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Appendix C

APPENDIX C
IMPLEMENTATION PRACTICES

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1.0 INTRODUCTION

The practices described in this section are those referenced in Chapter 5-Management Objectives and Actions. Chapter 5 and this appendix are meant to be used together. Chapter 5 describes what is to be done, when it is to be done, and where it is to be done. This appendix provides specific information on how to carry out the management actions directed in Chapter 5. The discussion below provides the level of detail needed to carry out the management and maintenance recommendations at the park.

These implementation practices are based on recommendations from the UW Restoration Ecology Network program and adaptations from the *Richmond Beach Saltwater Park VMP* (City of Shoreline 1999), *Golden Gardens Park VMP* (Walker et al 2003), and *Sand Point Magnuson Park VMP* (Sheldon 2001). The practices are tailored to the specific conditions found at the park and consist of effective methods to establish and maintain native vegetation and habitats.

Before beginning the discussion on the management practices, the next section addresses important safety issues to consider when doing restoration projects; particularly when volunteer help is an integral part of the restoration efforts.

1.1 SAFETY ISSUES

1.1.1 HERBICIDE APPLICATION

Using herbicides is not recommended for volunteer labor. This control method requires careful handling and should only be done by a person licensed by the Washington State Department of Agriculture.

Most of the invasive species removal methods in this VMP consist of manual removal to order to utilize volunteers and community groups as much as possible. However, if conditions warrant, invasive species can also be controlled using herbicide. A few examples would be very dense thickets of Himalayan blackberry that manual methods have not been able to control, field bindweed in any amount, and on steep slopes where the roots of densely growing invasive species stabilize the slopes. In the last example where removal of the roots may de-stabilize the slope, using herbicide could effectively kill the invasive plants but leave the roots in place to hold the slope while new native plantings are becoming established.

Effective methods for herbicide application on each specific invasive species are covered in section 2.8, below.

1.1.2 SLOPES

Working on slopes is challenging and can result in injury to workers. In addition to the steepness of slopes found at the park, soils are sandy and prone to sloughing. The following guidelines are presented in Table A-1 (see page A-2) as guidelines to assist in reducing risk of injury to workers and damage to slopes. They set limits on where volunteers can work and provide for erosion control measures where warranted. It also provides some latitude for utilizing native regeneration where slopes do not require rapid vegetation cover.

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Table A-1. Guidelines for Working on Slopes

SLOPE	Re-vegetation Guidelines	Bioengineering Guidelines	Volunteer Involvement
0-15%	Immediately after clearing, fence off bare ground and plant with native vegetation to attain 100% foliar coverage* within 5 years of first clearing. Alternately, in existing forests where invasive species have less than 20% overall cover: after clearing, fence off bare ground and allow seed bank to sprout for one growing season. If native regeneration is not sufficient, plant to attain 100% foliar coverage* within 5 years of first clearing.	None	Yes
16-40%	Use above strategy to provide 100% foliar coverage* within 3 years of first clearing.	Prior to planting install facines or native woody debris fastened perpendicular to the slope at intervals of 3 to 4 feet.	Yes
41-60%	Install native plants as soon as bioengineering technique is installed. Attain 100% foliar coverage* within 3 years of first clearing.	Same requirements as for 16040% slopes, plus cover bare soil with erosion resistant mulch within 30 days of clearing. geotechnical review of project is required if any significant earth moving is planned.	Non-professional volunteers must be supervised by qualified professionals.
>61%	Seeding with sterile annual grasses recommended; planting native plants as soon as possible to provide 100% foliar coverage* within 3 years of first clearing; tree species are limited to shorter species (<30 ft. mature height).	Geotechnical design of project required with departmental review; geotextile coverage of bare soils strongly recommended.	Non–professional volunteer labor not permitted.

* Foliar coverage includes grasses and other groundcover in addition to leaves on shrubs and trees.

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2.0 MANAGEMENT ACTION TASKS

2.1 THREE YEAR ESTABLISHMENT AND CARE

Typically, new plantings should have an intensive follow-up care program for the first three years after the initial plant installation. When planning a project it will be important to commit to this follow-up care in order for the native plant restoration to become established and able to out-compete invasive species. The most important components of this care program are mulching, watering, and weeding. A three-year calendar showing the timing for maintenance actions is shown below in Table A-2. Adjustments to the three-year maintenance calendar, in terms of actions taken, should be made depending on the particular project site conditions.

New plantings should receive regular watering because of the western exposure and sandy soils. Site access can make this task labor-intensive. A means of conveying water to plantings could include a temporary irrigation system, spraying from a water tank, or hand-carried containers. The watering system should be developed for each project during the initial project planning stage.

Mulching at the time of plant installation is an important element in assisting a site to retain moisture and to reduce germination of weeds and invasive plants. Although, in limited cases a decision may be made not to mulch in very steep areas because the mulch would simply slide down the slope during heavy rains. Any decision to reduce mulching would need to be made early in the planning phases of the project and would need to be reviewed by the PRCS staff.

Weed control should be done with diligence given the abundant seed bank at the park. Based on previous restoration projects, the success of a habitat restoration projects at the park will depend on regular and frequent weeding of the newly planted area until the native plants can shade out the invasive species.

Detailed instructions on how to perform these and other implementation actions can be found in the following sections in this appendix:

Actions:	**section**
Mulching	2.2
Planting	2.3
Pruning and Vegetation Removal	2.4
Bioengineered Slope Stabilization	2.5
Amending Soils	2.6
Watering	2.7
Weeding and Invasive Species Control	2.8
Cryptobiotic Soils	2.9

Once the intensive three-year period is over and plantings have become established, the restored habitats will still need to receive attention and maintenance at a less intensive level. Care of these planted areas should be incorporated into regular ongoing maintenance that occurs within the management area that they are located.

In addition, there may be one time maintenance actions such as removing tree stakes and inorganic or fabric mulch, if used. If inorganic sheet mulch, such as plastic, was used in areas of severe invasive species problems, the plastic should be removed during the dormant season after 3 years. Where slopes are less that 15%, the entire area should be mulched with a 4-5 inch layer of composted wood chips. Where slopes are greater than 15%, Wood StrawTM (or similar material) may be a more appropriate mulch.

Table A-2. Three-Year Establishment Care Calendar

Timing (by month)[1]:	J	F	M	A	M	J	J	A	S	O	N	D
Action												
During Installation												
Mulching	To be done at the time of plant installation											
Watering	To be done at the time of plant installation											
Year 1												
Mulching								▒	▒	▒		
Weeding				•	•	▒	▒	▒	▒			
Watering					▒	•	•	•	•	•		
Year 2												
Mulching								▒	▒	▒		
Weeding				•	•	▒	▒	▒	▒			
Watering					▒	•	•	•	•	•		
Year 3												
Mulching				▒	▒						▒	▒
Weeding				•	•	▒	▒	▒	▒			
Watering					▒	•	•	•	•	•		
Removing Inorganic Mulch											▒	▒

1 The double columns for each month indicate the first two weeks and the later weeks in the month.

• Indicates specific time to perform action for the most beneficial results.

▒ Indicates a range of time to perform action as needed, in addition to the specific timing shown by "•". Actual timing & frequency during this range can be determined for each project based on the site conditions.

2.2 MULCHING

[Adapted from Seattle Department of Park and Recreation *Landscape, Horticulture and Urban Forestry BMPs* (1999), '*City Among the Trees*' (1998) and Sound Native Plants bulletin titled "*Mulches for Restoration and Mitigation Projects*" (2006)]

Mulching is one of the easiest and most important maintenance practices for protecting and nurturing all planted vegetation types. When site access is possible, mulching is an essential component of any natural area planting project for suppressing weeds and invasive plant species. Mulch helps to reduce root competition with weeds, conserves soil moisture and keeps soil cool, and adds organic matter to nutrient-deficient soils. In areas where slopes are steep, bioengineering techniques need to be incorporated prior to mulching in order to stabilize the slopes and to create benches so that the mulch does not slide off the slope (see section 2.5).

