Pioneer Park Forest Management Plan

Adopted
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Mercer Island Open Space Conservancy Trust
&
City of Mercer Island Parks and Recreation Department

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1. Introduction

Pioneer Park is a 113-acre park consisting of three 38-acre blocks of second-growth western-hemlock forest situated on the south-central spine of Mercer Island. The park represents the largest relatively unfragmented forest habitat remaining on the island, providing a range of ecosystem services and benefits including recreation, water retention and slowing storm water runoff, improving air quality, temperature buffering, wildlife and aquatic habitat. Pioneer Park provides nesting or foraging habitat for at least 74 avian species, including bald eagles and pileated woodpeckers. The park is home to over a dozen mammalian species, including little brown bats, the uncommon Douglas squirrel, mountain beavers, shrews, voles, and raccoons. The park provides a range of dry and wet habitats supporting an unknown number of invertebrate species. The park's forest soils nurture at least 38 species of mushrooms.

Riparian areas provide habitat for a greater number of wildlife species than any other habitat type. These areas serve as travel connectors between habitat types and provide food cover, microclimates and edge effects at adjacent forest margins. In Pioneer Park, the wetlands and ravine in the Northeast Quadrant are noteworthy for their diverse microhabitats, which attract a wide variety of wildlife species, including invertebrates, amphibians, reptiles, mammals and birds.

The matrix of trees, shrubs, soil, water, and wildlife in Pioneer Park comprise an unparalleled resource for the residents of Mercer Island. In the park, an island resident can find quiet, solitude and a world far different from urban existence. Here, too, once common plants and animals find an ideal place to live near a major urban center.

However, if left unmanaged, the forest in Pioneer Park will likely deteriorate. Laminated root rot is killing Douglas fir trees, while age is claiming many alders and maples. As these trees die, they leave “gaps” in the tree canopy of the park. In a wilderness setting, new trees would grow up in these gaps and restore “closed” canopy. However, invasive, non-native plants, notably ivy, holly and blackberry, are widespread in Pioneer Park and often take over wherever trees are dying. They prevent the regrowth or “regeneration” of canopy trees.

Left unmanaged, the forest canopy would become increasingly fragmented, and the ground would become a patchwork of invasive brambles and vine-choked trees. This fate can be seen in other public open spaces (the Queen Anne and Duwamish greenbelts in Seattle are examples). Not only would this affect the public’s enjoyment of the park, but it would also impact wildlife that relies on forest cover. The loss of canopy would increase the amount and rate of surface water flowing into Lake Washington.

The forest must also be managed if the park is to benefit the public. Park users and adjacent properties must be protected from undue risk of tree failure. Moreover, an uncontrolled fire could devastate the forest and neighboring homes. More commonly, however, it is humans that injure the forest by trampling vegetation, piling yard waste

around trees or harvesting greenery. Rarely are these activities malicious, nor is any one incident significant, but taken together they noticeably impact the health of the park.

This plan is intended to provide sensitive and efficient direction for management and intervention within Pioneer Park that will maintain the native forest ecosystem, protect public safety and enhance positive uses of the park over the long-term.

2. Plan Goals

The Open Space Conservancy Trust (the Trust) was established by an ordinance of the City of Mercer Island (the City) in 1992. The purpose of the Trust, according to the ordinance, is: to receive and hold open space properties in perpetuity, to protect, maintain and preserve these properties, and to insure that the development and use of the properties are consistent and compatible with the purposes of the Trust. The ordinance defines an open space property as a property with potential natural or scenic resources that has been reserved by Mercer Island City Council (Council) for passive and low impact forms of use, such as walking, jogging and picnicking. In 2003, the Trust adopted the following mission statement:

> *The Mercer Island Open Space Conservancy Trust is a board of citizen volunteers appointed by the City Council to oversee open space properties placed in the Trust as passive, low-impact recreational open space. The Trust manages these properties to protect, maintain and preserve them as natural, scenic and recreational resources, maintaining all their ecological, scenic, aesthetic, scientific, and educational attributes for the current and future residents of Mercer Island.*

In 1994, Council approved the document called ***Policies for Protecting, Maintaining and Preserving Mercer Island Open Space Conservancy Trust Properties***. That document provided direction for managing the park, including an extensive section called *Pioneer Park Site Management Plan*. It has been the guiding document for forest management in Pioneer Park. This new plan retains, restates and expands upon the goals and objectives outlined in that document.

The Trust board has expanded on the goals for forest management in Pioneer Park. The Board reviewed the assumptions that would underlie any plan (See Appendix A). It looked at alternative management scenarios for the park (see Section 7 and Appendix B). It considered how criteria for a sustainable urban forest should be applied to this park (see Appendix C). The goals below summarize the results that this plan will have on the long-term condition of the forest.

1. Pioneer Park will remain a healthy, sustainable native forest.
2. The soils of the park are the foundation for all life in the park. Therefore, they will be preserved, along with the living organisms and soil-building processes found there.

3. The forest will consist of plant species native to the Puget Sound basin. Plants native to the coastal northwest, but not endemic to the Puget Sound basin may be used, limited to sites where locally native species cannot perform a landscape function necessary for forest management.
4. Natural regeneration will be the primary mechanism for managing the forest vegetation, since this achieves ecological restoration with lower levels of input and disturbance. Plantings will be used where native regeneration is not sufficient to achieve plan goals.
5. Diversity of structure and composition will be managed. Too much or too little diversity impacts habitat, aesthetics, pest control, and management efficacy. Activities that increase diversity should not introduce excessive randomness to the forest composition.
6. Habitat will be preserved and enhanced to maintain the park's populations of native animals, including, but not limited to mammals, birds, reptiles and invertebrates.
7. The riparian environments within the park will be managed as in Goal 6 and also avoid adverse impact to aquatic habitat downstream from the park.
8. Invasive non-native plants will be controlled to achieve plan goals.
9. Park vegetation will not pose an unreasonable hazard to park users, adjacent streets or neighboring properties.
10. The vegetation in the park will be managed to enhance park users' passive enjoyment of a native forest setting.
11. Members of the Mercer Island community find ways to actively participate in restoration projects under the leadership of the Open Space Conservancy Trust.
12. The City of Mercer Island will manage the forest under the leadership of the Open Space Conservancy Trust.

See Appendix C for a more detailed exploration of these goals.

3. Location

Pioneer Park is located at the south end of Mercer Island in King County, Washington. It is comprised of the northeast quarter, northwest quarter and the southeast quarter of Section 30, Township 24 North, Range 5 East. The three quadrants meet at the intersection of Island Crest Way and SE 68th Street. Parking is available south of this intersection on the east side of the Island Crest Way, to the east of this intersection on the north side of SE 68th Street, and on the east side of 84th Avenue SE.

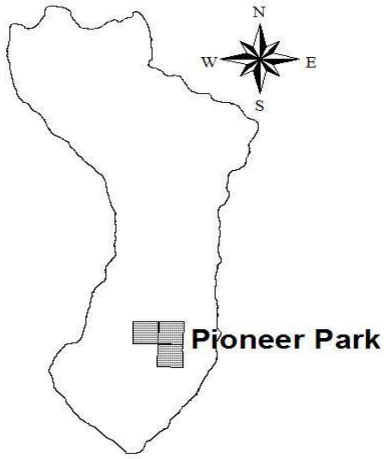


Figure 3.1: Location of Pioneer Park

4. Background

A comprehensive history of Pioneer Park can be found in the ***Pioneer Park Master Plan***, adopted in 2001. The definitive natural history of the park is contained in ***Pioneer Park: a natural history***, first published in 1972 and revised in 1990 (See Appendix I). This section will not duplicate those works, but will instead outline other information relevant to forest management in the park.

The Mercer Island City Council chartered the OSCT to protect, maintain and preserve Pioneer Park in a manner that will "maintain or enhance the present or potential conservation of natural or scenic resources of Mercer Island with the intent that any future use of the property be limited to passive and low impact forms of use such as walking, jogging or picnicking." All improvements to and uses of Pioneer Park "shall not change its character or impair any of its ecological, scenic, aesthetic or natural attributes." According to its bylaws, the Open Space Conservancy Trust's objectives and purposes include:

- To maintain, protect, and preserve properties placed by the City Council in the Mercer Island Open Space Conservancy Trust.

- To develop, evaluate, and promote policies to further the preservation and protection of these open space properties for the public use and enjoyment and for their environmental, aesthetic, scientific, and educational use.

In 1994, the Mercer Island City Council approved ***Policies for Protecting, Maintaining and Preserving Mercer Island Open Space Conservancy Trust Properties***. Subsequently, the Trust commissioned two studies of the park, one concerning invasive plants (Appendix D) and another concerning root rot in Douglas fir (Appendix E). In 2002, a survey of the park boundary was conducted to identify boundary trees and encroachments. Also in 2002, Sheldon and Associates completed a biological assessment of the riparian habitat in the ravine (Appendix F).

The Trust and the City have undertaken several restoration projects in the park. In 1997, a portion of the ravine overlook area was revegetated. Also in 1997, previously topped trees under the utility lines along SE 68th Street were removed and replaced by lower growing trees and shrubs. Starting in 1998, selected areas of root rot in the northeast and southeast quadrants were replanted. Large areas of invasive, non-native plants were removed and additional plantings were installed in 1999, 2000 and 2001. These plantings were maintained through the fall of 2002 by controlling the regrowth of the invasive plants competing with the plantings. Summaries of these projects can be found in Appendix G.

5. Inventory

5.1. Soils

Soils are the foundation of the park. Understanding soils and soil fertility is preliminary to all other plan items. The soils of Mercer Island are derived from material deposited by the Vashon glacier approximately 10,000 to 12,000 years ago. They are relatively young soils, coarse in texture and low in native fertility. According to the ***Soil Survey of King County***, there are three types of soils in Pioneer Park predominantly formed from glacial sand and gravel. In some areas, there is compacted glacial till near the surface that impedes drainage and causes local seasonal wetness. However, the most significant characteristic of the park's soils for forest management is their dryness during the growing season.

In the ravine, soil development is influenced by erosion and landslides. Upper ravine soils are thinner, while lower ravine soils have developed from accumulated colluvium that has worked its way down the slope. Local hydrology brings water to the surface in some areas, creating wetland soils along the stream corridor. In some sections, the stream channel contacts a compacted silt stratum commonly called "blue clay". This is a layer that is impermeable to groundwater flow and is sometimes implicated in landslide activity. Further discussion of soils in Pioneer Park can be found in ***Pioneer Park: a natural history***. See Appendix I for this comprehensive description of the natural resources of the park.

Colluvium: *soil that has collected on a slope by natural erosion and weathering.*

5.2. Overstory

Overstory of the park (vegetation at least 15' tall) was surveyed using a combination of digital aerial imagery, Light Distancing and Ranging (LIDAR) data and ground observation. Based on this analysis, the park contains 32 acres of conifer forest, 45 acres of broadleaf forest, and 40 acres of mixed broadleaf-conifer forest. Predominant species are alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), Douglas fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*).

LIDAR analysis shows that only about two thirds of the park is under closed canopy. The other third is split evenly between areas

How does LIDAR work?
An airplane flies over an area, directing a laser at the ground. The light bounces off layers of vegetation and returns to the plane. An instrument in the plane measures the time it takes for the light to return. From this, a computer calculates the distance from the plane to the object. The difference between the first "return" and the last "return" measures the height of the vegetation canopy.

with no canopy ("canopy gaps") and areas with fragmented tree canopy. The quadrant with the least canopy is the Northwest quadrant, and the quadrant with the most canopy is the Southeast quadrant. Table 5.1 gives a summary of these conditions. See Appendix H for more details of this analysis.

The structure of the forest (height of the canopy, canopy layering, canopy openings, grouping and dispersion of plant populations) indicates the integrity and habitat function of a forest. A forest typically becomes more complex in structure as it matures. Early successional forests typically have lower canopy, fewer canopy layers, and large patches of single species of plants. Over time, the trees grow taller and are more varied in height. As trees die, more sunlight reaches the forest floor, encouraging the growth of sapling trees. The dead standing trees ("snags") become habitat to over 100 vertebrate species. The canopy gaps that result also provide "edge" habitat. Eventually, stands of trees become more mixed in species composition and ground layer vegetation becomes more diverse as well.

	Northwest	**Northeast**	**Southeast**
Canopy Gap	20%	16%	13%
Fragmented Canopy	14.5%	18%	16%
Closed Canopy	65.5%	66%	71%

Table 5.1: Percentage of each quadrant containing tree canopy condition

Pioneer Park is developing structural diversity as it matures. The tree canopy is becoming more layered as tree age becomes more staggered. Many areas of the park have sapling trees regenerating in the understory. Openings in the tree canopy accelerate their growth. Gaps and fragmented canopy provide additional opportunities for new vegetation to establish. They are a natural part of forest succession. However, they need to be managed, given the presence of invasive, non-native species (see below).

5.3. Edges and "edge effects"

Most of the park is considered "edge" forest. This refers to the microclimatic difference between the conditions found at the edge of the forest and those found in the interior. Edges of forests have higher light levels, lower humidity, higher wind speeds, greater temperature fluctuations, and greater movement of wildlife. Edges are inherently less stable, more dynamic parts of the forest. This, combined with the surrounding urban environment, has made this forest susceptible to loss of "interior" forest conditions, the kind of conditions that we see in "old-growth" forests.

Scientists at the University of Washington have found that "edge effects" extend from the edge of the forest inward for a distance equal to three times the height of the canopy. Assuming an average canopy height of 100 feet, seventy percent of the area of Pioneer Park is "edge" forest.

Management activities can only partially mitigate "edge effects". Denser plantings along edges are one such mitigation. Periodic removal of sun-loving plants to favor shade-loving natives is another. However, these are only partial solutions. Therefore, a goal to develop "old-growth" forest character in most of Pioneer Park is probably not realistic. Nevertheless, increasing the complexity of forest structure and composition is a reasonable goal and "interior" forest character can be achieved in the middle of the park quadrants.

5.4. Tree Diseases

In 1999, Robert Edmonds, Ph.D. was commissioned to prepare the ***Management Plan for Tree Diseases in Pioneer Park*** (Appendix E). A number of tree diseases were identified on the site, the most significant of these being laminated root rot which affects Douglas fir trees. This is an endemic disease that travels from tree to tree by root grafts. The study includes an aerial map of areas most affected by laminated root rot, indicating that there are pockets of diseased firs in each quadrant of the park. The aerial survey conducted in Dr. Edmonds' study did detect affected trees, confirmed by ground survey. However, it did not identify all affected trees in the park, nor did it claim to. The Park Arborist has observed other trees infected with laminated root rot that were not detected by the aerial survey. It is reasonable to expect that every Douglas fir tree in Pioneer Park is vulnerable to laminated root rot because of its widespread presence. Hemlock and grand fir trees are also susceptible to this disease. Cedar is known to be resistant to the disease.

5.5. Understory

The understory vegetation (shrubs less than 15 feet tall) in Pioneer Park greatly influences both the character (for humans) and the habitat (for wildlife) of the park. The greatest threat to both comes from the introduction of invasive, non-native plant species. These species can be observed in every area of the park. The most widespread is English ivy (*Hedera helix*). It smothers ground layer vegetation and ultimately carpets the entire forest floor. It has been listed as a Class C noxious weed by the Washington State Noxious Weed Control Board. Along with ivy, holly (*Ilex aquifolium*) and laurel (*Prunus laurocerasus*) are becoming established in the understory of Pioneer Park. Meanwhile, blackberry (*Rubus discolor*) is becoming dominant along edges of the quadrants, in gaps, and wherever light levels are higher than in the forest interior.

Native understory vegetation is alive and well, however. In the upland of Pioneer Park, it is remarkably homogeneous. Common species such as sword fern, elderberry, hazel, Indian plum, trailing blackberry, salal and Oregon grape are dominant wherever invasive, non-native species are not established. The ravine contains stands of salmonberry, elderberry, and devil's club in wet soils, with sword fern carpeting drier slopes. Notably, occasional patches of vanilla leaf (*Achlys triphylla*) trillium (*Trillium ovatum*) and wild ginger (*Asarum caudatum*) are found sporadically throughout the park. These species have become rare in urban forests, but can still be found where taller shrubs or ivy have not crowded them out.

In 1996, Sarah Reichard, Ph.D. prepared the ***Pioneer Park Invasive Plant Report and Recommendations*** (Appendix D) in which she identified four non-native species of concern in the park: English ivy, herb Robert, Himalayan blackberry and English holly. In other parts of Mercer Island and around the Seattle area, additional species such as laurel (*Prunus laurocerasus*), wild clematis (*Clematis vitalba*), garlic mustard (*Alliaria petiolata*), periwinkle (*Vinca minor*), Norway maple (*Acer platanoides*), and Japanese knotweed (*Polygonum cuspidatum*) have become prevalent and may become a problem for Pioneer Park in the future.

The 2008 Forest Health Survey (Appendix R) of Pioneer Park showed that native understory is well established. However, the survey found several startling conditions that had been previously undocumented. First, tree regeneration was lacking in the park. Native conifer regeneration was found to average 24 stems per acre across the park. This was not sufficient to replace the canopy losses anticipated from attrition and laminated root rot. Furthermore, the Trustees consulted with Mike Nystrom from Washington State Department of Natural Resources. He stated that the dense shrub stands that develop in canopy gaps may take 100-200 years to produce new overstory trees absent management intervention.

Second, the excessive presence of regenerating holly trees was considered a great threat to native regeneration. Holly was found to average around 900 stems per acre across the park. Left unchecked, large areas of the park would become holly forests over time. Third, ivy was found to be growing up 20% of the overstory trees, potentially compromising the existing overstory's integrity.

5.6. Riparian Resources

The ravine area in the northeast corner of Pioneer Park includes seeps, upland swales and the headwaters of a perennial creek that drains to Lake Washington. This riparian area is unique within the park, offering a mosaic of diverse microhabitats characterized by hillside slope wetlands, dense forested canopy cover, and open canopy areas. A fuller assessment of Pioneer Park's Ravine Habitat is included in Appendix F.

The ravine's wetland and stream habitat in Pioneer Park attracts and supports a wide variety of wildlife species, including invertebrates, amphibians, reptiles, mammals and birds. Maintenance of riparian vegetation has been identified as a forest management policy because of its overall importance to the forest ecosystem. Riparian vegetation contributes twigs, leaves and other fine litter that are a critical component of the aquatic food base. Riparian vegetation moderates stream temperatures and root systems stabilize channel banks.

The vegetation of Pioneer Park's riparian plant community embraces a variety of species including red alder, bigleaf maple, western red cedar and others. Understory plants include native and non-native species. Giant conifer stumps indicate that a mature forest occupied this site in the past. This is a dynamic landscape; a combination of wet soils overlaying a compacted silt strata facilitates soil slippage and the deposition of sediments into the creek.

Good water quality is essential for growth, survival, reproduction and migration of individuals within the park's aquatic community. Degradation of watercourses or watercourse condition and water quality occurs because of removal of riparian vegetation, urban influences, and accelerated sediment input associated with management activities.

A healthy stream has a large variety of organisms. Indicators of healthy aquatic biological quality include fish, amphibians, macroinvertebrates, such as insects and crustaceans, and certain rooted aquatic vegetation and algae.

Three factors are critical in maintaining the aquatic habitat in Pioneer Park's wetlands and ravine.

1. The first factor is retention of the forest canopy bordering the stream and wetlands that directly provide the vegetative matter that is the base of the aquatic food chain. The streamside canopy also shades the watercourse and thus prevents increases in water temperature. High water temperatures (with less dissolved oxygen) tend to increase the metabolic rate of cold-water organisms causing increased stress.

