Cotton Hill Park
2010 Restoration Ecology Network (REN)
Final Report

Located in the Forbes Creek Watershed
110th Ave NE and NE 98th St, Kirkland WA 98033

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Project Summary

Project Name: Cotton Hill Park, University of Washington REN 2010
Location: 110th Ave NE and NE 98th St, Kirkland WA 98033
Year: Fall 2009 – Spring 2010
Client: Karen Story
Organization: Highlands Neighborhood Association

Figure 1: Before Restoration (Fall 2009)

Figure 2: After Planting (March 2010)

Cotton Hill Park is a 4.1 acre undeveloped park within the City of Kirkland, WA in the Forbes Creek Watershed (Fig. 1). The 2010 REN restoration site occupies an area of the park that is approximately 3,935 square feet and lies to the south of the 2009 REN site near the north end of the park (Fig. 2). Ecological restoration has been underway throughout the park with leadership from the City of Kirkland and a strong base of community volunteers from the Highlands Neighborhood Association who have conducted many work projects throughout the park. Projects have included invasive plant removal, native plant establishment, trail construction, plant ID sign design, and collaboration with Kirkland Junior High.

Prior to restoration, the 2010 REN site's canopy layer was composed of a sparse collection of cottonwood (*Populus* spp.) and red alder (*Alnus rubra*) trees. In the shrub layer and understory, native species such as salmonberry (*Rubus spectabilis*) and sword fern (*Polystichum munitum*) existed among dense populations of invasive species such as Himalayan blackberry (*Rubus armeniacus)*, reed canary grass (*Phalaris arundinacea)*, English holly (*Ilex aquifolium)*, and Enlish ivy (*Hedera helix)*. The presence of these invasive species inhibited the growth of native species and prevented succession of the site into a functioning system typical of Puget Sound lowlands. In order to facilitate the achievement of this successional target, the following goals and strategies were implemented in the 2010 restoration site.

1. Remove invasive species and install native species in order to promote the establishment of a native vegetation community typical of lowland Puget Sound conifer dominated forests and wetlands.
2. Promote community involvement in ongoing restoration through outreach to local community and schools.
3. Establish improved wildlife habitat through both plant selection and structural modifications to the site.

Figure 1: Location of Cotton Hill Park within Puget Sound area

Major Accomplishments

- **Planted forty-six native species with a total of 569 plants.**
- **Installed amphibian habitat structures**
- **Taught basic ecosystem and restoration principles to 6 classes of 7th grade students at Kirkland Junior High**
- **Restored close to 4,000 square feet of parkland**
- **Engaged over 100 community volunteers during the course of the project**

Cotton Hill Park
2010 Restoration Ecology Network (REN)
As-Built Report

May 28, 2010

Project Team:

Stephanie Grubb, Dylan Holm, Eliza Keeley, Kristie LaMar,

Jake Milofsky, Lara Ramey, and Sereyratana Som

Background

Site Assessment

The site is located in Cotton Hill Park, within the Kirkland city limits (Figure 1), and in the Forbes Creek Watershed, draining to Lake Washington, at location NW ¼ of NE ¼, Section 5, Township 25N, Range 5W in the Highlands neighborhood (Figure 2). The overall size of Cotton Hill Park is about 4 acres, and of that, we chose to restore.09 acres (3,935 ft^2). Our site is bordered to the north by the 2009 REN project site, to the east by a border of invasive species, to the south by a seasonal pond, and to the west by the north-south oriented trail. When entering the park from the main entrance off of 110th Ave NE and NE 98th St and following the trail, our site is on the right just past the seasonal pond. Our site has no measurable change in elevation; however there is significant microtopography (approximately .2-1m). The site lies at the bottom of a steep slope to its east, which blocks the morning sun; the site receives afternoon sun.

A few snags, several stumps, and coarse woody debris are present within the site. One prominent Pacific willow (*Salix lucida*) is leaning against a snag in the middle of our site. Himalayan blackberry (*Rubus armeniacus*) was the dominant species and covered most of the site, until it was removed during the January 18th Martin Luther King Jr. Day (MLK Day) work party. English ivy (*Hedera helix*) and English holly (*Ilex aquilfolium*) were present on the eastern part of the site and reed canary grass (*Phalaris arundinacea*) still dominates in and around the vernal pond. Native vegetation is scattered throughout the site. There are a few patches of salmonberry (*Rubus spectabilis*) present along the northeastern border, as well as a patch near the middle of the eastern border. The overstory canopy is patchy and provides partial cover (approximately 70%). One large black cottonwood (*Populus balsamifera ssp. trichocarpa*) is present at the northwestern point of our plot. The canopy from another black cottonwood 3.9 meters from our site hangs over at point C of Figure 3.

The soil is fairly uniform throughout the site, although the texture varies from clay loam to sandy clay loam. The entire site includes a 1-2 inch layer of recognizable organic matter mostly composed of deciduous leaves, and there is little humus above the mineral soil. The soil moisture

content was very high throughout the site, particularly by the pond on the day of the assessment, which occurred in early November. Surprisingly, evidence of gleying and mottling were not visible in the soil pits; this indicates that the site is seasonally saturated, rather than permanently saturated. This is reinforced by our project partner, who informed us that the site is drier during the summer months and that the seasonal pond dries up. Unfortunately, the majority of the site was formerly covered in invasive species, so observations were limited. However, the topography of the park, the supported vegetation, and the frequency of saturation implies that the water table does not drop very far. We chose plants that will tolerate seasonal saturation with periods of lower moisture as a solution to hydrologic challenges. There were some high precipitation events in the two weeks prior and there was a bit of rain on the day of the assessment, so we saw the site in its saturated condition.

Foot traffic and off-leash dogs are the only identifiable disturbances due to our site's close proximity to the trail. Cotton Hill Park is a popular route for students walking to and from both Peter Kirk Elementary School and Kirkland Junior High, so it can also be expected that kids and teenagers periodically explore the park off-trail, as was observed when we visited our site.

Restoration Needs and Opportunities

Urbanization and invasive species have spread across much of the Puget Sound area, leaving our urban parks in an unhealthy state of disarray. There are numerous ecological, personal, social, and cultural values inherent in restoration. According to Clewell and Aronsen (2007), "The crucial ecological value of ecological restoration from an objective, scientific point of view is the recovery of an impaired ecosystem to an intact condition in terms of its integrity and health." This is, of course, was our primary goal in restoring a site within Cotton Hill Park.

Restoration is needed in Cotton Hill Park because much of the area is completely dominated by a few invasive species, which provide very little structural and biological diversity of plants and wildlife. To satisfy our project partner's desires, we wished to help transform Cotton Hill from an invasive jungle of Himalayan blackberry bramble into a healthy urban forest dominated by conifers. Kirkland, as a Tree City USA member, has made protecting and enhancing urban forests a primary goal and our aim was to be a part of that process.

The community also has need for restoration in the park. The invasive species look messy and monotonous in color and structure, so it is not very aesthetically pleasing and provides habitat for a very limited number of wildlife species. After restoration, a more aesthetically pleasing variety of plants will be supported, thus a greater variety of habitat will be provided. This will attract more wildlife. Vertically, there will be much more variety of shapes and colors with a mix of trees, different shrubs and groundcovers. With the restoration of Cotton Hill Park, people can learn about their local, native environment and have an opportunity to experience the peace and beauty that the park can offer.

Community involvement is another great opportunity that restoration projects offer. At our first work party, sixty-nine neighbors, friends, and caring individuals came out to clear almost 4,000 square

feet. In today's society where people tend to feel disconnected from nature, restoration provides a unique opportunity to engage the community in the outdoors and educate them about the character of a healthy, native forest or wetland. Thus, our basic approach is to restore a 0.09 acre site within Cotton Hill Park by removing invasive species and planting native species that will eventually develop into a conifer forest with the physical help and support of the Kirkland Highlands neighborhood.

Figure 1: Cotton Hill Park in the Puget Sound region.

