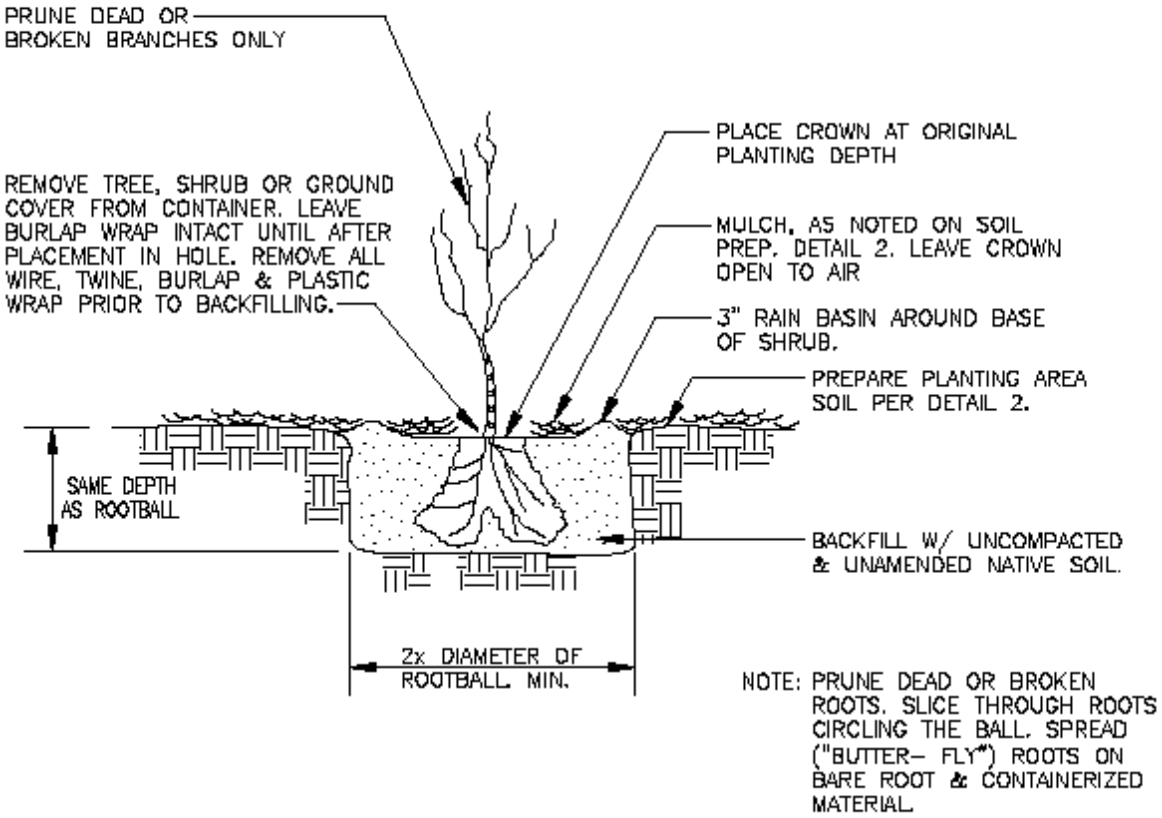
   NOTE: DO NOT INSTALL MULCH UNDER OR IN AREAS OF MOVING WATER.



(2) PLANTING AREA SOIL PREPARATION — NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

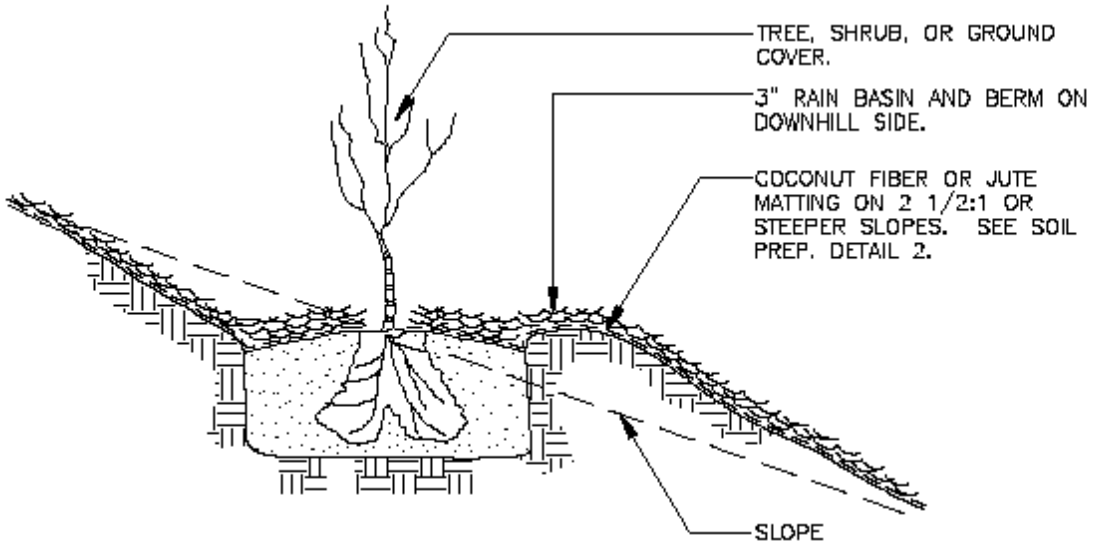


3 NATIVE TREE, SHRUB & GROUNDCOVER PLANTING

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.



SECTION

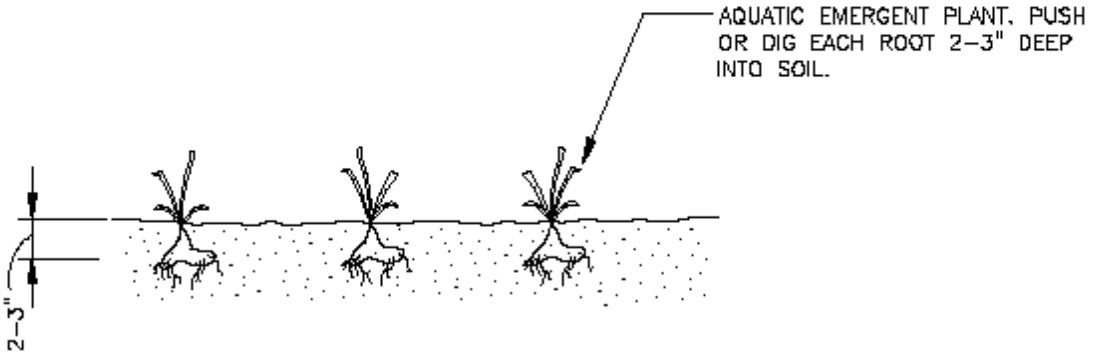
NOTE: SEE NATIVE PLANTING DETAIL 3 FOR ADDITIONAL INFORMATION.

4 SLOPE PLANTING DETAIL

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.



NOTE:
PLANT ALL AQUATIC EMERGENT PLANTS WHERE SHOWN ON TYPICAL PLANTING LAYOUT DETAIL 1, AND WHEN SOIL IS MOIST TO WET.

5 AQUATIC EMERGENT PLANTING DETAIL

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

V. References

Jongejan-Gerrard-McNeal 1995. Marymoor Regional Park 1995 Master Plan Update.

King County Noxious Weed Control Program 2011. 2011 King County Noxious Weed List. http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/laws/list.aspx

King County Noxious Weed Control Program 2011a. English ivy (*Hedera helix*) http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-ivy.aspx

King County 2011b. Himalayan Blackberry and Evergreen Blackberry *Rubus armeniacus (syn. Rubus discolor) and Rubus laciniatus*

http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/blackberry.aspx

King County 2011c. English Holly (*Ilex aquifolium*) http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-holly.aspx

King County 2011d. Cherry laurel (*Prunus laurocerasus*) http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-laurel.aspx

Wikipedia 2011. Marymoor Prehistoric Indian Site. http://en.wikipedia.org/wiki/Marymoor_Prehistoric_Indian_Site

USDA Forest Service 2005. Horse Chestnut (*Aesculus hippocastanum*). http://www.na.fs.fed.us/fhp/invasive_plants/weeds/horse_chestnut.pdf

USDA Forest Service 2006a. European White Birch (*Betula pendula*) http://www.na.fs.fed.us/fhp/invasive_plants/weeds/european-white-birch.pdf

USDA Forest Service 2006a. European mountain ash (*Sorbus aucuparia*) http://www.na.fs.fed.us/fhp/invasive_plants/weeds/european-mountain-ash.pdf

Appendix A. Invasive Species BMPs.

English Ivy

English ivy is one of the most invasive species in the Pacific Northwest. This evergreen climbing vine is capable of forming dense mats in the forest understory and excluding all other understory species. It can also climb up trees, preventing light from reaching the leaves and adding weight to the tree canopy, causing trees to weaken and fall during wind storms.

The most effective method for controlling English ivy is manual removal. Because English ivy can impact tree health by growing vertically, the first priority is to remove any vines growing on tree trunks and in the canopy. Install "survival rings" around trees by cutting or prying vines at shoulder height with the aid of a hand tool, killing any upper vines on the tree. Lower vines then need to be cleared, along with roots and vines found within at least a five foot radius of the base of the tree. For ivy growing along the ground, use hands or a small tool such as a hand tiller to pull or dig out the leaves and vines growing above the soil, as well as the woody roots growing just below the surface of the soil (King County 2004).

For disposal of hand-removed English ivy, several options are available. Disposal at a municipal vegetation waste facility is preferred. If the site will be monitored regularly, ivy can be piled on site on top of a paved area or tarp to prevent stems from re-rooting. Allow the pile to dry out, flipping periodically to ensure complete decomposition. Chemical methods of controlling English ivy are typically ineffective. The waxy leaves of the plant do not easily absorb herbicides, and herbicide run-off from the leaves results in risk to non-target plants (King County 2011a).

Best Management Practices for this plant can be found at:
English Ivy: http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-ivy.aspx

English holly, cherry laurel and Portugal laurel

Cherry laurel, Portugal laurel and English holly are evergreen trees that can reach up to 50 feet in height, but are usually shorter when present in the forest understory. All three species can form thickets in the forest understory, reproducing in low-light conditions and excluding native plant species. These trees can be difficult to control as they form extensive root sprouts after being cut down. The most effective method of control is to remove the entire root while the plant is small and can be pulled. If the plant is larger, it is possible to remove it using a weed wrench. If the tree is too large to be either hand pulled or removed with a weed wrench, cutting the stem at or above ground level and applying an herbicide such as 100% concentration of glyphosate directly to the cut portion of the stem as soon as possible is usually effective. Other methods of herbicide application include frilling (cutting into the cambium and applying herbicide to the wounds) and stem injection where time-release dosages are placed directly into the stem. These methods kill the trees in place which can be left to fall and naturally decompose. Due to the fact that these trees tend to root sprout and have many seedlings, monitoring around the infested areas on a

regular basis will be necessary for several years after removal. It is very important not to cut the trees down without herbicide application, as this can lead to numerous root sprouts and re-growth from the stem (King County 2011c, King County 2011d).