The best approach for large restoration sites is to divide the site into practical, smaller zones (relative to planting areas) and sheet mulch each zone. Sheet mulching is defined as a continuous layer of mulch 4 to 6 inches deep over the entire restoration site; and is particularly important where large areas of invasive species have been removed. Native plants can be installed through the mulch. The mulch will need to be moved back away from the stems/trunks of the plantings to prevent crown rot and/or insect damage. Mulch should be maintained at a depth of 4-6 inches throughout the 3-year establishment period.

Past mulching practices usually called only for mulching around each individual installed native plant. That method, found to have multiple disadvantages, often resulted in weeds quickly growing up into the mulch from the surrounding non-mulched areas and the loss/compromise of the moisture conserving function of the mulch. In contrast, sheet mulching will function to suppress weeds that compete with the new plantings for water and nutrients and will keep the soils moist and cool.

It may not be feasible to transport large quantities of mulch into the steeper areas of the Park where planting will occur. On areas where slopes are 15% or less, composted wood chips can be used as mulch. While wood chips of recycled plant material from the park may be available at no cost, this mulch material is not appropriate for steep slopes. In areas with mild slopes where there are also mature trees, the wood chip mulch must be composted for at least 4 weeks to prevent the accidental spread of pathogenic fungi to park trees.

On slopes greater than 15%, Wood Straw™ and/or straw can be used as mulch because of these materials have less tendency than wood chips to be washed off steep slopes during storm events. New plantings can be installed into both of these materials.

Plastic, landscape fabric or inorganic mulch should be avoided in most cases. The only exception would be areas that have dense thickets of invasive species where manual removal methods jave been ineffective or where steep slopes make is dangerous to remove the invasive species manually. In these cases, using fabric or inorganic mulch may be the most effective strategy to prepare the area for native plantings. If plastic weed cloth is used it will need to be removed once native plants are established; otherwise it will hinder rhizome and stolon growth and may take decades to break down. Compost or leaf mulch can be added either underneath the inorganic mulch layer if soil amendments are desired.

2.3 PLANTING

[Planting instructions are adapted from Seattle Department of Parks and Recreation *Landscape, Horticulture and Urban Forestry BMPs* (1999), King County Water and Land Resources Bulletin titled "*Live Stakes Cutting and Planting Tips*", and Sound Native Plants bulletin titled "*Mulches for Restoration and Mitigation Projects*" (2006)]

Due to the extensive cover of invasive species at the park, each management area should be divided into smaller, more practical and manageable zones when planning for native plantings. New native plantings should be done only in areas where invasive species have already been removed. Chapter 4 in the VMP discusses priorities regarding which management areas to begin restoration work on and also presents the Bradley Method as a way to determine the appropriate location and size of planting zones within each management area.

The basic procedure of plant installation is essentially the same no matter which management area they are planted in. The layout of plants should be in informal and irregular groupings of a variety of species to mimic naturally occurring plant communities. Specific instructions for planting trees, shrubs, and herbaceous material are given below.

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Site preparation, species selection, and planting layout are site-specific and depend on the ecological conditions present in each management area. Species lists for native plants that are appropriate for the various soil, sun, and moisture conditions at the Park are provided in Appendix B.

Plant material used for native plantings need to be obtained from local nurseries that raise plants that are acclimatized to western Washington's climate; that is, wet, cool winters and hot, dry summers. Native plants are available as bare root, container plants (in a vary of sizes), seeds, and live stakes. The type of plant chosen will depend on site conditions, budget, and water resources. Plant species, sizes, and type will need to be decided during the planning phase of a restoration project.

Each type of plant material has its advantages and challenges. Bare roots plantings are more economical that container plants; often 1/10 the cost of a container plant. However, there is a limited window of time that bare roots plants are available from growers, usually from October through December. And for the best survival and health of bare root plantings they must be installed between October through November or February through April. In addition, there tends to be greater mortality of bare root plantings. If this type of planting is used, up to 25% more plants will need to be used than if container plants are used.

Container plants are more flexible in planting time. However they require a lot more water to survive and thrive than do the bare roots plants. Container plants tend to be the more expensive way to purchase plants. However, they also usually have the most developed root system and tend to have the highest survival rate compared to the other planting types.

Live stakes are about as economical as bare roots plants. If they are collected on site by volunteers there is no cost for plant material, but there would be costs involved with organizing and managing the volunteers. Live stakes are easier to install than both bare root and container plants. The limiting factor for this type of plant material is that only a few native species will readily re-grow from stakes and quick timing between cutting and planting. Native species that readily grow from stakes include willows, black cottonwood, red-osier dogwood, and snowberry.

Seeds are the most economical, but there is uncertainty in the germination rate due to uncontrollable ecological conditions. Surface obstructions and depressions on the steep slopes at the park can assist with germination, as will seeding areas where the slopes have been benched using bioengineering techniques. Grasses and clovers tend to germinate more readily than shrubs, trees, and other herbaceous plants. A general seeding rate is 1000 to 1500 Pure Live Seed (PLS)/square meter.

The UW restoration project found that a number of native groundcover plants re-established on their own after removal of the Scots broom, including common yarrow and several grasses. The UW Restoration Ecology Network students found that American Dune grass plugs that were transplanted from the lower parking area had a higher survival rate than newly purchased grass plants in containers.

Trees

The two basic steps in planting are preparing the site, and setting the tree or shrub. Proper preparation will encourage root growth rather than adding to the difficulties already challenging the newly planted trees or shrubs.

- Protect bare root plants from root drying prior to and immediately after planting. It is best to soak the roots in containers of water for 24 hours before planting.

- Ideal planting hole is 3 times the diameter of the root spread or root ball (for smaller plants the planting hole should be no smaller than 12 inches wider than the root spread or root ball).
- One of the most common causes of plant mortality is planting too deeply, which results in stem rot and/or suffocation of the roots. In non-sandy soils, the most beneficial placement of the root ball is about ½ inch above the surrounding soil. In sandy soils, the root collar should be at the soil surface. In all cases, the plant needs to be seated firmly on undisturbed underlying subsoil.
- Backfill the planting hole with native soil (that is, soil from the restoration area).
- It is most beneficial to sheet mulch prior to planting. If mulch will only be placed around each plant, mulch around trees can be placed in a 36 inch diameter around the stem and around shrubs the mulch can be placed in a 24 inch diameter ring around each stem. In all cases, it is important to make sure the mulch does not touch the plant stem, but does cover most of the root ball.
- Trees should not be fertilized at the time of planting.
- Balled and burlapped (B&B) trees need to first be placed in the hole and plumbed vertically. All rope needs to be removed from around the tree trunk and the top 1/3 of the burlap needs to be folded back down into the hole. Whenever possible complete removal of the top third of burlap by cutting it away with a sharp knife is preferred. It is important not to remove any B&B packaging material until the tree is in the hole and securely plumbed in its final position.
- For container plants, rough up the soil and roots on the outer inch of the root ball before planting to stimulate growth. If the plant is root bound (roots are circling the outside of the root ball), tease them outward and prune off any that don't fit into the planting hole. There have also been recommendations from some restoration landscapers to remove all the soil around roots; however, this is a very labor intensive practice and it is easy to lose a major part of the rootball.
- Backfill soil in lifts of 4 to 6 inches at a time with compaction of each layer. Do not compact muddy backfill. Water thoroughly after back-filling to settle the soil, eliminate air pockets, and re-wet the root system.
- If the project scope allows, watering soil rather than compacting is preferred. Backfill ½ the soil in the tree pit and thoroughly drench with water. Complete backfilling and then thoroughly drench with water again. This method is preferred for removing air pockets and settling soil, but can be impractical on big jobs or jobs using volunteers.
- If hand-watering of trees is planned, any trees planted in sandy or loamy soils need to have a 3-inch high berm erected just past the perimeter of the planting hole to funnel water to the root ball and wet the hole/sidewall interface. Berms should not be constructed in clay soils or heavily compacted sites.
- Stake only in situations where normal planting procedures do not provide a stable plant; otherwise, staking is not needed.
- If stakes are used, ties for stakes should be a biodegradable or flexible fastener that avoids collaring the trunk if the ties are not removed in a timely fashion.
- Stakes must be removed at the end of the first year after planting.
- Do not wrap tree trunks.
- Remove tree trunk wrapping materials, tags, and all ties at the time of planting.