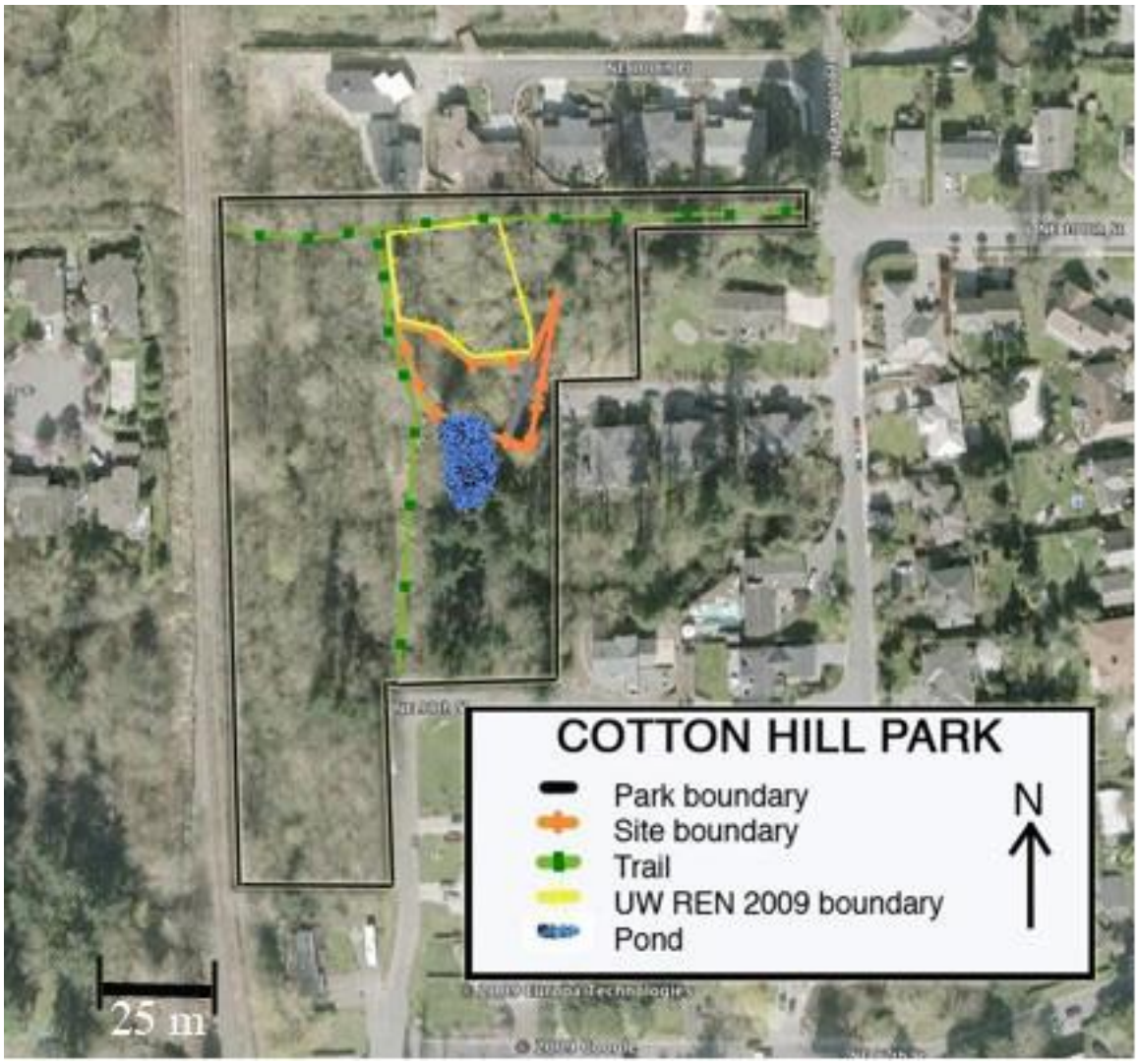

Figure 2: Map of Site Location within Cotton Hill Park.

Tasks and Objectives9

GOAL 1: *Promote the establishment of a diverse community of native vegetation typical of lowland Puget Sound riparian conifer dominated forests and wetlands.*

Objective 1.1: Remove and suppress invasive species within the proposed site

Task 1.1a: Remove all Himalayan blackberry biomass above and below ground.

Approach: Mechanically pulling up the root balls is effective in small areas (King County Noxious Weed Control Program 2005). However, this was not feasible in our project for logistical reasons, so we manually removed species. We cut canes of Himalayan blackberry to 1-2 feet above the ground to insure that the root balls could be located later. Next, for each plant we used a shovel to dig a hole

and grub out the root ball. We removed as much of the root material as possible to reduce the risk of reinvasion. The plant material was collected on tarps and piled at the southern entrance of the park for the city to pick up. Use of leather gloves and protective clothing were strongly recommended.

Task 1.1b: Remove all English ivy biomass above and below ground.
Approach: Hand pulling is one of the most effective ways to control English ivy (King County Noxious Weed Control Program 2004). The underground plant material was removed as much as possible, to prevent regrowth. Vines of English ivy growing on trees were cut, but not pulled off of trees as to avoid damaging the tree. All biomass was collected on tarps and piled at the southern entrance of the park to be collected by the city.
AD 1: Prior to planting, total removal was approximately 95% of above ground biomass and to 2 inches below ground. A thick stem that was wrapped around a snag was initially left, but was removed during a team site visit (post-planting) when new growth was seen. Some roots were left at a depth of 3 or more inches because the depth, with an additional 6 inches of mulch will likely be sufficient to suppress further growth.

Task 1.1c: Remove English holly biomass above and below ground.
Approach: Manual removal of smaller trees with shovels is effective, but removing larger trees can cause too much impact to the soil (King County Noxious Weed Control Program 2010). We cut large stems to 1-2 feet, then used shovels to dig up roots balls. We removed all parts of the roots. The biomass was collected and piled near the southern entrance to be collected by the city.

Task 1.1d: Remove above ground Reed canary grass.
Approach: Above ground biomass was removed using clippers in areas without standing water. We applied mulch over the remaining roots. Reed canary grass does not tolerate year round shade, so densely planting trees will help to control it (Reed canary grass, 2004). Pacific willow and red-osier dogwood (*Cornus sericea*) were densely planted to help shade out reed canary grass both on-site and in the adjacent seasonal pond. We recommend that conifer species be planted once these trees establish a dense seasonal canopy to provide shade (probably 3-5 years from now).
AD 2: Above ground reed canary grass was completely removed prior to planting throughout the site, except under the canopy of the cottonwood at the north-west corner of the site, which was left out due to time constraints.

During a post-planting team site visit this area was cleared, along with approximately 70% of the new growth.

Task 1.1e: Apply mulch

Approach: Mulch will help keep invasive species from returning and also help to protect the soil (Dorner 2002). Mulch has been, and will continue to be provided by the community partner and stored by the southern entrance of the park. After invasive removal, four to six inches of Arborist's mulch was applied evenly over our site except in very muddy and wet areas. After planting each plant received a mulch ring. This will be the only mulch applied in very muddy areas.

AD 3: In addition to the 4-6 inches applied throughout the site following invasive removal, mulch was added after planting to a total depth of 6-8 inches. Mulch was also added to areas that had been too wet prior to planting.

Objective 1.2 – Install structurally and biologically diverse species.

Task 1.2a: Order plants.

Task 1.2b: Plant multilayer canopy

Approach: Before installing plants into the site, we inspected them for disease, pests and root problems, such as girdling and circling roots. For each plant we dug a hole approximately twice the diameter of the root ball and a few inches deeper than the height. We freed the roots from the potting soil and spread them evenly in the hole as we placed the plant. Then as we filled the hole back in, the soil was gently compacted to prevent sinking (Dorner 2002).

GOAL 2: *Promote long-term community/volunteer interest, participation, and stewardship in and of Cotton Hill Park.*

Objective 2.1: Enlist existing community member involvement in the restoration process.

Task 2.1a: Organize work parties on Martin Luther King Day, January 18, 2010 and on March 20, 2010.

Approach: We will contact Karen Story (community partner) to arrange equipment and services provided by the city, and e-mail work party announcement to volunteers, using the established e-mail list from previous projects and events.

AD 4: Supplemental small work parties with fewer than ten volunteers were held on April 22, 2010; May 2, 2010; and May 8, 2010 to aide in mulching and invasive removal after planting. Having these smaller work parties allowed team members to more directly supervise how invasive species were being

removed and likely helped to reduce trampling of already installed native species.

Objective 2.2 – Perform community outreach to increase existing volunteer base through education.

Task2.2a: Visit local middle school

Approach: We contacted teachers to arrange a lesson plan that fits their curriculum and involves our restoration project. We arranged and led a field trip to the site.

AD 5: We taught an introduction to ecology and restoration lesson plan to a total of six periods of 7th grade science classes at Kirkland Junior High on April 23, 2010 and April 27, 2010 under the direction of Susan Crauer and Kathy Colombo. An interactive field trip to Cotton Hill Park was conducted on May 25, 2010 for four of these class periods. There is potential for future students to remain involved with Cotton Hill Park.

GOAL 3: *Encourage increased wildlife habitation of Cotton Hill Park.*

Objective 3.1: Enhance existing wildlife habitat with native plant species that will provide food and nesting sources to bird, and amphibian species.

Task 3.1a: Plant species that will provide food and habitat for amphibians

Approach: Plants were selected based on research on requirements of frog and salamander species that have been observed in the park.

AD 6: We planted 46 native plant species, 484 plants total, on March 20, 2010 and May 25, 2010 with the help from Kirkland Junior High students in Susan Crauer's classes. See Chart 2 for all plant species that were planted in each polygon.

Task 3.1b: Plant species that will provide food for birds

AD 7: Bitter cherry (*Prunus emarginata*), Huckleberry (*Vaccinium parvifolium*), Indian plum (*Oemleria cerasiformis*), Salmonberry (*Rubus spectabilis*), Snowberry (*Symphoricarpos albus*) and Twinberry (*Lonicera involucrata*) were planted on March 20, 2010. Coastal strawberry species (*Fragaria chiloensis*) were planted on March 25, 2010.

Objective 3.2: Install habitat structures to increase habitation potential.

Task 3.2a: Aggregate downed logs to create amphibian habitat.

Approach: Coarse woody debris was collected during invasive removal at the site. We redistributed the pieces in a random (natural) pattern, maintaining contact with damp soil as much as possible.

AD 8: Woody debris was redistributed randomly but in natural patterns near the pond on May 25, 2010 with the help from Susan Crauer's students from Kirkland Junior High.

Specific Work Plans

Site Preparation Plan

Current Conditions

Site Polygons (Map 3):

The site was divided into four distinct polygons, each of which were delineated according environmental factors such as soil moisture content, exposure to sunlight, current existing vegetation, and potential human disturbance.

Polygon 1 is located in the eastern portion of the site Polygon 1 is the furthest north of all the polygons. It is located east of the 2009 UW REN site at the base of a west-facing hill. The area of Polygon 1 is approximately 149 m^2 (1600 ft^2), making it the largest polygon. Compared to the other three polygons, soil is relatively dry. It also has partial to full shade during the growing season when the surrounding deciduous trees leaf out, which results in higher soil moisture retention during that time.