Best Management Practices for these plants can be found at:
English Holly: http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-holly.aspx

Cherry Laurel: http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-laurel.aspx

Norway maple, horse chestnut, European white birch, one-seed hawthorn, golden chain tree, white poplar, sweet cherry, cherry plum, black locust and European mountain ash

Norway maple, horse chestnut, European white birch, one-seed hawthorn, golden chain tree, white poplar, sweet cherry, cherry plum, black locust and European mountain ash are deciduous trees that can form dense thickets in the forest understory and exclude native trees and shrubs. Manual means of controlling these tree species include hand pulling small seedlings and removing young trees with a weed wrench where possible. It is easier to implement manual control when the soil is moist. If the tree is too large for manual removal, girdling can be an effective means of control. Girdling can be accomplished by cutting through the bark and growing layer (cambium) in a complete ring around the trunk. This method is most effective in the spring. An herbicide such as 100% concentration of glyphosate applied directly to the cut portion of the stem as soon as possible is usually effective. Other methods of herbicide application include frilling (cutting into the cambium and applying herbicide to the wounds) and stem injection where time-release dosages are placed directly into the stem. These methods kill the trees in place which can be left to fall and naturally decompose. Larger trees can also be cut down although re-growth should be monitored and removed for several years after the tree is cut down to prevent re-sprouting (USDA Forest Service 2005, USDA Forest Service 2006a, USDA Forest Service 2006b).

Best Management Practices for these plants can be found at:
Horse Chestnut: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/horse_chestnut.pdf
European White Birch: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/european-white-birch.pdf
European Mountain Ash: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/european-mountain-ash.pdf

Himalayan blackberry

Himalayan blackberry is a vigorous evergreen shrub armed with prickles on the stems. This plant thrives in open, disturbed areas but can also invade forested areas on both wet and dry sites. Invasive blackberries often form large thickets that exclude all other species and can also climb and smother small trees.

Control of invasive blackberries requires management over a number of years. Based on the size of the site, various strategies can be effective. For small infestations of invasive blackberries, manual removal is appropriate. For larger infestations, mechanical methods such as mowing or brush cutting can be effective. Manual control consists of cutting blackberry canes with loppers or pruners one foot above the ground. Depending on the size of the plants, dig up the root balls using tools such as a hand tiller, shovel, pulaski, or pick mattock. Canes can be piled on site on top of a tarp or an impervious surface and left to decompose. Place any root balls on top of the pile to avoid re-rooting. Due to possible vigorous re-sprouting from the root crown, monitoring the infested area on a regular basis will be necessary for several years after removal. Removal procedures are repeated as necessary for complete control. After removing invasive blackberries, the area should be replanted with natives and mulched to help deter future invasive growth (King County 2005). Another potential chemical control method being tested on steep slopes and in areas with dense cover of native species is the cut and dab method. This technique involves the application of herbicide directly to freshly cut blackberry canes. The advantages of this method include minimizing soil disturbance and damage to existing vegetation.

Biological methods of controlling blackberry are also an option. The introduction of animals such as goats or pigs can be useful in controlling infestations from one to four years old. Chemical methods of controlling large blackberry infestations are also known to be effective, especially if combined with other methods such as mechanical control and monitoring (King County 2011b).

Best Management Practices for this plant can be found at:
Himalayan Blackberry: http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/blackberry.aspx

Appendix B. Plant Community Species List

CONIFER & BROADLEAF EVERGREEN TREES		
ABBREV	**COMMON NAME**	**BOTANICAL NAME**
AG	GRAND FIR	ABIES GRANDIS
M	MADRONE	ARBUTUS MENZIESII
PC1	SHORE PINE	PINUS CONTORTA
PI	WESTERN WHITE PINE	PINUS MONTICOLA
PS	SITKA SPRUCE	PICEA SITCHENSIS
PS1	SCOTS PINE	PINUS SYLVESTRIS
PM	DOUGLAS FIR	PSEUDOTSUGA MENZIESII
SS	REDWOOD	SEQUOIA SEMPERVIRENS
TP	WESTERN RED CEDAR	THUJA PLICATA
TH	WESTERN HEMLOCK	TSUGA HETEROPHYLLA
DECIDUOUS TREES		
ABBREV	**COMMON NAME**	**BOTANICAL NAME**
AM	BIGLEAF MAPLE	ACER MACROPHYLLUM
AR	RED ALDER	ALNUS RUBRA
BP	PAPER BIRCH	BETULA PAPYRIFERA
CN	PACIFIC DOGWOOD	CORNUS NUTALLII
FL	OREGON ASH	FRAXINUS LATIFOLIA
P	BLACK COTTONWOOD	POPULUS TRICOCARPA
PE	BITTER CHERRY	PRUNUS EMARGINATA
PT	QUAKING ASPEN	POPULUS TREMULOIDES
QG	GARRY OAK	QUERCUS GARRYANA
QR	RED OAK	QUERCUS RUBRA
RP	CASCARA	RHAMNUS PURSHIANA
UNDERSTORY TREES & LARGE SHRUBS		
ABBREV	**COMMON NAME**	**BOTANICAL NAME**
AC	VINE MAPLE	ACER CIRCINATUM
CD	DOUGLAS HAWTHORN	CRATAEGUS DOUGLASII
CS	REDTWIG DOGWOOD	CORNUS STOLONIFERA
LI	TWINBERRY	LONICERA INVOLUCRATA
MF	WESTERN CRAB	MALUS FUSCA
PC	WESTERN NINEBARK	PHYSOCARPA CAPITATUS
R	CLUSTERED WILD ROSE	ROSA PISOCARPA
RB	SWAMP CURRANT	RIBES BRACTEOSUM
S	WILLOW – PACIFIC, SCOULER'S SITKA	SALIX LASIANDRA, SCOULERIANA, SITCHENSIS
WETLAND EMERGENTS		
ABBREV	**COMMON NAME**	**BOTANICAL NAME**
AE	PACIFIC SILVERWEED	AGENTINA EGEDII
CA1	COLUMBIAN SEDGE	CAREX APERTA
CA	SITKA SEDGE	CAREX AQUATILIS
CO	SLOUGH SEDGE	CAREX OBNUPTA
LA	SKUNK CABBAGE	LYSICHITON AMERICANUS
OS	WATER PARSLEY	OENANTHE SARMENTOSA

SL	BROADLEAF ARROWHEAD	SAGITTARIA LATIFOLIA
SC	WOOL GRASS	SCIRPUS CYPERINUS
SM	SMALL-FRUITED BULRUSH	SCIRPUS MICROCARPUS
SC1	COOLEY'S HEDGENETTLE	STACHYS CHAMISSONIS V. COOLEYAE

NATIVE PLANT WHOLESALE NURSERIES RESOURCES AND LINKS

The following wholesale nurseries are native plants growers. Several also grow a wide selection of ornamentals as well. Those specializing in bare root stock include Balance Restoration (wetland species including emergents), Fourth Corner Nurseries, and Lawyer Nursery. Others listed trend towards container stock.

Colvos Creek Nursery, http://www.colvoscreeknursery.com

Balance Restoration, LLC 27995 Chambers Mill Road Lorane, OR 97451-9707. T:541.942.5530. F:541.942.7265, balancenursery@yahoo.com

Forest Farm, http://www.forestfarm.com

Fourth Corner Nurseries, http://fourthcornernurseries.com

Lawyer Nursery, Inc., http://www.lawyernursery.com

Tissues & Liners or T & L Nursery, http://www.tandlnursery.com

Storm Lake Growers, Inc., http://www.stormlakegrowers.com

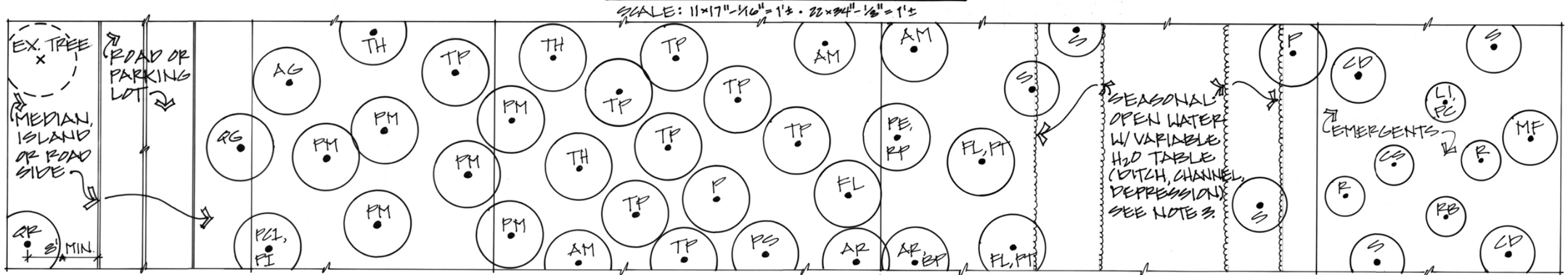
Wabash Farms, PO Box 291 31218 SE 408th ST. Enumclaw, WA 98022, 360-825-7051

Link to King County listing of native plant nurseries:

http://www.kingcounty.gov/environment/stewardship/nw-yard-and-garden/native-plant-nurseries-washington.aspx

SAMPLE PLANS

SCALE: 11×17"-1/16"=1'± · 22×34"-1/8"=1'±



- 80% OAKS AT 20-50' APART
- 5% BIGLF MAPLE AT 25-50' APART & 20' FROM PAVEMENT
- OPEN GROVES OF CONIFERS WHERE SPACE ALLOWS

OAK SAVANNAH

- 100% CONIFERS AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- OCCASIONAL DECIDUOUS & BROADLF EVERGREEN

UPLAND FOREST

- 75% CONIFERS AT 12-25' APART
- 25% DECIDUOUS AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- UNDERSTORY/LARGE SHRUBS OPTIONAL OR AS 2ND PHASE; AT 8-25' APART