Shrubs

- Refer to general guidelines for trees, above.
- Protect bare root plants from root drying prior to and immediately after planting.
- Plant shrubs with proper spacing to allow for spread at mature size.
- Rough up the soil and roots on the outer inch of the root ball before planting to stimulate growth. If the plant is root bound (roots are circling the outside of the root ball), tease them outward and prune off any that don't fit into the planting hole.
- Plant bare root stock at the same depth as they were grown in the nursery.

Herbs

- Space plantings to provide adequate coverage to compete with weeds.
- Remove containers prior to placement in the planting pit.
- Rough up the soil and roots on the outer inch of the root ball before planting to stimulate growth.
- If the plant is root bound (roots are circling the outside of the root ball), tease them outward and cleanly prune exceptionally long roots to create a uniform root mass.
- Protect bare root plants from root drying prior to and immediately after planting.

Live Stakes

Live stakes are cuttings harvested from live native plants. Stakes are cut from the parent plant and then installed directly into the soil where they establish roots and grow to maturity. The best species to use for live stakes are willow species, black cottonwood, snowberry, and red-osier dogwood. A moist substrate is needed for at least 4-6 weeks during the period the live stake is rooting and becoming established. Although live staking can be done throughout the year, to maximize survival the best time for taking cuttings and installing them is during the dormant season, between early November and late February. Success rates for drier sites may be increased if larger cuttings are used.

Stakes can be harvested from an appropriate site or purchased. For the best survival rates, they need to be installed as soon as possible after harvesting – ideally within 24 to 72 hours – and kept wet in a bucket, out of the wind and in the shade until installed. Stakes need to be at least 2 to 3 feet in length and 3/4 inch or more in diameter for willows and cottonwood, and greater than 1/2 inch in diameter for red-osier dogwood and snowberry. If harvesting your own stakes, no more that 5% of the parent plant should be removed at any one time to avoid injuring the plant.

Stakes can simply be pushed into the ground where the soil is soft enough, or by using rebar to create a planting hole in compact and gravelly soils. Hitting the stakes with a mallet is not recommended as this disrupts the plant's internal water balance. The stake must be installed as vertically as possible and right side up; that is, with the buds facing up. They need to be installed at least half way into the ground, and can be installed deeper with 3 to 6 inches remaining above ground with a minimum of 2 buds showing above ground. Lightly pack the soil around the stake so that no air pockets remain. Watering the stakes will help remove air pockets and create good soil contact below the ground for the length of the stake, particularly when rebar has been used as a planting tool. No additional topsoil is needed.

2.4 PRUNING AND VEGETATION REMOVAL

[Information in this section is adapted from. *A City Among the Trees: An Urban Forestry Resource Guide* (City of Seattle Urban Forest Coalition. 1998).]

Pruning is not a common practice of forest management in natural areas but can be important for achieving safety and forest health goals. Pruning and removal of park vegetation must be done under supervision of qualified professionals, either City staff or hired contractors. Technical expertise is required to avoid damaging valuable vegetation. Normally, native shrubs on hillsides do not need pruning, except along street or trail edges to allow for ease of traffic.

For the most part, trees in Richmond Beach Saltwater Park will be left to grow naturally. In rare instances, trees may be pruned or removed when it is necessary to avoid and minimize risks to park users, adjacent properties, and right-of-ways. Any removal of trees needs to follow typical permitting and procedures for hazard trees. Other than the specific situations listed above, tree pruning or removal is discouraged. In order to create healthy and structurally-diverse native habitat, any maintenance of trees needs to be restricted to achieving a direct project objective. Such objectives could include:

- A mature tree could be pruned or removed to encourage nearby sapling trees to grow or for a specific park improvement project. Wherever possible, the preferred technique for reducing competition will be pruning. If a tree is removed, it can be converted to a 'snag', essentially a branchless trunk, rather than complete removal. This reduces costs and increases habitat features at the Park.
- A gap can be created in the forest by cutting down 3 trees to allow shade tolerant tree saplings to thrive within the forest canopy. A larger gap can be created to provide enough sunlight to allow sun-loving saplings to grow.
- A group of closely growing 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 grow to mature size. Some planned projects may plant trees closely together to quickly create shade for the purpose of discouraging the re-growth of invasive species. In this case the planting plan would need to include thinning in the future to allow for healthy tree growth.
- Low branches on trees along a trail or road may be pruned to provide overhead and side clearance.
- Trees may be pruned to maintain the view corridor from the upper terrace. In this case, trees should never be 'topped' as this creates an unhealthy tree and a potentially hazardous situation for park users. Instead, any tree that interferes with the upper terrace views should be limbed and cut back to create a snag or stump as a habitat feature.
- Except for the purposes of snag creation, trees in the Park should never be topped.

In most cases, derelict trees in natural areas do not pose a hazard and should be left standing. If the tree is defective AND it may fall on park users, trails, roads, or other park infrastructure; it would be considered to be a hazard.

- Any hazard trees that are not able to be made safe by corrective pruning will need to be removed.
- Work with the PRCS to alert the community before tree removal begins to provide opportunity for comment.

Large woody debris and brush piles are critical habitat elements that are often lacking in habitat areas of parks. When large trees have been removed, recycle as much of the parts of the woody debris on site as possible. Trunks and large branches that will not sprout can be placed directly on the ground within the habitat areas to function as large woody debris. Brush (non-sprouting limbs and branches from the tree tops) can be used for wildlife brush piles scattered throughout the habitat zones. Placement of brush piles and large woody debris is dependant on the slopes. Brush piles should only be placed on slopes that are 30% or less because on steeper inclines the weight of the wood has the potential to cause slides after the slope becomes saturated during the wet season; thus, disturbing vegetation and soils in newly restored areas. Logs can be placed on level ground and slopes. However, if logs are placed on slopes greater than 30% that have trails or other activity areas downslope, the logs will need to be well anchored for public safety reasons.

Habitat features can be placed within both wetland and upland habitat in the Park. Smaller material not used for brush piles can be chipped and used as mulch.

2.5 BIOENGINEERED SLOPE STABILIZATION

[Adapted from *Bioengineering Techniques to Revegetate Streambanks* (Moore et al 1996)]

Steep slope stabilization will be an important element in minimizing soil erosion following invasive species removal. It will also establish beneficial conditions for new habitat plantings. Live stakes, fascines, brush layering, and other organic material can be used for this purpose. Eventually, the roots of native plans that have been installed on the slopes will also serve to stabilize the slopes.

Live stakes planted at 1 to 2 feet on-center can be used to stabilize slopes. Willows, black cottonwood, and red-osier dogwood can be used on moist to wet slopes. Snowberry can be used on moist to dry slopes. Section 2.3 in this appendix has instructions and installation methods for live stakes.

Fascines are recommended on the dry steep slopes found at the park. A fascine is a long-cylindrical bundle of brush material that is anchored perpendicular to the slope. Ideally, fascines should be placed on slopes that are steeper than 30 percent at the Park. Fascines are known to reduce soil erosion by slowing the flow of runoff down the slope face and trapping soil particles that would otherwise wash downslope. They add organic material to the soil as they decompose and create relatively level benches for native plantings.

Typically fascines are created from live stakes. At the park, Scots broom removed during invasive species control can be recycled into fascines. Th tough dense branching of the Scots broom can serve to retain loose soil. As it degrades over time it will provide much needed nutrients to the soils. Only Scots broom that is not in flower, has not gone to seed, and from which the roots have been removed should be used to create fascines. The individual plants can be tied using biodegradable jute to create the bundles. The length of the bundle will depend on the length of the slope to be stabilized. Fascines can be lashed together to build them to the length needed. Or, if created at shorter lengths, overlap the fascines enough to eliminate gaps.