Polygon 2 is a unique "Transition Polygon" between Polygons 1 &3. The total area is 49.72m^2. The polygon extends from the trail to the eastern border of the site. The northeast border is the edge of the 2009 UW REN plot and includes their buffer/access path, ~~which will no longer be needed since invasives have been cleared in this area~~.

AD 9: In response to client request, we did not remove the 2009 UW REN buffer/access path. Instead we expanded it to form a trail which starts at the north-south trail, cutting though Polygons 4, 2, and 3 just south of the large cottonwood tree. The trail then merges with the previous buffer/access path which goes along the northern border of Polygon 2 and curves around the eastern border of 2009 UW REN site and connects to the park's east-west trail. The new trail is bordered with woody debris from our site and is filled with 6-8 inches of mulch.

The northwest border is shared with Polygon 1. The southern border is shared with Polygon 3. The borders were determined based on soil moisture (as indicated by soil saturation on January 21, 2010) and on vegetative conditions. Though the water table varies throughout the year, the moisture level in Polygon 2 is believed to remain high even in the summer months. In the winter months the water table is high, creating soil moisture levels that are higher for Polygon 2 than Polygons 1 & 4 but still lower than Polygon 3. ~~This polygon has few established native species and little shade.~~ The NE portion has been disturbed by a high level of traffic from the 2009 UW REN project. These conditions are characteristic of an earlier successional stage than the stages other polygons in our restoration site.

AD 10: After invasive removal, several sword fern and salmonberry plants became visible, and in late winter/early spring (prior to planting) many Indian plum plants emerged.

Polygon 3 is 134.36 m^2 located to the north of and adjacent to the seasonal pond and is buffered from the trail to the west by Polygon 4. Portions of this area are flooded during the rainy season and remain moist to wet throughout the year. Due to slight differences in topography, there are microclimates available to host plants that are less tolerant of water level fluctuations. Current plant species that were identified include small clusters of native salmonberry, sword fern (*Polystichum munitum*) and Indian plum (*Oemleria cerasiformis*). Invasive Himalayan blackberry was abundant

throughout the polygon, occupying raised microclimates and denying sunlight to natives that might have grown in inundated spaces underneath. Reed canary grass invades from the southern border indicating that while this area is flooded during parts of the year, it dries out enough for reed canary grass to survive during the growing season. There is minimal shade in this area, the majority of the landscape receiving full sun for all but the morning hours.

Polygon 4 is the "People Polygon" because it borders the trail, and so it is the part of the plot that will have the most interaction with people (and dogs). It is the smallest polygon at 32.9 m^2 (354.13 ft^2). The north-south trail defines the western border of Polygon 4. The north-east boundary is the south-west border of Polygon 3, and was determined based on microelevation and the resultant soil moisture and vegetation. Polygon 4 has lower soil moisture, and has several established sword ferns. Seasonal shade is provided by two large cottonwoods at the NW and SW corners of the polygon. These conditions will support some of the species of the Western red cedar - grand fir - sword fern (*Thuja plicata – Abies grandis - Polystichum munitum*) association. This will facilitate the establishment of a later successional, conifer dominated ecosystem (objective 1.2).

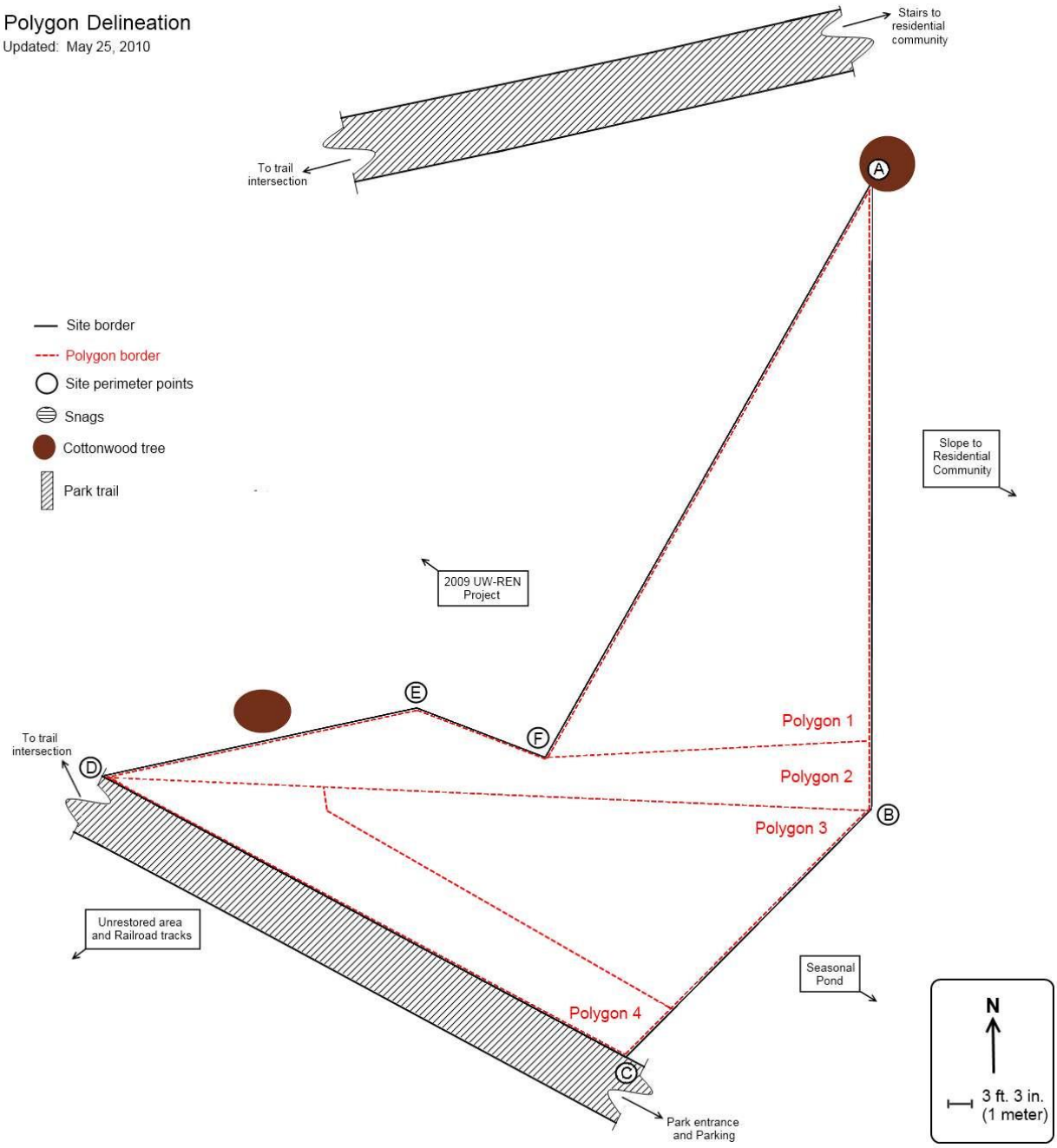

Figure 3: Map of Site Polygons

Site Vegetation (Maps 4 & 5)

Originally, the site was covered in a significant amount of invasive Himalayan blackberry with prominent patches of English holly and English ivy as well. During the January 18 work party a significant portion of these non-native invasive species were removed, though it is likely that portions

still exist from which new plants will emerge. Other invasive species that remain on site include reed canary grass, herb Robert (*Geranium robertianum*), and creeping buttercup (*Ranunculus repens*).

A variety of native species exist on site such as several mature cottonwood trees, sword fern, salmonberry, and Pacific willow. These species were preserved during the work party and their health will be promoted in order to help establish the new community of native plants on site once the restoration project has been completed.