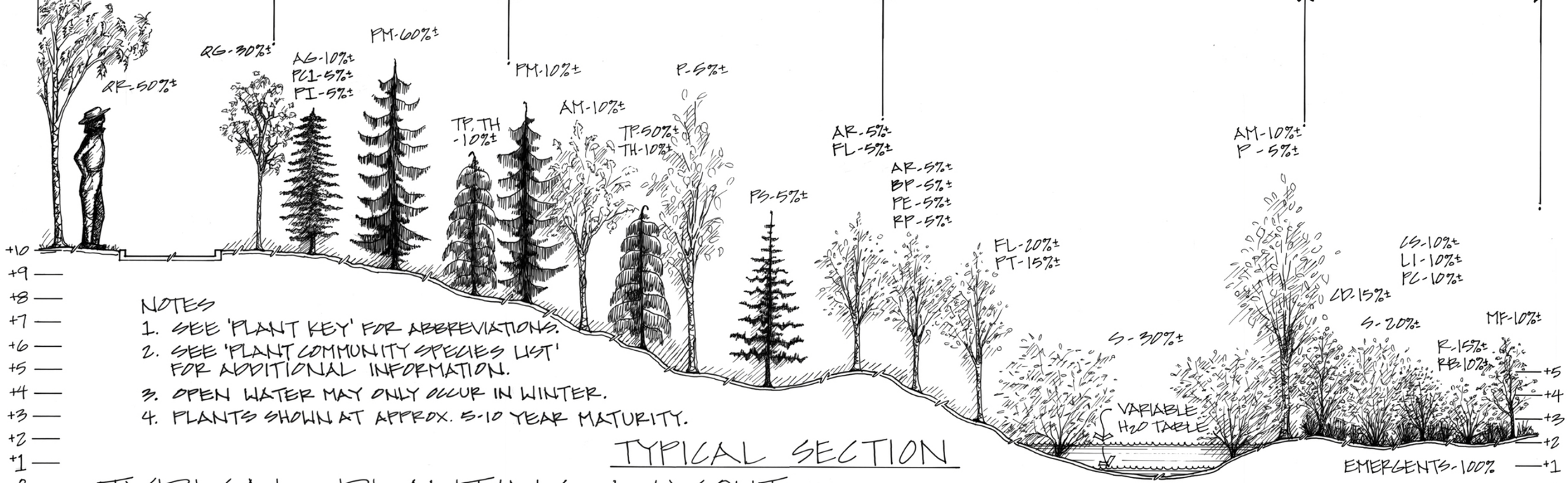
CONIFER WETLAND

- 100% DECIDUOUS TREES AT 12-40' APART
- APPROX. 3-7 TREES/1000 S.F.
- UNDERPLANT W/ LARGE SHRUBS OPTIONAL OR AS 2ND PHASE. EXCEPTION: OFF-LEASH AREA-PLANT BORDER OF BARRIER SHRUBS

DECIDUOUS WETLAND

- 100% LARGE SHRUBS AT 8-20' APART
- APPROX. 5-15 SHRUBS/1000 S.F.
- UNDERPLANT 100% W/ EMERGENTS

WET MEADOW



NOTES

1. SEE 'PLANT KEY' FOR ABBREVIATIONS.
2. SEE 'PLANT COMMUNITY SPECIES LIST' FOR ADDITIONAL INFORMATION.
3. OPEN WATER MAY ONLY OCCUR IN WINTER.
4. PLANTS SHOWN AT APPROX. 5-10 YEAR MATURITY.

TYPICAL SECTION

VARIED SCALE

① TYPICAL PLANTING LAYOUT

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

CONIFER WETLAND COMMUNITY (CW)

DESCRIPTION: EVERGREEN TREE DOMINATED WETLAND PLANT COMMUNITY.

FUNCTIONS: HABITAT, VISUAL & NOISE BUFFER OR SCREENING, SHADE.

EVERGREEN TREE SPECIES: CLIMAX FOREST SPECIES

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
TP	50%	WESTERN RED CEDAR	THUJA PLICATA	BARE ROOT (2-0/2-1) OR PLUGS; 100' + HT; PLANT 12' – 25' APART; HIGH SPOTS OR HUMMOCKS WITHIN WETLANDS & CHANNEL / WETLAND EDGES
TH	10%	WESTERN HEMLOCK	TSUGA HETEROPHYLLA	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 12' – 25' APART; HIGH SPOTS OR HUMMOCKS WITHIN WETLANDS & CHANNEL / WETLAND EDGES; SHADE.
PS	5%	SITKA SPRUCE	PICEA SITCHENSIS	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 12' – 25' APART; IN WETTER PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES
PM	10%	DOUGLAS FIR	PSEUDOTSUGA MENZIESII	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 12' – 25' APART; ON HIGHEST, DRIEST PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES

DECIDUOUS TREE SPECIES: PIONEER SPECIES FOR INITIAL SHADE

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AM	10%	BIGLEAF MAPLE	ACER MACROPHYLLUM	BARE ROOT,18-36” HT; 60'+ HT; PLANT 25' APART; ON HIGHER PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER/SHADE SPECIES
AR	5%	RED ALDER	ALNUS RUBRA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 12 – 20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & NITROGEN-FIXING SPECIES
P	5%	BLACK COTTONWOOD	POPULUS TRICOCARPA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 25' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES (RAPTOR PERCH, HERON ROOKERY)

FL	5%	OREGON ASH	FRAXINUS LATIFOLIA	BARE ROOT, 18-36” HT; 60'-80' HT; PLANT 25'-40' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE

UNDERSTORY TREE / LARGE SHRUB: OPTIONAL OR FOR LATER PHASE PLANTING AFTER TREE COVER ESTABLISH; PROVIDE APPROX. 30-50% AREA COVERAGE; *MIX OF SPECIES DEPENDENT ON SITE CONDITIONS INCL SUN/SHADE & HYDROLOGY.

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AC	PHASE 2	VINE MAPLE	ACER CIRCINATUM	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-12' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; PREFERS SHADE
PE	PHASE 2	BITTER CHERRY	PRUNUS EMARGINATA	BARE ROOT, 12-18” HT; 25'+ HT; PLANT 12'-15' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN – SHADE TOLERANT
S	PHASE 2	WILLOW, PACIFIC, SCOULER'S, SITKA	SALIX LASIANDRA, SCOULERIANA, SITCHENSIS	BARE ROOT, 12-18” HT; 15'-30'+ HT; PLANT 15'-20' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES; PREFERS SUN
TB	PHASE 2	DOUGLAS HAWTHORN	CRATAEGUS DOUGLASII	BARE ROOT (2-0/2-1) OR PLUG; 15'-25' HT; PLANT 20'-25' APART; ON HIGHER, DRIER AREAS WITHING WETLANDS & ALONG CHANNEL / WETLAND EDGES; SHADE

DECIDUOUS WETLAND COMMUNITY (DW)

DESCRIPTION: DECIDUOUS TREE DOMINATED WETLAND PLANT COMMUNITY.

FUNCTIONS: HABITAT, FILTERED SCREEN / VIEWS, SHADE.

DECIDUOUS TREES:

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT

AM	10%	BIGLEAF MAPLE	ACER MACROPHYLLUM	BARE ROOT, 18-36” HT; 60'+ HT; PLANT 25' APART; ON HIGHER PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER/SHADE SPECIES
AR	5%	RED ALDER	ALNUS RUBRA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 12 – 20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & NITROGEN-FIXING SPECIES
BP	5%	PAPER BIRCH	BETULA PAPYRIFERA	BARE ROOT, 12-18” HT; 25'+ HT; PLANT 12'-15' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN – SHADE TOLERANT
FL	20%	OREGON ASH	FRAXINUS LATIFOLIA	BARE ROOT, 18-36” HT; 60'-80' HT; PLANT 25'-40' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE
PT	15%	QUAKING ASPEN	POPULUS TREMULOIDES	BARE ROOT, 12-18” HT; 30'+ HT; PLANT 15'-25' APART; PREFERS EDGES OF DRAINAGES & CHANNELS; SUN
P	5%	BLACK COTTONWOOD	POPULUS TRICOCARPA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 25' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES (RAPTOR PERCH, HERON ROOKERY)
PE	5%	BITTER CHERRY	PRUNUS EMARGINATA	BARE ROOT, 12-18” HT; 25'+ HT; PLANT 12'-15' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN – SHADE TOLERANT
RP	5%	CASCARA	RHAMNUS PURSHIANA	BARE ROOT, 12-18” HT; 30'-40'+ HT; PLANT 15'-25' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN OR SHADE
S	30%	WILLOW, PACIFIC, SCOULER'S, SITKA	SALIX LASIANDRA, SCOULERIANA, SITCHENSIS	BARE ROOT, 12-18” HT; 15'-30'+ HT; PLANT 15'-20' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES; PREFERS SUN

EVERGREEN TREES: OPTIONAL &/OR AS A LATER PLANTING PHASE UNDERPLANTED WITHIN ESTABLISH DECIDUOUS TREE CANOPY COVER FOR ADDITIONAL DIVERSITY. ** MIX OF SPECIES DEPENDENT ON SPECIFIC SITE CONDITIONS INCL. HYDROLOGY & TOPOGRAPHY.

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
TP	PHASE 2	WESTERN RED CEDAR	THUJA PLICATA	1 – 5 GALLON CONTAINER; 100' + HT; PLANT 12' – 25' APART; HIGH SPOTS OR HUMMOCKS WITHIN WETLANDS & CHANNEL / WETLAND EDGES
TH	PHASE 2	WESTERN HEMLOCK	TSUGA HETEROPHYLLA	1 – 5 GALLON CONTAINER; 100'+ HT; PLANT 12' – 25' APART; HIGH SPOTS OR HUMMOCKS WITHIN WETLANDS & CHANNEL / WETLAND EDGES; MUST BE SHADED.
PS	PHASE 2	SITKA SPRUCE	PICEA SITCHENSIS	1 – 5 GALLON CONTAINER; 100'+ HT; PLANT 12' – 25' APART; IN WETTER PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES
PM	PHASE 2	DOUGLAS FIR	PSEUDOTSUGA MENZIESII	1 – 5 GALLON CONTAINER; 100'+ HT; PLANT 12' – 25' APART; ON HIGHEST, DRIEST PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES

UNDERSTORY TREES / LARGE SHRUBS: BARRIER SHRUBS FOR 'LIVING FENCE' BORDER OR FOR LATER PHASE PLANTING AFTER TREE COVER ESTABLISH; PROVIDE APPROX. 30-50% AREA COVERAGE; ***MIX OF SPECIES DEPENDENT ON SITE CONDITIONS INCL SUN/SHADE & HYDROLOGY.

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
CD	PHASE 2	BLACK HAWTHORN	CRATAEGUS DOUGLASII	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 12'-20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE; THORNY
CS	PHASE 2	REDTWIG DOGWOOD	CORNUS STOLONIFERA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE

LI	PHASE 2	TWINBERRY	LONICERA INVOLUCRATA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; PREFERS SHADE
MF	PHASE 2	WESTERN CRAB	MALUS FUSCA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 12'-20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE
PC	PHASE 2	WESTERN NINEBARK	PHYSOCARPA CAPITATUS	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-SHADE
R	PHASE 2	CLUSTERED WILD ROSE	ROSA PISOCARPA	BARE ROOT, 12-18” HT; 12'+ HT; PLANT 8'-15' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN; THORNY
RB	PHASE 2	SWAMP CURRANT	RIBES BRACTEOSUM	BARE ROOT, 12-18” HT; 8'+ HT; PLANT 8'-12' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-SHADE; THORNY

WET MEADOW COMMUNITY (WM)

DESCRIPTION: UNDERSTORY TREE/ LARGE SHRUB & EMERGENT DOMINATED WETLAND PLANT COMMUNITY.
FUNCTIONS: HABITAT, FILTERED SCREEN / VIEWS, SHADE.