Fascines can also be created using cleared Himalayan blackberry stalks. However, this plant can root from stems that come into contact with the ground. If using this plant for fascines, it will be important to lay them on plastic and dry them completely before creating fascines. Because of the thorns on this plant, it may not be a preferred species for this purpose.

To install the fascines, start at the bottom of the slope and place them perpendicular to the slope fall line. Then pound stakes into the ground at intervals of 3 to 4 feet immediately downslope and angled slightly away from the fascine. Only about 4 inches of the stake should be visible above the fascine. In previous fascine installations, the UW Restoration Ecology Network students found that untreated 2X2 wooden stakes that were at least 4 feet long were necessary to create a sturdy anchor for the fascines, given the loose sandy soil conditions at the park. For extra stability, pound wood stakes through the middle of the fascine at a 45 degree angle to the slope and placed so that they are staggered between the downslope stakes. Once the fascines are anchored, soil from the slope above the fascine is shoveled down against the fascine and stomped down well to work the soil through the fascine. In general, after backfilling, only the very top 10 to 15% of the fascine should be visible. The UW Restoration Ecological Network students found that building the fascine wide enough to be able to leave approximately 8 inches of fascine exposed above the resulting bench worked well at the Park in order to shield the new plantings from wind and sun.

After installing the first fascine, work up the slope to place additional fascines. Given the loose and erosion-prone soils at the Park, fascines should be placed every 3 to 5 feet up the slope.

Live fascines can also be used at the Park when the right conditions are present and are constructed and installed in the same manner as discussed above for the Scots broom fascines. Live fascines provide added erosion control as the fascines develop root systems. Use the species discussed in the section 2.3 in this appendix. However, given the dry conditions at the Park, live fascines will be most successful in areas with seeps. Live fascines made from snowberry may be successful in dry areas, but should be placed late in the fall and will need to receive the same irrigation as recommended for new plantings.

After the fascines are placed, foot traffic through the stabilized area should be minimal to reduce disturbance to the area. Soil amendments can be carefully hand-dug into the resulting benches prior to planting native vegetation. Any irrigation placed in the area should be placed to minimize the erosive force of water moving down slope (eventually, the established native plantings will serve to reduce water erosion throughout the area). It is important not to ignore the project after it has been installed. Periodic maintenance is needed to check the stability of the placed fascines. additional fascines may need to be placed to stop any continuing erosion. Checking the terraces also allows for observation of the new native plantings and to monitor whether the plants are receiving enough water to survive. In the first summer after planting, maintenance check-ups should be conducted every few weeks. After that, the frequency of needed check-ups can be determined on a project specific basis.

Brush layering is a re-vegetation technique that combines layers of dormant cuttings (live stakes) with soil to re-vegetate and stabilize slopes. Cuttings are placed on horizontal benches that follow the contour of the slope. The benches are cut to angle down and back into the slope. For narrow benches, the benches can be created using shovels. For larger benches, mechanized equipment can be used where access is available.

The dormant branches can be cut from the parent plant at 3-4 feet in length and ¼ to 2 inches in diameter. The same storage and timing of planting should be followed as described in section 2.3 for live stakes. Begin by creating a bench at the bottom of the slope so the bench is 2-3 feet deep and angles slightly down and into the slope. Dormant branches are placed on the bench, slightly criss-crossing, with the cut ends placed into the slope and the tips extending beyond the edge of the bench by no more than ¼ of the total branch length. Plant 20-25 branches per linear yard. Place 24 inches of soil on top of the branches and tamp into place. Continue to build layers up the slope.

The steep slopes at the Park can be treated with this technique if a biodegradation fabric (such as jute netting) is used to hold the soil in place between the plant layers. The lower edge of the fabric would be placed on top of the first layer of dormant branches to anchor in the cloth, 24 inches of soil is placed on top of the fabric, then the fabric is rolled up over the soil and into the next bench and the next layer of dormant branches will be placed on top of the fabric. The fabric should not entirely cover the branches, but should be at least 1 foot into the bench.

The **Brush Donut** is a technique devised by Kern Ewing and used by the UW Restoration Ecological Network students to protect the new plantings located in severe conditions. Brush donuts protect plantings on steep slopes from drying out due to high exposure to wind (hot in the summer and cold in the winter) and sun. They help to slow evaporation from soils around the plantings, add organic matter to the soil as they decompose, and provide some protection from slope erosion around the plantings due to rain drops or irrigation spray. The brush donut is made using Scots broom after the roots have been removed and the branches are bound in a wreath shape. One wreath is made for one planting in order to provide maximum protection to the new plant. It should be large enough to be placed around the new planting without touching any part of the plant. The wreath should be staked in place to keep it from falling against the planting. It is easiest to make the donut while the Scots broom is still relatively green and easy to bend.

2.6 AMENDING SOILS

Soils in Richmond Beach Saltwater Park are well-drained, mineral soils with sandy textures. Organic content is very low in these upland soils. A few areas in the park do have soils that contain some level organic material; these include the wetland where there are organic mucky soils that are poorly drained and in the lower levels of small gullies where a small amount of organic material has collected.

Typical soil characteristics at the park favor dry upland plant species that have adapted to dry, drought-like conditions. For optimal plant survival and success, planting projects should use species that are adapted to the existing microclimates where the planting will take place (see Appendix B). Soil moisture and canopy closure (e.g. sun or shade) will be the most important indicators influencing species selection for a particular management area.

Even with careful attention to choosing species that have a greater tolerance for the dry conditions at the park, the well-drained sandy soils necessitate special attention to provide and retain moisture for new plantings. While all projects will require irrigation to ensure that new plants survive (see section 2.8), organic soil amendments will greatly help hold moisture near the plant's root ball to increase its chance of survival given the rugged conditions at the park. Amendments that can perform this function include high-quality compost, starch-based irrigation supplements and polymer hydrogel granules. Each of these is discussed in detail below.

In the case where compost amendments are part of a planting project, the best results are attained by amending the soils throughout the planting area, rather than only amending the soils within the planting hole. Generally, the best way to add soil amendments is to clear the area of invasive plants, aerate or scarify the soil if they have become compacted, and then spread the amendment (compost or the equivalent) on the surface throughout the planting area. In some cases, the compost can be tilled into the top 6 to 12 inches of the soil. In areas that had been overgrown by dense thickets of invasive species, tilling in the compost is not recommended as it will bring the weed seeds to the surface and will allow for easy germination of weeds. Tilling of the compost can be done where the topography is relatively level and there were few invasive species. If any area is to be tilled, care must be taken to avoid the root zones of mature trees. New information

about tree root systems shows that tree roots can be relatively shallow and extend well beyond the drip line of the tree. Seasonal timing of tilling in amendments should be such that bare soils are not exposed to winter rains. Therefore, if done in the fall after summer weed removal, exposed soil and compost will need to be seeded or covered with wood chips (in level areas), straw or Wood Straw™ (in steeper areas) whether or not the site is planted that season. It should be noted that straw often includes weed seeds and can introduce unwanted, non-native plants to the restoration area.

For logistical reasons such as cost, access, steep slopes, or lack of machinery, amending in this way may not be feasible. In this case, limiting the plant palette and planting into existing soil, or choosing a different technique are recommended. Ample opportunity exists to experiment with soil amendments in the different Landscape Zones and slopes at the park in order to explore other ways to improve soil health and thereby increase planting success. A few examples are given below.

Starch based irrigation supplements are containers of water combined with small amounts of food-grade starch to turn it into a gel. The container is opened and buried upside down next to new plants at the time of planting (or in the spring if the plants were installed during the early winter). As soil temperature warms during the summer, soil microbes decompose the starch, releasing the water contained in the gel. These supplements are used in roadside planting projects by several state highway departments. They are expensive on a per-plant basis, but may be effective where no other solution is feasible.