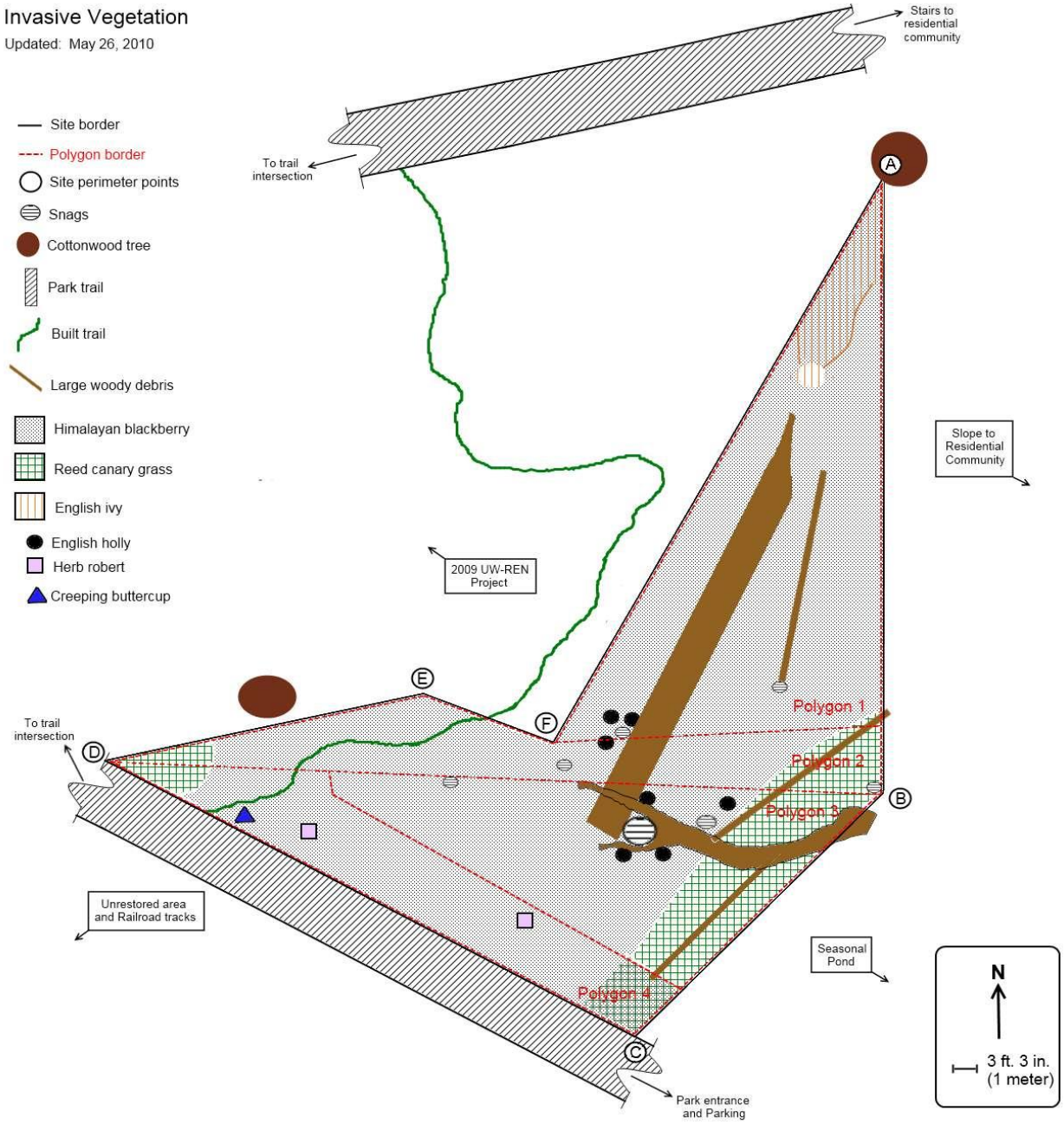

Figure 4: Map of Invasive Vegetation Cover (prior to MLK Jan 18th work party)

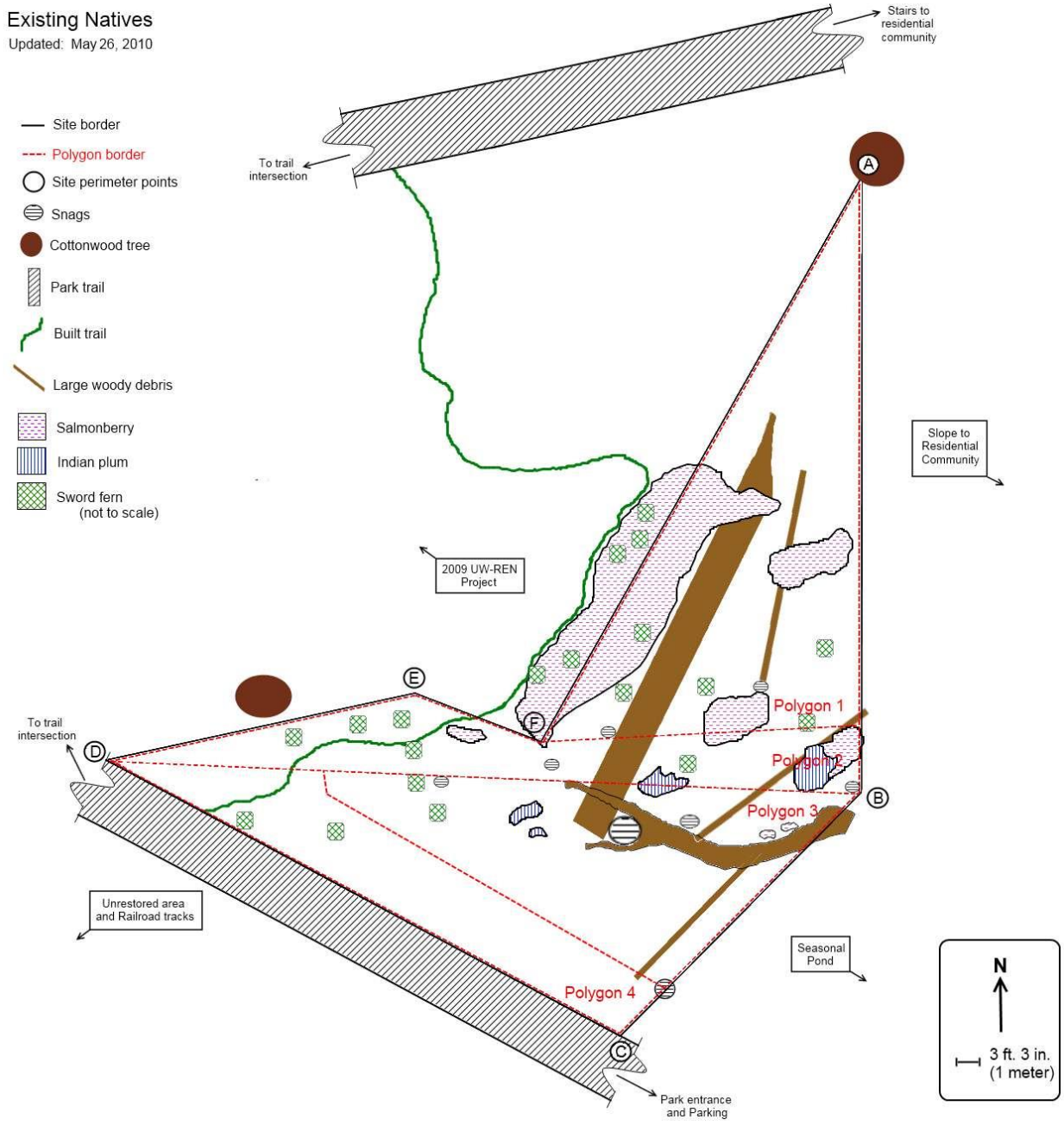

Figure 5: Map of Exisiting Native Species

Site Preparation Activities (Map 6)

A significant portion of site preparation took place on January 18 when

the majority of the invasive species on site were removed. This set the stage for all of the other activities to take place on site. As previously mentioned, Himalayan blackberry, English holly, and English ivy were removed in large quantities. Polygon 1 had a significant amount of English ivy and out of concern for its potential to re-grow, mulch was applied on the ground in the area where the ivy was removed. Woody debris was also removed from Polygon 1 in order to facilitate ease of movement for volunteers during subsequent work parties.

Polygon 2 was also cleared of much woody debris in order to facilitate easier planting later on. Himalayan blackberry and English holly were present in significant quantities in this polygon, and were removed during the January 18 work party. Topographical changes were made in Polygon 2 in the form of hummock construction. These areas of elevated ground provide a drier microclimate and facilitate the growth of plants that will not tolerate the seasonal saturation that is likely in Polygon 2.

AD 8: In addition to the Douglas-firs that were planted in Hummock 2 on March 20th, several ground cover species were planted as part of the KJH field trip on May 25. The species include false lily-of-the-valley (*Maianthemum dilatatum*), lily of the valley (*Convallaria majalis*) , bleeding heart (*Dicentra Formosa*), Oregon oxalis (*Oxalis oregana*), coastal strawberry (*Fragaria chiloensis*), and fringe cup (*Tellima grandiflora*) because these are appropriate for our target ecosystem.

Polygons 3 and 4 received a similar treatment, with Himalayan blackberry being removed and woody debris being collected and stored off site. Polygon 4 was mulched as well.

AD 9: The elevation of Polygon 4 was leveled out by adding up to 3" of soil to the lower, wetter middle area of the polygon. The team made the decision because this provides drier soil, which will support the same groundcover species throughout the polygon. Mulch was also applied. This decision was made on-site when there was extra soil available after hummock construction.

For the site as a whole, mulch was only applied to select locations (Polygons 1 and 4) that were deemed dry enough to support the mulch. The concern was that mulching the moist areas might lead to mulch incorporating into the muddy substrate which could reduce soil nitrogen later in the spring when plants are installed.

AD 10: The water table in the site has lowered since winter and some areas became dry enough to be mulched. These areas were either sheet-mulched with 6 inches of mulch or were given a ring of mulch as the team deemed appropriate during subsequent work parties.

The woody debris that was cleared at the work party on January 18, 2010 was stockpiled for use later on as habitat structures. The debris remained out of the way during planting .

AD 11: With the help of the students of KJH, the woody debris was placed in Polygons 2 & 3 in the wet area around the seasonal pond. This will provide habitat for Pacific chorus frogs and long-toed salamanders.