UNDERSTORY TREES / LARGE SHRUBS

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
CD	15%	BLACK HAWTHORN	CRATAEGUS DOUGLASII	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 12'-20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE; THORNY
CS	10%	REDTWIG DOGWOOD	CORNUS STOLONIFERA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE

LI	10%	TWINBERRY	LONICERA INVOLUCRATA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; PREFERS SHADE
MF	10%	WESTERN CRAB	MALUS FUSCA	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 12'-20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE
PC	10%	WESTERN NINEBARK	PHYSOCARPA CAPITATUS	BARE ROOT, 12-18” HT; 15'+ HT; PLANT 8'-15' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-SHADE
R	15%	CLUSTERED WILD ROSE	ROSA PISOCARPA	BARE ROOT, 12-18” HT; 12'+ HT; PLANT 8'-15' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN; THORNY
RB	10%	SWAMP CURRANT	RIBES BRACTEOSUM	BARE ROOT, 12-18” HT; 8'+ HT; PLANT 8'-12' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-SHADE; THORNY
S	20%	WILLOW, PACIFIC, SCOULER'S, SITKA	SALIX LASIANDRA, SCOULERIANA, SITCHENSIS	BARE ROOT, 12-18” HT; 15'-30'+ HT; PLANT 15'-20' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES; PREFERS SUN

WETLAND EMERGENTS

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AE	5%	PACIFIC SILVERWEED	ARGENTINA EGEDII	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
CA1	5%	COLUMBIAN SEDGE	CAREX APERTA	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
CA	5%	SITKA SEDGE	CAREX AQUATILIS	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN

CO	20%	SLOUGH SEDGE	CAREX OBNUPTA	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
LA	5%	SKUNK CABBAGE	LYSICHITON AMERICANUS	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SHADE – PART SHADE
OS	5%	WATER PARSLEY	OENANTHE SARMENTOSA	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
SL	5%	BROADLEAF ARROWHEAD	SAGITTARIA LATIFOLIA	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
SC	20%	WOOL GRASS	SCIRPUS CYPERINUS	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
SM	20%	SMALL FRUITED BULLRUSH	SCIRPUS MICROCARPUS	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN
SC1	10%	COOLEY'S HEDGENETTLE	STACHYS CHAMISSONIS V. COOLEYAE	BARE ROOT SEEDLINGS, PLANT 1-2' APART; CAN TOLERATE WET AREAS WITHIN WETLANDS & ALONG CHANNEL/WETLAND EDGES; SUN

DECIDUOUS TREES: OCCASIONAL TREE WITHIN WET MEADOW HABITAT; MIX OF SPECIES DEPENDENT ON SITE CONDITIONS & PREFERENCE

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AM		BIGLEAF MAPLE	ACER MACROPHYLLUM	BARE ROOT, 18-36” HT; 60'+ HT; PLANT 25' APART; ON HIGHER PLACES WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER/SHADE SPECIES
AR		RED ALDER	ALNUS RUBRA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 12 – 20' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & NITROGEN-FIXING SPECIES

FL		OREGON ASH	FRAXINUS LATIFOLIA	BARE ROOT, 18-36” HT; 60'-80' HT; PLANT 25'-40' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN-PART SHADE
P		BLACK COTTONWOOD	POPULUS TRICOCARPA	BARE ROOT, 12-18” HT; 80'+ HT; PLANT 25' APART; CAN TOLERATE WETTER AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; GOOD PIONEER & HABITAT SPECIES (RAPTOR PERCH, HERON ROOKERY)
PT		QUAKING ASPEN	POPULUS TREMULOIDES	BARE ROOT, 12-18” HT; 30'+ HT; PLANT 15'-25' APART; PREFERS EDGES OF DRAINAGES & CHANNELS; SUN
RP		CASCARA	RHAMNUS PURSHIANA	BARE ROOT, 12-18” HT; 30'-40'+ HT; PLANT 15'-25' APART; CAN TOLERATE MOIST AREAS WITHIN WETLANDS & ALONG CHANNEL / WETLAND EDGES; SUN OR SHADE

UPLAND FOREST COMMUNITY (UF)

DESCRIPTION: EVERGREEN TREE DOMINATED UPLAND PLANT COMMUNITY.
FUNCTIONS: HABITAT, VISUAL & NOISE BUFFER OR SCREENING, SHADE.

EVERGREEN TREE SPECIES: CLIMAX FOREST SPECIES

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AG	10%	GRAND FIR	ABIES GRANDIS	BARE ROOT (2-0/2-1) OR PLUG; 80'+ HT; PLANT 15'-25' APART; SUN-PART SHADE
TP	10%	WESTERN RED CEDAR	THUJA PLICATA	BARE ROOT (2-0/2-1) OR PLUGS; 100' + HT; PLANT 12' – 25' APART; MOISTER & SHADIER AREAS OF UPLAND
TH	10%	WESTERN HEMLOCK	TSUGA HETEROPHYLLA	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 12' – 25' APART; MOISTER & SHADIER AREAS OF UPLAND
PC1	5%	SHORE PINE	PINUS CONTORTA	BARE ROOT (2-0/2-1) OR PLUG; 60'+ HT; PLANT 15'-25' APART; SUN-PART SHADE
PI	5%	WESTERN WHITE PINE	PINUS MONTICOLA	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 20'-40' 25' APART; SUN-PART SHADE

PM	60%	DOUGLAS FIR	PSEUDOTSUGA MENZIESII	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 12' – 25' APART; SUN-PART SHADE

BROADLEAF EVERGREEN & DECIDUOUS TREE SPECIES: OCCASIONAL IN OPEN AREAS AND AT FOREST EDGES

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AC		VINE MAPLE	ACER CIRCINATUM	BARE ROOT, 12-18" HT; 15'+ HT; PLANT 8'-12' APART; FOR MOISTER & SHADIER AREAS
AM		BIGLEAF MAPLE	ACER MACROPHYLLUM	BARE ROOT,18-36" HT; 60'+ HT; PLANT 25'-50' APART; PREFERS SUN-PART SHADE; CAN BECOME SPECIMEN IN OPEN LAWN AREAS
CN		PACIFIC DOGWOOD	CORNUS NUTALLII	BARE ROOT, 12-18" HT; 30'-40' HT; PLANT 15 – 20' APART; PREFERS FOREST EDGES
M		MADRONE	ARBUTUS MENZIESII	1 GALLON CONTAINER; 50'-60'+ HT; PLANT 25' APART IN DRIEST, SUNNIEST, WELL-DRAINED AREAS

OAK SAVANNAH COMMUNITY (OS)

DESCRIPTION: OAK-GRASSLAND DOMINATED UPLAND PLANT COMMUNITY.

FUNCTIONS: ENTRY BOULEVARD & PARKING LOT TREES, HABITAT, AESTHETICS.

DECIDUOUS TREES:

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
AM	5%	BIGLEAF MAPLE	ACER MACROPHYLLUM	BARE ROOT,18-36" HT; 60'+ HT; PLANT 25'-50' APART; PREFERS SUN-PART SHADE; CAN BECOME SPECIMEN IN OPEN LAWN AREAS; PLANT MIN. 20' FROM PAVED EDGES
QG	20%	GARRY OAK	QUERCUS GARRYANA	5 GALLON CONTAINER; 60'+ HT; PLANT 20'-30' APART ALONG ENTRY BOULEVARD; TRANSITION TO NATIVE PLANTING
QR	40%	SCHUMARD OAK OR RED OAK	QUERCUS SCHUMARDII OR RUBRA	2' CALIPER, B&B; 60'-80' HT; PLANT 30'-50' APART IN ENTRY BOULEVARD MEDIAN

SMALL EVERGREEN TREES: SUITABLE FOR PARKING LOTS AND GROVES ALONG BOULEVARD

PC1	10%	SHORE PINE	PINUS CONTORTA	BARE ROOT (2-0/2-1) OR PLUG; 60'+ HT; PLANT 15'-25' APART; SUN-PART SHADE
PS1	10%	SCOTCH PINE	PINUS SYLVESTRIS	BARE ROOT (2-0/2-1) OR PLUG; 60'+ HT; PLANT 15'-25' APART; SUN-PART SHADE

LARGE EVERGREEN TREES: OCCASIONAL IN OPEN GROVES ALONG BOULEVARD AND IN LARGE PLANTING AREAS IN PARKING LOTS.
**** MIX OF SPECIES DEPENDENT ON SPECIFIC SITE CONDITIONS & PREFERENCE**

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
PI	5%	WESTERN WHITE PINE	PINUS MONTICOLA	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 20'-40' 25' APART; SUN-PART SHADE
PM	5%	DOUGLAS FIR	PSEUDOTSUGA MENZIESII	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 15' – 25' APART; SUN-PART SHADE
SS	5%	REDWOOD	SEQUOIA SEMPERVIRENS	BARE ROOT (2-0/2-1) OR PLUGS; 100'+ HT; PLANT 25' – 50' APART; PART SHADE – SHADE

FRUIT TREES AND BERRIES

DESCRIPTION: EDIBLE LANDSCAPE RELATED TO P-PATCH

FUNCTIONS: URBAN AGRICULTURE, HABITAT, FILTERED SCREEN BETWEEN P-PATCH PARKING LOT AND P-PATCHES, AESTHETICS.

FRUIT TREES AND BERRIES

ABBREV	% OF MIX	COMMON NAME	BOTANICAL NAME	INITIAL SIZE; EVENTUAL SIZE; SPACING; ENVIRONMENT
FT		FRUIT TREES CULTIVARS SUITABLE TO WESTERN WA, INCL APPLE, PEAR, CHERRY, ASIAN PEAR, ETC.		BARE ROOT OR CONTAINER; RECOMMENDED RESOURCES / SOURCES: RAINTREE NURSERY, WSU EXTENSION SERVICE
BB		BLUEBERRY VARIETIES & CULTIVARS SUITABLE TO WESTERN WA		BARE ROOT OR CONTAINER; RECOMMENDED RESOURCES / SOURCES: RAINTREE NURSERY, WSU EXTENSION SERVICE
B		BERRY VARIETIES SUITABLE TO WESTERN WA, INCL RASPBERRY, BLACKBERRY, LOGANBERRY, ETC.		BARE ROOT OR CONTAINER; RECOMMENDED RESOURCES / SOURCES: RAINTREE NURSERY, WSU EXTENSION SERVICE

Appendix C. Planting and Soil Preparation Diagrams

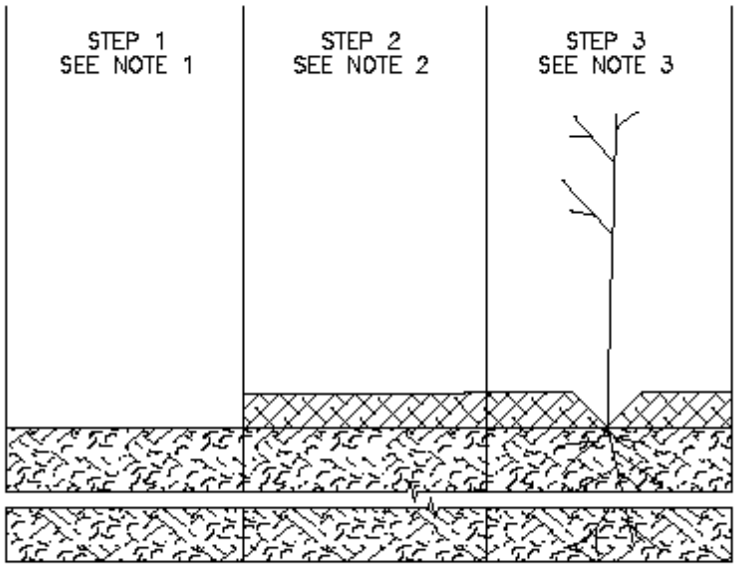
SOIL PREPARATION SEQUENCE

1. PLACE 4–5 LAYERS OF OVERLAPPING CARDBOARD TO SHEET MULCH ON TOP OF EXISTING SOIL AND/OR GRASS SPECIES (E.G. REED CANARY GRASS). SHRUBBY INVASIVES, SUCH AS HIMALAYAN BLACKBERRY, SHOULD BE MOWED DOWN AND PREFERABLY REMOVED PRIOR TO SHEET MULCHING.