Polymer hydrogel is a powder that is mixed in small amounts with native soil during planting. The polymer granules absorb water and swell exponentially. They hold water in gel form and keep moisture available to plant roots that come in contact with the wet granules. They have a mixed reputation, partly because they are easy to overuse.

A simple application of Wood Straw™ (or a more traditional mulching material, like leaf mulch, wood chips, and/or straw) spread onto the soil surface is also a good way to effectively get organic content back into the soil and hold moisture in the ground. The Wood Straw™ is designed to allow plants to establish via seed as opposed to more traditional mulch material that functions to suppress the growth of plants from seed. This function of the traditional mulch material is useful to suppress weeds, but also can retard the germination of native plants from seeds. If wood chips are used they must be composted to avoid spreading decay fungi to living, mature and healthy trees.

2.7 WATERING

Watering is the key to maximizing survival and establishment of new plantings. The greater Seattle area gets an average of 39 inches of rain each year, but only 13 of those inches typically fall during the growing season. Plants grown in a nursery are acclimated to exactly the opposite condition: they receive regular watering to facilitate rapid growth. For these reasons, summer watering during the first three years is critical to help the plants acclimate to the radically different moisture regime present throughout most of the park. They must grow an entire new root system before they can survive in the summer dry season. This is why summer watering for new plants, even drought-tolerant natives, is important. For most efficient watering, establishment of an irrigation infrastructure for areas that require regular watering is recommended.

Planning for temporary or permanent irrigation should be part of all restoration projects. The University of Washington Restoration Ecology Network found that the plants that received

irrigation survived; however, the plants that did not receive water died within several months. Given the steep slopes and few water supply lines at the park, water delivery to planting sites will require good planning during the design of restoration projects and extra labor to install an efficient and cost-effective irrigation system. Some areas will be close to quick couplers so that hoses can be attached for irrigation. Other areas may be close to a road or a path where a truck with a water tank can spray water onto the planting areas. The preferred method will be to set up a temporary irrigation system to deliver water throughout the restoration area, with special attention paid to making sure that the higher elevation portions of the restoration site are well covered. Down slope areas will also need to receive adequate water coverage. In addition, down slope areas will receive some irrigation from upslope areas as the water moves down slope via surface and groundwater runoff.

Hand watering is another option, but one that must be weighed against the dedicated labor required. Missing a watering on the sunny, west-facing slopes on a hot summer day can be the difference between healthy, surviving plants and the failure of the restoration area. In addition, the repeated foot traffic can cause damage to plants and encourage erosion. This is of particular concern where steep slopes and/or cryptobiotic soils are present. Cryptobiotic soils take a relatively long time to develop and are quite fragile. Repeated foot traffic can easily destroy these soils and the slope stabilization function they provide.

Spray heads can be used on level ground and areas where slopes are less than 30%. The spray heads need to be raised at least 3 feet above ground to allow for adequate head-to-head coverage as grasses become established and the new plantings grow during the 3-year establishment period. On slopes that have an incline greater than 30%, using numerous heads that deliver in water in small fan spray patterns or soaker hoses buried beneath mulch is preferred over fewer spray heads that deliver large streams of water. The repeated, percussive force of water sprays on steep slopes can cause erosion. The resulting gullies and rills can unearth new plantings and undermine the success of the restoration area. When using smaller fan-spray heads or soaker hoses, planning is imperative to make sure that all plants receive irrigation water. Drip lines are not recommended on the sandy soils at the park because the emitters tend to deliver water in a vertical column directly below the emitter and miss the roots of the new plants.

General irrigation guidelines:

- Water new trees and shrubs thoroughly at the time of planting.
- Water new trees and shrubs at the equivalent of 1" of rainfall weekly during the first two summers after planting, tapering watering (to ½") weekly in the third year.
- Begin watering at the beginning of June to prevent drought stress, and earlier if spring rains do not occur in May.
- During years of extreme drought, water highly visible, natural planting areas along roads and trails and along the top of slopes.
- See sections 2.3 and 2.1 in this appendix for additional instructions on watering newly installed trees and shrubs.

2.8 WEEDING AND INVASIVE SPECIES CONTROL

[Information in this section is adapted from articles by The Nature Conservancy (2004), the University of California Integrated Pest Management Program (2003), Sound Native Plants (2006), The Seattle Times (2006), Jonathon Soll (2004), King County Natural Resources and Parks (2006 and 2007); University of California (2003), and from Golden Gardens Park Vegetation Management Plan (2003).]

APPENDIX C
IMPLEMENTATION PRACTICES

All restoration projects at the park will include initial removal of invasive species prior to planting native vegetation. Continuing control of weeds and invasive plants is also an important part of the 3-year establishment care (see section 2.1) for all newly planted areas. The most commonly occurring and problematic non-native invasive species in the Park are listed below with a brief description of their characteristics and recommended eradication and control methods for that particular species. Recommendations and protocols in this plan (including herbicide use) are intended to be used in accordance with the PRCS's best management practices and policies regarding park maintenance and public safety and health.

All projects where dense thickets of invasive species need to be removed will benefit from thorough planning prior to starting the project. Each project will need to include selecting from a combination of control and removal methods, implementing one or more of those methods, monitoring results, conducting on-going weed and invasive removal, evaluating the success in reducing the unwanted species, and determining whether additional actions are needed to achieve the goal of reducing competition with native plantings.

In general, weeds and invasives should be cleared from the entire restoration area. If the restoration site is very large and weeding the entire area is not feasible, then weeding should be done in at least a 6-foot diameter around each native tree, shrub, grass, and groundcover. This will need to be done throughout the 3-year establishment period (or until the woody native plants are at least 4 feet tall). Weeding once a month for this purpose is optimal. Where weeds are very aggressive, cardboard can be laid out as sheet mulch (that is, a continuous layer over the entire restoration site). Cardboard serves as a good temporary deterrent to weed re-emergence and works well where there is no slope.

Woody debris from invasive plant removal that does not sucker or sprout from cuttings or branches can be used to create habitat features (see section 2.5).

The most effective long-term control of invasive shrub species can be achieved by using a combination of control methods, reducing site disturbance, and establishing healthy native plant communities. All control efforts should be directed over time towards establishing and maintaining native plant communities, which will create the shady conditions that are not conducive to invasive species. Invasive species infestations that pose the greatest threat to desirable plant communities are those populations that should be targeted first. In addition, to keep the weed control workload at the most reasonable level possible, new infestations that re-emerge after the initial removal effort should be targeted for control before they, once again, become widespread or well established. Invasive control should focus on those species and infestations that are 1) the fastest growing, 2) the least established but potentially threatening, 3) the most disruptive to functional habitat, and 4) listed noxious weeds with mandated control.

The science of removal and control of invasive species is always evolving. The information in this plan provides the latest up-to-date methods of controlling the invasive species that have been observed at the park. It may also be useful to check the King County Noxious Weed Best Management Practices website at http://dnr.metrokc.gov/wlr/LANDS/Weeds/bmp.htm as this website is continually up dated with new information. Recently, goats have been used in the greater Seattle area as a method to control invasive species. However, because goats will eat everything – both native and non-native species – and their hoofs tear up the ground, this method is not recommended for the park.

The following text describes in detail how to remove each of the identified non-native invasive plants or noxious weeds found in the Park. Non-native invasive species that are not specified below can be removed as needed and appropriate.

APPENDIX C
IMPLEMENTATION PRACTICES

An important safety issue to note is that all work with herbicides must be done by landscape professionals licensed to apply herbicides by the Washington State Department of Agriculture. **Volunteers should not work with herbicides**.

2.8.1 ENGLISH IVY (*HEDERA HELIX*)

English ivy is a broad-leaved evergreen non-native invasive found in the Forest Zone-Upland Forest Management Area next to the beach access trail. Occurring on the forest floor and climbing up tree trunks, this species is one of the biggest threats to forest health. It has no natural predators or pests, does not provide beneficial habitat for native wildlife and reduces native plant diversity.