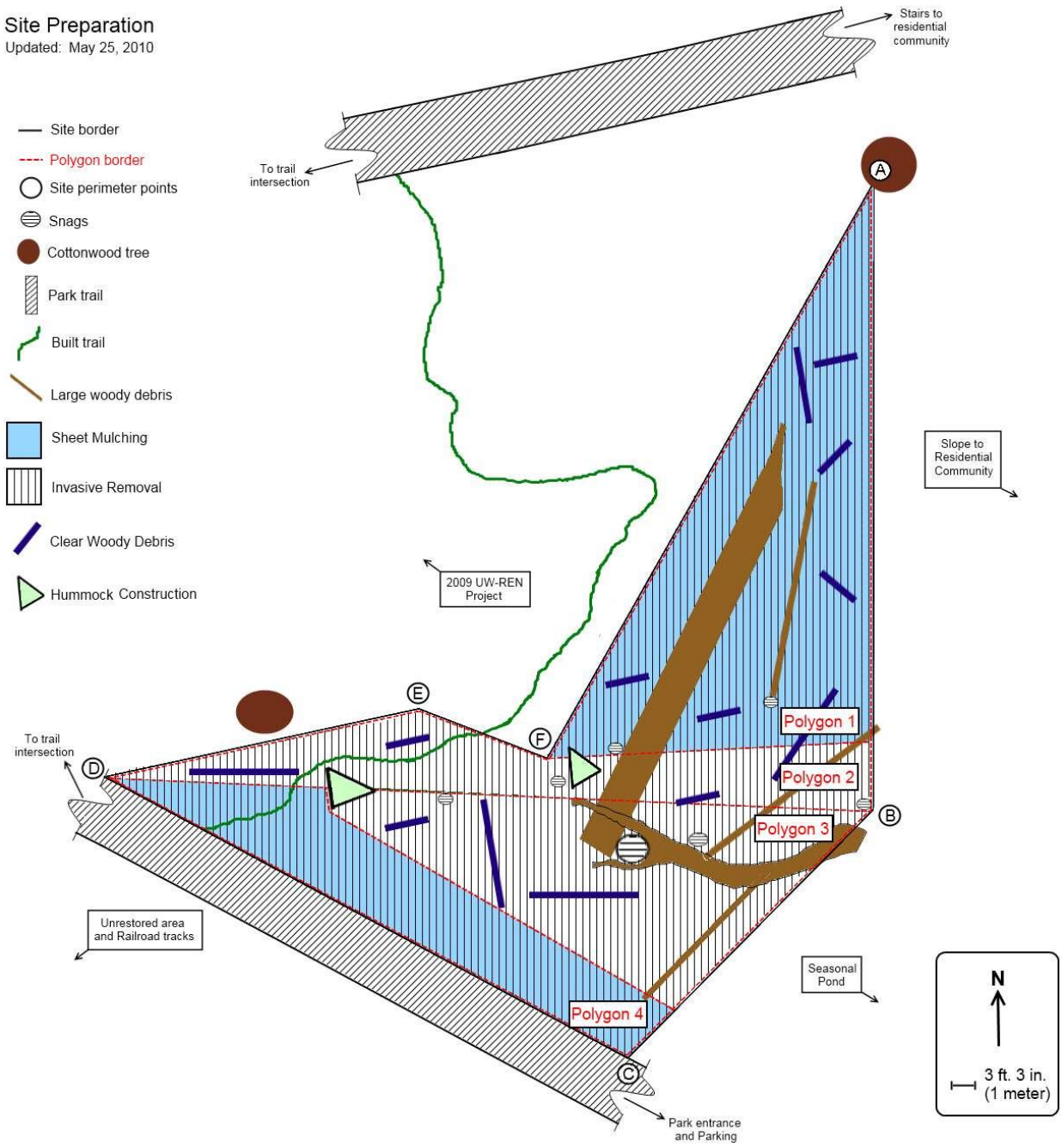

Figure 6: Map of Site Preparation Activities

Logistical Considerations (Map 7)

Cotton Hill Park is located in a residential community and accessible via small surface streets. Fortunately, there is a small parking area for park visitors near the south end of the park. The parking area is connected to the pedestrian trail, making it a good staging area as it is out of the way and provides access via the trail to our restoration site. The parking area is large enough to provide staging

for tools, a volunteer table/tent, or mulch. It can also accommodate several vehicles on days when our team drives to the site.

During volunteer days it is necessary to utilize the surrounding streets for overflow parking from the volunteers driving to the site. The best location for overflow parking is south of the park along 110th Ave NE. There are houses on the eastern side of 110th Ave NE and no sidewalk or shoulder, so it is important for volunteers to park on the western side of the street to avoid damaging the front yards of the residents on the street.

Figure 7: Map for Work Party Logistics

Planting Plans

Polygon 1

Plant selections are based on the Western red cedar-grand fir - sword fern plant association from Washington Department of Natural Resources (2006). This association was chosen because it matched the moisture content and light availability for our site. Plants installed are as follows: grand fir, western red cedar, western hemlock (*Tsuga heterophylla*), salmonberry (*Rubus spectabilis*), ocean spray (*Holodiscus discolor)*, Nootka rose (*Rosa nutkana*), thimbleberry (*Rubus parviflorus*), trailing blackberry (*Rubus ursinus*), snowberry (*Symphoricarpos albus*) , salal (*Gaultheria shallon*), foam flower (*Tiarella trifoliate*), Pacific starflower (*Trientalis latifolia*), trillium (*Trillium ovatum*), fringe cup, spreading wood fern (*Dryopteris expansa*), sword fern (*Polystichum munitum*), lady fern (*Athyrium filix-femina*), and low Oregon grape (*Mahonia nervosa*). Trees were spaced at 3.5m on center. Shrubs were spaced at 1.2 m

centers. Ground covers and ferns were spaced at .9 m centers. These spacings were the average recommended spacings from the Washington State Department of Ecology chart (Calculating…2006). Trees and shrubs were ordered as bareroot due to cost restraints. Ground covers were in pots from 4" – 1 gallon. These plants were chosen because they tolerate partial shade to full shade. They also do well in drier soils. These species will provide a diverse canopy (objective 1.2). They also provide habitat for birds and wildlife (objective 3.1). Six to eight inches of mulch has been applied to the ground to protect the soil and help deter invasive species from resprouting. Shovels and wheelbarrows were used to dig holes for the plants and to transport mulch from the mulch pile.

Polygon 2

For Polygon 2 the intended plant association is red alder - sword fern (*Alnus rubra - Polystichum munitum)(Chappell 2006)*. The plant association of Western red cedar - Grand Fir - Sword Fern (Chappell 2006) is the long-term goal for the site, but the lack of native species and shade has made polygon two a much earlier successional stage. The species that were planted include: red alder, Pacific ninebark (*Physocarpus capitatus*), red-osier dogwood, and sword fern. ~~Salmonberry will not be planted in this polygon due to the amount that is already onsite and is capable of spreading rapidly under the right conditions. Since the invasive species have been removed, the ones left on the site should be able to become more established, and will be sufficient for the intended plant association.~~

AD 12: Salmonberry was planted because the team decided that the extent of the existing salmonberry would not be sufficient to repress invasive species.

Red alders came in bare root form and were planted at a spacing of 1.8m on center (o.c.). Pacific ninebarks were planted at a spacing of .9m on center. Red-osier dogwoods were planted at a spacing of .3 - .6m on center. Sword fern were planted out of 3.5" pots and were planted at a spacing of .9 m on center (Calculating… 2006). The red alder were more heavily focused in the center of Polygon 2 to facilitate the transition from the current lack of shade to the shady conditions needed for needed for the plant association of Western red cedar - Grand Fir - Sword Fern (Chappell 2006) that we are trying to reach. The red-osier dogwood and Pacific ninebark were planted throughout the site, higher densities were applied underneath the standing snags to help control invasive species that can be spread by birds roosting in these areas and defecating. Sword fern were planted throughout the polygon as well; with more being installed in the southern half of the site, as the northern half already has a few.

Materials used for the implementation for this polygon include shovels for digging holes for the new species, mulch, and wheelbarrows for transporting the mulch. After the planting was completed,rings of mulch were installed around each of the native species planted. Mulch will be applied depending on soil moisture conditions.

The forms, spacing, and numbers of species that will go into this polygon are based on cost, planting guide lines(, and an equation that gives you the numbers of how many species can be planted in the total area for the polygon, that takes the area of the polygon (49.72m^2) and the spacing between the species being implemented (Calculating…2006).

With the woody debris removed from this area for invasive removal during the work party we discovered a long-toed salamander (*Ambystoma macrodactylum*). This debris will be put back into the polygon to make salamander and other amphibian habitat and breeding grounds.

Polygon 3

The suite of plants placed in this polygon was chosen based on their ability to tolerate full sun and fluctuating water levels (Cooke 1997) as well as their structural diversity (Objective 1-2). The intended plant association to be installed follows the Willow – red-osier dogwood (*Salix/Cornussericea)* plant community (Kunze 1994) and includes Pacific willow, sitka willow *(Salix sitchensis)*, small-fruited bulrush *(Scirpus microcarpus)*, red-oiser dogwood , slough sedge (*Carex obnupta*), ~~sawbeak sedge *(Carex stipata),*~~ tall mannagrass (*Glyceria elata*), black twinberry (*Lonicera involucrata*), Pacific ninebark, and Oregon ash (*Fraxinus latifolia*). Shrubs, excepting Pacific and sitka willows, were installed at 1 m centers. Trees were installed at 3.66m centers and graminoids at .5m centers. Pacific and sitka willow were installed at .76m centers to facilitate efficacy in shading out reed canary grass (Kim et Al. 2006) (Objective 1-1). Tall mannagrass and slough sedge were chosen as cover and potential food sources for duck species (WNPS 2007) as well as potential vegetation for eggs of amphibian species (Washington 2009)(Objective 3-1). Tall mannagrass also has a wide range of shade tolerance (2007 Dec 12) and was chosen to out-compete reed canary grass as shade increases from maturing willow species(Objective 1-1).

AD 13: Sawback sedge was not planted because

Polygon 4

Species selection for this polygon is based on the conditions as well as the desired Western red cedar - Grand Fir - Sword Fern association (Chappell 2006) and aesthetic character. All of the species are tolerant of moist conditions, and the amount of shade should be sufficient to support the plants selected. A high density of trees is desired to provide a dense canopy in the future; however the availability and location of shade and moisture were limiting factors in vegetation placement in this polygon. For this reason, average density, as specified in Sound Native Plants spacing guidelines, was applied for tree placement (Calculating…2006). The middle of Polygon 4 has a lower elevation that is too subtle to measure, however this part was significantly more saturated than the rest of the polygon. Although this will dry out more during the summer months, we are concerned that the winter saturation may cause root rot for the trees. A variety of vegetative structures, has been selected (objective 1.2), to achieve a multi-level canopy with particular emphasis on groundstory, to suppress invasive species. The species selected include: Western red cedar, bitter cherry (*Prunus emarginata*) vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), and sword fern. High density is desired in this polygon, to provide attractive green cover and to discourage people from entering the site. The groundcover species (salal and sword fern) came in one gallon containers because that was the form available, so they were spaced at 2 ft on center, or less. The vine maple came as bare root, so the spacing is 4 ft on center (Calculating…2006).