2. PLACE WOOD CHIP MULCH TO 6–8 INCH MIN. DEPTH OVER CARDBOARD. INSTALL COCONUT FIBER OR JUTE MATTING ON TOP OF WOOD CHIP MULCH TO STABILIZE 2 1/2:1 OR STEEPER SLOPES.

3. AFTER 6–12 MONTHS, PLANT MULCHED AREA WITH NATIVE SPECIES. (SEE PLANTING DETAIL 3.) RESTORE WOOD CHIP MULCH TO 3–4 INCH MIN. DEPTH AFTER COMPLETION OF PLANTING. FOR RESTORING WOOD CHIP MULCH ON SLOPES 2 1/2:1 OR STEEPER, INSTALL WOOD CHIPS OVER COCONUT FIBER OR JUTE MATTING.

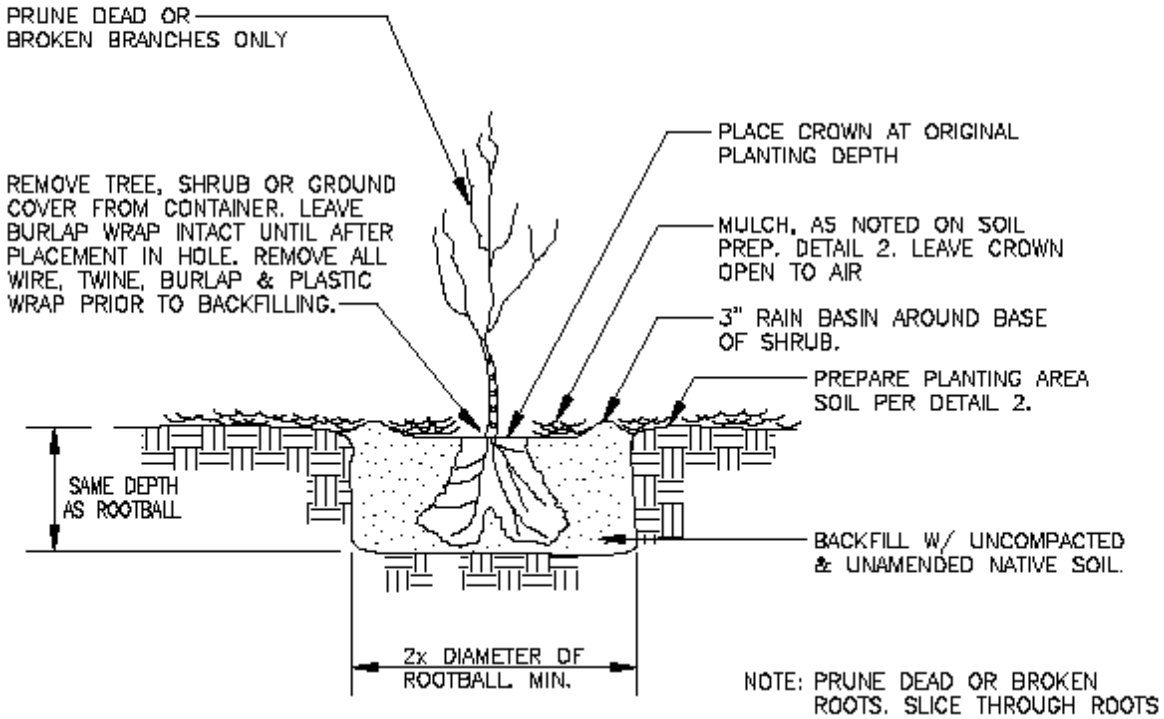
   NOTE: DO NOT INSTALL MULCH UNDER OR IN AREAS OF MOVING WATER.



(2) PLANTING AREA SOIL PREPARATION — NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

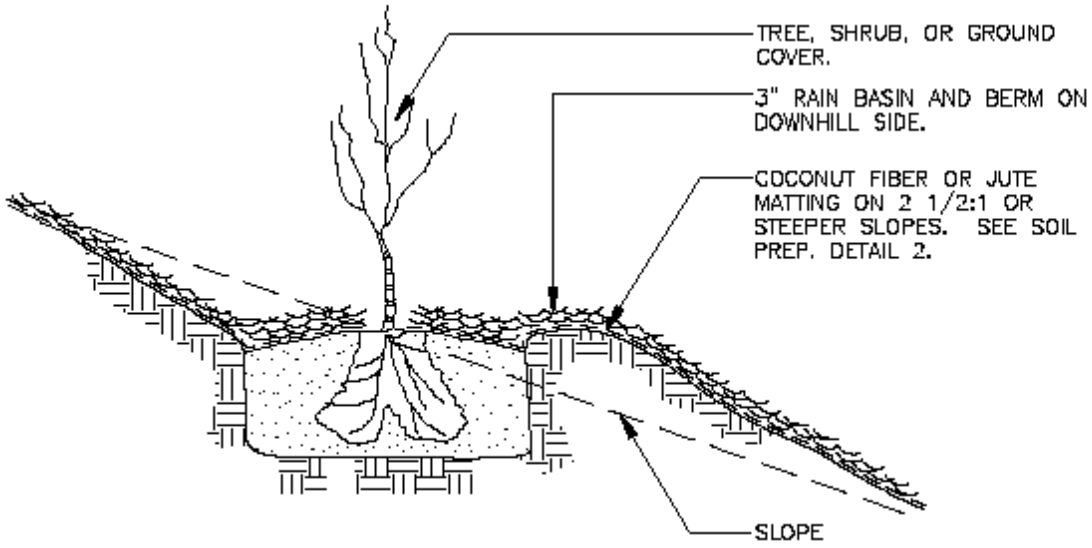


3 NATIVE TREE, SHRUB & GROUNDCOVER PLANTING

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.



SECTION

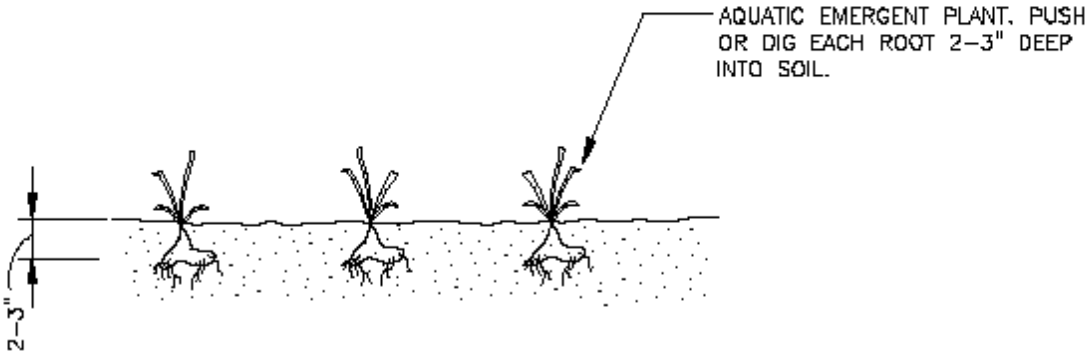
NOTE: SEE NATIVE PLANTING DETAIL 3 FOR ADDITIONAL INFORMATION.

4 SLOPE PLANTING DETAIL

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.



NOTE:
PLANT ALL AQUATIC EMERGENT PLANTS WHERE SHOWN ON TYPICAL PLANTING LAYOUT DETAIL 1, AND WHEN SOIL IS MOIST TO WET.

5 AQUATIC EMERGENT PLANTING DETAIL

NOT TO SCALE

MARYMOOR PARK TREE MASTER PLAN

GAYNOR, INC.

Appendix D. Green Parking Lot Information

Department of Planning and Development
CAM Client Assistance Memo 515
Seattle Permits
— part of a multi-departmental City of Seattle series on getting a permit

Green Parking Lots

September 30, 2005

WHO SHOULD CONSIDER GREEN PARKING LOTS?

If you're looking for a cost-effective option for meeting landscaping and water quality requirements when building or redeveloping a parking lot, consider "going green."

WHAT ARE GREEN PARKING LOTS?

Green parking lots reduce runoff that is discharged into local water bodies by using permeable paving and natural drainage landscapes.

Alone or together, these two strategies can be used to meet water quality and landscape requirements and provide credit toward flow control requirements for parking lots.

Permeable Paving

Permeable pavements include pavers, grid systems, porous asphalt and porous concrete. Pavers may be pre-cast sections or individual units that fit together. They are available in a variety of patterns and colors and can be used to enhance the project's aesthetic. Grid or lattice systems are rigid plastic forms that are filled with gravel or soil and vegetation. Porous asphalt and porous concrete are similar to conventional asphalt and concrete in structure and form except that the fines (sand and finer material) have been removed.

When installed over a drainage storage bed, these permeable pavements allow rain to infiltrate through the voids of the permeable surface. Beneath the permeable surface, runoff storage is achieved and/or infiltration occurs where soil permits. Surfaces that infiltrate 100% of the six-month storm runoff may be eligible to be removed from area calculations for water quality requirements. See attached handout for more information on different types of permeable paving.

Natural Drainage Landscapes

Natural drainage landscapes include bio-swales, rain gardens, and bioengineered planting strips that can improve water quality and reduce runoff.

Bio-swales are open, linear channels that filter stormwater as the water flows through vegetation to the discharge point. Although their width and length vary as needed to achieve function, at a minimum they are two feet wide at the bottom and have a maximum slope of 2.5:1.

Rain gardens are shallow depressions in the landscape and are designed to hold and infiltrate runoff. They are amended with bioengineered soil and vegetated with plants that are adapted to both wet and dry conditions.

Bioengineered planting strips are similar to bio-swales but they include an infiltration component. As with rain gardens, native soil below the swale is excavated and backfilled with gravel and loamy sand and planted with shrubs and groundcover.