2. The second factor is to maintain complex structure in the streams and wetlands through the contribution of large woody debris. As streamside trees die, they often fall into or adjacent to the channel, creating complex stream and riparian pool habitats.

3. The third factor is limiting the input of sediment to stream channels. Excess fine sediment can impact salmonids through degradation of spawning gravel and reduction of aquatic food production.

5.7. Wildlife Resources

Avian resources have been well documented in Pioneer Park (see Appendix I: ***Pioneer Park: a natural history***). A summary inventory of mammalian species in Pioneer Park was undertaken in the past, but this analysis is incomplete (*ibid.*). Little is known about the extent, health or population trend-lines for reptiles, amphibians, invertebrates and aquatic species utilizing Pioneer Park. Further inventory and analysis of these wildlife resources would prove valuable to maintaining and protecting biodiversity values in Pioneer Park.

5.8. Management Resources

Management resources are the people, funds and "tools" that are dedicated to the park on an ongoing basis. The "tools" are not so much hardware as the plans, standards, policies, technologies and protocols used in the management of the natural resources. It is important to establish whether these "tools" meet industry standards (commonly referred

to as "Best Management Practices") and whether they are based on "Best Available Science."

Management resources for Pioneer Park are detailed in Appendix J. They include the lead involvement of Mercer Island Parks and Recreation in the daily management of the park. The City's Maintenance Department and Development Services Group also have involvement with the park. Puget Sound Energy also has interest where power line clearance zones overlap park boundaries. State urban forestry programs, State "land grant" colleges, the International Society of Arboriculture and the Society for Ecological Restoration have been sources for publications and technologies that make up many of the "Best Management Practices" that pertain to forest management. These are listed in the Appendix.

5.9. Community Resources

Community resources are the people, funds, expertise and political support that are volunteered in support of the park. Unlike management resources, they are not necessarily dedicated to or fit for a particular service. However, these resources have proven to be indispensable for the long-term sustainability of urban forests.

The Open Space Conservancy Trust is the main community resource dedicated to the park. This non-profit volunteer board represents the community that is served by the park. Other community resources include: Ivy Brigade, Committee to Save the Earth, youth and school programs, businesses, religious congregations, service clubs and concerned citizens. Descriptions of these resources can be found in Appendix K.

6. Analysis

Pioneer Park is an unusually large area of native forest set within a suburban landscape. Pioneer Park can remain a viable native forest with management by the City and involvement of the community.

In summary, its strengths are:

- Large overall size of the park
- Overall abundance and diversity of native vegetation
- Natural regeneration of both trees and shrubs
- Connectivity with forest landscapes on nearby properties
- Ongoing funding of forest management projects
- Conservation of the park property in trust
- Community sense of "ownership" of the park

Challenges are:

- Droughty soils and unpredictable summer rain

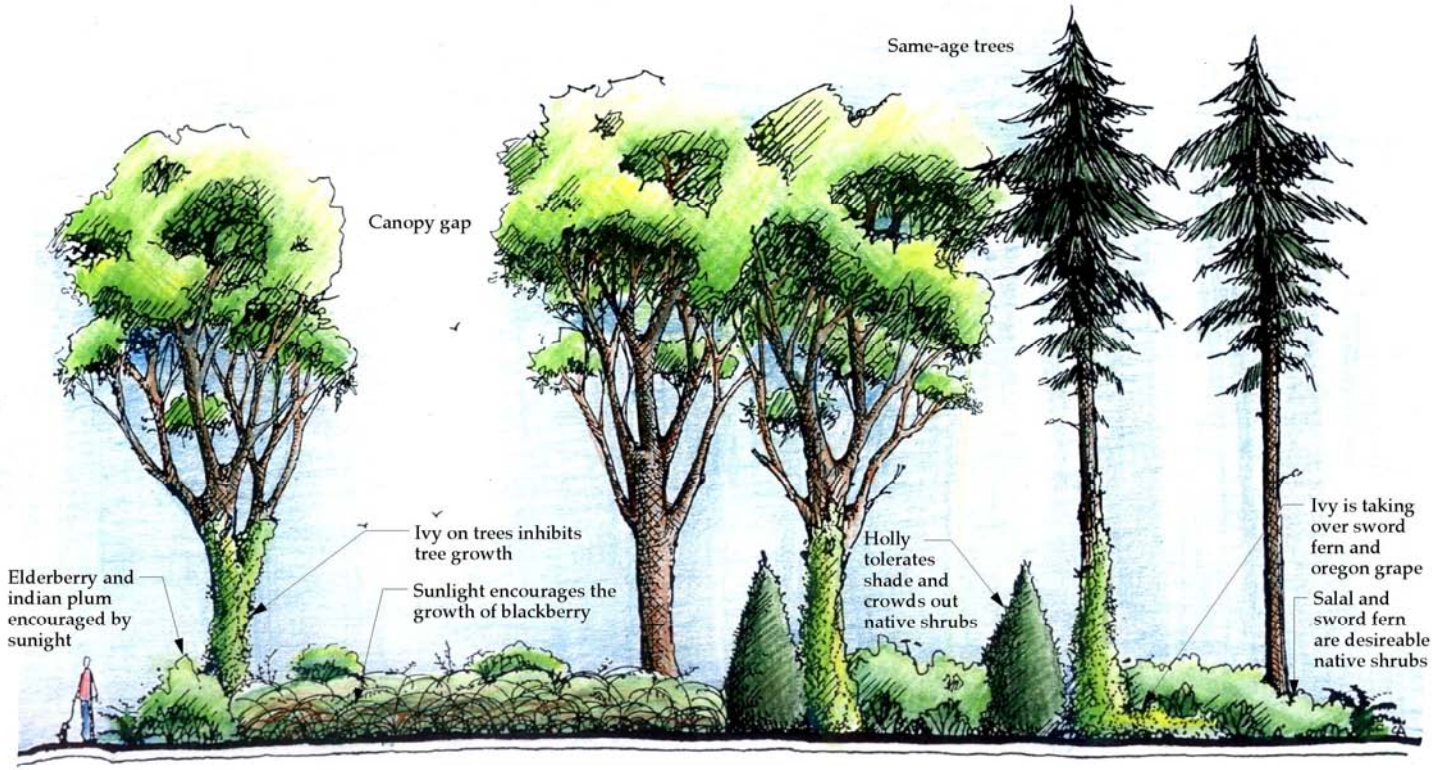
- Fragmentation of the habitat, i.e. the roads separating the quadrants
- Exposed edges of the park causing higher light and wind levels in the park interior – "Edge effects"
- Managing hazard trees, especially from laminated root rot
- Managing fire potential
- Numerous and widespread canopy gaps
- Invasive plant patches
- Laminated root rot pockets
- Instability in the ravine
- Boundary encroachments
- Damage to vegetation from trampling
- Organizing volunteers
- Funding limitations
- Lack of canopy regeneration
- Excessive non-native holly regeneration
- Ivy growing in canopy trees

7. Overall Strategy

The Trust board considered several scenarios for managing Pioneer Park that would achieve different long-term results (see Appendix B). The "Deep Forest" strategy would drive forest succession towards a conifer-dominated forest with dense canopy. The "Purely Native" strategy, like Deep Forest, would aggressively control invasive, non-native plants, but instead utilize "natural regeneration" relying on self-seeded plants to restock the forest rather than actively planting nursery stock. The "Basic Canopy" offered a more casual approach to invasive plant control. It would focus on controlling plants only as they impacted tree canopy or affected the park user's experience. This third approach would manage canopy regeneration by plantings or natural regeneration.

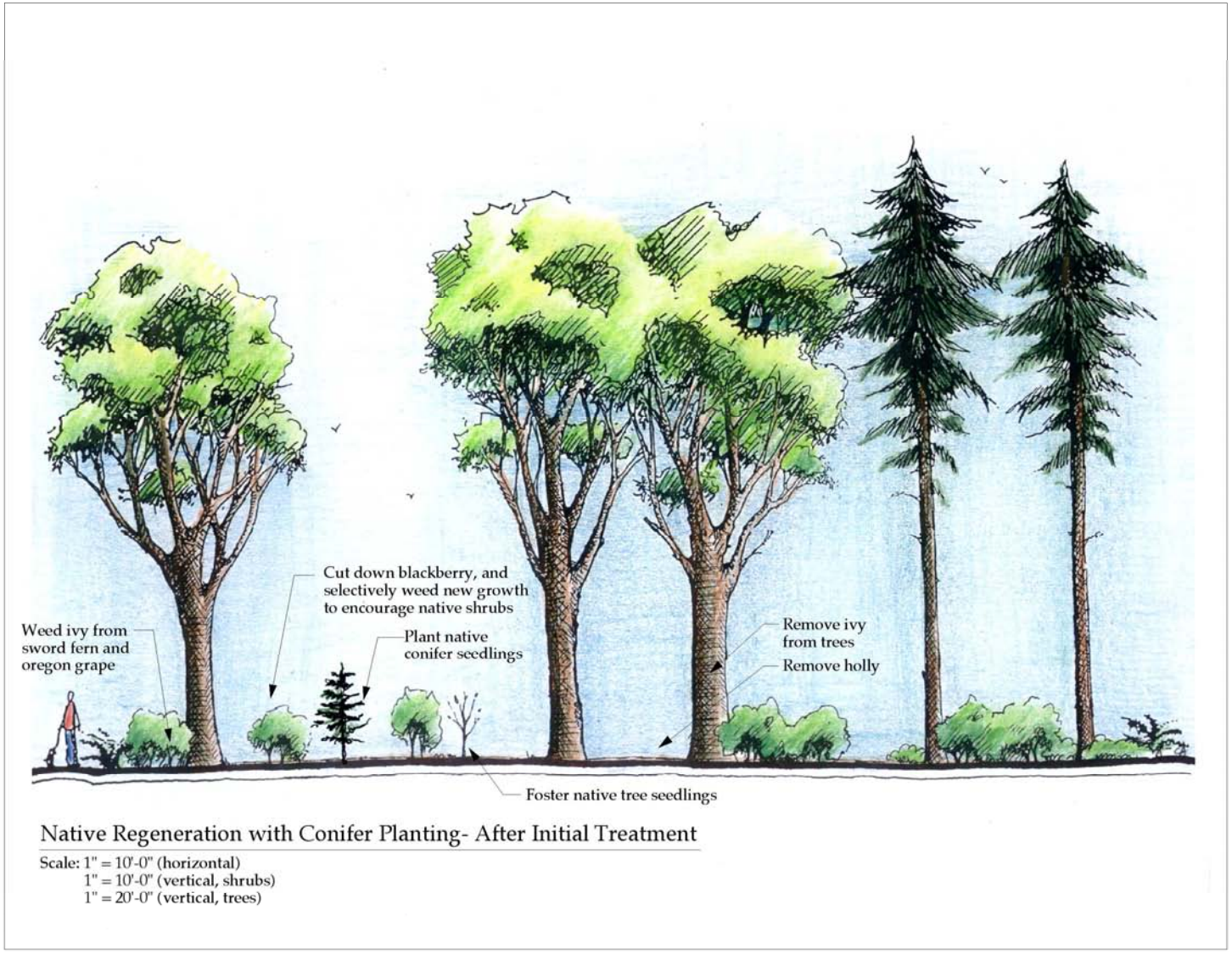
The Trust board and City staff eventually developed a strategy that relies predominantly on native regeneration, as in the "Purely Native" strategy, but also incorporates some conifer planting to direct succession toward a more evergreen forest. In 2008, the Trust authorized a thorough analysis of Pioneer Park's forest to determine whether this original strategy would be sufficient to protect the health of Pioneer Park. The 2008 Forest Health Survey (Appendix R) concluded that canopy regeneration in Pioneer Park is not sufficient to maintain tree canopy in the park. The survey indicated the need for more conifer regeneration in the forest. Therefore, the Open Space Trust decided to support a change in strategy that focused on planting new conifer tree canopy throughout the park. The new strategy also called for targeting specific invasive plant species that compete with native tree regeneration. This represented a significant change in strategy from the 2003 version of this plan.

The following illustrations depict the types of management activities that would influence the forest.



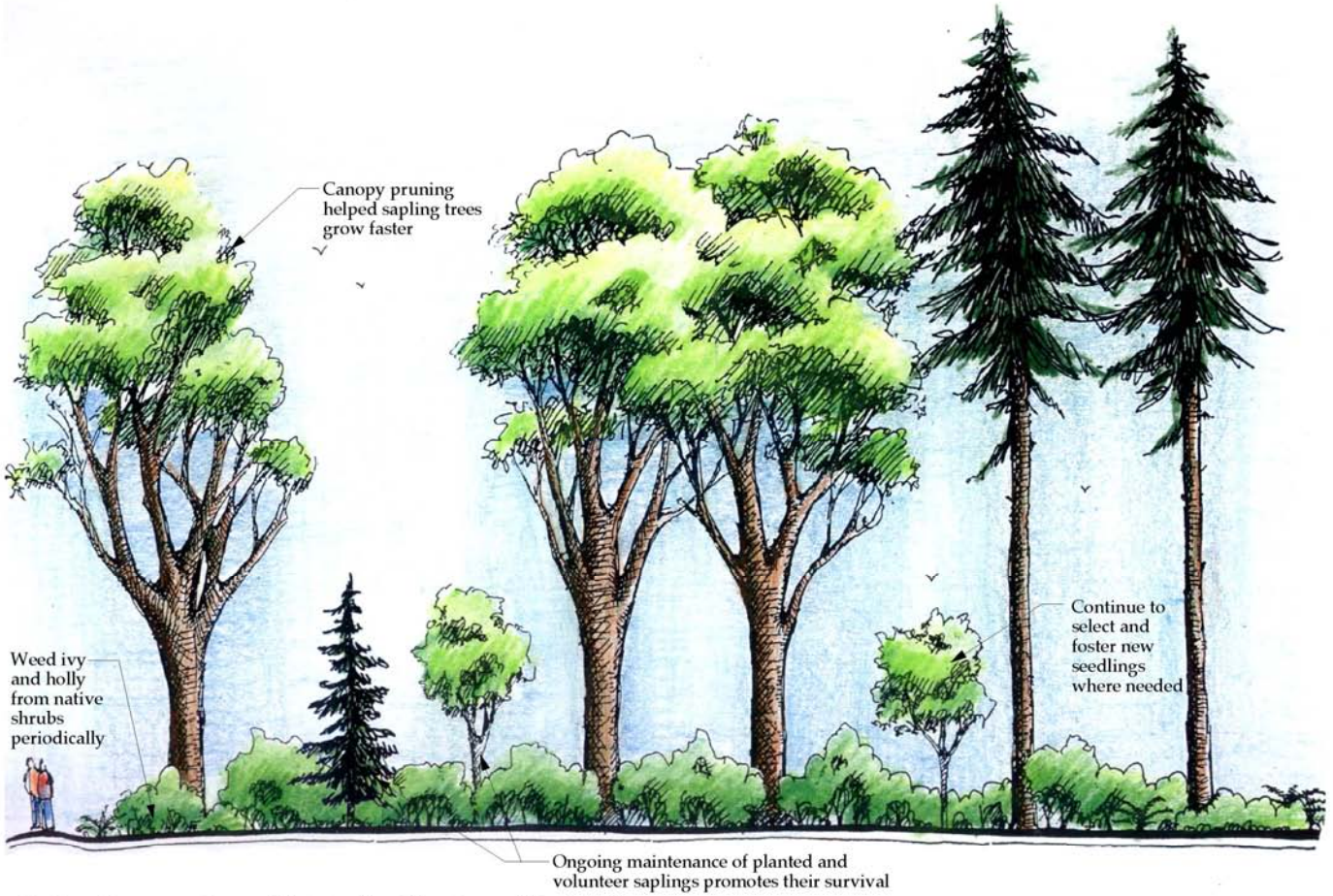
Existing Conditions and Issues

Scale: 1" = 10'-0" (horizontal)
1" = 10'-0" (vertical, shrubs)
1" = 20'-0" (vertical, trees)



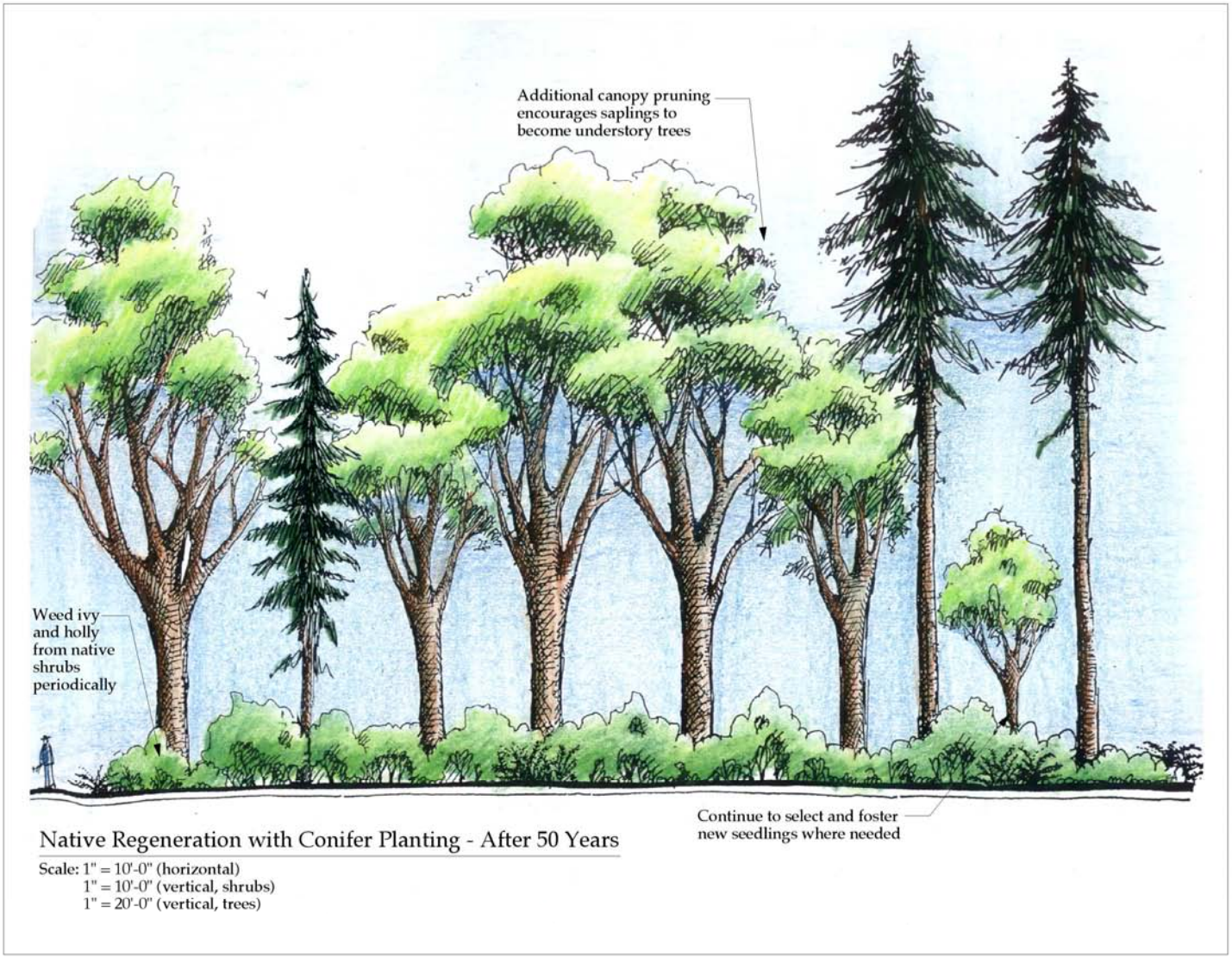
Native Regeneration with Conifer Planting- After Initial Treatment

Scale: 1" = 10'-0" (horizontal)
1" = 10'-0" (vertical, shrubs)
1" = 20'-0" (vertical, trees)



Native Regeneration with Conifer Planting- After 20 Years

Scale: 1" = 10'-0" (horizontal)
1" = 10'-0" (vertical, shrubs)
1" = 20'-0" (vertical, trees)


Additional canopy pruning encourages saplings to become understory trees
Weed ivy and holly from native shrubs periodically
Continue to select and foster new seedlings where needed
Native Regeneration with Conifer Planting - After 50 Years
Scale: 1" = 10'-0" (horizontal)
1" = 10'-0" (vertical, shrubs)
1" = 20'-0" (vertical, trees)

The Trust board's vision for Pioneer Park is to achieve the complexity and character that can be found in native forests uninfluenced by urbanization. Therefore, conifer trees and evergreen understory will be favored in the overall strategy of using the natural regeneration of native plants to achieve an overstory and understory full of native species. Since natural regeneration is not sufficient, the main management tool will be planting new conifer trees and controlling vegetation that competes with desired tree regeneration.