Growth Habitat

English ivy spreads locally through vegetative growth (that is, any stem that touches the ground can root and form a new plant and/or new shoots can form from the existing root system) and new plants can grow from cut or broken pieces of stems that fall onto and root in the soil. Ivy growing on the ground is a relatively slow growing. Seeds are produced during the vertical phase of ivy growth. The ivy seed disperses over longer distances by being carried to new areas by birds. Thus, preventing the ivy from climbing trees and other surfaces is a priority level of control.

Ivy is shade tolerant and attaches to the bark of trees, by way of small rootlike structures. Older ivy vines have been reported to reach 1 foot in diameter. As the ivy climbs in search of increased light, it engulfs and kills branches by blocking light from reaching the host tree's leaves. Branch dieback proceeds from the lower to upper branches, often leaving the tree with just a small green "broccoli head." The host tree eventually succumbs entirely from this steady weakening. In addition, the added weight of the vines makes infested trees much more susceptible to wind throw during high rain and wind events and heavy snowfalls. Trees heavily draped with ivy can be hazardous if near roads, walkways, and other peopled areas. On the ground, English ivy forms dense and extensive monocultures that exclude native plants.

Recommended Control Treatment:

Tools needed:

- 1"-diameter cutting-capability hand pruner
- Pruning saw
- Work gloves
- Heavy duty yard waste bags

Hand-pulling appears to be the most effective removal method for this plant. Any efforts to control ivy should initially target vines climbing into trees. Vines should be cut at the ground level at the base of the tree and then again at shoulder height; all the way around the circumference of the tree. Cut vines should not be pulled down out of trees, as they die they will loosen their hold on the tree and loose mass, relieving the tree of the stress. Pulling the vines from the tree will result in further stress to the tree. A radius of 5 feet all the way around the base of the tree should also be cleared of ivy – called a 'tree lifesaver'.

Patches of ivy on the ground are best removed by hand pulling and rolling the vines into a mat or ball. Rolled up mats or balls can be left on site on large blue tarps until they dry; making it easier to transport offsite without the risk of leaving any live plant pieces behind. Rooted portions left in the ground will remain alive and should be pulled or repeatedly cut to the ground as they re-sprout. Because cutting will likely result in vigorous regrowth, vigilance is required to ensure long term control. More extensive instructions for manual ivy removal can be found at www.ivyout.org .

If conditions warrant, ivy can also be controlled using glyphosate herbicide. This process requires careful material handling and patience and should only be a licensed applicator. This method may be a preferred strategy on slopes where ground disturbance is undesirable.

Removal of dense mats in the ground layer where there is still a fairly intact native shrub layer can be done without replacement planting. Removal of dense mats in the ground layer lacking native shrubs and herbs should only be done if subsequent re-planting using native species is an option. On slopes less than 40 percent, it may be productive to leave the ground bare and unplanted for one growing season. This gives the area a chance to recruit native plant regeneration from the existing seed bank in the soil. If this technique is used, it is important to leave the soil surface scarified (lightly raked) and fence the area to prevent foot traffic. During the following three growing seasons, regeneration of ivy and/or other invasive species must be carefully weeded from the desirable native regeneration. This takes a discerning eye and sensitive touch; and is an ideal strategy for sites being maintained by volunteer groups.

If native recruitment is not successful, high density planting and intensive maintenance should be provided so that 100% cover by native plants is achieved within three years.

On slopes greater than 40 percent, placing fascines and immediate re-planting and sheet mulching are recommended to guarantee adequate foliar coverage under critical slope conditions. Any newly planted areas should have an additional 10-foot wide buffer between the plantings and any adjacent ivy patches.

2.8.2 HIMALAYAN BLACKBERRY (*RUBUS ARMENIACUS*)

This species is prevalent throughout the Park in large thickets on sunny, steep, west-facing slopes. Blackberry is shade-intolerant and opportunistic on disturbed sites, so long-term control is linked to successful establishment of healthy native plant communities that create undesirable conditions for the blackberry.

Growth Habit:

Blackberries spread via seed and vegetative reproduction (that is, any stem that touches the ground can root and form a new plant and/or new shoots can form from the existing root system). While it does provide good wildlife habitat value as food, refuge and cover for birds and small mammals, Himalayan blackberry competes with native shrubs, herbs, and grasses for water and sunlight. It out-competes desirable native vegetation through dense canopy formation and high water sequestration. Over time, it can completely engulf native vegetation and form a solid thicket up to 10 feet tall or higher.

Recommended Control Treatment:

Tools needed:

- 1 ½”-diameter cutting-capability two-handed lopping shear
- 1”-diameter cutting-capability hand pruner
- Work gloves
- Heavy duty yard waste bags
- weed wrench (see http://www.weedwrench.com/)
- shovel
- Mulch that is designated to be free of weed seeds

Small areas of Himalayan blackberry, or blackberries around trees or shrubs, can be controlled through manual removal of the plant by first cutting the stems back to 6 inches tall using hand pruners or two-handed loping shears; preferably as the plants begin to flower. Because the plants

will still send out new sprouts from the root crown, the root mass of each plant (the bulbous, gnarled mass of the crown that is visible just a few inches below ground) can be hand removed with a weed wrench, claw mattock, pulaski or shovel. The entire root mass should be removed and all parts of the plant need to be bagged immediately and removed from the site. After removing the root mass, the resulting hole should by mulched to at least 6 inches deep to discourage germination of Scots broom; another invasive species that also occurs in the Park and will sprout aggressively wherever there is exposed, disturbed soil. Because blackberry can re-sprout from roots left in the ground, continuing maintenance is necessary to make sure this species does not become re-established.

Blackberry can be chemically controlled where thickets are very dense or where total root removal is not possible. The UW Restoration Ecology Network program found that Roundup gave poor results; however, Crossbow did have the desired results. With any application of herbicide, always read and follow the label instructions. The best results were obtained by cutting the canes back to about 6 inches above the ground and applying the herbicide after the new leaves emerged. Use of this method in late spring when new growth occurs involves cutting each cane and immediately brushing the cut surface with the herbicide. If this method is used in late summer (August to September), herbicide can be applied to the leaves following seed set and while the plants are still actively growing. If applying herbicide to the leaves, care must be taken to avoid direct spray or overspray onto adjacent desirable native species' leaves or stems. Subsequent treatments, if needed, should occur in early fall (if weather permits) and before the first frost. Using a lower concentration of herbicide allows the individual plant to continue functioning long enough to translocate the chemical to the roots. Several treatments may be necessary. This chemical should be used following the manufacturers recommendations. Plants treated chemically need to be monitored to determine if another treatment is necessary.

The method(s) chosen for control of blackberry depend mainly on how extensive the infestation is and the available labor resources. Removal, other than in areas with sparse occurrences and a relatively intact healthy existing plant community, should not be done unless subsequent replacement native planting is planned. Replanting cleared areas will serve to shade out invasive seedlings. In areas of steep slopes, the Bradley method described in section 6.3 Planting is recommended to avoid disturbing large sections of unstable soil. In addition, bioengineering techniques described in section 6.5 should be implemented immediately to stabilize the slopes.

The timing for native woody plantings will be site dependant and must be determined at the time of project planning. In some instances, planting in the fall immediately after summer removal work is desirable. In other cases, re-planting in areas where dense thickets were removed may not be done until control of re-sprouts over a 2 year period is complete. If this occurs on steep slopes, it is important to implement bioengeered slope stabilization (see section 6.5) and hydroseed using native grasses and forbs (see section 6.3). Whether the area is planted immediately or planted later, regeneration of any invasive species in the cleared area must be carefully weeded. If native plants have been installed or are regenerating on their own, weeding out invasives must be done with a discerning eye and sensitive touch.

2.8.3 SCOTS BROOM (CYTISUS SCOPARIUS)

Scots broom is prevalent throughout the Park occurring in large thickets in sunny slopes and on the beach. It is shade-intolerant and opportunistic on disturbed sites, so long-term control is linked to successful establishment of healthy native plant communities that create undesirable conditions for this species. Because Scots broom seeds remain viable for many years, a focused invasive species maintenance program for this species will need to be conducted for at least 7 years. After that, annual removal of Scots broom seedlings will still need to be conducted each

spring in areas dominated by native grass and shrubs to ensure the long-term health of these native communities.