AD: Additional ground cover species were planted during the KJH field trip. The species include: tiger lily (*Lilium columbianum*), bleeding heart, Oregon oxalis, coastal strawberry, lily of the valley, and false lily-of-the-valley. These were added because higher planting density was desired to suppress reed canary grass, and a sufficient number of salal was unavailable

Chart 1: Materials Required

	Materials	Qty yd^3	Source	Tools	#	Source
Tasks 1.1a -e	Mulch	~~Unknown~~ 10	City of Kirkland	shovels	~~10~~ 24	City of Kirkland
				rakes	~~10~~ 8	City of Kirkland
				loppers	~~10~~ 14	City of Kirkland
				gloves	~~70~~ 47	City of Kirkland
				wheelbarrows	3	City of Kirkland
				pitch forks	4	City of Kirkland
				buckets	25	City of Kirkland
				tarps	5	City of Kirkland
				cones	4	City of Kirkland
				canopy shelter	1	City of Kirkland
				trash can	1	City of Kirkland
				recycling can	1	City of Kirkland
				compost can	1	City of Kirkland
				first-aid kit	1	City of Kirkland
				porta-potty	1	City of Kirkland
Task 1.2a	n/a			n/a		
Task 1.2b	Mulch	~~19~~ 23.5	City of Kirkland	shovels	24	City of Kirkland
	Soil	3.5	City of Kirkland	rakes	8	City of Kirkland
				loppers	14	City of Kirkland
				gloves	47	City of Kirkland
				wheelbarrows	3	City of Kirkland
				pitch forks	4	City of Kirkland
				buckets	25	City of Kirkland
				cones	4	City of Kirkland
				trash can	1	City of Kirkland
				recycling can	1	City of Kirkland
				compost can	1	City of Kirkland
				first-aid kit	1	City of Kirkland
				porta-potty	1	City of Kirkland
Task 2.1	n/a			e-mail	n/a	
Task 3.1a	Snags		Onsite			
Task 3.1b	Coarse woody		Onsite			

	debris					

Chart 2: Plant List

	Polygon 1			Polygon 2			Polygon 3			Polygon 4			Hummock 1			Hummock 2		
Species	**#**	**Form**	**Centers (m)**	**#**	**Form**	**Centers (m)**	**#**	**Form**	**Centers (m)**	**#**	**Form**	**Centers (m)**	**#**	**Form**	**Centers (m)**	**#**	**Form**	**Centers (m)**
Abies grandis	~~3~~ 1	bareroot	3.66															
Acer circinatum										20	bareroot	1.22						
Alnus rubra				15	~~bareroot~~ 1 gal	1.80												
Athyrium filix-femina	~~5~~ 10	~~4"- 1 gal~~ 1 gal	0.91															
Carex obnupta							10	1 gal	0.91									
Convallaria majalis				**6**	**bareroot**	**.3**										**5**	**bareroot**	**.3**
Cornus sericea				**25**	**pots**	**1.22**	15	~~live stakes~~ **bareroot**	1.22									
Cornus stolonifera				40	livestake	0.3-0.6	15	livestake	1.22									
Crataegus douglasii	**3**	**bareroot**	**0.91**	**1**	**bareroot**	**0.91**												
Dicentra formosa	**8**	**1 gal**	**0.91**													**2**	**1 gal**	**0.3**
~~*Dryopteris expansa*~~	~~10~~	~~4"- 1gal~~	~~0.91~~															
Fragaria chiloensis										**9**	**4”**	**0.3**				**3**	**4”**	**0.3**
Fraxinus latifolia							~~5~~ 4	~~bareroot~~ 2 gal	3.66									
Gaultheria shallon	~~10~~	~~4"- 1gal~~								~~40~~ 5	1 gal	0.91						

Glyceria elata							10	10" plugs	0.91									
Holodiscus discolor	~~10~~ **5**	~~4"- 1gal~~ **bareroot**	**0.91**															
~~*Juncus ensifolius*~~							~~10~~	~~1 Gal~~	~~0.91~~									
Lilium columbianum				**3**	**1 gal**	**0.3**				**5**	**1 gal**	**0.3**	**2**	**1 gal**	**0.3**			
Lonicera involucrata							~~10~~ **5**	bareroot	1.22									
Lonicera involucrata							**2**	**livestake**	**1.22**									
Mahonia nervosa	~~4~~ **8**	1gal																
Maianthemum dilatatum																**6**	**bareroot**	**.3**
Oxalis oregana										**9**	**4”**	**0.3-0.6**				**3**	**4”**	**.3**
Philadelphus lewisii	**4**	**bareroot**	**0.91**															
Physocarpus capitatus				~~30~~ **35**	bareroot	0.90	~~10~~ **15**	~~1 gal~~ **bareroot**	1.22									
Picea sitchensis							**4**	**2 gal**	**1.22**									
Polystichum munitum	~~15~~ **7**	4"- 1 gal	0.91	~~30~~ **26**	3.5" pots	0.91				~~26~~ **25**	1 gal	0.91						
Prunus emarginata				**1**	**2 gal**	**0.91**	**1**	**2 gal**	**0.91**									
Pseudotsuga menziesii													**2**	**bareroot**	**1**	**3**	**bareroot**	**1**
Rhamnus purshiana	**3**	**bareroot**	**0.91**															
~~*Rosa gymnocarpa*~~ ***Rosa nutkana***	10	1 gal	1.22										**3**	**livestake**	**0.5**			

Rosa pisocarpa							~~5~~ 2	1 Gal	0.91									
Rosa pisocarpa							**7**	**livestake**	**0.91**									
~~***Rubus parviflorus***~~	~~8~~	~~4" 1gal~~	~~1.22~~															
Rubus spectabilis	~~8~~ 3	1gal	1.22															
Rubus spectabilis	**15**	**bareroot**	**1.22**															
Rubus ursinus	~~10~~ 1	4"- 1gal	1.22															
Salix hookerana							**18**	**pots**	**0.76**									
Salix lucida ssp. *lasiandra*							~~25~~ 12	livestake	0.76									
Salix sitchensis							~~25~~ 4	livestake	0.76									
Salix sitchensis							**8**	**livestake**	**0.76**									
Scirpus microcarpus							~~10~~ 20	1 Gal	0.91									
Spirea douglasii																**1**	**livestake**	**0.91**
Symphoricarpos albus	~~10~~ 20	~~4" 1gal~~ bareroot	1.22															
Tellima grandiflora	~~8~~ 11	4"	0.91				**1**	**4”**	**0.91**	**9**	**4”**	**0.3- 0.6**	**4**	**4”**	**0.3-0.6**	**3**	**4”**	**0.3- 0.6**
Thuja plicata	~~3~~	~~bareroot~~	~~3.66~~							~~2~~ 4	~~bareroot~~ 2 gal	3.66						
Tiarella trifoliata	~~5~~ 8	1gal	0.91															
~~***Trientalis borealis***~~	~~5~~	~~4" 1gal~~	~~0.91~~															
Trillium ovatum	~~5~~ 2	4"- 1gal	0.91										**2**	**0.5 gal**	**.3**			
Tsuga heterophylla	~~2~~ 5	~~bareroot~~ 1 gal.	3.66															

Vaccinium ovatum	**7**	**1 gal**	**0.91**															
Vaccinium parvifolium	**8**	**1 gal**	**0.91**															
TOTAL	**139**			**152**			**153**			**86**			**13**			**26**		

Work Timeline

Task	Description	January	February	March	April	May	June
1.1a	*R. armeniacus* removal						
1.1b	*H. helix* removal						
1.1c	*I. aquifolium* removal						
1.1d	*P. arundinacea* removal						
1.1e	Apply mulch						
1.2a	Order plants						
1.2b	Plant multi-layer canopy						
2.1a	Organize MLK day work party						
2.2a	Visit local middle school						
3.1a	Plant species that will provide food and habitat for amphibians						
3.1b	Plant species that will provide food for birds						
3.2a	Pile downed logs to create amphibian habitat						

Original Plan
Actual Execution
Overlap

Design for the Future

The Kirkland Highlands Neighborhood and the City of Kirkland are very supportive of the restoration efforts at the Cotton Hill Park. Last year's accomplishment motivated many people from the neighborhood to get involved in the community work parties. Their involvement was shown during the work parties for Arbor Day on November 14, 2009 and for MLK Day on January 18th, 2010. On MLK Day, they had a total of sixty nine volunteers participating from the neighborhood and the surrounding area, including groups of local students. The participants helped clear the invasive species and lay mulch across the UW REN 2010 restoration site. Our restoration goals are to promote the establishment of

native vegetation of lowland Puget Sound riparian forests and wetlands, to establish long-term stewardship, and to encourage increased wildlife habitation of Cotton Hill Park.

Valuable educational information can be passed along to many people who pass through the park daily. On January 22, 2010 we noticed that many kids walked through the park from nearby schools while our group was re-measuring the site. The City of Kirkland has already created a "Restoring Cotton Hill Park" sign and soon it will be displayed in front of the park to inform people who commute through it everyday. This sign will inform people of the goals for restoring this park and the importance of how sustainable natural forests can help the ecosystem and improve the community. In addition to educational goals of this restoration, the sign also illustrates what people in the local community can do to help restore a forest once invaded by invasive species and to return it back to its natural stage. Moreover, the addition of simple plant identification signs would also be beneficial as it would help people learn about the wide variety of native plants in their area and their importance to the ecosystem.