Canopy gaps are a natural part of forest ecology. However, the introduction of non-native invasive plants to the Pacific Northwest has drastically changed forest succession. Himalayan blackberry, English ivy and other non-native species are well established in the forest of Pioneer Park. These species are so competitive that they can inhibit regeneration of native canopy trees. Their presence is correlated with higher light levels, such as are found in canopy gaps and in areas where the tree canopy is fragmented. Therefore, a primary strategy of maintaining forest cover in Pioneer Park is to manage gaps and fragmented canopy so that non-native, invasive plants do not prevent new trees from growing. Some invasive species will spread regardless of tree cover. English ivy, holly and laurel tolerate shade and propagate under dense canopy. Therefore, an equally important strategy of this plan is controlling these species on a parkwide basis.

Another cornerstone of the strategy for Pioneer Park involves a system of experimentation and decision-making to develop techniques that work best for the conditions in the park and the goals we are trying to achieve. Until now, techniques for planting, watering, or invasive plant control have been tried in various areas of the park with varying results. However, there is no systematic way of tracking and evaluating these results to learn from them. A system of "adaptive management" will allow the Open Space Conservancy Trust and the City of Mercer Island to evaluate results of management strategies and create new strategies for future projects.

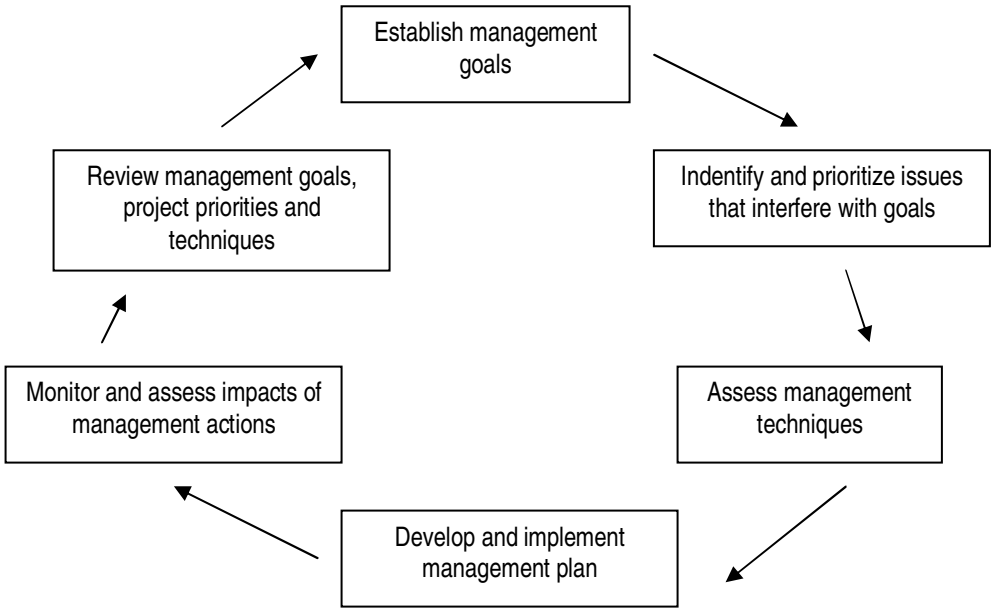


Figure 7.1: Adaptive Management Flowchart (adapted from Schwartz and Randall (1995) in Luken and Thieret (1997)).

The process of adaptive management has begun with this plan. It begins with defining management goals in Section 2. The management issues that impact these goals are summarized in Sections 5 and 6. Sections 7, 8 and 9 detail the strategy and techniques needed to achieve the management goals. Taken together, these comprise the core of the Pioneer Park Forest Management Plan and complete the first half of the adaptive management system.

Management projects will begin after adoption of this plan by the Open Space Conservancy Trust. The Parks and Recreation Department will plan and implement projects under their leadership. The Park Arborist will be responsible for monitoring and evaluating the results of the projects. Discussions of these results with the Open Space Conservancy Trust may lead to reevaluation of the goals, priorities and techniques contained in this plan after several projects are completed.

The 2008 Forest Health Survey (Appendix R) provided the first chance to evaluate the effectiveness of management strategies. As a result, a new work plan (Appendix S) is being adopted to replace the original work plan contained in Section 9 below.

8. General Management Prescriptions

Management prescriptions will fall into two categories: ones that will be applied on a park-wide basis, and ones that pertain to specific areas within the park. Park-wide prescriptions may include techniques for the management of the following:

8.1. Project Planning

All project proposals, whether initiated by the City, the Trust or another community entity should provide the City and the Trust basic information on the project in a standard format. The form in Appendix L is proposed for this purpose. This form should be reviewed by City staff and Trust board members before the project is executed. This will help incorporate the goals of this plan into every project and provide a basis on which to conduct an evaluation of the project at its completion. The essential data on the form should be entered into a database.

8.2. Hazard Trees

Hazard trees are a result of a tree failing, hitting a “target” and causing damage or injury. A target could be either property (car, house, another tree) or a person. The chance of this happening depends on the likelihood of the tree failure, the size of the failure and the likelihood of hitting a “target”.

The likelihood of failure can be evaluated if a “defect” (i.e. rot, dead branch, lean) can be seen or measured. This must be done by an experienced arborist who can assess the severity of the defect in comparison to other trees of the same species. It is important to note that virtually <u>all</u> trees have defects. The task is to rate those that have a high probability for failure.

The next step is to estimate the size of the part that will fail. A cavity at the base of the tree could cause the entire tree to fail. This type of failure can cause significant damage. On the other hand, a severe cavity on a small branch would be less significant, even if the likelihood of failure was greater.

Not all targets have the same value. Obviously, damage to a house is likely to be more costly than damage to a fence. People are found more often along the edges of the park (on foot, in cars or in houses) than in the middle of the park. If a tree is leaning away from a target, it is less likely to be affected by the tree's failure. The three factors of relative risk – likelihood of failure, size of failure and value of the target – must be considered together to properly manage hazard trees.

This general philosophy of tree hazard management has been developed over the past twenty years, and is most recently summarized in ***Evaluating Trees for Defect*** (2002). This evaluates trees based on six characteristics that are most common indicators of defect: lean, roots, cracks, branch attachments, cankers & decay, and dead wood. In addition, the information provided in Dr. Edmonds' report (Appendix E) on laminated root rot can be used to assess conifers. Where a tree's condition is in dispute, the protocol described in ***A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas 2nd Edition*** (1994) should be used by both parties to resolve the dispute. This provides an extensive evaluation of the tree in question.

Since hazard rating is proportional to the likelihood of hitting something, it is prudent to inspect areas that have more vulnerable targets. The boundaries of the park are where the most risk factors are found. Cars in the road, houses next to the park, power lines, and pedestrians are most likely to be found at the boundaries. Therefore, more frequent and in-depth inspections should occur there. Conversely, the likelihood of a tree hitting something on an interior trail varies with the use of the trail. Higher traffic trails should be inspected more frequently than lower traffic trails. Therefore, the priority for hazard tree survey should be as follows:

Boundaries	once per year, or after a severe storm
Perimeter trails	once per year, or after a severe storm
Primary interior trails	once every two years, or after a severe storm
Secondary trails	once every two years, or after a severe storm

Hazard survey may be conducted by the Park Arborist, or by Parks and Recreation staff trained in hazard tree identification. Citizens also are encouraged to call about trees that look suspicious.

8.3. Fire Management

Pioneer Park is susceptible to fire primarily from human behavior. Historical incidents of encampment (with fire) and fire works used in the park are particular concerns. The forest is prone to drought because the soils are well drained. Woody debris has built up in the park, increasing fuel loading. Houses back up to the park with minimal distances

between structures and stands of dense vegetation. The interior of the park is not accessible to fire vehicles because the trails are too narrow for them.

However, the size of the park and the cooler, moister climate of Western Washington reduce risk in comparison to Eastern Washington forest landscapes where fire protection standards have been developed. The quadrants are surrounded by a network of fire hydrants that can supply water to the park perimeter and significant portions of the interior. Fire Station 92 is located across the street from the park. The staff of Mercer Island Fire Department is highly trained in incident response. Furthermore, mutual aid agreements with other cities would enable the City to sustain a response and provide specialized capabilities as conditions warrant.

Limitations in response include the difficulty of conveying water to the center of a quadrant. For certain hydrants, vegetation poses a barrier to trail access. City firefighters have not received training specific to the situation in Pioneer Park. These limitations are certainly addressable.

The goals of this plan are directed toward maintaining a diverse native forest with dense vegetation buffering the edges of the park and abundant deadwood for wildlife habitat. The generally accepted principles of fire management along wildland interfaces run counter to these goals. Prescriptions for reducing risk to adjacent properties usually include extensive pruning of trees and shrubs to reduce ladder fuels and clearing the ground layer of woody debris to reduce fuel loads.

These two goals can be reconciled to achieve dense vegetation along park edges while achieving some reduction of ladder fuels and fuel loads along residential border of the park perimeter. Neighbor partnerships would be sought to “adopt” areas of the park. These neighbors, under the direction of City staff, would restore and maintain the portion of the park behind their houses within a certain distance of the residence depending on the terrain and the vegetation found there. For example, neighbor partners would foster dense, low-growing evergreen shrubs in the understory and periodically thin tall shrubs and dead branches to inhibit a ground fire from climbing into the canopy. Neighbors also would work to eliminate firewood and debris piles along property boundaries. City staff would support these activities with debris pickup, tool lending and technical assistance. The City would also remove the wood from trees that they cut down in these areas, instead of leaving them to decompose.

See Appendix M for the full plan.

8.4. Tree Pruning and Removal

Trees in Pioneer Park will be pruned or removed when it is necessary to mitigate risk to park users, right-of-way or adjacent properties. Otherwise, tree work will be restricted to instances where it directly achieves a project objective. Such instances might include:

- A mature tree may be pruned or removed to encourage nearby sapling trees to grow. Wherever possible, the preferred technique for reducing competition will

be pruning. If a tree is removed, it should be converted to a "snag", essentially a branchless trunk. This reduces costs and increases habitat features in the park.

- A group of sapling trees may be "thinned" by cutting down weaker, damaged or poorly located trees until there is enough space between the remaining trees for them to remain at a mature size. Some planned projects may plant trees closely together to be thinned in the future for this same reason.
- Low branches on trees along a trail may be pruned to provide overhead and side clearance according to the ***Pioneer Park Master Plan***.
- Trees and shrubs along Island Crest Way may be pruned to provide roadway clearance or allow motorists and pedestrians on the street to have views into the forest.

Trees in Pioneer Park will not be pruned or removed for other reasons. Pruning and removals that are not safety-related must be reviewed by Mercer Island staff and the Open Space Conservancy Trust through a Project Planning Form (see Appendix L). All trees that fall within the forest due to a natural course of events will be left in the forest. If a tree needs to be removed along the park perimeter for forest management or maintenance, the Open Space Conservancy Trust will determine how the wood will be disposed. Removals on steep slopes, in slide-prone areas, in wetlands, watercourses or buffer areas are subject to Section 19 of the Mercer Island City Code "The Tree Ordinance".

8.5. Tree Roots and Tree Protection

Tree roots are mostly invisible to us, and most of the injury that occurs to trees is to their roots. Trees are vulnerable to compaction by traffic from trucks and heavy equipment. Trees may take up to ten years to show visible signs of construction damage to roots, and there is little remedy once the damage is done. Preventing damage is most important.

The two most critical elements of tree protection are:

- A site evaluation by a qualified arborist when planning maintenance or construction activities to identify tree protection issues.
- An on-site meeting of maintenance or construction staff with a qualified arborist to insure that protection measures are understood by everyone involved.

For routine maintenance activities, it is most critical that staff understand where tree roots are likely to be found and when compaction is most likely to be a problem. The sandy soils found near Pioneer Park are resistant to compaction when soils are relatively dry. Wet soils are most vulnerable to compaction.

For construction activities, it is critical that a qualified arborist work with designers to establish tree protection zones on plan drawings and that the contractor understand his or her responsibility inside and outside these zones. Protection zones are designed to protect where trees are most vulnerable. They are usually fenced off and all construction activity is prohibited within them. However, contractors may also be required to report whenever they dig up any root greater than 2" diameter. This would allow the project arborist to

track impacts to trees as they occur and recommend changes to construction, if trees are being more heavily impacted than anticipated.

8.6. Trails and Roots

On dirt or gravel trails, exposed tree roots may be covered with dirt or gravel sufficient to reduce the trip hazard. On paved asphalt trails, bridging with asphalt or root pruning may be required according to the specific situation. Rerouting the trail will be considered if no other corrective measure is feasible. Future conflicts between tree roots and paved surfaces should be prevented by proper design, including compacted subgrade and use of root barriers along pavement edges.

8.7. Exotic Invasive Control

Recommendations for control are found in the 1996 ***Pioneer Park Invasive Plant Report and Recommendations***. (See Appendix D) These and additional recommendations are given here. These recommendations will be a starting point to tailor control practices specific to the situations found in Pioneer Park. Through evaluation of control projects, project managers will refine control strategies to achieve more efficient and environmentally sensitive weed control.

Blackberry

Projects in Pioneer Park to date have relied exclusively on digging out plants. This has been a successful first step. However, the area treated has been limited, and repeated visits have been necessary. WSU Cooperative Extension recommends both manual and chemical controls for blackberry. They recommend a combination of cutting, digging and applying glyphosate herbicide (Roundup®.) Another experimental technique involves cutting the stem off about a foot from the ground and painting undiluted glyphosate in the freshly-cut, still damp stem.

Initial control of blackberry will be accomplished by non-chemical means. If necessary, chemical use will be limited to glyphosate products because of their relative safety, low toxicity, immobility in the soil and rapid breakdown. The decision to use glyphosate will be made depending on the extent of the area to be managed, the level of infestation, the ability to limit application only to the target plants, and the availability of trained personnel to carry out the work.

In the 2008 Forest Health Survey, active removal of blackberry is recommended only in preparing areas for tree planting. This control consists of blackberry ‘knockdown’ or brushcutting, which reduces the height of blackberry canes to one foot, allowing new trees access to light and water. By planting trees densely throughout Pioneer Park, Himalayan blackberry, which thrives in high-light areas, will be greatly reduced through the creation of shade.

Ivy

The first stage of ivy control is cutting vines growing up trees to prevent fruiting. Every vine is severed around the base of the tree and the vines are left to die. The second stage of control is cutting ivy away from the tree for a distance of four feet, creating a "lifesaver" around the tree. The third stage of ivy control is pulling ivy from the ground where it is mixed in with native vegetation. The fourth stage is smothering or cutting blankets of ivy that carpet the forest floor. These are all excellent activities for volunteers.

Applying Herbicide

The decision to apply herbicide will be made by the Trust board on a case-by-case basis through project planning (see 8.1). Herbicides applied at Pioneer Park will be used sparingly and in conjunction with other control methods. . Applications may be made several ways. A sponge applicator would spread the chemical directly on the leaves or cut stems of the target plant. A drill or knife would expose the inner bark and the chemical would be dispensed into the cut from a pump bottle. In any case, the application would be restricted to the target plant.

Researchers at the University of Washington have tested herbicide, heat, steam and mechanical means of control, but they have not provided any clear answers about these techniques yet. The Thornton Creek Alliance has had success with controlling blankets of ivy with horticultural weed block fabric, applied over the leaves for two growing seasons. This excludes all sunlight and slowly starves the ivy. The herbicide technique used on laurel and holly below should also be tried on large ivy vines to see if it can be effective there as well.

In 2008, a demonstration project authorized by the trust consisted of spraying 5% Roundup with dye marker on a carpet of ivy in the northeast quadrant. Spraying took place on a sunny, warm day in late winter, as recommended by Nature Conservancy web resources. The control method was found to be successful at targeting ivy but preserving herbaceous native perennials. Nevertheless, the Trust expressed concern about the impact of Roundup® on salamanders, frogs and other native terrestrial vertebrates. Recent research shows that certain formulations of glyphosate herbicide, such as AquaMaster®, which contain no surfactant, have little to no effect on amphibian health (Mann and Bidwell, 1999; Howe et al, 2004). Further investigation of ivy control should be pursued under the direction of the Trust.

Laurel and Holly

Small plants (less than 1" diameter) can be pulled with a weed wrench or dug out with a shovel. Workers must be careful not to confuse holly with the native Oregon grape. Larger plants have been cut down with saws and removed from the park. Removing larger plants has resulted in large areas of ground disturbance and compaction from foot trampling back and forth between the plant and the waste collection area.

In an effort to find an alternative, glyphosate herbicide was tested on a limited basis in Pioneer Park. The concentrate was applied by drilling trunks of larger trees with a ¼ inch drill bit and injecting 1cc of Roundup Pro® concentrate into each hole. Stems were drilled every two to three inches around their circumference. Dying plants have been left

standing to minimize site disturbance. These experiments should be expanded to develop more accurate dosages for control. The City and the Trust can then evaluate the value of this technique in comparison to physical removal.

Herb Robert, Bindweed, Other Herbaceous Perennials

Herb Robert is easily pulled by hand. However, the established seed bank may result in new crops emerging for several years. Bindweed is very difficult to control by hand. Its fleshy roots break easily and resprout rampantly. It responds well to foliar application of glyphosate (Roundup®) herbicide applied to the leaves at the dilution recommended on the label. In most instances, the vine is tangled with desirable vegetation. In these situations, the herbicide should be applied by sponge applicator to limit application to the target plant.

8.8. Rare or Unusual Plant Species

A signature plant of the park, Trillium (*Trillium ovatum*) is locally rare and difficult to propagate. This species, as well as vanilla leaf (*Achlys triphylla*) and wild ginger (*Asarum caudatum*) may be losing ground in competition with invasives and other natives. Areas where these are found should be protected from this encroachment. Other rare or unusual plant species may be found as project work progresses and should be added to this section. Rare or unusual plants should be propagated and replanted in restoration project areas where they are suitable choices.

8.9. Off-trail Use

Off-trail use in the park has impacted park vegetation. Both humans and dogs have trampled desirable vegetation. Unfortunately, native vegetation gets preferentially trampled because it is low growing and easy to step on, whereas blackberry and holly are prickly and are generally avoided. New trails develop by repeated use of the same route. Educating park users is the most obvious first step to address this issue. Where off-trail use has damaged park resources such as steep slopes, unstable soils or locations with sensitive plant species, further off-trail use will be discouraged. Woody debris, signage and/or barriers may be placed along trails to discourage off-trail traffic where vegetation has been impacted.