All systems include an overflow system such as a perforated pipe or a raised overflow device to convey excess drainage to another system or discharge point. These natural drainage landscapes can help reduce the volume of runoff generated from parking lots and filter, infiltrate and store runoff for slower discharge. Existing landscape features such as planters and landscape strips can be converted to natural drainage landscapes.

HOW DO GREEN PARKING LOTS MEET REQUIREMENTS?

The green parking lot strategies described above may help meet requirements for several City codes, including:

- Seattle Municipal Code (SMC) Ch.22.800, Stormwater, Grading, and Drainage Control Code
- SMC 23.47.016, Screening and Landscape Standards
- DPD Director's Rule (DR) 26-2000, Volume 3, Flow Control Technical Requirements Manual

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- DPD DR 27-2000, Volume 4, Stormwater Treatment Technical Requirements Manual
- DPD DR 13-92, Landscape Standards for Compliance with the Land Use Code and SEPA Requirements

Stormwater Treatment Technical Requirements

Depending on the site, SMC 22.800-22.808 and DPD DR 27-2000 require new and redeveloped parking lots to meet water quality treatment requirements.

Landscaping Requirements

SMC 23.47.016 specifies landscaping requirements for parking lots. These requirements are articulated further in DPD DR 13-92.

Water Quality Treatment Requirements

Permeable paving can reduce the size of engineered stormwater treatment facilities by reducing the amount of runoff needing treatment. If designed to infiltrate the six-month storm, permeable pavement can be used to get a one-to-one impervious surface reduction credit for water quality treatment requirements.

Credit Toward Flow Control Requirements

DPD DR 26-2000 specifies how credit toward flow control requirements can be achieved.

Natural drainage landscapes may be used to meet both landscaping and water quality requirements. Parking lot areas that direct runoff to natural drainage landscapes may be eligible for water quality credit if they are sized to filter or infiltrate the six-month storm event. Permeable paving can be designed to meet water treatment requirements and provide credit toward flow control requirements. Refer to the codes and manuals listed above for design requirements.

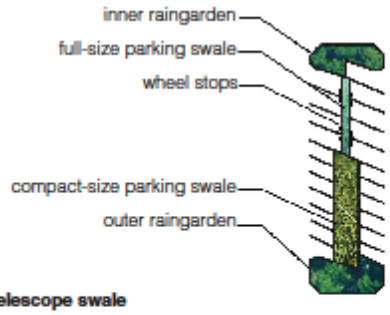
ADDITIONAL BENEFITS FROM GREEN PARKING LOTS

In addition to achieving landscaping, water quality treatment and flow control requirements, green parking lots may reduce capital costs and overall facility maintenance costs. Green parking lots also enhance the pedestrian experience for clients and customers by providing green islands in a sea of asphalt. Additional benefits include an increase in the amount of infiltration surfaces that filter and attenuate stormwater runoff flows, which can enhance the protection of nearby water bodies. The next section illustrates how these benefits can be achieved.

GREEN PARKING LOT DESIGN OPTIONS

Three innovative design options were developed for an existing 15-acre commercial parking lot to evaluate the feasibility and cost-effectiveness of green parking lots. Each of the three options uses permeable pavements and/or natural drainage landscapes. These options demonstrate that parking lots can achieve water quality treatment requirements using green strategies. Although unquantified for this project, the use of a natural drainage landscape is anticipated to reduce the total volume of stormwater from the site through some infiltration. For this case study, each green parking lot design option was compared to a conventional parking lot design that was being considered. A long-term economic analysis of the capital and maintenance costs found the green parking lot design options to be equal to or less expensive than the conventional parking lot design.

The green parking lot design options demonstrate that different combinations of porous asphalt, unit pavers, rain gardens and telescope swales can be used to meet the water quality treatment requirement. With the exception of the telescope swale, each of these elements has specific technical requirements for their design and construction that can be found in DPD DR 26-2000. The telescope swales are a strategy specifically designed to integrate into parking lots. Telescope swales are designed to have multiple sections that vary in width over the length of the swale to accommodate both compact and standard size parking spaces (see figure).



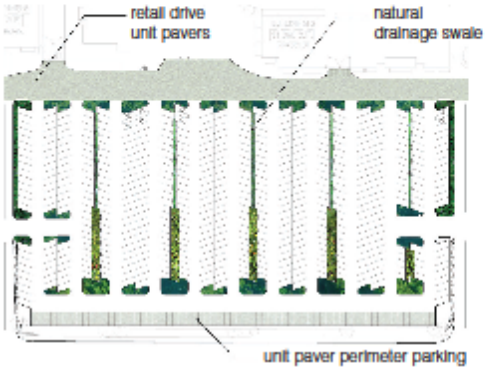
Telescope swale
Image courtesy of SvR Design Company

Option one is the conventional parking lot design to which the three green parking lot design options were compared. The conventional parking lot proposed to use detention vaults with water quality treatment filters to manage stormwater runoff.

Option two combines three strategies: telescope swales, unit pavers and porous asphalt. Telescope swales are distributed throughout the main parking lot. Unit pavers are used along the "retail drive" and in the perimeter parking spaces. Porous asphalt is proposed for the lower-use parking lot. This option enhances water quality, allows partial infiltration, attenuates very small storms, and contributes to the aesthetics of the parking lot design.

Option three also uses the telescope swales throughout the main parking lot and unit pavers along the retail drive and in the perimeter parking spaces. However, telescope swales replace the porous asphalt in the lower-use parking lot. The stormwater benefits of option three include enhanced water quality and attenuation of very small storms, but there is less infiltration than with option two.

Option four uses only telescope swales, which are used throughout the main parking lot and replace the porous asphalt in the lower-use parking lot. Catch basin filters replace the unit pavers along the perimeter of the parking lot. Since the entire permeable pavement area is replaced in this option, stormwater infiltration is less than that estimated for options two and three. Although not as effective as options two



Green parking lot design options
Image courtesy of SvR Design Company

Cost Comparison of Conventional and Green Parking Lot Designs*

	Option 1: Conventional Design w/ Water Quality Filters	Option 2: Pavers Porous Asphalt Telescoping Swales	Option 3: Pavers Telescoping Swales Water Quality Filters	Option 4: Telescoping Swales Water Quality Filters
Total Capital Costs ($ Mil.)	$6.60	$6.37	$6.10	$5.73
Maintenance Costs ($/yr.)				
Sweeping**	$35,040	$35,040	$35,040	$35,040
Landscaping	$20,000	$24,000	$24,000	$24,000
Water Quality	$14,000	$ 2,000	$ 4,000	$ 6,000
Total	$69,040	$61,040	$63,040	$65,040

*planning level estimates

**The Low Impact Development Technical Guidance Manual for Puget Sound recommends maintaining permeable pavements with high-efficiency or vacuum sweeping twice per year. Preferably, sweeping would occur once in the autumn after leaf fall, and again in early spring. For porous asphalt, high pressure hosing should follow sweeping once per year. The standard maintenance procedures for this commercial parking lot include vacuum sweeping, therefore the use of permeable pavement did not add an additional vacuum sweeping cost.

and three, this option is anticipated to enhance water quality and increase infiltration when compared to standard technologies.

The estimated total capital costs of construction for the green parking lot design options are less than the conventional parking lot design option. Additionally, the estimated maintenance costs for the green parking lot design options are less than the maintenance costs for the conventional parking lot design. Replacement of the water quality filters for the conventional parking lot design option is estimated at $14,000 per year. The estimated maintenance costs for the green parking lot design options are estimated to be $2,000-$6,000 when water quality filters are replaced with telescope swales.

GREEN PARKING LOT DESIGN CONSIDERATIONS

What is the native soil infiltration rate?

Since infiltration is one function of green parking lots, understanding the infiltration rate will help determine which strategies are appropriate and how they need to be designed. Greater infiltration rates can reduce the size and the cost of the facilities. Keep in mind that the low infiltration rates found in Seattle's typical glacial till soils can be significant enough to provide water quality benefit. Rates greater than or equal to 0.5 inch/hour are acceptable for designing an infiltration facility. See DPD DR 26-2000 for guidance on determining soil infiltration rates.

If the 0.5 inch/hour infiltration rate threshold is not achieved, please see DPD DR 26-2000 for additional flow control design guidance.

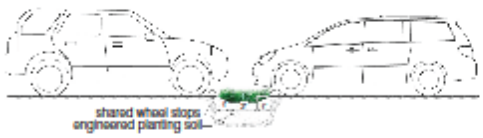
What is the minimum number of parking spaces required?

In addition to stormwater and landscaping requirements, there may be minimum requirements for the number and size of parking spaces. The dimensions and shape of natural drainage landscapes can be modified to fit adjacent to parking spaces.

Consider directing drainage flows to natural drainage landscapes along the perimeter, to swales between parking rows, and to rain gardens at the end of parking bays. Swales can be designed to accommodate the number and size of parking spaces desired.

Can wheel stops or curbs with curb cuts be positioned to allow vehicle bumpers to overhang natural drainage landscapes to economize space?

Yes. The image below illustrates this feature.



Full size swale
Image courtesy of SvR Design Company

Can compact spaces be located adjacent to larger natural drainage landscapes?

Yes. The image below illustrates this feature.

Compact size swale
Image courtesy of SvR Design Company

How much space is available for green parking lot strategies and what is the minimum dimension for the natural drainage landscape?

Each strategy should be sized to filter or infiltrate the six-month storm from the adjacent drainage area.

FIVE STEPS TOWARD A GREEN PARKING LOT

1. Determine native soil infiltration rate.
2. Determine the direction of stormwater flow and where it needs to be collected.
3. Determine opportunities for incorporating permeable pavement and natural drainage landscapes.

- Calculate the drainage area being directed to each natural drainage landscape area. Try to distribute flows to multiple landscaped areas.
- Incorporate permeable pavement in areas where appropriate, especially in over-flow parking areas,

fire lanes and other lower use areas. Determine impervious surface reduction credits and adjust the total area required for flow control and stormwater treatment. This can significantly reduce additional facility needs.

4. Determine the required dimensions for natural drainage landscape areas and ensure that the receiving area is sufficient and practical.

- For sizing bio-swales, refer to the continuous inflow biofiltration swale sizing method in DPD DR 27-2000. For calculating size, width can be the average width of the swale area. The following modifications to the standard biofiltration swale sizing can be made: Flow rate can be modified to account for water infiltrated into the native soil; and vegetation type can be substituted with native plantings with non-woody, high stem density. If vegetation used is over 18 inches high, the maximum water quality treatment depth can be increased to 6 inches.
- For sizing rain gardens and bioengineered planters, refer to the sand filter sizing method in DPD DR 27-2000. Maximum depth of surface ponding is 10 inches. Soil used in rain gardens should meet City of Seattle Specification 09-14.1(3)C, Bioretention Soil Type 2, and should be modeled using a hydraulic conductivity of 1 inch/hour maximum in areas not anticipated to have pedestrian traffic through the rain garden, and 0.5 inch/hour maximum in areas that do anticipate pedestrian traffic.