Growth Habit:

Scots broom is very efficient at spreading and out-competing native plants. Spreading via seeds, Scots broom can produce hundreds of seedpods per bush. The pods often open explosively and the seeds can widely scatter over long distances. The seeds are long-lived and, over time, it can form 100 percent cover and spread into adjacent areas.

Recommended Control Treatment:

Tools needed:

- Heavy duty yard waste bags
- Heavy work gloves
- weed wrench (see http://www.weedwrench.com/)
- Mulch that is designated to be free of weed seeds

Removal of seed-producing age plants is the most labor intensive, but it important to reduce spread and seed accumulation. Removal can be done incrementally as resources are available. Proven strategies include hand clearing, mowing, and hand cutting. It is important to keep soil disturbance to a minimum during these control activities as bare soils and mixing of the surface soils encourages germination of the existing seed bank of this and other invasive species. In addition, long-term management will be needed to exhaust the seed bank and prevent re-colonization in cleared areas due to seedlings or roots left in the soil that have re-sprouted.

Hand clearing permits the removal of weeds without damage to surrounding native vegetation. Root removal is important as young plants tend to re-sprout from roots left in the ground. Young plants up to 3 ft. in height growing in moist soil can be easily pulled out by hand, roots and all. A recommended tool for removing more mature plants is the Weed Wrench (http://www.weedwrench.com/) or some similar device.

The best timing for hand pulling is in the late spring (May) just before the plants go to flower. Unless the pulled plant is to be used to create fascines for slope stabilization, all parts of the plant need to be bagged immediately and removed from the site. Wherever a plant is pulled from the ground, weed-free mulch should be placed 6 inches deep over any exposed soils. This step is imperative to reduce seed viability as Scots broom will sprout aggressively wherever there is exposed, disturbed soil.

Scots broom can also be cut back as an effective control measure. Plants should be cut below the basal node (that is, near or below the ground level) where the stem is more yellow than green. Old plants in dry soil have a nearly zero re-growth rate if cut correctly. About half of young plants that have been cut back will re-sprout. For this reason, two to four passes through the area to be cleared should be done in May and June before seed set to make sure all flowering plants have been removed; with a follow-up visit in July to cut down any plants that were missed and have gone to seed. All plants with flowers or seeds must be immediately bagged and removed from the site.

On level ground, mechanized equipment can be used to remove Scots broom using a tractor-mounted mower. Because these cuts are higher than the recommended basal cuts, the plants have a greater tendency to re-sprout. Using this method, broom plants typically require several cuttings before individual plants die. The best time for the first cutting is when the plants begin to flower (late May-June) when root reserves are lowest and new seeds haven't been produced.

Follow-up mowing on a regular basis throughout the summer is necessary to remove re-sprouted plants. All plants with seeds must be bagged and removed from the site.

Native plantings should be installed in cleared areas to shade out invasive seedlings. In areas of steep slopes, the Bradley method described in section 6.3 Planting is recommended to avoid disturbing large sections of unstable soil. In addition, bioengineering techniques described in section 6.5 should be implemented immediately to stabilize the slopes.

The timing for native woody plantings will be site dependant and must be determined at the time of project planning. Regeneration of any invasive species in the cleared area must be carefully weeded. If native plants have been installed or are regenerating on their own, weeding out invasives must be done with a discerning eye and sensitive touch.

2.8.4 FIELD BINDWEED (CONVOLVULUS ARVENSE)

Bindweed is a pervasive and very invasive perennial vine that winds around and overtops woody vegetation, forming a strangling mat over low shrubs and groundcover. It thrives in disturbed sites, especially sunny locations with moderately dry soils. It is most prevalent at the Park to the east of the Wetland/Stream Management Area.

Growth Habit:

Field bindweed spreads by seeds, an individual plant can produce 500 seeds. This species can also spread via vegetation reproduction from any small fragment of stem or root, and by an extensive root system. Most parts of the bindweed roots can produce buds, which then create new roots and shoots. Roots capable of budding are found to depths of 14 feet. By this means a single field bindweed plant can spread more than 10 feet in a growing season.

Recommended Control Treatment:

Tools needed :

- Heavy duty yard waste bags
- Roundup™ in a spray bottle

If herbicide is to be painted onto leaves (method #2):

- Glyphosate (non-selective) commercial brands: Aquamaster™, AquaPro™, Aqua Neat™, Glypro™, Rodeo™
- Small paint brush

Hand cutting or pulling does not serve to control field bindweed and only results in the spread of this species. Two different methods tried-and-true methods are described below. When using herbicides, treat the bindweed plants before they are drought stressed and preferably at the flowering stage of growth. Re-treatments will be necessary to control both established plants and seedlings.

Because of the dense extent of the morning glory infestation to the east of the wetland/stream Management Area, the most efficient way to remove the bindweed will likely be to initially hand pull the bind weed. Then revisit the area in four to six weeks and use a method that has been used successfully in the Pacific Northwest (Seattle Times 2006). This method calls for unwinding the bindweed from other plants and gathering up the runners without pulling them out of the ground. Stuff the runners into a plastic bag and use a twist tie to gently close off the bag near the ground (including as many leaves as possible). Poke a small hole in the bag, insert the spray tip of a pump sprayer and soak the bindweed with Roundup. The bindweed, roots and all, should be dead

after a few days and can be pulled up, placed entirely in the plastic bag, removed off site and disposed of appropriately.

A second method that can be used is to paint the leaves of bindweed using a 2 to 4% solution (volume to volume) of glyphosate. Be sure not to allow the herbicide to touch mature leaves or green bark of nearby native shrubs or trees or injury/death may result. To reduce the chance that glyphosate will contact desirable plants, place the bindweed vines on newspaper before painting the leaves with glyphosate. Once the glyphosate solution has dried on the bindweed leaves, the newspaper can be removed. Any regrowth of the field bindweed must be retreated.

Drought tolerance is a characteristic of field bindweed. So watering the mitigation area during the dry months of the year can assist desirable native species in competing better with bindweed.

2.8.5 JAPANESE KNOTWEED (*POLYGONUM CUSPIDATUM*)

Japanese knotweed s a semi-woody, bushy perennial that is persistent and aggressive in the landscape. At least one patch of Japanese knotweed occurs in the Upland Forest – Forest Zone near the beach access trail. It can tolerate a variety of adverse conditions including full shade, high temperatures, high salinity, and drought. Once sprouted, it is a rapidly colonizing invasive pest in natural areas and poses a significant threat to riparian areas. Rapid spring growth and deep extensive root systems enable this species outcompete most other plants – including trees and shrubs. It lowers the quality of riparian habitat and, dispite its large rhizome mass, it provide poor erosion control.

Growth Habit:

Japanese knotweed spreads rapidly from stout long rhizomes (spreading roots). While it does spread from seeds, this does not appear to be the primary source of spreading. Knotweed typically starts growing in April, although stems from deeply buried roots can emerge in late summer. It grows extremely fast in the spring and can reach heights of up to 10 feet. When it is cut or damaged, it vigorously and rapidly re-sprouts from the roots and rhizomes. Rapid upward growth slows in July and is greatly reduced after August. It dies back to the ground after the first hard frost and returns each spring from the same root system.

Its extensive roots can spread 20 feet from the parent plants and can penetrate 7 feet down into the soil. It spreads rapidly via vegetative reproductions: roots and stem fragments as small as ½" can form new plant colonies, cut or broken stems will sprout if left on moist soil or put directly in water, fragments are spread by animals, earthmoving equipment, careless clearing, and high water. It takes advantage of freshly disturbed soil and grows faster than native species and most other weeds; suppressing or killing the other species.