8.10. Habitat Management

Wildlife habitat will be managed to promote species diversity and to ensure that populations of indigenous species are maintained. This can be best achieved through the maintenance and enhancement of habitat values. Habitat values that lead to species diversity include the following elements: breeding, foraging, watering, rearing, hiding and thermal cover.

Wildlife management within Pioneer Park is focused primarily on the protection and enhancement of key habitat and structural components that are utilized by a diversity of species. Snags and down logs will be maintained through the retention and recruitment of snags over time. Snags are used to some degree by all major groups of wildlife species

found in Pioneer Park. Their primary value is as a nesting and roosting site, or foraging for insects. Species excavate their own cavity, utilize previously excavated cavities or utilize natural cavities and crevices. Other species use the tops of larger snags as nest and roost sites. Species in Pioneer Park that use cavities in snags include hairy woodpecker, chestnut backed chickadee, red-breasted nuthatch, screech owl, violet-green swallow, brown creeper, Douglas squirrel and two bat species. Species that nest or roost at the top of snags include red-tailed hawk, raven, and osprey. Retention of dead and down materials are particularly critical in riparian areas.

Snags can be created from trees that are scheduled for removal. Logs from removed trees can be left lying on the ground and allowed to decompose. These features are most effective in their woodland context. It is less effective to create a snag along a busy street, or leave a log in the middle of a lawn, for example. Typically, snags should be at least 10 inches in diameter, and are most effective in the 22 to 46 inch diameter range.

9. Site-Specific Prescriptions

See Appendix S for the 2008 Forest Health Work Plan

9.1. Work Plan

To guide the first phase of plan implementation, a set of priority projects have been outlined with initial cost estimates. These costs have been planned to spread out over 10 years. Specific timing and locations of these projects can be found also in Appendix N.

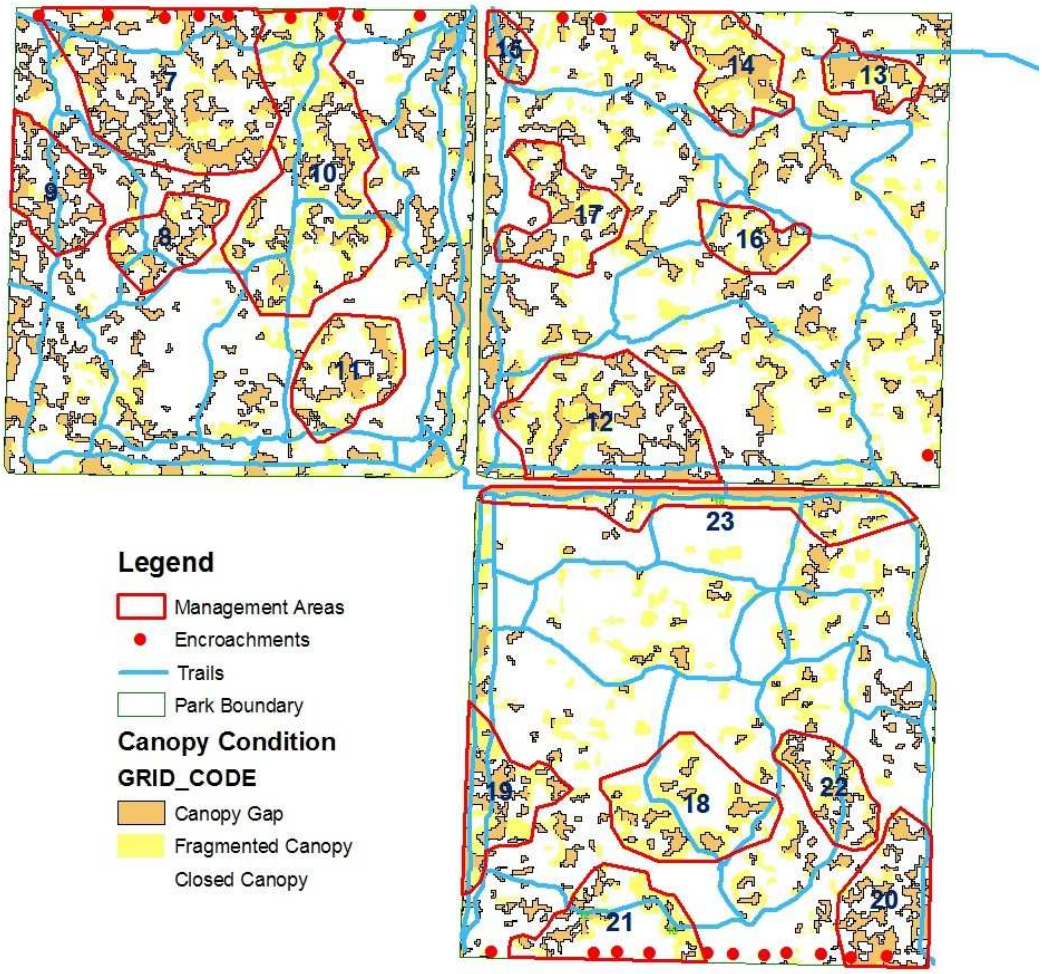


Figure 9.1: Canopy Condition and Management Areas

Project	Project Type	Acres	Quadrant	Priority	Goal	Total Cost
1	controlling ivy in trees, laurel and holly	113	all	1	control invasive plants in non-project areas	$50,000
2	public education	113	all	1	raise public awareness about park environment	$20,000
3	neighbor partnerships	3	all	1	recruit park stewards from adjoining neighbors	$10,000
4	wildlife habitat assessment	113	all	2	inventory wildlife habitat and determine needs	$3,000
5	tree risk management	113	all	1	prune or remove hazard trees	$20,000
6	forest management plan	113	all	1	revise plan with experience and data from projects	$18,000
7	NW regeneration mgmt w/conifer planting	5.36	NW	1	foster native regeneration, plant conifers, control invasives	$59,326
8	NW regeneration mgmt w/conifer planting	1.28	NW	1	foster native regeneration, plant conifers, control invasives	$14,882
9	NW regeneration mgmt w/conifer planting	1.52	NW	1	foster native regeneration, plant conifers, control invasives	$17,524
10	NW regeneration mgmt w/conifer planting	5.54	NW	2	foster native regeneration, plant conifers, control invasives	$61,232
11	NW regeneration mgmt w/conifer planting	1.82	NW	1	foster native regeneration, plant conifers, control invasives	$20,762
12	NE deciduous regeneration mgmt	3.86	NE	1	encourage deciduous regeneration, control invasives	$43,046
13	NE ravine mgmt w/planting	0.77	NE	2	install erosion control, replant canopy trees	$9,407
14	NE ravine mgmt w/planting	1.69	NE	1	install erosion control, replant canopy trees	$19,429

Project	Project Type	Acres	Quadrant	Priority	Goal	Total Cost
15	NE regeneration mgmt w/conifer planting	0.46	NE	2	foster native regeneration, plant conifers, control invasives	$5,991
16	NE deciduous regeneration mgmt	0.96	NE	2	encourage deciduous regeneration, control invasives	$11,449
17	NE regeneration mgmt w/conifer planting	2.35	NE	1	foster native regeneration, plant conifers, control invasives	$26,520
18	SE deciduous regeneration mgmt	2.76	SE	2	encourage deciduous regeneration, control invasives	$30,984
19	SE deciduous regeneration mgmt	1.68	SE	1	encourage deciduous regeneration, control invasives	$19,229
20	SE regeneration mgmt w/conifer planting	2.02	SE	2	foster native regeneration, plant conifers, control invasives	$23,003
21	SE deciduous regeneration mgmt	2.11	SE	1	encourage deciduous regeneration, control invasives	$23,909
22	SE deciduous regeneration mgmt	1.27	SE	2	encourage deciduous regeneration, control invasives	$14,859
23	Utility canopy conversion	2.07	SE	1	remove hazard trees, plant trees that won't grow into powerlines	$23,562

Figure 9.2: Forest Management Project Summary Grouped by Quadrant

See Appendix N for an expanded version of this list. The topics covered below govern how the site-specific project should be planned and implemented.

9.2. Trees

Species Selection

This plan identifies tree species to be planted in Pioneer Park. The presence of laminated root rot makes plant selection for reforestation projects challenging. Douglas fir is the native tree most adapted to the general condition of the park. However, it is most vulnerable to laminated root rot. Moreover, most native conifers are at least somewhat susceptible to *Phellinus weirii*, the organism that causes the disease. Native pines and western red cedar are tolerant of the disease. Additionally, several non-native choices were made in the year 2000 project to avoid susceptible species. Specifically, ponderosa pine and coast redwood were selected as resistant species. However, these selections conflict with the goal to maintain a native forest. Alder and maple regenerate in canopy gaps and are resistant to laminated root rot. This regeneration will be encouraged and the planting of exotic conifers will be discouraged, except where conifers are required and no native species are adequate selections. The table below lists tree selections that are considered native.

Species	Height in ft.	Habitat
Western hemlock (*Tsuga heterophylla*)*	150	Flats and slopes
Western red cedar (*Thuja plicata*)*	150	Moist flats and lower slopes
Douglas fir (*Pseudotsuga menziesii*)*	200	Flats, slopes, ridges
Western white pine (*Pinus monticola*)	125	Flats, slopes on sandy soil
Shore pine (*Pinus contorta* var *contorta*)	30	Swamps, prairies
Yellow pine (*Pinus ponderosa*)	150	Gravelly prairies
Grand fir (*Abies grandis*)	125	Flats
Sitka spruce (*Picea sitchensis*)	150	Moist bottoms
Western yew (*Taxus brevifolia*)	30	Moist flats and slopes
Madrona (*Arbutus menziesii*)*	30-80	Drier slopes
Chinquapin (*Chrysolepis chrysophylla*)	50	Dry forests
Bigleaf maple (*Acer macrophyllum*)*	100	Bottoms and slopes
Red alder (*Alnus rubrum*)*	60	Flats, slopes, near water
Black cottonwood (*Populus trichocarpa*)*	100	Valley bottoms
Western dogwood (*Cornus nutallii*)*	50	Flats, slopes with Douglas fir
Scouler's willow (*Salix scouleriana*)*	50	Openings and edges
Birch (*Betula papyrifera*)	50	Flats
Rocky Mountain maple (*Acer glabrum*)	40	Forested slopes
Quaking aspen (*Poplulus tremuloides*)	30	Wet areas
Bitter cherry (*Prunus emarginata*)*	40	Openings in forest
Garry oak (*Quercus garryana*)	40	Gravelly prairies and parkland
Ash (*Fraxinus latifolia*)	50	Low-lying wet areas, rivers

Crabapple (*Malus fusca*)	30	Wet brushy thickets
Hawthorn (*Crataegus douglasii*)	30	Wet brushy thickets
Pacific willow (*Salix lasiandra*)	50	Low-lying wet areas
Cascara (*Rhamnus purshiana*)*	40	Second growth & forest openings
Vine maple (*Acer circinatum*)*	40	Moist soils, adaptable

*previously existing in Pioneer Park

Figure 9.3: Trees of the Western Hemlock Zone (after Kruckeberg 1991)

Tree Replacement/Stand Regeneration

This plan is intended to insure that there are new trees to replace those that die. In closed canopy conditions, mature native trees would occur within a range of 10-30 feet apart. Therefore, this plan will adopt a guideline to recruit a viable tree sapling anywhere there is a space of greater than 30 feet between trees. This guideline may be adjusted for local site conditions.

Tree seedlings will be encouraged in several ways. The ground in the area can be scarified to receive seeds falling from neighboring trees. A sapling can be transplanted from another area. Existing saplings in a good location can be encouraged by clearing competing vegetation away from them. Nursery stock can be purchased where none of the above options are viable. Conifer species will be the preferred tree for planting where laminated root rot is not likely to affect them.

Root Rot Pockets

Laminated root rot is the biggest challenge to the goal of increasing conifer composition in the park's tree canopy. Most native conifers are at least somewhat susceptible. Dr. Robert Edmonds in his 1999 report to the Open Space Conservancy Trust (Appendix E) offered options for controlling the disease that involved highly invasive techniques, including logging and digging out stumps. At that time, the Trust decided not to pursue these techniques. Instead, a milder strategy of replanting with less susceptible species was pursued.

In his report, Dr. Edmonds outlined the symptoms of laminated root rot and the trees that are most susceptible to laminated root rot. This information is reproduced here, as follows:

Typical symptoms and signs of laminated root disease

Symptoms (tree responses)

- Reduced height growth
- Formation of root disease centers
- Wind thrown trees with distinctive root balls lying in many directions
- Standing dead trees
- Excessive cone crop
- Thinning and yellowing foliage
- Wood in roots and butt of tree delaminating at annual rings
- Incipient decay stain in butt of tree
- Hollow internal tree butts

Signs

- Buff colored ectotrophic hyphae growing on the outside of the roots
- Red setal hyphae growing in the wood
- Annual fruiting bodies on upturned roots with brown pore surface (very rare)

Highly susceptible	Douglas fir Grand fir Mountain hemlock Pacific silver fir White fir
Intermediately susceptible	Western hemlock Giant sequoia Noble fir California red fir Pacific yew Sitka spruce Subalpine fir Western larch
Tolerant	Lodgepole pine Western white pine Ponderosa pine
Resistant	Western red cedar Yellow cedar Incense cedar Redwood
Immune	Bigleaf maple Red alder Vine maple

*Figure 9.4: Susceptibility of tree species to Phellinus weirii in lowland Puget Sound (additional species from **Common Tree Diseases of British Columbia**)*

This information will be used to manage laminated root rot in Pioneer Park. Nevertheless, it is an endemic disease, difficult to detect and impossible to eradicate. The aerial survey conducted in Dr. Edmonds' study did detect affected trees. However, it did not identify all affected trees in the park, nor did it claim to. The Park Arborist has observed other trees infected with laminated root rot that were not detected by the aerial survey. Furthermore, many trees that have failed from laminated root rot have exhibited few if any of the symptoms or signs listed above.

In order to manage root rot, additional detection techniques will be needed. Internal investigation of tree root crowns through increment coring or Resistograph drilling may be necessary in high-risk situations. Conservative management in these situations may require removing trees that appear normal and healthy.

Immune trees will be preferred for stand regeneration in and adjacent to root rot pockets. If a conifer species is essential in these situations, red cedar should be considered first. If the area is unsuitable for red cedar, certain species that are native to the Pacific Northwest but not indigenous to this area should be considered for planting. These include: western white pine, incense cedar, coast redwood, and Modoc cypress.

9.3. Understory Vegetation

Natural Regeneration

Natural regeneration occurs when seeds or roots in the soil sprout. This is usually triggered by removing competing vegetation and tilling of the soil surface. Once this triggering has occurred, the regeneration success depends on controlling competing vegetation and preventing further disturbance. Furthermore, rampant new growth should be thinned to allow less vigorous species to establish. For example, elderberry is a successful regeneration species, but thinning of elderberry early on could allow other species – Oregon grape, salal, etc.- to grow also.

Plant Selection

Natural regeneration is the preferred method for reestablishing native understory plants in Pioneer Park. Planting shrubs may become necessary where the forest floor has been so radically altered that the native seed bank is no longer viable. In those cases, nursery-grown plants can be planted to reestablish native understory. Appendix O provides a list of plants suitable for planting in Pioneer Park and the conditions required for each plant. All plants on the list are native to the Puget Sound basin. This list is intended to be used as a first step in designing a planting. A mixture of species should be selected for the conditions at the site where they will be planted.

Planting Design

The layout of plants should be designed to promote optimal growing conditions for the plants. Trees should be surrounded by native groundcovers. Shrubs should be located between trees. The diagram below is an example of a planting layout. It shows salal and sword fern planted in the shade of the cedar trees, providing the proper microclimate for

these plants. Plant species are not mixed together randomly, but placed in groups, as they might be found in the field.

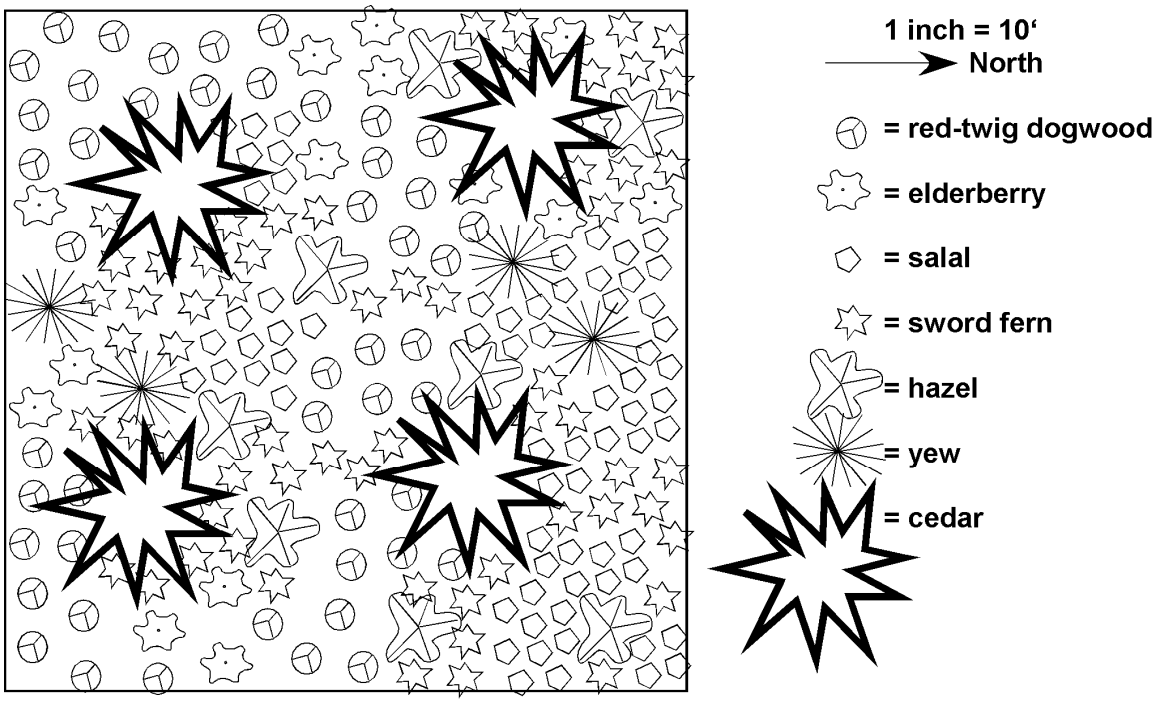


Figure 9.5: Sample Planting Template for Restoration Plantings

Spacing on this list is purposefully tight. In the initial plantings at Pioneer Park, plants were spaced very widely (4-5’ or more) and dispersed over a large area. This made it difficult to maintain them. Tighter spacing gives full coverage faster, even if it means thinning (i.e. removal of trees) must be done later to maintain forest health. In general, the benefit of the shrub plantings must be carefully weighed against the high cost of this restoration option. Wherever possible, native regeneration should be used where revegetation is needed.

Plant Sources

Plants may be purchased through wholesale nurseries or obtained through the local Natural Resources Conservation District. Plants may also be grown by volunteers if they have sufficient skills and commitment to produce viable plants. All plants should meet minimum standards for nursery stock, otherwise efforts to plant and maintain them will be wasted.