5. Identify location of overflow structure and where the structure is to be connected to the storm sewer.

One or more green parking lot strategies can provide multiple benefits. A green parking lot can prevent pollution at the source, remove pollutants before runoff is discharged, control discharge rates of stormwater runoff, and provide a pleasant experience for clients and customers. Green parking lots may save capital and maintenance costs and will enhance creek protection. For your next parking lot project, consider the benefits of a green parking lot.

Access to Information

Links to electronic versions of DPD **Client Assistance Memos (CAMs)** and **Director's Rules** are available on the "Publications" page of our website at **www.seattle.gov/dpd/publications**. Paper copies of these documents, as well as additional regulations mentioned in this CAM, are available from our Public Resource Center, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, (206) 684-8467.

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WHAT ARE PERMEABLE PAVEMENTS?

Permeable pavements are surfaces that allow water to pass through voids in the paving material and/or between paving units while providing a stable, load-bearing surface. An important component to permeable pavements is the reservoir base course, which provides stability for load-bearing surfaces and underground storage for runoff.

What are the benefits of using permeable pavements?

Permeable pavements reduce impervious surfaces and can be used to achieve City of Seattle water quality requirements and credit toward flow control requirements. The capital and maintenance costs of permeable pavements can be less than conventional pavement materials if stormwater detention and/or water quality treatment is required.

What permeable pavements meet the City of Seattle standards?

When properly designed, porous concrete, porous asphalt, plastic grid systems and interlocking pavers meet the City of Seattle standards for pedestrian and/or vehicular use. A comparison of porous concrete, porous asphalt, plastic grid systems and interlocking pavers is presented in Table 1 (see reverse side).

What are some general design standards for permeable pavements?

- Use surface material that allows infiltration.
- Place a minimum 6-inch depth of aggregate base/storage bed below the permeable pavement surface.
- Provide positive drainage from the permeable surface (slope surface at 1% to 2%).
- Provide surface conveyance system as if material was impervious. Drain stormwater to a designed discharge point.
- Evaluate the need of perforated overflow pipe with project engineer or geotechnical engineer.
- Provide cleanouts when a perforated pipe is installed.

What are some general limitations of permeable pavements?

- Achieve a 2% slope or flatter. The maximum slope for any permeable pavement is 5%.
- Locate permeable pavements 300 feet away from steep slopes.
- Avoid use at high-use sites, commercial services for autos, i.e., gas stations, auto repair, auto wash, commercial truck parking areas, heavy industrial activity areas and areas with high pesticide use.
- Avoid use where seasonal high groundwater is at or near ground surface.
- Avoid use in areas subject to heavy, routine sanding for traction during snow and ice accumulation.
- Separate permeable pavements from arterial streets with a minimum 5-foot width-planting strip.
- Eliminate or minimize sediment from adjacent areas onto the permeable surface.
- Maintain a minimum 5-foot setback between any part of the permeable paving and any structure or property line.
- Avoid run-on from adjacent surfaces. If runoff comes from minor or incidental pervious areas, those areas must be fully stabilized.
- Avoid use on USDA Type D soil, or soils with a design infiltration rate of less than 0.5 inch per hour, unless a professional engineer submits design.
- Surface material cannot be treated with top-coat or slurry seal as this will clog the pores.

See Table 1. Permeable Paving Materials on reverse side.

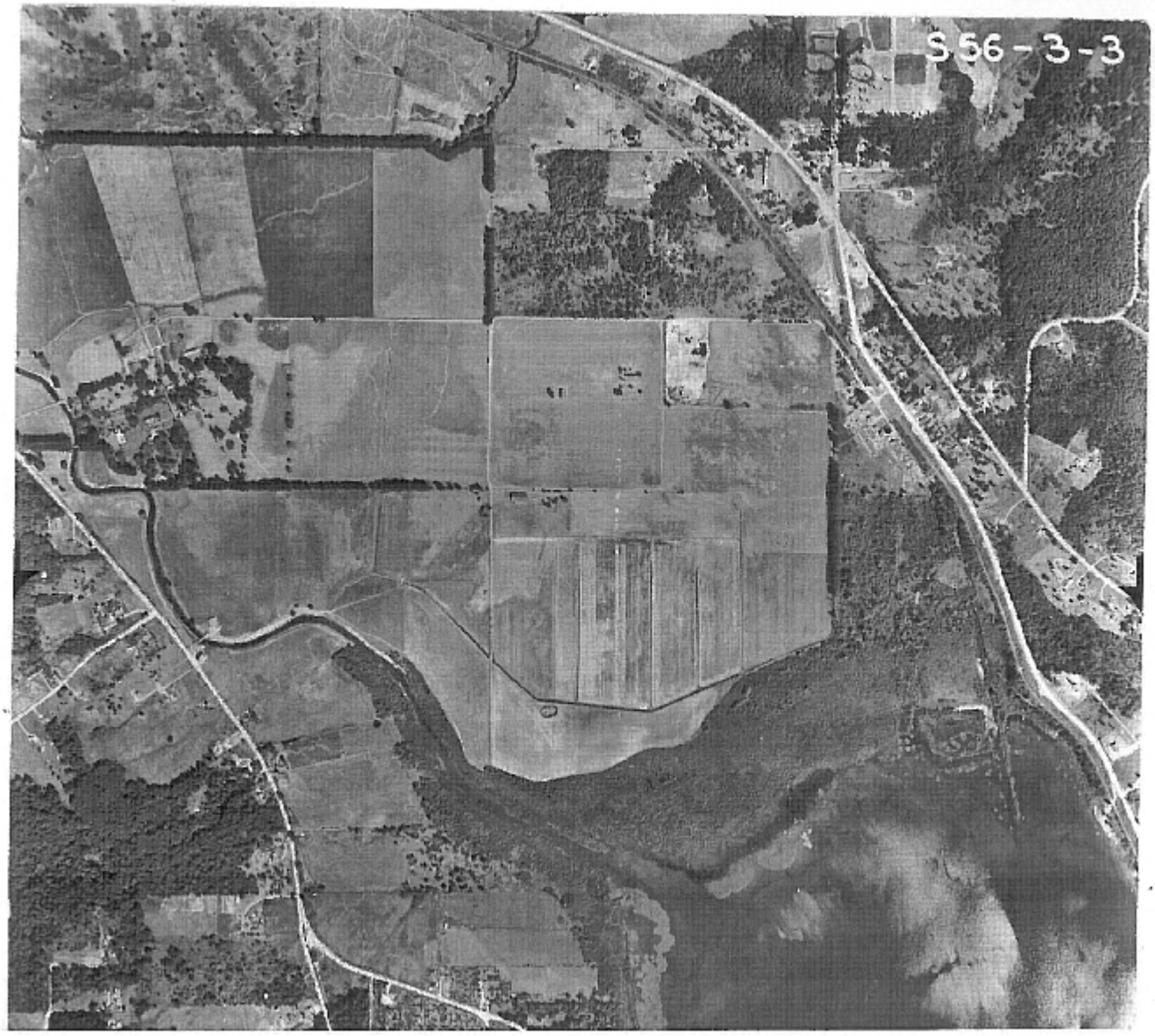
Table 1. Permeable Paving Materials

Permeable Paving	Description/Design Considerations	Limitations	Maintenance	Cost[1]
Porous Concrete  *Image ©2020 Engineering*	Porous Concrete is similar to standard pavement in aesthetics and load-bearing capacity, but the fine material (sand and finer) has been reduced or eliminated in the mix. As a result, channels form between the aggregate in the pavement surface to allow water to infiltrate. Acceptable porous concrete materials have a minimum of 15% voids and a minimum design infiltration rate of 200 inches/hour. Properly installed and maintained porous concrete is expected to have a service life that is longer than conventional asphalt, but shorter than conventional concrete.	■ Application must be large enough to be cost effective for supplier to mix material. ■ System must be designed with an overflow or lateral release from the storage bed.	■ Annual vacuum sweeping or high pressure hosing required to maintain function.	$3 to $5 per square foot. Costs are comparable to conventional concrete.
Porous Asphalt  *Image courtesy Cahill & Associates*	Porous Asphalt looks like conventional asphalt and it provides a load-bearing surface for low-traffic areas and pedestrians. The elimination of fines and the mix of stone aggregate and asphalt binder results in voids that allow water to infiltrate. Acceptable porous asphalt materials have a minimum of 15% voids and a minimum design infiltration rate of 200 inches/hour. Properly installed and maintained porous asphalt has a service life that is comparable or longer than conventional asphalt.	■ Application must be large enough to be cost effective for supplier to mix material. ■ System must be designed with an overflow or lateral release from the storage bed.	■ Annual vacuum sweeping or high pressure hosing required to maintain function.	Approximately $1 per square foot. Application needs to be minimum size due to manufacturing requirements.
Grid/Lattice Systems Image  *Image courtesy Invisible Structures, Inc.*	Plastic Grid Systems are rigid, plastic cells that are filled with gravel or soil and grass. The cells allow water to infiltrate. The grid sections interlock and are pinned in place. Acceptable grid/lattice systems (filled with soil or sand medium) materials have a design infiltration rate of 10 inches/hour. Properly installed and maintained, plastic lattice systems have an expected service life of approximately 20 years.	■ Typical uses include alleys, driveways, utility access, loading areas, trails, and parking lots with relatively low traffic speeds (15-20 mph maximum).	Vegetated Systems: ■ May need occasional reseeding ■ Requires mowing and irrigation. Non-Vegetated Systems: ■ May need occasional refilling of crushed rock or gravel.	$3 to $4 per square foot.
Interlocking Pavers  *Image courtesy City of Seattle—Thor Peterson*	Interlocking Pavers are cast-in-place systems or modular pre-cast blocks that have wide joints or openings that are filled with gravel or soil and grass. They are available in a variety of materials, colors, and shapes. Acceptable interlocking pavers have a minimuim of 12% open space, and a minimum design infiltration rate of 10 inches/hour (when filled with soil or sand medium).	■ System must be designed with an overflow or lateral release from the storage bed.	■ Periodically add joint material (sand) to replace material that has been moved/worn by traffic or weather. ■ Easy to repair, since units are easily lifted and reset.	Approximately $2.50 to $4.50 per square foot.