Recommended Control Treatment:

Tools needed :

- Heavy duty yard waste bags
- Glyophsate
- Jk injection tool (jkinjectiontools.com)
- Paint marker or marker tool
- Aquamaster or Roundup Pro Concentrate

Numerous methods of control have been tried on this insidious invasive plant. Prior to the injection method, a combination method using manual and mechanical tasks was used. The manual/mechanical method combined covering and cutting the knotweed. However, this method

requires a committed effort of twice per month treatments for at least 3 years and, due to the tenacious tendencies of this plant, even then does not always succeed.

Herbicide injection method is more time and labor intensive than foliar spray sinve every cane over ½" in needs to be treated. However, use of this method in King County resulted in 95% success rates in killing the knotweed in the first year of treatment and injection of the knotweed has not affected surrounding desirable native plants. Another advantage is that there are no cut stems to deal with (eliminating the possibility of further spreading the plants).

Start by inspecting the Japanese knotweed canes closely, you'll see that it is segmented. Where one segment ends and another begins, you will find a node. Between the nodes is a hollow tube, the same as occurs with bamboo. The injection needs to be done close to the ground between the first and second nodes (or between the second and third nodes if the stem is too woody lower down). The herbicide must be applied to every cane that is ½" and larger in diameter, injecting into the hollow section between the nodes. There will always be small stems, less than ½" in diameter, that must not be injected. In many cases, these stems will die after the application, but not always. Injections will need to be repeated in future years as necessary.

Although it's certainly possible to use the injection method at other times of the year, it is best to inject the plants is from mid-June to the end of September. Waiting till late summer or early autumn takes advantage of the plant's transfer of nutrients down through the canes into the rhizomes before the first frost. Currently, only Aquamaster and Roundup Pro Concentrate are labeled for stem injection. Follow the directions on the stem injection gun, especially for calibration and cleaning. Inject 3 to 5 ml into the stems (following directions provided on your herbicide label). Make sure the herbicide is delivered into the hollow section of the stem

2.8.6 ENGLISH HOLLY (*ILEX AQUIFOLIUM*)

English holly is a broadleaf evergreen tree/shrub that is grown ornamentally in the northwestern United States and Canada but is also commonly found escaping into forests where it can dominate the tall shrub layer and suppress germination and growth of native tree and shrub species. English Holly saplings were observed in the Upland Forest (Forest Zone) at the Park. In King County, English holly is classified as a Weed of Concern and its control is recommended in natural areas that are being restored to native vegetation and in protected forest lands.

Growth Habit:

This species prefers at least partial shade and is generally found in the understory of upland forests or along forest edges. I grows in shade or sun in well-drained soil and spreads via seeds distributed by birds. Trees and saplings also sucker and re-sprout vigorously when disturbed.

Recommended Control Treatment:

Tools needed :

- Heavy work gloves
- weed wrench (see http://www.weedwrench.com/)
- shovel
- pruning saw

Small seedlings and saplings can be pulled or dug up when soil is moist. Mature trees have deep and extensive roots so digging is labor-intensive and results in considerable soil disturbance if all of the roots are removed. Instead, the mature trees can be controlling by cutting or frilling (girdling the trunk by making a series of downward overlapping cuts all the way around the trunk and leaving the chips attached to the trunk at the base of the cut) the tree. Applying herbicide

with the cut stump or frilling method is most effective. Foliar herbicide treatment is not very effective due to the thick, waxy leaves. This technique should be used before fruit production so that standing plants do not have fruit on them. Treated cut stumps should be checked for re-sprouts every 2 to 6 months for the first year after cutting and re-treated as necessary. Where no herbicide is used, repeated cutting will be required to weaken and eventually kill the tree over time. This requires diligent follow-up visits over a period of at least several years to remove suckering growth that resulted from the initial cutting.

2.8.7 REED CANARYGRASS (*PHALARIS ARUNDINACEA*)

Reed canarygrass has not been observed at the park. However, as invasive species in the wetland and riparian areas are removed and soils are disturbed, it is likely that this species will appear at the Park. This grass

Growth Habit:

Reed canarygrass can readily form monocultures given adequate sun and moisture. Due to its vigorous growth, relatively tall habit and heavy seed production, it out-competes many native species available for sun and water. It also spreads vegetatively by rhizomes (an underground stem that sends out roots and new plant shoots).

Recommended Control Treatment:

Tools needed:

For mulching method:

- Cardboard
- Hand shears
- Weed free mulch
- shovel
- 2-gallon container native plants (see list below)
- Seed for meadow barley (see specifications below)

For herbicide method:

- Hand shears
- Glyphosate (non-selective) commercial brands: Aquamaster™, AquaPro™, Aqua Neat™, Glypro™, Rodeo™
- Backpack sprayer

Since reed canarygrass requires full sun, dense plantings of shrubby vegetation provides a fairly successful defense against reed canarygrass. The reed canarygrass will not disappear all together, but will be controlled to the point that it cannot form a monoculture and displace native species. The recommended native plantings in the Wetland/Stream Management Area will eventually create the shade needed to control the reed canarygrass. Initially, however, there will be enough sun to warrant the need to control this species.

If the reed canarygrass occurs only in small, scattered patches mulching is recommended to control it. This method uses cardboard laid out on top of the reed canarygrass around the new and existing native plantings to create shade. The cardboard should be overlapped and covered with a 6-inch layer of weed-free mulch so that no grass can grow up between the pieces of cardboard. If necessary, the reed canarygrass can be cut down to 4 inches tall using a hand shear, but extreme care must be taken to make sure that no native plants are cut down or injured. All cut grass must be either bagged and removed from the site to avoid spreading the seed. The area will

need to be checked periodically to make sure that the reed canarygrass is not growing up around the edges of the cardboard or coming up in additional areas.

For larger patches of reed canarygrass the herbicide method may be more appropriate. For this method, the grass should be cut back to 4 inches in height in the spring. This must be done with hand tools and prior to seed set to avoid spreading any seeds. Grass clippings need to be immediately bagged and removed from the site. Once the reed canarygrass has re-grown to 12 inches tall, herbicide can be applied using glyphosate at a rate of two percent. It should be sprayed again in the fall, with or without cutting. In areas where the reed canarygrass is near new or previously existing native plants, care must be taken to avoid spraying (either directly or by over-spray) the adjacent desired native vegetation.

2.8.8 LISTED NOXIOUS WEEDS

Currently, four of the five invasive species discussed above fall into King County's 2007 Non-Designated Noxious Weed List; including English ivy, field bindweed and Scots broom. Control of these species is recommended, but not required in King County. Japanese knotweed is a class B noxious weed listed on Washington State's noxious weed list. Control of this species is highly recommended but not required in King County. No other listed weeds were observed at the Park.

2.9 CRYTOBIOTIC SOILS

Cryptobiotic soils were discovered by the UW Restoration Ecology Network students on the steep sandy slopes at the Park. Formed by a network of sandy soil and living filaments, including lichens and mosses, these soil crusts increase the stability of otherwise easily eroded soils, increase water infiltration in regions that receive little precipitation, and increase fertility in soils often limited in essential nutrients (Belnap 2004). Cryptobiotic crusts are important for the restoration and stabilization of sandy slopes.

Biological soil crusts can assist in protecting highly erodible soils from wind and water erosion. The soil-binding action of this crust can extend down to 6 inches below the soil surface. Crustal cover is not reduced in drought, compared with vascular plants and these organic crusts are present year-round. Plants growing on crusted soil often show higher concentrations and/or greater total accumulation of various essential nutrients when compared to plants growing in adjacent, non-cryptobiotic crusted soils.

These soils are extremely susceptible to disturbance by trampling and take a very long time to recover. In the UW restoration site it was difficult to both remove the extensive Scots broom thicket and protect the crust. Restoration participants were aware of maintaining the crust and made every attempt to replace the disturbed crust or refrain from trampling the crust. Given the importance of the crust at the restoration site, the UW group set up an experiment to determine the most advantageous method of re-establishing this crust. Monitoring of this experiment results will hopefully yield information to aid in crust re-establishment in areas of disturbance.

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