Planting Technique

Nursery grown plants should be planted in October, November or February to have the best chance of survival. Plants should be handled by their containers or root balls, never lifted by their tops. Container plants should be unpotted by turning the pot upside down and shaking the plant free while holding onto it. Burlapped plants should be planted with the fabric removed or cut away as much as possible. Planting holes should be dug only to the depth of the root mass. It should be dug at least twice as wide as the root mass to

allow friable soil for new roots to grow into. Planters should check container plants for circling roots and cut them where they exist. Planters should check burlapped plants for excessive soil around the stem and raise the root flair to the surrounding grade when adjusting it in the planting hole. Backfill should be unamended native soil. All plants should be watered thoroughly within 15 minutes of planting to displace any air pockets around the roots. New plantings should receive 2-3" of composted wood chip mulch spread around the base of the plant, but kept from contact with the stem of the plant.

The above activities should be organized to minimize the number of times the soil must be walked on. Soils in planted areas become compacted by repeated visits to clear, plant and maintain. New plantings may take longer to establish with compacted soil surrounding them. Advanced planning can reduce compaction and increase the success of the restoration project. For example, boards can be laid down along the most heavily traveled routes to create pathways and prevent compaction.

9.4. Signs

All projects are recommended to have temporary signs that explain the goals of the project and contact information. These should be placed at strategic locations where they are visible to park users at least one week prior to the beginning of visible project work.

9.5. Maintenance

No restoration project can succeed without maintenance. Therefore, all projects must have a maintenance plan. These plans must show activities, schedules, assignment of responsibilities and costs for these activities. Project planners are strongly suggested to budget 50% of their available resources for the maintenance of any project where plants are being established.

Maintenance of a project should include watering, weeding, fertilization, plant replacement and monitoring. The scope and frequency of these activities will depend heavily on the type of project, its goals and the site conditions. A trained horticulturist should consult with the project leader to determine what level of maintenance will be necessary to insure project success.

A particular concern should be the need for watering plantings where dry soil conditions are anticipated. Mortality on recent plantings has been particularly high from extremely dry summer weather conditions. Hand watering is expensive because most water must be carried to the plants (usually with difficult access) by hand. Managers must be strategic about where to apply watering services to maximize plant survival because it would be impossible to water all new plants in the park.

Watering should begin in late May as soon as rainfall falls below one inch per week. Early watering is critical because plants go dormant after repeated drought stress and do not start regrowing until the next growing season. Gel watering supplements may help mitigate these conditions. These are packages of water held by a binder that are installed when the plant is planted. They slowly release the water to the plant over three months.

They can be replenished during the growing season. Polymer crystals may also help plantings retain moisture. These products should be trialed in future planting projects.

9.6. Monitoring

Projects should be visited and inspected throughout the year to insure consistency with the plan. This typically does not require significant time, but it is important to have this continuity to circumvent problems that may arise. Recommended monitoring intervals are monthly from April-October, and in December and February.

9.7. Record Keeping and Evaluation

Mercer Island Parks and Recreation will be the location for records of site projects for Pioneer Park. Each project will have a separate file. Evaluating a project helps all future efforts by sharing information on what worked and what did not work. The first evaluation would typically occur the third year after plantings have been completed to properly evaluate survival. A second evaluation may be useful another three or four years later. The project should be evaluated by someone who is not directly leading the project for best results. The evaluator should work closely with the project leader to inspect the project. The evaluator should write a brief description of the observed results, compare it to the objectives stated on the Project Planning Form, and make recommendations for future projects of this type.

9.8. Edges

The edges of Pioneer Park require the highest level of management. They are the most heavily maintained parts of the park and are also most vulnerable to risk. Therefore, separate issues have been identified here for the forest edges.

Power Lines

In general, the vegetation under and around power lines should be converted to plant species that do not grow taller than 20' to avoid conflicts with electrical transmission (see Appendix Q). Because of the expense of this objective, it will be achieved primarily through attrition of existing trees and control of tree regeneration in these corridors. The exception to this is a project identified in Section 9.1 above to continue the work begun in 1997 along the SE 68th Street power line corridor. Additional trees along this corridor will be removed and replaced to reduce risk from previously topped trees that may fail and damage transmission lines. This work will be planned and executed in partnership with Puget Sound Energy according to the schedule in Appendix N.

Utility Boxes

Utility boxes are located in the right-of-way along Island Crest Way and SE 68th Street. Members of the community have raised concerns about the appearance of them against the natural setting of Pioneer Park. The ***Pioneer Park Master Plan*** calls for screening these boxes with native shrubs to mitigate the aesthetic impact of these boxes. This plan adopts that objective as well.

Encroachments

The boundary survey conducted in 2002 and subsequent inspections identified 24 areas along residential boundaries where non-park uses of park property are occurring. Many of these are piles of yard waste or stacks of firewood. Some are substantial homeowner improvements, including lawn, play equipment, fences or sheds. Appendix P is a list of these areas identified by the adjacent property address. An objective of this plan is to restore all of these areas to appropriate native vegetation indistinguishable from the rest of the park landscape.

Encroachments will be dealt with in the following manner: The City of Mercer Island, on behalf of the Open Space Conservancy Trust, will contact neighbors of the park who have encroachments in the park. Each situation will be considered on an individual basis. The main objective will be for the neighboring property owner to remove the encroachment and restore the park vegetation to the standards and with the methods described in this plan. The Park Arborist will work with neighbors to design and maintain the restoration. Hopefully, constructive engagement with neighbors will remedy most, if not all the identified issues. This approach recognizes that the park benefits from good relationships with its neighbors. Unresolved encroachments will be referred to the City Attorney.

Residential Edge Landscaping

The conditions of the edges of Pioneer Park are important to the integrity of the park. Additional buffering of the park edges would reduce the incursion of invasive, non-native plants into the park and increase the habitat value of the park. One objective of this plan will seek to educate neighbors about the benefits of landscaping with native plants along their boundary with the park. The Washington State Department of Fish and Wildlife and Seattle Audubon Society have developed educational materials to encourage landscaping with native plants for wildlife, and the Open Space Conservancy Trust will offer such materials to interested neighbors.

Turf

Turf margins of the park are maintained along the entire length of Island Crest Way and on the north side of SE 68th Street. Islands of trees and native vegetation are interspersed within these turf areas. These turf areas create a foreground for the forest edges that frames these streets. These turf areas will be maintained at their current size. Tree islands may be relocated over time as trees die.

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11. Appendix A: Assumptions for Forest Management

Resource Management

- The City will continue to support the vision of Pioneer Park as a sustainable native forest.
- The funding of maintenance in the park will not change substantially from 2001-2002 levels. Existing maintenance resources have occasionally been devoted to managing vegetation, but only in conjunction with trail maintenance or boundary issues.
- In addition, City Council will likely continue to allocate $50,000 annually for forest management for Pioneer Park through 2008. City Council approves Capital Improvement Project funding with each biennial budget.
- The Park Arborist will be responsible for implementation of this plan.
- The plan that results from this process will provide sufficient direction and detail so that the Park Arborist can implement projects without further planning with the Open Space Conservancy Trust or the general public. The OSCT will receive a quarterly report on proposed and accomplished projects and will give feedback to the Park Arborist at that time. Adjacent residents that are affected by specific projects will be contacted about Parks and Recreation activities in advance.
- The Parks and Recreation Department will be the lead agency for implementation of this plan and will be responsible for contacting other agencies with jurisdictions that overlap in the park.
- From preliminary conversations with Mercer Island Fire Department staff, fire risk is a consideration in Pioneer Park. Parks and Recreation will consult with Fire staff and Washington State Dept. of Natural Resources to assess fire risk and develop fire management protocols in the event of a fire.
- Parks maintenance staff will be involved in the implementation of this plan, but their existing maintenance responsibilities prevent them from being extensively involved on an ongoing basis without additional resources. Plan implementation will be accomplished by contractors or seasonal labor.
- Maintenance of plantings is essential for successful forest management. This means that approximately 50% of the cost of restoration planting projects will be spent in the preparation and installation phase, and 50% will be spent in the maintenance phase (over several years) to insure plant establishment and control of competition.
- Baseline data will be collected as part of the planning process to provide long-term monitoring capabilities. This data will be stored in a geographic information system where this is feasible.
- Arboricultural industry standards, such as ANSI A300, ANSI Z133 and ISA Pruning Guidelines will be followed where applicable.
- Tree hazards will be managed through periodic inspections by trained staff to detect defects that might cause structural failure. Inspections will follow industry-accepted protocols. Areas with higher risk potential will be inspected more frequently.

Community Framework

- The community will continue to support the vision of Pioneer Park as a healthy, sustainable native forest.
- The Open Space Conservancy Trust will continue to advocate for the best possible management of the park and educate the greater community about the value of the park.
- Volunteer and service learning activities will contribute to stewardship of the park at roughly double historical levels (historically there has been one volunteer project and one service learning project (i.e. school group) in the park each year).
- Parks and Recreation staff will seek cooperation of residents along the park boundary to help us manage the edges of the park adjacent to their property according to the plan.

Vegetation Resource

- The existing forest in Pioneer Park is the result of historical events of both human and non-human origin.
- The forest condition within each quadrant varies from place to place, but these variations can be typified by observable criteria, namely the composition, age and condition of the tree canopy. Groups of trees of similar composition, size and condition (stands) will be the primary unit of analysis for this study.
- Management of the forest should achieve a distribution of tree ages within a tree stand whereby enough younger trees are available to replace older trees that are lost through natural attrition or planned thinning.
- Management of the forest should retain the multi-layered canopy structure typical of a coastal Pacific Northwest forest. This includes ground layer, understory and overstory vegetation.
- Managing diversity is an important part of forest management. Too much or too little diversity impacts habitat, aesthetics, pest control, and management efficacy. Activities that increase diversity should not introduce excessive randomness to the forest composition.
- The forest canopy bordering the stream and wetlands directly provides the vegetative matter that is the base of the aquatic food chain. The streamside canopy also shades the watercourse and thus prevents increases in water temperature. High water temperatures (with less dissolved oxygen) tend to increase the metabolic rate of cold-water organisms causing increased stress.
- Additions of large, woody debris maintain the complex structure in the streams and wetlands . As streamside trees die they often fall into or adjacent to the channel creating complex stream and riparian pool habitats.
- Excess fine sediment in the stream channel can impact salmonids through degradation of spawning gravel and reduction of aquatic food production. Maintaining vegetation

cover on the slopes next to the stream corridor is essential to prevent siltation of the stream channel.

- Most of the park is considered "edge" forest. This refers to the microclimatic difference between the conditions found at the edge of a forest and those found in the interior. Edges of forests have higher light levels, lower humidity, higher wind speeds, greater temperature fluctuations, and greater movement of wildlife. Edges are inherently less stable, more dynamic parts of the forest. This, combined with the surrounding urban environment, has made this forest susceptible to loss of "interior" forest conditions, the kind of conditions that we see in forested wilderness areas. Management activities can only partially mitigate "edge effects". Therefore a goal to develop "old-growth" forest character is probably not realistic.
- Park users enjoy the experience of being in a mature native forest reminiscent of "old-growth" forests they may have experienced elsewhere. Edge effects have to be controlled or mitigated to maintain this type of forest character.
- All alternatives for this park include control of invasive exotic plants (e.g. blackberry, holly, laurel, ivy). Some restriction of these plants must be achieved to sustain the forested condition of this park.
- Invasive exotic plants cannot be eradicated, only controlled to target levels. Control of invasive exotic plants will employ either ground layer disturbance or the targeted use of herbicides, or both. Either technique is best employed as part of an integrated strategy for successfully controlling the target plant with the least amount of external consequences. For example, a strategy for controlling blackberry might consist of digging out roots initially, with subsequent control accomplished by sponge application of Roundup® herbicide. This would avoid repeated digging and confines chemical use to resprouting shoots.
- Strategies requiring heavy equipment, such as logging, will not be used to manage the forest.
- Wildlife habitat will be managed to promote species diversity and to ensure that populations of indigenous species are maintained. This can be best achieved through the maintenance and enhancement of habitat values. Habitat values that lead to species diversity include the following elements: breeding, foraging, watering, rearing, hiding and thermal cover.
- Wildlife management within Pioneer Park is focused primarily on the protection and enhancement of key habitat and structural components that are utilized by a diversity of species. Snags and down logs will be maintained through the retention and recruitment of snags over time. Snags are used to some degree by all major groups of wildlife species found in Pioneer Park. Their primary value is as a nesting and roosting site, or foraging for insects. Species excavate their own cavity, utilize previously excavated cavities or utilize natural cavities and crevices. Other species use the tops of larger snags as nest and roost sites. Species in Pioneer Park that use cavities in snags include hairy woodpecker, chestnut backed chickadee, red-breasted nuthatch, screech owl, violet-green swallow, brown creeper, Douglas squirrel and two bat species. Species that nest or roost at the top of snags include red-tailed hawk, raven, and osprey. Retention of dead and down materials are particularly critical in riparian areas.

- Woody debris and snags will be left in the park as much as possible, except where they present a hazard, or are located in landscaped edges where their habitat value is diminished and aesthetic quality is also a consideration.
- All wildlife management will be conducted under the jurisdiction of the Washington Department of Fish and Wildlife. Nuisance wildlife species will not be managed by changing or reducing habitat in the park unless management activities target only the nuisance species.
- Clearance for power lines must be maintained by Puget Sound Energy according to state law. There is some cooperative basis for managing trees around power lines, but this will not remedy the fundamental incompatibility of mature native trees near power lines. A combination of inspection and new horticultural strategies may provide a more stable landscape in the power line clearance zone.
- Utility boxes in the right-of-way require gravel pads and access. Vegetation can mitigate their visual impacts to a limited degree. Such mitigation will be developed where it is missing or inadequate.
- At intersections and curves in the road, there are sight distances that must be maintained for traffic safety. Vegetation may be pruned or removed to maintain this sight clearance.
- Turf edges to the park will be maintained along the west sides of the southeast and northeast quadrants and along the east and south sides of the northwest quadrant.

12. Appendix B: Alternative Forest Management Scenarios

The following descriptions illustrate general long-term results that could be expected from distinct goals for managing the forest vegetation. All typologies tend towards a more conifer-dominated forest, which is the natural direction of forest succession in this region. Please keep in mind:

- These typologies could be applied to the entire park or to only a portion of the park.
- Strategies within each typology are not necessarily exclusive to that typology.
- There are gradients of choice in between these alternatives. Distinctions between typologies have been created for the purposes of discussion.
- The final "vision" for Pioneer Park's forest may contain an intermediate typology or one that is not described here.

Deep Forest

Goal: The overriding goal of this alternative is to create interior forest habitat in Pioneer Park to promote the survival of trillium, sword fern and other native understory species. This goal recognizes the historical existence of a lower-growing understory that was found in the park when it was purchased by the City in the 1960's.

Strategy: The primary strategy for this alternative would be the establishment of dense conifer overstory and dense evergreen edge plantings. Additional strategies include control of invasive exotic plants, planting of some semi and non-native tree species that would improve the canopy integrity, and selective thinning of deciduous trees once conifers are established. Some tall overstory (e.g. elderberry, hazel, Indian plum) would be trimmed back to favor salal, sword fern, Oregon grape, etc.

Invasive Control: Blackberry would be the highest priority for control, since this indicates high light levels. These areas would be densely replanted with trees. Ivy and other invasives would be controlled secondarily to limit the spread of such plants until less favorable forest conditions are created, or to protect new tree plantings.

Character: The character of this forest type in thirty years would be a noticeably denser forest of adolescent conifer trees mixed in with existing mature trees. Light levels in the forest would be lower. Views into the park would be restricted by dense vegetation along the edges.

Costs: Short term cost is expected to be highest because of the extensive planting and invasive control. However, long-term cost of this alternative is expected to be lowest of all the alternatives because the dense overstory provides the most effective control of invasive exotic plants.

Limitations: One limitation of this alternative is that it is most effective if applied to an entire quadrant. More limited applications will reduce the effective interior area. Application to less than half a quadrant would probably be ineffective. Another limitation of this alternative is its initial expense.

Purely Native

Goal: This alternative would utilize only the native plant species currently found in the park. Genetic conservation of plant populations in the park could also be a secondary goal.

Strategy: Management activities would consist of aggressive control of invasive exotic plant species and dispersed planting of evergreen and deciduous overstory species. Native regeneration of overstory and understory would be utilized as much as possible. Canopy gaps would be managed or created for forest regeneration. Since root rot is a significant management issue, choices of overstory trees would be limited in affected areas and tend to favor red cedar and deciduous species which are resistant.

Invasive Control: Invasive control is the cornerstone of this strategy. As much as possible, existing native vegetation would be "liberated" from invasive exotic species. Natural regeneration of understory would be preferred over replanting where practical, even if this results in less diversity.

Character: The character of this forest in thirty years would be a mixed forest of predominantly mature deciduous trees with adolescent conifer trees dispersed throughout. Cedar would predominate as regeneration, with hemlock represented to a lesser degree, alder and bigleaf maple in remnant canopy gaps and Douglas fir in edges along the south and west quadrant boundaries. Understory vegetation would consist primarily of taller "brushy" species, including elderberry, Indian plum, and hazel. Trillium, salal, Oregon grape and sword fern would be expected to become less prevalent. Edges of the park would be moderately permeable.

Costs: Short term costs are expected to be somewhat lower than for the Deep Forest alternative, since it places less emphasis on planting. Because this alternative does not effectively reduce light levels in the park, long term control of invasive exotic plants will keep long-term costs higher than for the Deep Forest alternative.

Limitations: One limitation of this alternative is the long-term expense of continually controlling invasive plants. These costs should become less with adequate initial efforts, but routine control efforts will be necessary at substantial levels to achieve goals. Another limitation is the loss of understory species that are both environmentally and aesthetically desirable.

Basic Canopy

Goal: This alternative would be the most flexible about the content of the forest, instead focusing on retaining an attractive forest character for park users and existing wildlife. The primary goal would be on maintaining a continuous tree canopy.

Strategy: Tree selection would be primarily native, but selected semi and non-native species would be used as in the Deep Forest option to improve canopy integrity. Understory content would be less important than maintaining a balance of vistas and enclosures along trails and in the periphery of the park. Woody debris would be managed more actively to move down logs outside of trail corridors.

Invasive Control: Invasive exotic plants would be controlled, but more selectively than in the Deep Forest and Native Only options. Emphasis would be on low visual impact strategies and maintaining planted trees.

Character: The character of this forest in thirty years would be a mixture of evergreen and deciduous canopy, intermediate in conifer character between the Deep Forest and Natives Only alternatives. However, the understory would be more diverse than either of the above scenarios because tall "brushy" species would be controlled in areas to provide visual landscape diversity.

Costs: The short term cost should be lowest of the three alternatives, but long-term costs are expected to be greater.

Limitations: One limitation of this alternative is the continuing costs for invasive control, which is expected to remain fairly constant for the long-term. Another limitation is the loss of native plant populations as the park is managed for structure, rather than for species content.