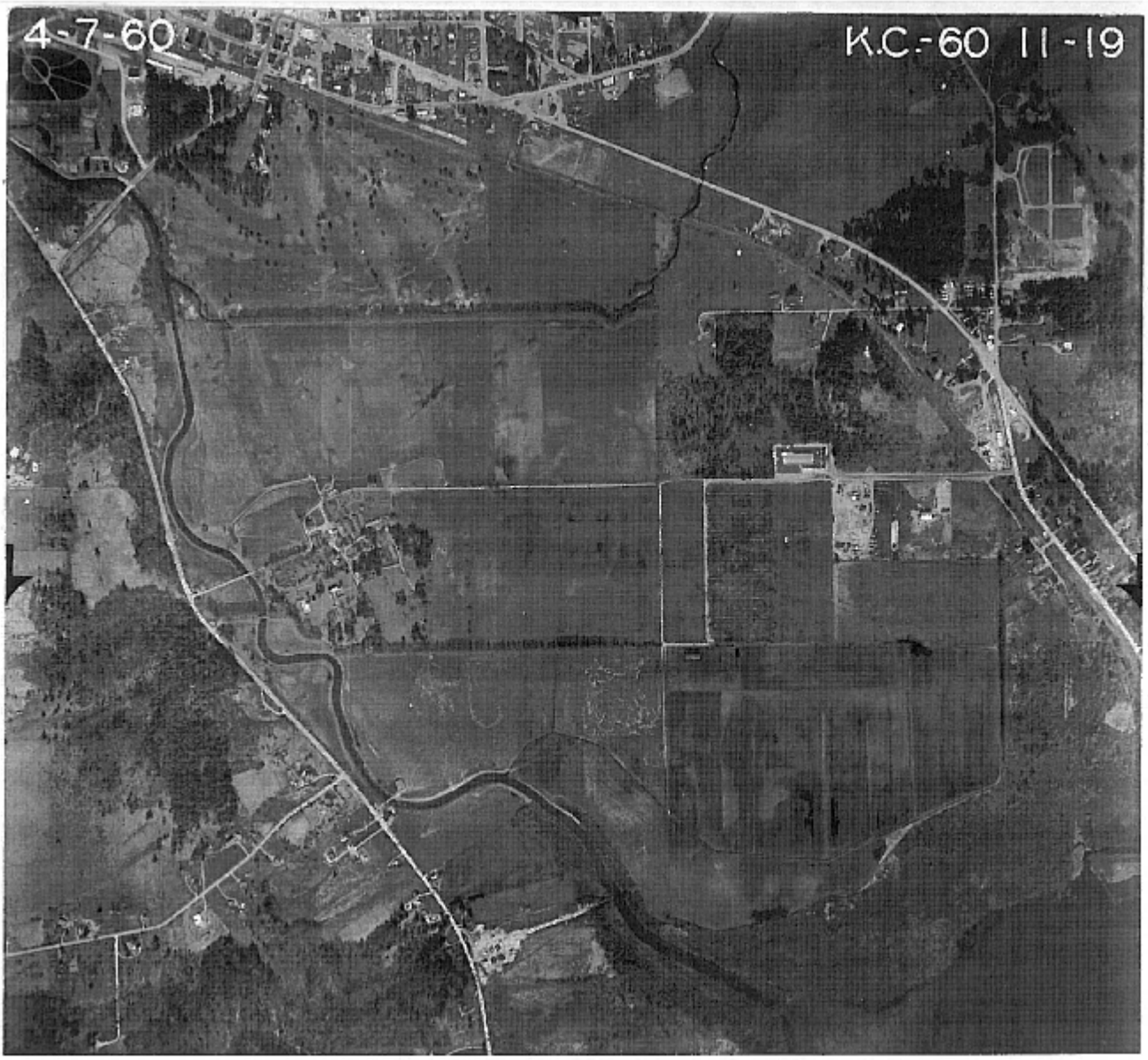
[1] Cost for aggregate base/storage bed varies with depth and are not included in cost estimate. Costs and the majority of the design guidance in this document has been obtained from the Puget Sound Low Impact Design Manual; see **www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm** for full document.

Appendix E. Aerial photos of Marymoor Park from 1936-2004

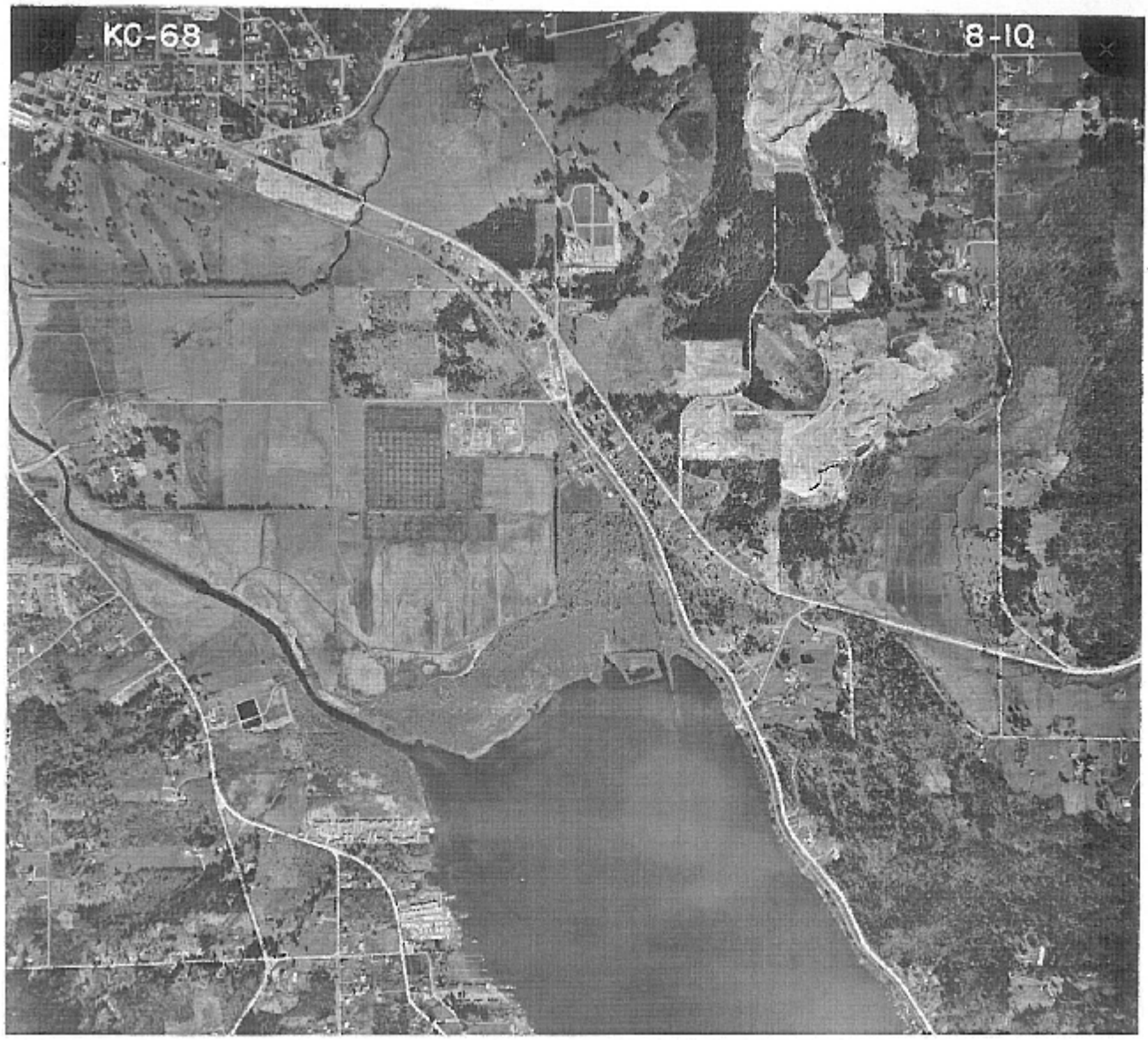
1936



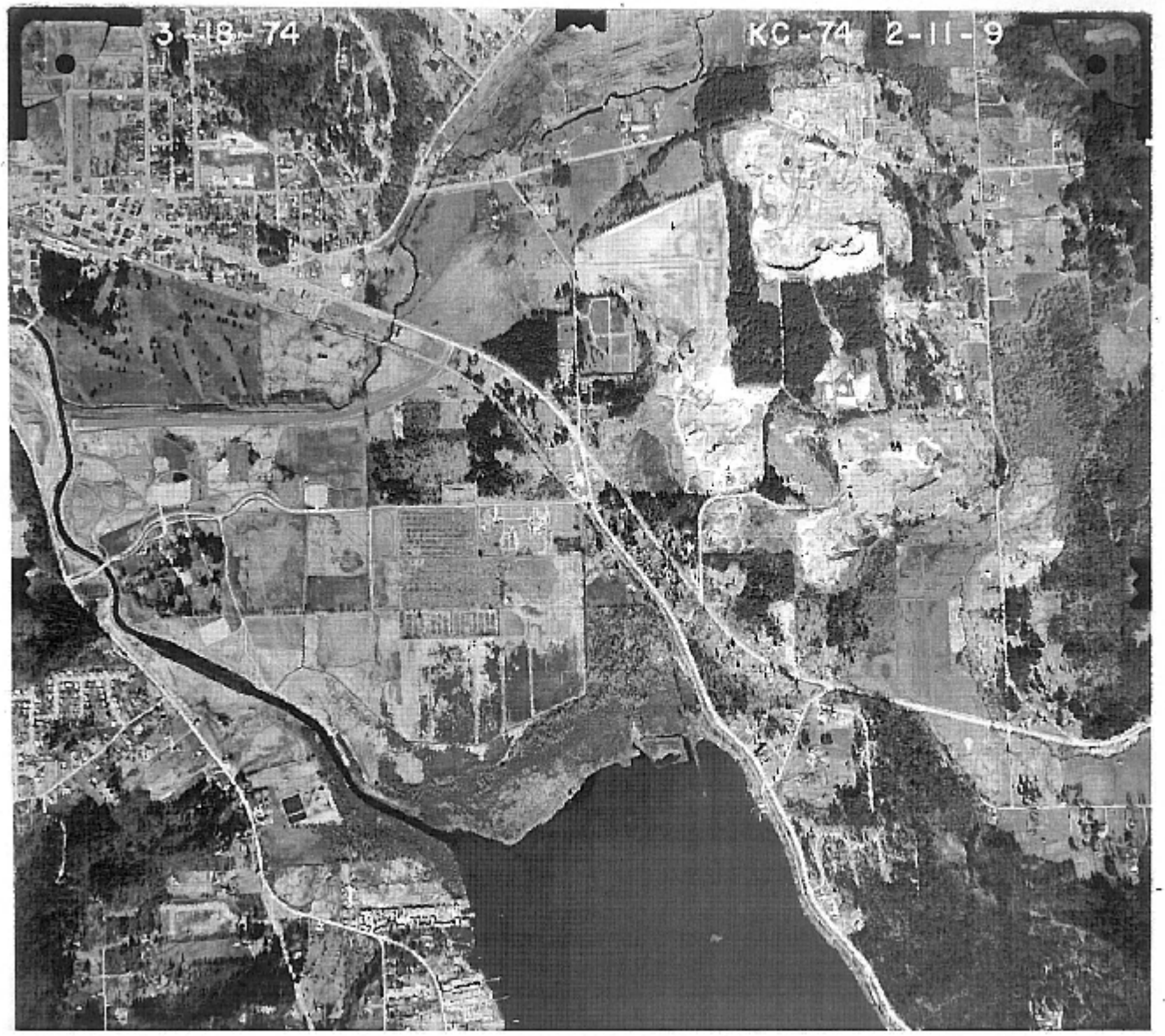
1956



1960



1968



1974

1980

2004