According to Clewell and Aronson (2007), "Local residents automatically become stakeholders in the restoration. They need to know how the restored ecosystem can benefit them personally," (P.183). Therefore, involving the community in this project will offer them an opportunity to further develop their sense of ownership and see the differences each of them could make by participating as volunteers (objective 2.1). People will be more likely to continue maintenance and management and will also be less likely to degrade the site by littering or walking off the trail; thus following through with our goals for a sustainable natural forest that can provide educational & recreational opportunities and protect native wildlife habitats. The interaction and engagement between people in the communities can lead to more ecological restorations within the park as well as other nearby parks. In fact, the City of Kirkland has over 1000 volunteers and 400 Highlands Neighborhood listing in the database, which we could use to invite people to the future work parties.

One approach to getting kids involved in stewardship is to visit local schools (Task 2.2a) within the Lake Washington School Districts such as Kirkland Junior High & Peter Kirk Elementary schools and to talk about how important sustainable forests are to wildlife habitats, as well as the people who live nearby. Teachers perceive restoration to be "the perfect vehicle to inculcate ecological values into the culture, the community, or the next generation." (Clewell and Aronson, 2007) This, of course, falls into our community outreach plans in restoring a site within the Cotton Hill Park as well as promoting long-term community/volunteer interest, participation, and stewardship (Goal 2). Therefore, teachers from Kirkland Junior High and/or Peter Kirk elementary schools will need to be contacted for possible community volunteer stewardship of the park. This opportunity enables the students to experience real life hand-on restoration project. In fact, we have contacted Mrs. Susan Crauer, the Science Department Head at the Kirkland Junior High. She is very pleased to hear about our restoration work at the Cotton Hill Park, and she would be interested in having her students be a part of this project. Few topics that she mentioned are how energy flow through food [Internet]/chains, biotic and abiotic factors in the ecosystem. Another best topic that fits with their curriculum is the general observation of growth rates in the ecosystem. I think that her students would benefit from our restoration work. During the restoration, the students can participate in making plant signage, invasive plant removal, and installation of native species in various types of soil and conditions. Post-restoration activities, which could be molded into curriculum, could be plant identification and assessment of survival rates of the plants. The school during the Science Fair event hosts another great opportunity for students to express

their interest and increase their knowledge & enthusiasm for science. According to the Lake Washington School District [KIJH:]site under Science Fair Handbook, several project possibilities are listed such as insect's life cycle, the effect of light on plant's growth and the effect of soil on growth of plants. This presents a great opportunity for the students to be involved in the planting events, and one of the goals in particular is to observe the growth rate of plants under different light variations afterwards.

Currently our UW REN 2010 restoration site mainly consists of few sword ferns, salmonberry, and Pacific willow that were able to survive underneath all the Himalayan blackberry, English holly, reed canary grass, and English ivy. One of our goals is to remove all invasive species (objective 1.1) and replace them with a mixed of native conifer-deciduous trees, shrubs and groundcovers (objective 1.2). The existing canopy cover we observed, are from black cottonwood, red alder, and Pacific willow. Our site is divided into four different polygons depending on various factors described earlier under Specific Work Plans. Mulch was applied to suppress the English ivy and to prevent erosion. On February 15, 2010, I stopped by the park and noticed that none of the English Ivy has returned yet, so the mulch is actually suppressing this invasive species. Conifer species such as Western red cedar and Western hemlock will be planted in areas where partial or full shade is available so that they can out compete and suppress the invasive species. We hope that the coniferous trees will provide habitat (objective 3.1), food and canopy cover (objective 1.2) during the cold seasons while deciduous trees drop their leaves. Other deciduous trees, shrubs and ground covers such as red-osier dogwood, snowberry and sword ferns will be planted in partial and full sun exposed areas where the soils are moderately moist. Our hope is that these plant species will grow faster and shade out the invasive species. In Polygon 2, several hummocks will be constructed to create a drier microclimate and facilitate the growth of plants that will not tolerate the seasonal saturation. Trees, in general, are very important for various reasons because they help filter pollutions out of the water and air as well as prevent flooding and soil erosion. Not only do these mixed coniferous-deciduous forest benefit to the wildlife habitats, but they also provide the aesthetic to the park and community. Therefore, to ensure the viability of the plants' survivals, more restoration activities should be done on the site until both coniferous and deciduous species reach their autogenic stages.

Lessons Learned

Logistics:

- Create an online workspace using Catalyst or another program and upload ALL related documents, maps, images, and reference materials so that the whole group has access to them. This is much more efficient than constantly e-mailing group members.
- Start the year well organized with a plan for growth and changes to the original plan that allows you to track those changes. Keep all data (including budgets, plant lists, time sheets, and materials) in a spreadsheet or database system and track the changes made throughout the year (not just the "current" version).
- Review as many documents from previous REN projects as you have access to. These contain valuable information and resources that can save you a lot of time. Just be extra careful to avoid plagiarism.

- For small maintenance work parties, aim to have a ratio of leaders to volunteers of only 1:2 or 1:3 to ensure that volunteers do not remove the wrong plants.
- The person who does photo points should be the same person that creates the maps.
- Consider assigning a "compiler" as well as an "editor" so that the compiler can compile all the information for the large documents, and the editor can have a fresh look on the document when editing for consistency, grammar, and accuracy.

Plants and Materials:

- When considering budget, use the UW-REN budget allotment first, before using funds from a grant of project partner because the UW-REN budget is money that you cannot get back if it is unused; whereas, the project partner can save unused money to fund other projects or a future REN project.
- When calculating how much mulch to order, take into consideration how many plants will be in the polygon that you will have to mulch *around* instead of over. We estimate that plants account for about 25% of the polygon. Calculating volume of mulch based on the area of the polygon and the depth of mulch that will realistically be applied, and then multiplying that amount by 0.75, should provide a better approximation of the mulch needed.
- Consider weather fluctuations when trying to plan work parties. If spring arrives earlier than usual, you will need to get livestakes in the ground sooner than expected, so you need to be prepared with your plants.

Working with Kirkland Junior High:

- Make worksheets for each student so that everyone in the group stays on-task.

Recruit additional adult leaders for the field trip from the REN class or the community to ensure a smooth flow and facilitate a connection between KJH and the surrounding community

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EarthCorps

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Personal Account. Karen Story.

Appendix B: Plant Identification Signs

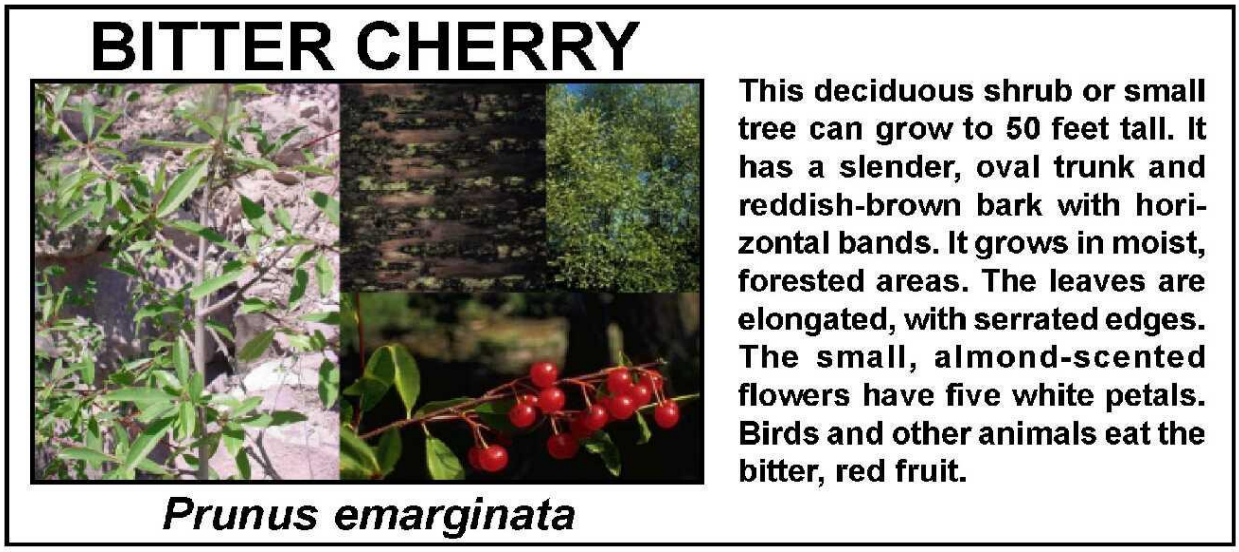
Produced by: David Arthur, http://www.davidarthur.us/

Text by: Stephanie Grubb, Eliza Keeley, Kristie LaMar, and Karen Story

Images, used with permission, by: David Arthur; Virginia Polytechnic Institute and State University - Dendrology, (http://www.cnr.vt.edu/dendro/wwwmain.html); and Auburn University - Dendrology, photographer Mike Hogan (http://www.forestry.auburn.edu/samuelson/dendrology)

Signs installed by: Karen Story and Highlands Neighborhood Volunteers

The UW 2010 REN team recommends that additional plant ID signs could be added in the future for twinberry, snowberry, nootka rose, Pacific dogwood, lady fern, fireweed, trailing blackberry, slough sedge, and rush.