	Deep Forest	**Purely Native**	**Basic Canopy**
TREES: What trees are planted/fostered? How are they located? How are existing trees handled?	Mostly conifer species, including some non-native species are planted or selected from on-site regeneration. The trees are planted densely to get new canopy going quickly. Existing deciduous trees are pruned or "snagged" to favor conifer species.	Any native trees are considered acceptable. They are selected from existing regeneration that occurs from invasive weed control and understory management.	Trees are only planted in canopy gaps. Any native trees are considered acceptable. Conifers are preferentially planted in gaps where root rot is not prevalent.
Density of tree regeneration	High – with subsequent thinning	High with subsequent thinning	Low – only in gaps
INVASIVES: How much are invasives controlled? How are they controlled?	Invasive plants are controlled aggressively everywhere. Ivy is weeded out of native groundcovers.	Invasive plants are controlled aggressively everywhere. Ivy is weeded out of native groundcovers.	Invasive plants are controlled where they inhibit canopy growth (ivy on trees, blackberry patches) or threaten to significantly encroach on the forest (seed-producing holly). Ivy on the ground is allowed to remain.
SHRUBS: What understory plants are encouraged?	Native evergreen groundcover (sword fern, salal, Oregon grape) are fostered where they exist, and are replanted where they are absent. Tall native shrubs are cut back where needed to allow this.	All native understory plants are considered acceptable, except where they compete with canopy regeneration. Invasives are aggressively weeded out.	Understory is only manipulated along trails, selectively encouraging evergreen groundcovers to provide more openness for park users. Otherwise, understory is only controlled around planted trees.

13. Appendix C: Criteria for a Sustainable Urban Forest in Pioneer Park

(after Clark, et. al. ***Model of Urban Forest Sustainability*** 1997)

13.1. Vegetation Resource

Goal		Criteria
Soil Conservation	Protect the park's soils to insure biological function, nutrient cycling and soil building processes	Forest soils are living systems that build soil and provide the rooting environment for all vegetation in the park. Compaction, disturbance, changes in drainage and other human influences damage the health of the soil ecosystem. Protection and periodic additions of organic matter preserve the soil ecosystem.
Canopy Structure	Achieve appropriate canopy cover and layering	Canopy should be mostly continuous over the site. Multiple layers of understory are desirable for habitat and canopy integrity. Gaps should be created or replanted to manage for structural diversity.
Age Distribution	Provide for uneven age distribution	A mix of young and mature trees is essential if canopy cover is to remain relatively constant over time. Planting or recruitment of native regeneration will increase age diversity.
Species Mix	Provide for a diversity of primarily native species	Species diversity is important for the long-term health of the forest. Dry soil conditions and the persistence of laminated root rot makes species selection very site-specific.
Invasive, Non-native Species	Control the extent of blackberry, ivy, holly, laurel and other species identified as such	The introduction of invasive, non-native species has changed the ecology of the forest. Native plants, including trees, will be displaced unless the invasive plants are controlled. Eradication is not a goal of this plan, however.

Habitat	Preserve and enhance habitat features to maintain native wildlife populations	The park contains wildlife that depend on particular forest features, such as tree canopy, gaps, nesting cavities, perched wetlands, etc. Identify native wildlife species and their habitat needs to inform management objectives.
Edges	Manage park edges to maintain forest integrity and character	Edges must contain dense vegetation to protect the forest interior from wind and sun. Edges along public right-of-way should also allow some views into the forest.

13.2. Community Framework

OSCT Leadership	OSCT board members create initiatives to carry out plan goals	The OSCT board members communicate the long-term direction for the park. They develop connections with constituents, educate the public and recruit resources on behalf of the park.
Neighborhood involvement	Neighbors of the park and nearby residents take active role in park projects and park monitoring	Local residents assist the City by monitoring the park and reporting problems to City staff. Residents work with City staff to implement restoration projects according to plan. City staff develop technical competence in "core" volunteers.
Education	Materials and planned activities help the greater community become aware of Pioneer Park and learn the value of its ecosystem	Island residents benefit from Pioneer Park, but their understanding of the park depends on different strategies for outreach that are tailored to the various levels of awareness among island residents.
Volunteerism	Volunteers provide a significant amount of the labor for restoration projects	People come to volunteer at the park for scheduled project events. Volunteers are both individuals from the community and members of service groups. City staff and core volunteers provide training and leadership.

Local Businesses	Local businesses promote involvement in the park and support projects with cash and in-kind donations	The South Mercer shopping center and food service businesses are current places for partnerships. Business connections should be expanded island-wide.
Green Industry Capability	Landscape and tree care firms that work in the park meet plan goals	The restoration work proposed for the park is not traditional work for the Green Industry. New work skills and methods are needed to accomplish plan goals.
Public Agency Cooperation	County and State agencies provide technical assistance and regional perspectives	Issues facing Pioneer Park are common for all urban forests in the Pacific Northwest. Projects such as regional ecosystem analysis can help educate the greater public about the benefits of urban forest canopy.

13.3. Resource Management

Management Plan	Develop a forest management plan with input from stakeholders	A management plan should represent a consensus of the community about the future of the forest. The plan guides the resource managers in their operations and projects. It also provides a way for citizens and private groups to participate as partners in forest management activities.
Funding	Develop and maintain adequate funding to implement this management plan	Public and private funding for Pioneer Park depends on recognition of the park as a resource for the greater community. Mercer Island City Council currently funds all forest management in the park.
Staffing	Employ and train adequate staff to maintain and manage the park	Mercer Island Parks and Recreation is responsible for maintenance and management of the park. Staff have various levels of involvement with the park according to their areas of responsibility. Currently, staff do not perform all work associated with forest management in the park.

Planning and Assessment tools	Develop methods for documenting site conditions, operations and projects. Evaluate activities and improve future projects with resulting input.	The City maintains a GIS database that serves as a top level planning tool for forest management. Additional planning and assessment tools such as protocols and forms must be developed. This information is useful when it is stored systematically so it is accessible to future managers.
Citizen safety	Maximize public safety with respect to trees	Managing hazard trees requires inspection protocols and schedules, plus ability remedy hazards a timely manner. Fire safety depends on prevention and response capabilities.
Vegetation protection	Trees and shrubs are protected from damage by park users, management activities and neighbors	Protection of vegetation in native forest settings focuses on preventing compaction and disturbance to the soil around trees and shrubs. Theft or vandalism of vegetation is also an issue.
Species selection	Species are selected to fit the particular growing conditions where they are located	To preserve the plant communities in the park, native species are strongly preferred for planting wherever possible. Certain coastal northwest species may be used where locally native species cannot perform as needed for plan objectives.
Standards for tree removal	Trees are removed to achieve management goals	Clear policy concerning tree removals is needed avoid arbitrary and ad hoc decision-making by managers.

14. Appendix D: Park Invasive Plant Report and Recommendations

15. Appendix E: Management Plan for Tree Diseases in Pioneer Park, Mercer Island

16. Appendix F: Pioneer Park Ravine Habitat Assessment memo

DATE: 29 April 2002
TO: Paul West, City of Mercer Island
FROM: Marcia Fischer and Elissa Ostergaard, Sheldon and Associates
SUBJECT: Pioneer Park Ravine Habitat Assessment

The habitat of the ravine area in the northeast corner of Pioneer Park is mature, floristically diverse second-growth forest surrounding a steep-sided ravine through which flows a small creek. The riparian habitat along the creek and ravine is unique within the park, which is primarily upland forest. The riparian area is a mosaic of diverse microhabitats characterized by hillside slope wetlands, dense forested canopy cover, and open canopy areas. The forest is a mixture of coniferous and deciduous trees dominated by bigleaf maple, Douglas fir, and western hemlock. Black cottonwood dominates where the ground is moist. Habitat succession is in evidence, with large early successional species such as bigleaf maple and Douglas fir making way for western red cedar and western hemlock saplings.

The steep slopes of the ravine, intensity of stormwater flows, and geology of the ravine allow for frequent tree blow-down. Downed trees have opened the forest canopy, allowing dense undergrowth to flourish. Downed trees function as nurse logs for young tree and shrub saplings, and woodpecker holes can be seen at very close range. Gaps left by upturned rootwads provide opportunities for pioneer species to become established. Understory plants are very diverse, and include native species such as devil's club, salmonberry, Indian plum, salal, western hazel, large-leaf avens, trailing blackberry, long-leaved Oregon grape, horsetail, and stinging nettles, among others. Long-lived plant species such as red huckleberry, trillium, at least six fern species (sword, deer, lady, bracken, maidenhair and licorice), and giant conifer stumps are indications of the mature forest which once was present at the site. Non-native plant species are relatively uncommon, present primarily in isolated areas of recent disturbance. Non-native species include Himalayan blackberry, English ivy, English holly, English laurel, mountain ash, and a horticultural variety of St. John's wort.

The diversity of the microhabitats and the presence of water associated with the stream and hillside wetlands attracts a wide variety of wildlife species, including invertebrates, amphibians, reptiles, mammals, and birds. Riparian systems are generally extremely productive in terms of invertebrates and plants. They attract wildlife for feeding and nesting, and often function as migration corridors. Invertebrates in the stream may include mayflies, caddisflies, midges, true flies, worms, and snails, among others. These are a food source for numerous terrestrial predator species. The moist riparian woodlands are likely inhabited by terrestrial salamanders such as Ensatina and western red-backed salamanders, which prefer hiding under abundant downed logs and leaf litter. If shallow ponds are present nearby, the riparian area may also attract Pacific tree frogs, long-toed salamanders, and red-legged frogs. Pacific giant salamanders may breed in the stream and burrow underground in the moist forest. Garter snakes are likely to prefer basking in large brush or rock piles or along sunny slopes in the riparian area, where food is abundant. Raccoon, Virginia opossum, bats, and small mammals such as the creeping vole, dusky shrew, Trowbridge shrew, vagrant shrew, and deer mouse are also likely to inhabit the riparian area. Douglas squirrel, a relatively uncommon native squirrel, was observed at the site (April 24, 2002).

The area provides excellent opportunity for passive recreational use by hikers, educational groups, and nature lovers, birdwatchers in particular. Migratory birds are attracted to large trees such as those present along the ravine, and warblers are particularly attracted to black cottonwood trees. Pileated woodpeckers are found in the area, and abundant snags provide myriad habitat opportunities for cavity-dwelling birds such as chickadees, swallows, downy woodpeckers, and nuthatches, among others. Birds of prey such as red-tailed hawks, Cooper's hawks and sharp-shinned hawks tend to be attracted to such areas where they can be seen to hunt for small birds and mammals.

17. Appendix G: Summary of Forest Management Projects to Date

17.1. Revegetation projects

In 1997, a slope revegetation project was completed at the Twin Cedars Overlook in the northeast quadrant.

In 1998, a crew of 2-5 removed 11 tons of invasive plants during a 2 month period.

Beginning in 1999, the City Council funded forest management CIP projects for Pioneer Park. This funding initiated the first large-scale approach to forest management in the park. That year, the southeast quadrant was replanted in areas of root rot as identified in the report by Edmonds on tree diseases.

Year 2000 was the first major project. This project built on the experience gained from previous projects in 1997, 1998 and 1999. Brian Gilles was hired as a consulting arborist to plan and direct the project in cooperation with Bob Stagman from the Open Space Conservancy Trust Board. A crew of 10 from Green Life Landscaping was hired and spent three weeks clearing 36 tons of invasives from the park and planting 1600 plants. Volunteers helped to plant a portion of the plants.

In June of 2001, Parks and Recreation rehired Green Life Landscaping to weed the plantings which were being overgrown. Mortality on coast redwood and ponderosa pine was noticed in several areas. New seedlings of native elderberry were observed "volunteering" in many planting areas. This native regeneration was an unexpected benefit of this project.

In the Fall of 2001, the previous year's plantings were weeded again, and new trees were planted in existing planted areas. New areas in the northeast and southeast quadrants were planted as well. A total of 875 trees and 1900 shrubs were planted. Shrubs were concentrated in forested areas along the east side of Island Crest Way. In response to public comment from the previous year's plantings, only native plants were used in the 2001 plantings. In some areas of the southeast quadrant, debris piles were made to avoid hauling off organic waste.

In Spring of 2002, the previous two years of plantings were weeded. In Fall, 2002, a fourth round of weeding was completed. At the time, one-fourth of the 2001 trees were dead or dying. In contrast, year 2000 plants were surviving well. The cause was attributed to an exceptionally dry summer and early fall, combined with the sandy, well-drained conditions. One hundred trees were replanted where the previous year's trees had died.

These projects have provided us with a wealth of experience that has been analyzed and used to formulate management prescriptions for Pioneer Park. See Sections 8 and 9 (above).

17.2. Transmission Line Project

In late fall of 1997, Puget Sound Energy sponsored a project along the south side of SE 68th Street to protect the transmission lines that provide electricity to Mercer Island. This stretch of roadway had a history of outages from tree failures. The project removed Douglas fir, bigleaf maple, red alder and madrona that were underneath the clearance zone of the lines. Replacement plantings included hazel, vine maple, elderberry, ocean spray, salal, sword fern and huckleberry. Resprouting maples were recut in the fall of 2002.

18. Appendix H: Summary of Stand and LIDAR Analyses

Overstory of the park was surveyed using a combination of digital aerial imagery, Light Distancing and Ranging (LIDAR) data and ground observation. Staff delineated stands using ArcView GIS software and 1999 color orthophotos. Stand delineation was based on canopy composition, except where topography or hydrology was observed to be a strong environmental influence. Therefore, ravine areas containing steep slopes (>40%) or wetlands were considered separate stands. The two most dominant tree species found in each stand was recorded. Based on this analysis, the park contains 32 acres of conifer forest, 45 acres of broadleaf forest, and 40 acres of mixed broadleaf-conifer forest.

Marshall and Associates conducted an analysis of LIDAR data captured in late 2000 and early 2001. This data was collected by flying over the area with laser equipment to measure ground level and intermediate heights of objects that the light beam intercepted in a 6' spacing. For the purposes of this analysis, the difference between the height of the "first return" and the ground level was considered to be the canopy height in each 6' x 6' "pixel". Canopy heights were grouped into classes as follows:

0-4 feet	bare earth, prone vegetation
5-15 feet	shrub vegetation
16-30 feet	small trees
31-50 feet	medium trees
>50 feet	tall trees

Areas of six pixels (216 square feet) or greater in prone or shrub vegetation were considered canopy gaps. Each non-gap pixel was also rated for actual height variability in comparison to its neighbors. A window of seven by seven pixels around each pixel was analyzed for height variability. That is, within the seven by seven pixel frame, the standard deviation of the height in each pixel was calculated relative to all the pixels within the frame. Areas of low variability were considered "closed" canopy using a standard deviation breakpoint of 875. Areas of high (standard deviation above 875) variability were considered "fragmented" canopy. The center pixel of the frame was then labeled with a code for either "closed" or "fragmented" . The entire frame was then moved over one pixel and the calculation redone.

Results from this analysis are as follows:

	Northwest	**Northeast**	**Southeast**
Canopy Gap	19.9%	15.5%	13%
Fragmented Canopy	14.5%	17.8%	16%
Closed Canopy	65.5%	66%	71%

Percentage of the total area of each quadrant containing each canopy condition

Ground surveys with the resulting data in May of 2003 verified the accuracy of both the extent and the location of these canopy conditions.

19. Appendix I: Pioneer Park: a natural history

20. Appendix J: Summary of Management Resources for Pioneer Park

Management resources are the people, funds and "tools" that are dedicated to the park on an ongoing basis. The "tools" are not so much hardware as the plans, standards, policies, codes and protocols used in the management of the natural resources. It is important to establish whether these "tools" meet industry standards (so-called "Best Management Practices") and whether they are based on "Best Available Science."

20.1. Parks and Recreation

The City of Mercer Island's Parks and Recreation Department has primary responsibility for managing Pioneer Park. Multiple staff have responsibilities in Pioneer Park. The Director is the liaison to the Open Space Conservancy Trust that owns the park. The Park Arborist has the responsibility for planning and management of trees and natural vegetation in the park. The Parks and Recreation Manager directs overall staff operations in the park. This position makes decisions that affect the park's overall character, such as annual trail maintenance schedule or permanent improvements. The Park Generalist works for the Parks and Recreation Manager and manages the daily schedule of the crews. The Park Team Leader has primary responsibility for maintenance in the park and supervises other employees that work there. The Team Leader directs or performs litter pick up, mowing, brushing trails, weeding beds, blowing leaves, servicing trash cans, clearing down trees, and inspecting the site routinely. A three-month seasonal position supports the Team Leader in carrying out these tasks during the summer months.

20.2. Maintenance

The City's Maintenance Department has management responsibilities in and adjacent to the park. The Assistant City Engineer is responsible for maintaining the watercourse in the ravine as a drainage utility. Pioneer Park has significant vegetation in the adjacent right-of-ways. The City's Right-of-Way Manager is responsible for maintaining the streets and public improvements in the right-of-way. This position makes decisions about vegetation in the right-of-way, such as the need for routine trimming of vegetation along the roadway or removing trees that are a hazard. The Park Arborist consults with the Right-of-Way Manager as needed on such issues. The Right-of-Way Manager utilizes City staff and independent contractors to perform such work.

20.3. Development Services Group (DSG)

The City's Development Services Group administers the City's Land Use Code, as well as develops the public infrastructure on the island. The Traffic Engineer is responsible for designing roadways and pedestrian access on the island. Vegetation and trees are issues for sight distance, roadway clearance, roadway safety, etc.

DSG also maintain the City's geographic information system. This system is a computer-based system that contains topography, orthophotos, boundaries, and other digital data that can be useful for forest management. They own a differential geographic positioning system (GPS) that can be useful for pinpointing the location of trees or other objects in

the field. For example, Pioneer Park's trail system was mapped using differential GPS. This technology has limited usefulness under tree canopy, however. Most work must be done during winter months for it to be effective.

DSG also develops and administers the City's tree ordinance and critical areas regulations. Work in the ravine area in the northeast quadrant of Pioneer Park must adhere to these regulations when trees or vegetation are removed. The Parks and Recreation Department obtains an annual permit for tree removals that are necessary for forest management city-wide. The City's Code Officer issues this permit in consultation with the City Arborist.

20.4. Puget Sound Energy

Puget Sound Energy has responsibility to maintain electrical transmission lines on Mercer Island. PSE contracts with Asplundh Tree to perform pruning on trees within the clearance zone of its power lines. This is done on a three to five year cycle. PSE receives a permit for this pruning through the City's Development Services Group. In Fall of 1997, PSE and the City completed a vegetation management project under the power lines on SE 68th Street to replace existing trees that were causing power outages with lower-growing trees. PSE returned in 2002 to remove maples that had resprouted.

20.5. Contractors

A resource often overlooked in planning is the availability of qualified contractors to perform work as it has been planned. Much of the work in this plan requires specialized training and experience to achieve plan objectives. Landscape contractors that specialize in forest restoration will enhance the outcome of project work. To date, the City of Mercer Island has contracted with Green Life Landscaping for the majority of the restoration work in the park. This contractor has proven experience in implementing restoration projects in the park. However, future projects may have different objectives or strategies from those previously implemented. It can be difficult to find qualified contractors for this type of work.

20.6. Technology

Technology for forest management is changing as new research and products become available. The potential of technology is to decrease costs or increase efficiency. However, new technologies also require a "learning curve" that requires an investment of time and resources before it begins to yield benefits. Technology choices will influence the way projects are implemented. For example, one area of experimentation in Pioneer Park is with watering supplements. These are slow-release tubes of water in gel form that are installed at planting. These supplements may improve survival of plants, however they are considered experimental at the current time. Using this technology on a trial basis will help the adaptive management strategy determine whether this has real potential for all projects.

20.7. Funding

Funding for Forest Management has been provided by City Council in the form of a Capital Improvement Project. Fifty thousand dollars per year has been allocated to the park since the year 2000.

20.8. Standards

There are numerous standards that apply to tree care operations. They include:
American National Standards Institute A300 – Pruning (2001)
American National Standards Institute Z133.1 – Tree Care Operations
International Society of Arboriculture *Best Management Practices: Tree Pruning*
American Nursery and Landscape Assoc. *American Standard for Nursery Stock*
Council of Tree and Landscape Appraisers *Guide for Plant Appraisal, 9th Edition*

There are other publications that are not technical standards, but are recognized as the most current and thorough information on the subject. These publications were written by leading experts and have withstood peer scrutiny. Publications that fit this description include:

Trees and Development: a technical guide to preservation of trees during land development
A Photographic Guide to the Evaluation of Trees in Urban Areas
Evaluating Trees for Defect
Flora of the Pacific Northwest
The Natural History of Puget Sound Country
Gardening with Native Plants of the Pacific Northwest
The Once and Future Forest: a guide to forest restoration strategies
Urban Forestry: Planning And Managing Urban Greenspaces
Arboriculture: integrated management of landscape trees, shrubs, and vines. 3rd Ed.

A third category of publications are those developed by local agencies and non-profits with technical information useful for forest management in this region. They are not standards, but they offer the best compilation available on the subject. Examples are:

Naturescaping - A Place for Wildlife
A Manual of Native Plant Communities for Urban Areas of the Pacific Northwest
Slope Stabilization and Erosion Control Using Vegetation
Guideline Specifications for Nursery Tree Quality

This plan recognizes these resources as representative, but not inclusive of the best available science in the field of urban forestry. While a reasonable effort has been made to compile leading information, there may be additional resources that would be valuable to this forest management plan. Furthermore, information becomes more complex over time. The value of new standards should be evaluated and ranked as were the resources listed above.

21. Appendix K: Summary of Community Resources for Pioneer Park

Community resources are the people, funds, expertise and political support that are volunteered in support of the park. Unlike management resources, they are not necessarily dedicated to or fit for a particular service. However, these resources have proven to be indispensable for the long-term sustainability of urban forests. They are a challenge to include in a plan, since they may be available only for limited commitment or go away without notice. Therefore, it is difficult to develop a plan that relies heavily on community resources for implementation.

21.1. Open Space Conservancy Trust

One of the strengths of Pioneer Park is that it has a dedicated body of citizens that serve as a bridge between management resources and community resources. The Open Space Conservancy Trust was chartered in 1992 to own the park and oversee its management. Its board consists of seven members that are selected by City Council. The Board's primary responsibilities are to direct the long-term management of Pioneer Park and to provide input and feedback to the Parks and Recreation Department about its short-term management of the park. It also has responsibilities to communicate with citizens about the park. The Board meets monthly to review management issues germane to Pioneer Park. The Board also publishes a newsletter and periodically hosts open houses to exchange information and ideas with the greater public about the park.

21.2. Ivy Brigade

The Ivy Brigade is a group of volunteers that meet monthly during the non-winter months to remove ivy from trees in the City's parks. Some members also do ivy removal on their own schedule as time permits. They are coordinated by a part-time volunteer coordinator and a Park Team Leader.

21.3. Committee to Save the Earth (CSE)

CSE maintains the native plant garden at Mercerdale Park, and is interested in conservation activities. To date, they have not had explicit involvement in Pioneer Park, but have been involved in tree planting on School District property.

21.4. Youth and School Programs

High school students from the Youth and Family Services E-team have worked in the park during the school year, and the YFS VOICE program sponsors similar summer projects for high school youth. Islander Middle School 8th grade students have turned out occasionally to earn service hours as required for their graduation. Eagle Scouts have also accomplished significant trail work in the park.

21.5. Businesses

Starbucks Coffee Company has expressed interest in supporting some volunteer efforts in the park. The extent of this interest has not been explored. Other businesses in the South End QFC shopping center have not yet been approached for support.

21.6. Churches, Synagogues, Mosques, Temples

Religious groups often organize community service activities. These activities are usually one-time events. Some religious groups have holidays that relate to environmental stewardship. For example, the Jewish calendar includes a tree planting holiday called Tu b'Shevat. To date, this kind of volunteering has played a limited role in Pioneer Park.

21.7. Service Groups

Service organizations such as Rotary Club, Seattle Works, and United Way may be available for volunteer projects. These groups typically seek a large project on a one-time or annual basis. Large projects require recruiting or training volunteer leaders. Discussions about this type of involvement may help find ways to achieve more continuity with these service groups throughout the year.

21.8. Environmental Groups

Individuals affiliated with environmental groups, such as Seattle Audubon and Washington Native Plant Society, have volunteered in the park. These individuals have demonstrated technical competence in their interest area and have contributed substantially to the management of the park. Contacting other such individuals through the local chapters of environmental groups could be very productive.

21.9. Neighbors and Concerned Citizens

Neighbors of the park are potential park stewards. They can help in several ways: monitoring forest conditions, maintaining the edge of their property, preventing dumping in the park, and partnering on restoration projects. To date, Parks and Recreation has made no effort to recruit this kind of help. However, several neighbors have volunteered and are awaiting direction from Parks and Recreation staff.

Individual park users can play a role in environmental stewardship. They often call the Parks and Recreation Department to report problems in the park. Volunteers also can work on their own, once they are registered and oriented as volunteers. Parks and Recreation staff would help them find tasks that achieve forest management goals. Undirected "guerrilla" projects in the park are discouraged because they are likely to work counter to the goals of this plan.

22. Appendix L: Project Planning Form

Pioneer Park
Restoration Project Planning Form

Name of Project_____

Project Manager:_____ Contact Phone_____

Dates of Project:_____ Duration of Project_____

Location: Quadrant:_____ Address or Area:_____ (*show on attached map)*

Size of Project (sq ft)_____ Number of trees being removed_____

Describe Project:_____

_____

_____

Objectives:

GOAL	Objective	Quantities
Tree regeneration		
Invasive control		
Understory treatment		
Community Involvement		

Is this project identified in the Pioneer Park Forest Management Plan? Yes/No

If yes, what project number? _____ Page number in plan ____ Phase _____

If no, does this project conform to the goals and objectives of the Plan? Yes/No
Explain:

Project was reviewed by Parks and Recreation staff on _____date

Project was reviewed by the OSCT Board on _____date Approved? Yes/No

Who will perform the project? Please give names and contact information.

Contractor_____

City Staff_____

Volunteers_____

Cost for the project _____ Fund source _____

Public notification for the project _____

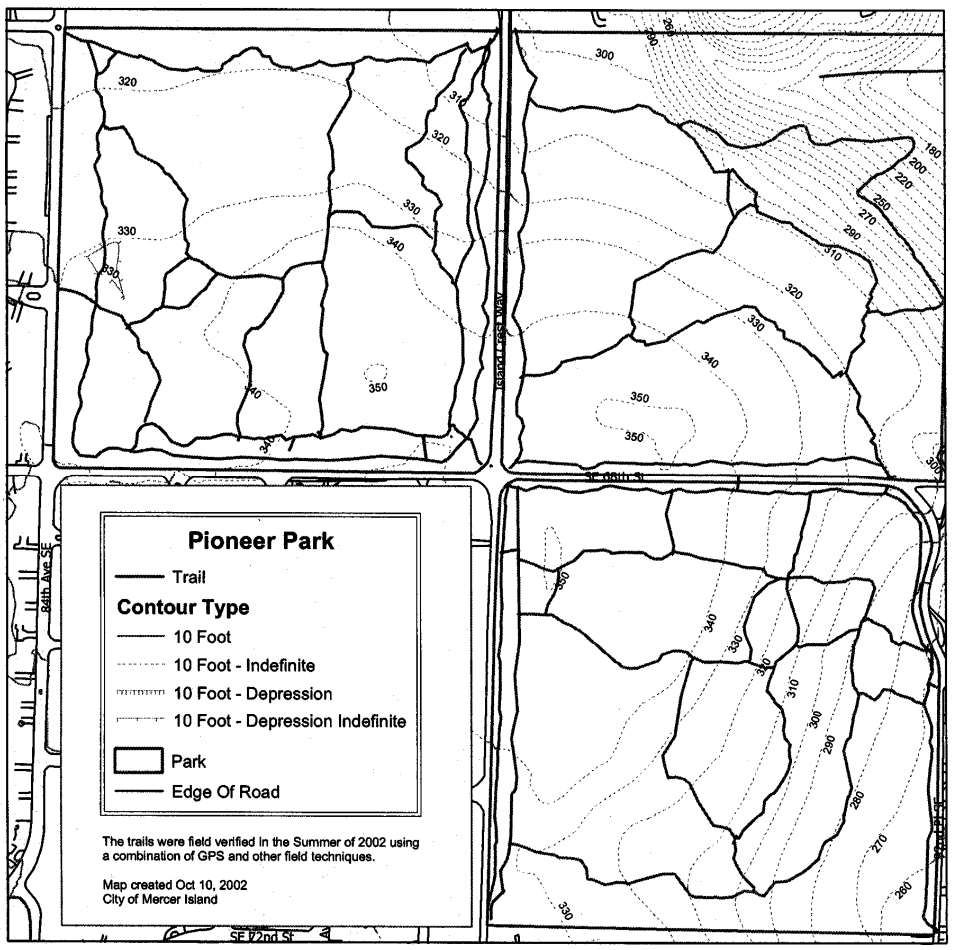
Signs will be located where?_____

Attach Maintenance Plan showing activities, schedule, assignment of responsibility and costs.

For how many seasons?_____ Cost of maintenance_____

Will Parks staff perform any of this work?_____

Who will evaluate the project?_____ At what intervals?_____



23. Appendix M: Pioneer Park Fire Management Plan

23.1. Introduction

Pioneer Park is susceptible to forest fires of natural and human origin. The risk can be partially managed by planning for an occurrence and intervening to mitigate risk factors before such an occurrence. This plan does both within the constraint of preserving the native forest in Pioneer Park and using the resources currently available to the City of Mercer Island. The goal of this plan is to guide City departments to better protect Pioneer Park and the surrounding neighborhood from fire. It begins by assessing current resources and proposes certain goals for fire management. Then it describes actions for mitigation of risk factors and improving response to fire occurrences.

23.2. Resource Assessment

Forest Fire Occurrence

Fire Department Resources

The Mercer Island Fire Department (MI Fire) would be the first response to fire occurrence. MI Fire has seven fire fighters stationed on the island at any one time. Three are located at Station 92, across the street from Pioneer Park. However, either station might respond to the fire based on the battalion's availability. The incident commander would make the decisions about fighting a fire based on the situation. Washington State Department of Labor and Industries allows fire fighters in structural protective clothing to work a maximum of one hour on a wildfire. First response by on-duty staff could be followed by calling out for mutual aid from adjacent jurisdictions to insure coverage of the incident. If required, off-duty staff could be called to report for duty as the incident commander deems necessary.

Mutual aid agreements with other jurisdictions allow MI Fire to request fire units from other fire departments. Bellevue and Eastside Fire and Rescue have resources that would be useful for forest fire fighting. For example, Eastside Fire and Rescue has personnel trained in fighting wildland fires. These resources might be needed depending on the extent of a fire.

Washington State Department of Natural Resources (DNR) has capability to fight wildland fires. They may be called in, if necessary, when local and mutual aid resources are exhausted. They offer many resources most fire departments do not have, such as inmate crews, wildland engines, and experienced overhead (aerial) support. Eastside Fire and Rescue currently houses and operates a CO-OP H5S engine owned by DNR. Response time is expected to be less than two hours. The main office is located in Enumclaw. The City would be responsible for the cost of any resources utilized. This includes logistical support, such as food, restrooms, lodging, etc.

Hydrants and Trail Access

Pioneer Park has fire hydrants along all of the perimeter roads (See figure 1).

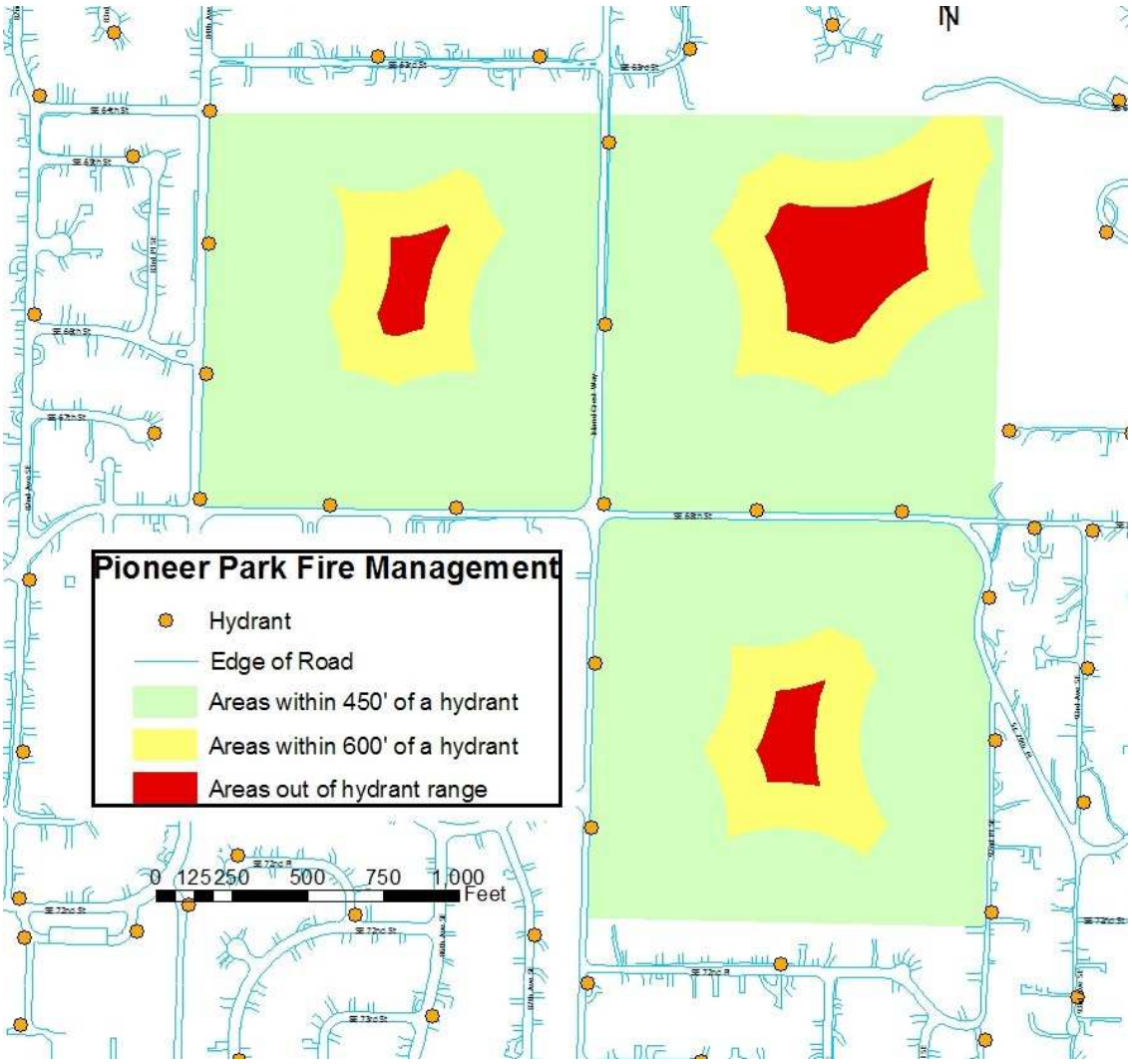


Figure 1: map showing hydrant locations and coverage in Pioneer Park.

Other boundaries also have hydrants available through private property. Only the very center of each quadant and some parts of the ravine in the Northeast quadrant are more than 600 feet from an available hydrant (See Figure 1). The 600 foot buffer is based on MI Fire having 600 feet of hose available for hydrant hook up. Realistically, topography and trail access reduce the actual distance that water can be conveyed into the park by fire hose. A distance of 450 feet is the maximum extent that water can be reliably conveyed into the park. This leaves significant areas of the park without access to water in case of a fire.

23.3. Goals and Priorities

The goals of the Pioneer Park Forest Management Plan are directed toward maintaining a diverse native forest with dense vegetation buffering the edges of the park and abundant deadwood for wildlife habitat. The generally accepted principles of fire management along wildland interfaces run counter to these goals. Prescriptions for reducing risk to adjacent properties include removing trees to increase distances between trees, extensive pruning of trees and shrubs to reduce ladder fuels and clearing the ground layer of woody debris to reduce fuel loads.

These two goals can be partially reconciled to achieve dense vegetation along park edges while achieving some reduction of ladder fuels and fuel loads along residential portions of the park perimeter. Furthermore, the size, location and hydrant system surrounding the park, as well as the immediate availability of a highly trained, well equipped firefighting staff, make this situation distinct from typical wildland fire situations. Prescriptions for wildland fire scenarios assume lower levels of immediate response than we might expect on Mercer Island. Nevertheless, any response to fire in the park will be limited.

The priorities for MI Fire response in any situation are (in priority order) life, property, and incident stabilization. Protecting forest vegetation would fall into the third priority. Protecting lives and adjacent homes would be the overriding concern of the incident commander in a forest fire situation. A large fire in the park would burn sizable portions of the park before it could be brought under control.

23.4. Evaluation

Pioneer Park is susceptible to fire primarily from human behavior. Historical incident of encampment (with fire) and fireworks use in the park are particular concerns. The forest is particularly prone to drought because the soils are well drained. Woody debris and organic “duff” have built up in the park, increasing fuel loading. Houses back up to the park, with minimal distances between structures and stands of dense vegetation. The interior of the park is not accessible to fire vehicles because the trails are too narrow for them.

However, the size of the park and the cooler, moister climate of Western Washington reduce risk in comparison to Eastern Washington forest landscapes. The quadrants are surrounded by a network of fire hydrants that can supply water to the park perimeter and significant portions of the interior. Fire Station 92 is located across the street from the park. The staff of MI Fire is highly trained in incident response. Furthermore, mutual aid agreements with other cities and the availability of DNR crews would enable the City to sustain a response and provide specialized capabilities as conditions warrant.

Limitations in response include the difficulty of conveying water to the center portion of a quadrant. For certain hydrants, vegetation poses a barrier to ready trail access, while other hydrants have no trails that lead into the park. City firefighters have not received training specific to the situation in Pioneer Park. These limitations are certainly addressable (See Action Items, below)

	Safety factors	Risk factors
Fire Occurrence	• Well-developed trail system • Extensive fire hydrant network around park perimeter • Nearby location of Fire Station 92 • Trained and coordinated firefighters • Mutual aid agreements with other cities • Availability of DNR resources • Standard incident protocols are expected to work for possible fire scenarios	• Narrow trail widths • Some hydrant locations are not close to trail access points • Lack of water conveyance to the interior of the park • Lack of firefighter training specific to Pioneer Park
Fire Mitigation	• Street buffers • Low summer temperatures • Winter rainfall • Low summer wind speeds • Small land area	• Seasonal low rainfall • Droughty soils • Woody debris and "duff"(ground fuel load) • Encampment activity • Fireworks use in the park • Minimal backyard buffers

Figure 2: Case-specific factors in Fire Occurrence and Fire Mitigation at Pioneer Park

23.5. Vegetation Management Plan

Neighbor partnerships will be sought to "adopt" areas of the park for fire mitigation (and also habitat improvement, as described in the Pioneer Park Forest Management Plan). Participating neighbors, under the direction of City staff, would restore and maintain the portion of the park behind their houses within a certain distance of the residence depending on the terrain and the vegetation found there. City staff would recommend ways the forest edge should be managed to meet forest management and fire management goals. The neighbors and City staff would develop a work plan cooperatively. The following describe some examples of these activities. Neighbor partners would foster dense, low-growing evergreen shrubs in the understory and periodically thin tall shrubs and dead branches to inhibit a ground fire from climbing into the canopy. Neighbors also would work to eliminate firewood and debris piles along property boundaries. City staff would support these activities with debris pickup, tool lending and technical assistance. The City would also remove the wood from trees that they cut down in these areas, instead of leaving branches and logs to decompose.

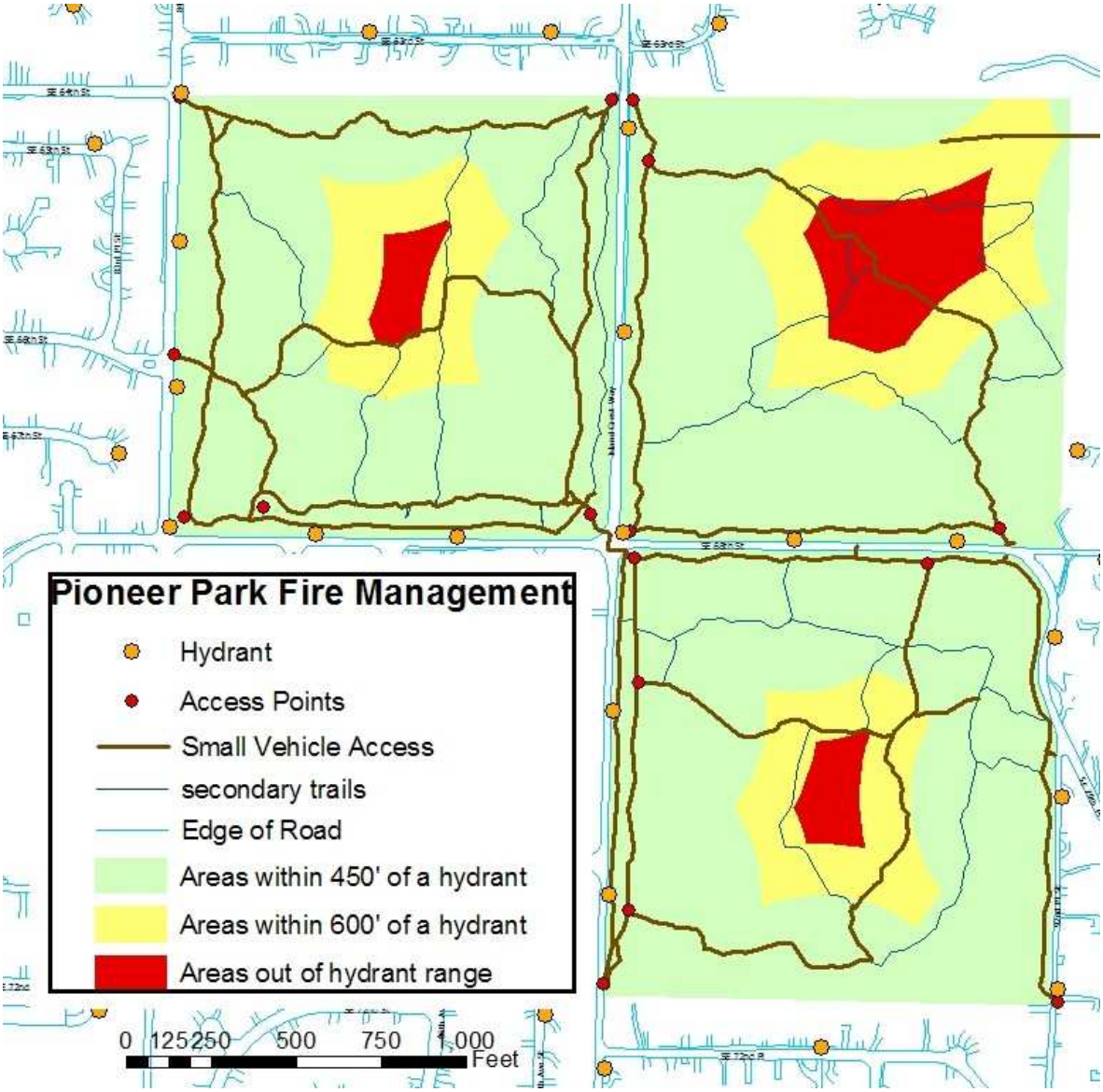


Figure 3: Fire Occurrence Resources, including small vehicle access, entry points, hydrant locations and secondary trails (see Appendix for larger version)

23.6. Action Items

Fire Occurrence

1. MI Fire will offer training for Station 92 staff pertinent to the Pioneer Park situation. The DNR Western Washington Interagency Training Committee provides standard training on wild fire situations. If existing training is not adequate or pertinent to the Pioneer situation, MI Fire will propose specialized training and a budget for that.
2. MI Parks will give Pioneer Park trails access information to MI Fire in formats most useful to MI Fire staff.

3. MI Fire will familiarize staff with Pioneer Park and evaluate its existing equipment for anticipated incidents in the park.
4. MI Parks and MI Fire will develop a list of desirable basic fire fighting hand tools to be stored in fire caches at Station 91 and 92.
5. Both departments will further research the availability of DNR for fire response and determine what conditions may warrant their involvement.

Forest Fire Mitigation

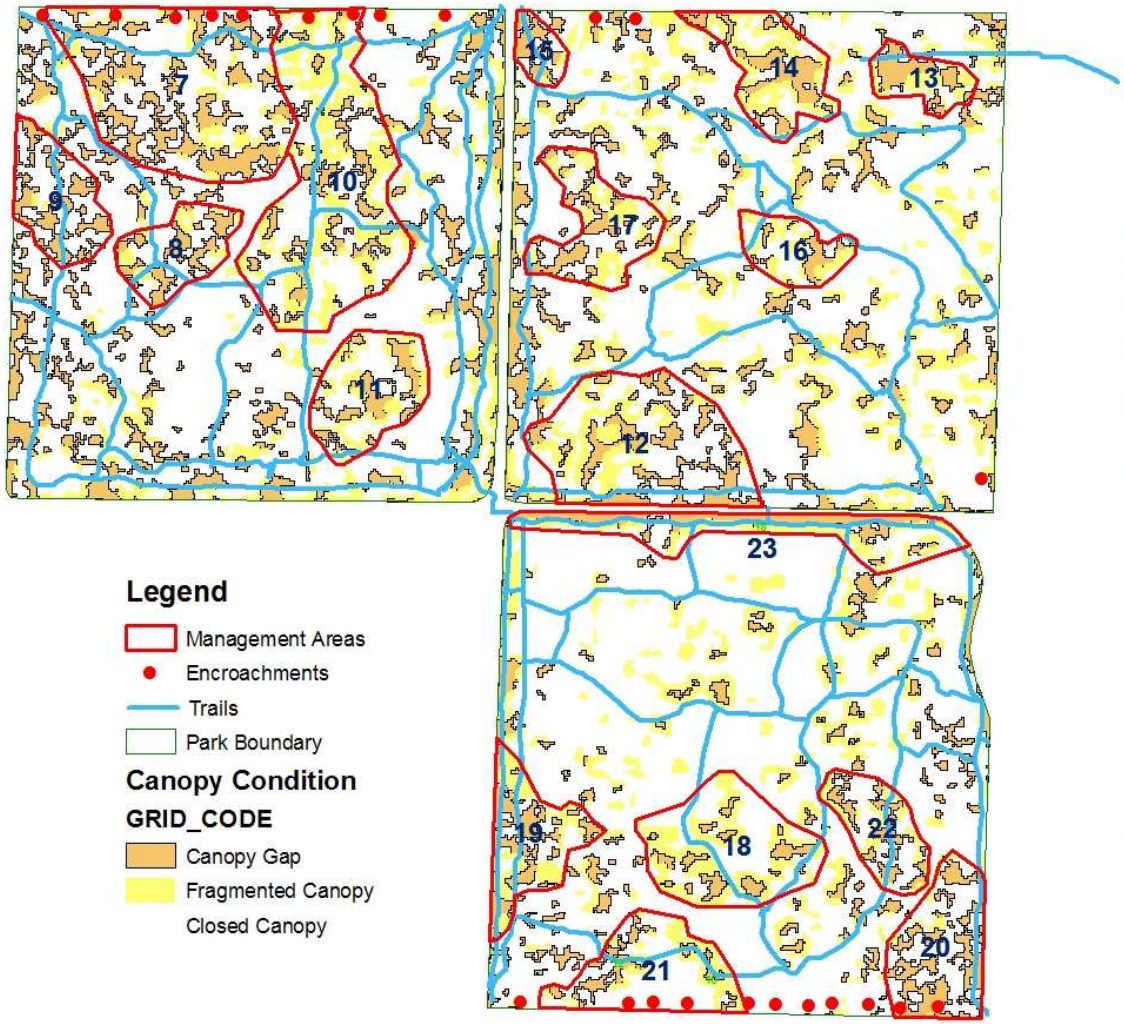
1. MI Parks will approach park neighbors and work with them to reduce fire potential and improve habitat value along the residential perimeter of the park.
2. MI Parks will conduct an educational campaign about fire-wise landscaping with adjacent property owners using existing educational materials.
3. MI Parks will patrol remote locations of the park during summer months to discourage encampment activity.
4. MI Parks will conduct an educational campaign with citizens about fire risk in Pioneer Park.
5. MI Parks and MI Fire will develop a plan to improve trail access into the park for a narrow vehicle and create access points where the trail system does not connect well with existing hydrant locations.

23.7. Costs

This plan is intended to work within the existing resources as much as practical. Certain items proposed above may be purchased within existing budgets, while others may represent new costs. Budget planning is beyond the scope of this plan. Items that may represent new purchases include:

- Training for MI staff
- Public education materials and events
- Tool caches for Fire Stations 91 and 92

24. Appendix N: Forest Management Projects



Pioneer Park Forest Management: Canopy Condition and Management Areas

Management areas have been identified based on the presence of canopy gaps, fragmented canopy and vegetation condition within those areas. Priorities are outlined in the associated spreadsheet.

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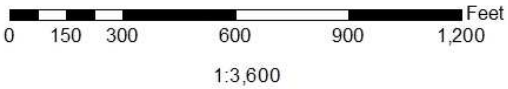

1:3,600

25. Appendix O: Restoration Plant List for Pioneer Park

	BOTANICAL NAME	COMMON NAME	LOCATION	EXPOSURE	SPACING
	Abies grandis	Grand Fir	M>U	FSn - Sh	>= 15' o.c.
	Arbutus menziesii	Madrona	U>M	FSn	>=10' o.c.
	Pinus contorta v. contorta	Shore Pine	U>W	FSn	>=10' o.c.
	Pinus monticola	Western White Pine	U>M	FSn	>=15' o.c.
EVERGREEN	Pseudotsuga menziesii	Douglas Fir	M>U	FSn - PSh	>= 15' o.c.
TREES	Thuja plicata	Western Red Cedar	W > U	FSn - Sh	>= 15' o.c.
	Tsuga heterophylla	Western Hemlock	W > U	FSn - Sh	>= 15' o.c.
	Taxus brevifolia	Pacific Yew	W>M	FSn - PSh	>= 10' o.c.
	Alnus rubra	Red Alder	W>U	FSn - PSh	>= 10' o.c.
	Acer circinatum	Vine Maple	W, U	PSh	>= 6' o.c.
BROADLEAF	Acer macrophyllum	Bigleaf Maple	M>U	FSu - PSh	>= 10' o.c.
TREES	Amelanchier alnifolia	Serviceberry	U > W	FSn - PSh	>=6' o.c.
	Arbutus menziesii	Pacific Madrone	U>M	FSn	>=10' o.c.
	Betula papyrifera	Paper Birch	M>W	FSn	>=10' o.c.
	Craetegus douglasii	Pacific Hawthorn	M	FSn	10' o.c.
	Fraxinus latifolia	Oregon Ash	W>U	FSn - PSh	>= 10' o.c.
	Cornus nuttalii	Pacific Dogwood	U.M	FSn – PSh	10’ o.c.
	Prunus emarginata	Bitter Cherry	M>U	FSn	10' o.c.
	Quercus garryana	Oregon Oak	U	Fsn	10' o.c.
	Rhamnus purshiana	Cascara	W>M	FSn - PSh	10' o.c.
	Cornus stolonifera	Red Osier Dogwood	W>M	FSn - PSh	4' o.c.
	Corylus cornuta californica	Hazelnut	U > W	FSn - Sh	>= 6' o.c.
	Gaultheria shallon	Salal	M>U	FSn - Sh	18" o.c.
	Holodiscus discolor	Oceanspray	U>M	FSn	4' o.c.
	Lonicera ciliosa	Creeping Honeysuckle	U	FSn-PSh	4' o.c.
SHRUBS	Lonicera involucrata	Honeysuckle	W>U	FSn-PSh	3' o.c.
	Mahonia aquifolium	Tall Oregon Grape	U	FSn - PSh	4' o.c.
	nervosa	Cascade Oregon Grape	U >M	PSh - Sh	18" o.c.
	Oemlaria ceraciformis	Indian Plum	W>U	PSh - Sh	6' o.c.
	Oplopanax horridum	Devil's Club	W	PSh	4' o.c.
	Pachistima myrsinites	Oregon Box	M>U	PSh - Sh	2' o.c.
	Philadelphus lewisii	Mock Orange	M>U	FSn - Psh	6' o.c.
	Physocarpus capitatus	Pacific Ninebark	W, U	FSn - Psh	8' o.c.
	Rhododendron macrophyllum	Pacific Rhododendron	M>U	PSh	random
	Rosa gymnocarpa	Baldhip Rose	U	FSn-PSh	4' o.c.
	Rosa nutkana	Nootka Rose	M > U	FSn - PSh	5' o.c.
	Rubus parviflorus	Thimbleberry	W>U	FSn - PSh	4' o.c.
	Rubus spectabilis	Salmonberry	W>M	fSn - Sh	4' o.c.
	Salix scouleriana	Scouler's Willow	W>M	FSn	2' o.c.
	Salix hookeriana	Hooker's Willow	W>M	FSn	2' o.c.
	Salix laisandra	Pacific Willow	W	FSn	8' o.c.
	Sambucus racemosa	Red Elderberry	M>W	FSn-PSh	4' o.c.
	Spiraea douglasii	Hardhack	W>U	FSn	3' o.c.
	Symphoricarpos alba	Snowberry	M > U	FSn - PSh	4' o.c.

	Vaccinium ovatum	Evergreen Huckleberry	U>M	FSn - PSh	4' o.c.
SHRUBS	Vaccinium parvifolium	Red Huckleberry	W>M	PSh	4' o.c.
	Viburnum edule	Moosewood	W	FSn - PSh	6' o.c.
	opulus (trilobum)	High Bush Cranberry	W > U	FSn - PSh	6' o.c.
	Adiantum pedatum	Maidenhair Fern	W	Sh	random
	Athyrium filix-femina	Lady Fern	W>M	PSh-Sh	random.
	Blechnum spicant	Deer Fern	U > W	PSh - Sh	random
FERNS	Dryopteris expansa	Wood Fern	U	PSh-Sh	random
	Gymnocarpium dryopteris	Oak Fern	W, U	Sh	18" o.c.
	Polystichum munitum	Sword Fern	W, U	FSn - Sh	3' o.c.
	Achlys triphylla	Vanilla Leaf	W, U	PSh - Sh	12" o.c.
	Aquilegia formosa	Red Columbine	W, U	FSn - PSh	random
HERBACEOUS	Aruncus diocus (sylvester)	Goat's Beard	W	FSn - PSh	random
	Circaea alpina	Enchanter's Nightshade	U, M	PSh-Sh	12" o.c.
	Claytonia siberica	Miner's Lettuce	M,U	FSn-Sh	12" o.c.
PERENNIALS	Dicentra formosa	Western Bleeding Heart	W, U	PSh - Sh	12" o.c.
	Fragaria vesca	Wood Strawberry	U	FSn-PSh	12" o.c.
	Geum macrophyllum	Large-Leaf Avens	U	PSh-Sh	random
	Maianthemum dilatatum	False Lilly-Of-The-Valley	W > U	PSh - Sh	18" o.c.
	Osmorhiza chilensis	Sweet Cicely	U	PSh-Sh	random
	Tellima grandiflora	Fringecup	U	FSn-PSh	random
	Tiarella trifoliata	Foamflower	W>U	FSn - PSh	18" o.c.
	Tolmiea menziesii	Piggyback Plant	W>M	PSh	18" o.c.
	Trientalis borealis latifolia	Starflower	U	PSh	12" o.c.
	Trillium ovatum	Western Wake Robin	U	PSh	random
	Vancouveria hexandra	Inside-Out Flower	M>U	PSh-Sh	12” o.c.
	Carex obnupta	Slough Sedge	A	PSh - Sh	18" o.c.
WETLAND	Lysichitum americanum	Skunk Cabbage	A, W	PSh - Sh	random
	Juncus ensifolius	Dagger Leaf Rush	A, W	FSn - PSh	12" o.c.
	Oenanthe sarmentosa	Water Parsely	W	FSn - PSh	18" o.c.
	Sagittaria latifolia	Arrowhead, Wapato	A, W	FSn - PSh	12" o.c.
	Scirpus microcarpus	Small Fruited Bullrush	W>A	FSn - PSh	18" o.c.
	M=Mesic U = Upland				
	A = Marsh (Aquatic) W = Wetland				
	FSn = Full Sun PSh = Part Shade Sh = Shade				
	o.c. = on center >= greater than or equal				

26. Appendix P: Identified Encroachments in Pioneer Park

Street Number	Street	Type of encroachment
6306	84th Av SE	yard waste
8421	SE 63rd St	lawn, rockery, yard drain, wood pile
8437	SE 63rd St	lawn, shed, landscaping
8445	SE 63rd St	yard waste
8453	SE 63rd St	yard waste
8611	SE 63rd St	lawn, landscaping, yard waste
8621	SE 63rd St	yard waste
8631	SE 63rd St	landscaping, gravel path, wood pile
8651	SE 63rd St	yard waste
8817	SE 63rd St	lawn, landscaping, arbor
8807	SE 63rd St	fence
6250	89th Av SE	yard waste
7190	SE 72nd Pl	shed, fence, lawn, yard waste
8836	SE 72nd Pl	fence
8838	SE 72nd Pl	light on tree
8852	SE 72nd Pl	firewood, debris
8868	SE 72nd Pl	gravel path, bark area
8874	SE 72nd Pl	yard waste, firewood
9100	SE 72nd Pl	compost bin, yard waste
9108	SE 72nd Pl	swing set
9116	SE 72nd Pl	compost bin
9120	SE 72nd Pl	yard waste
7201	92nd Av SE	lawn, doghouse, wood pile, compost bin
9200	SE 68th St	driveway

27. Appendix Q: Trees Suitable for Transmission Line Corridors

Species	**Common Name**	**Height Ft**	**Width Ft**	**Location Relative to Power Lines**
Acer circinatum	Vine maple	20	15	under
Acer glabrum	Rocky Mtn maple	30	20	Side
Amelanchier alnifolia	Serviceberry	15	15	Under
Calocedrus decurrens	Incense cedar	40	15	side
Corylus cornuta	Hazel	15	15	under
Crataegus douglasii	Pacific hawthorn	20	15	Under
Cupressus bakeri	Modoc cypress	30	10	Side
Juniperus scopulorum	Juniper	30	10	Side
Lithocarpus densiflorus	Tanbark oak	20	15	Under
Pinus contorta var contorta	Shore pine	30	20	Side
Rhamnus purshiana	Cascara	30	15	Side
Taxus brevifolia	Pacific yew	20	20	Under

28. Appendix R: 2008 Pioneer Park Forest Health Survey

29. Appendix S: Forest Health Work Plan