BLEEDING HEART

Dicentra formosa

This fragile, low-growing perennial has fern-like foliage and delicate, heart-shaped, pink and purple flowers on arching stems. It prefers moist shade. Sometimes it will awaken for a second bloom in the fall. The plants spread with the help of ants, which collect the seeds, take them to their hills, eat part of the seed, and leave the rest behind to germinate. The roots have medicinal value.

WESTERN RED CEDAR

Thuja plicata

These evergreens can grow up to 200 feet tall and can live for 1,000 years. They are found in moist, shady Pacific Northwest forests, and have scale-like leaves and fibrous, reddish bark. The soft, decay-resistant wood is used for siding and decks. It is also used to line closets because the aromatic oils repel moths. Northwest Coast Indians built houses and canoes from cedar and used the bark to make baskets, mats, and clothing.

FRINGECUP

Tellima grandiflora

This is a low-growing, herbaceous perennial found in moist forests, along stream banks, and in meadows throughout western North America. The small, whitish flowers grow on tall, fuzzy stems, and the petals are deeply fringed. The Skagit Indians pounded the whole plant, boiled it to make tea, and used it to cure many ailments.

INDIAN PLUM

Oemleria cerasiformis

This deciduous, shade-loving shrub can grow up to 17 feet tall. It is one of the first plants to flower in the spring, and the white flowers are an early source of nectar for bees. Animals love the half-inch long, bitter-sweet fruit. The plants are either male or female, and both are needed to produce fruit. The pale green leaves are long ovals and have a slight cucumber smell.

PACIFIC NINEBARK

Physocarpus capitatus

This easy-to-grow, deciduous shrub grows up to 13 feet tall. Although it prefers moist, wet sites, it is drought-tolerant. The name comes from the appearance of the bark, which is flaky and peels away in many layers. It has maple-shaped leaves and domed clusters of small, white flowers. The fruit is a glossy, red pod that turns brown as it dries before splitting open to release its seeds.

RED ALDER

Alnus rubra

This fast-growing, relatively short-lived, deciduous tree is the most common hardwood in the coastal Pacific Northwest. It can reach 120 feet tall. It is the first tree to colonize open spaces and prepares the soil for conifers by fixing nitrogen. Alders are drought-tolerant but prefer moist shade. They have mottled gray-white bark and small brown cones that remain throughout winter. The leaves and flowers provide food for butterflies.

RED-OSIER DOGWOOD

Cornus sericea

This is an elegant, open shrub with clusters of white flowers in the spring, bluish berries in the fall, and striking red bark in the winter. It grows up to 15 feet tall and sends up multiple stems to form thickets that birds and deer love. These plants prefer wet areas in sun or shade and can grow in shallow water.

SALAL

Gaultheria shallon

This leathery-leaved, low-growing shrub, a member of the heather family, is considered the best ground cover for Northwest gardens. Salal prefers shade and likes moist or dry soil. It is one of the most popular foliage plants for flower arranging. The dark blue berries were a significant food resource for Northwest Indians, who ate them fresh or dried them into cakes.

SALMONBERRY

Rubus spectabilis

These edible orange to red berries are one of the first to ripen in the Pacific Northwest. These deciduous shrubs like moist soil, and their arching branches often form dense thickets. The stems are lightly covered with prickles. The deep, pink flowers attract hummingbirds. Native Americans used the berries and sprouts for food and the bark and leaves as a natural astringent.

SWORD FERN

Polystichum munitum

The king of Northwest ferns, these stately, evergreen plants have erect leaves that radiate from their base to form a crown. Individuals can grow up to 3 feet tall. They prefer the understory of moist, coniferous forests at low elevations. Native Americans used the underground rhizomes as a food source during times of famine. As older fronds die they provide excellent amphibian habitat near their base.

VINE MAPLE

Acer circinatum

This small, often multi-stemmed, deciduous tree is known for its brilliant fall color. It can grow up to 25 feet tall and has winged fruits, small white flowers, and distinctive lobed leaves. Vine maple flourish in moist woods with dappled shade and along stream banks. It provides nesting sites and cover for many birds and mammals. Chipmunks and birds eat the seeds, and caterpillars forage on the leaves.

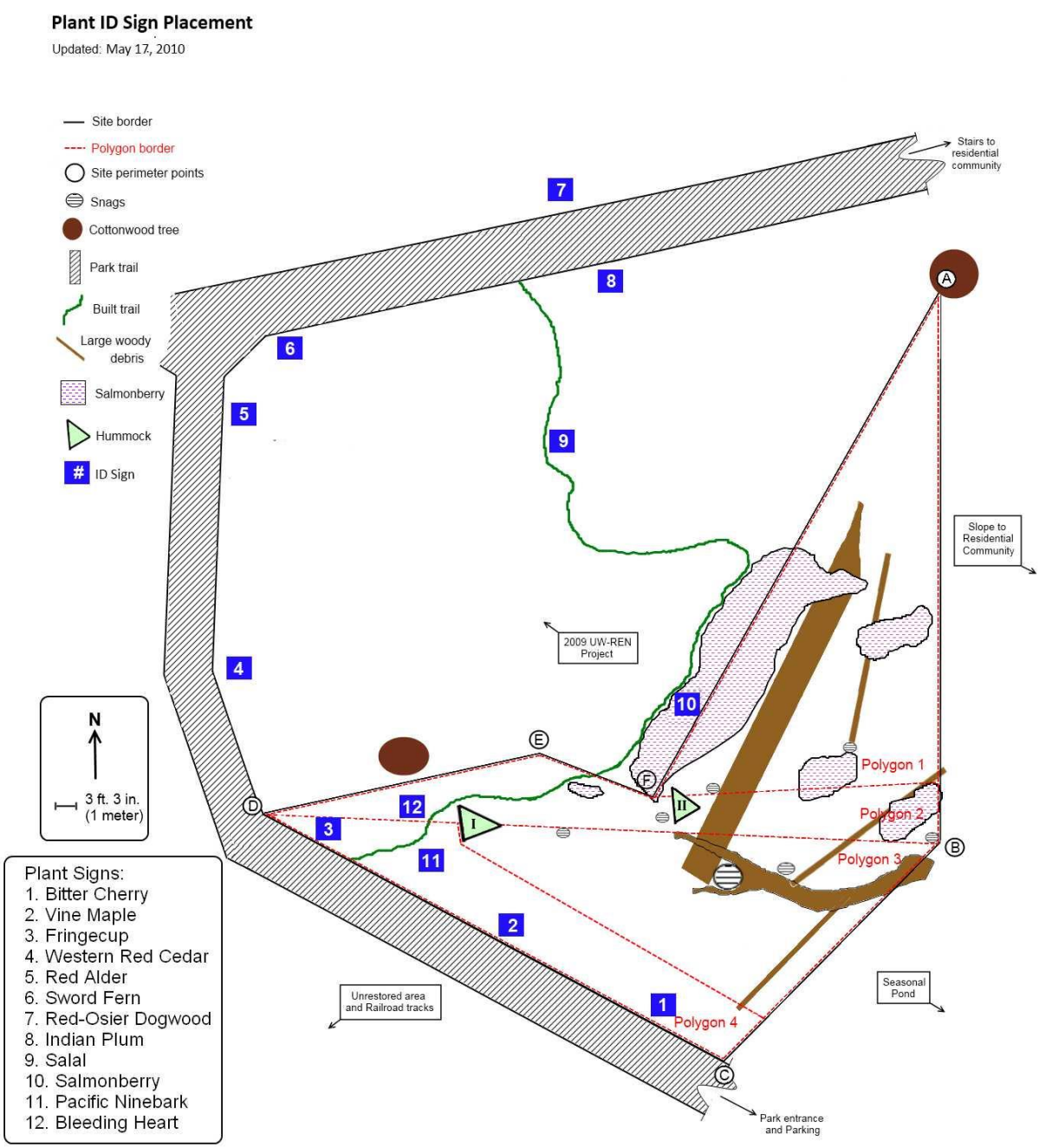


Figure 8: Map of Plant ID Signs

Cotton Hill Park
2010 Restoration Ecology Network (REN) Stewardship Plan

Located in the Forbes Creek Watershed
110th Ave NE and NE 98th St, Kirkland 98033

Project Team:

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University of Washington
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UNIVERSITY of WASHINGTON
School of Forest Resources

GREEN KIRKLAND PARTNERSHIP

city of kirkland washington

UNIVERSITY OF WASHINGTON
BOTHELL SEATTLE TACOMA

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Project Summary

Cotton Hill Park, Kirkland WA
Client – Karen Story
Organization – Highlands Neighborhood Association

Photo Point 15: 40° NNE; Cross-site view with built mulch path in the foreground, along with Hummock 1.

Photo Point 15: 210° SSW; At Point A, the built trail traverses from center to bottom right.

Cotton Hill Park is a 4.1 acre undeveloped park within the City of Kirkland, WA in the Forbes Creek Watershed (Fig. 1). The 2010 REN restoration site occupies an area of the park that is approximately 3,935 square feet and lies to the south of the 2009 REN site near the north end of the park (Fig. 2). Ecological restoration has been underway throughout the park with leadership from the City of Kirkland and a strong base of community volunteers from the Highlands Neighborhood Association who have conducted many work projects throughout the park. Projects have included invasive plant removal, native plant establishment, trail construction, plant ID sign design, and collaboration with Kirkland Junior High.

Prior to restoration, the 2010 REN site's canopy layer was composed of a sparse collection of cottonwood (*Populus* spp.) and red alder (*Alnus rubra*) trees. In the shrub layer and understory, native species such as salmonberry (*Rubus spectabilis*) and sword fern (*Polystichum munitum*) existed among dense populations of invasive species such as Himalayan blackberry (*Rubus armeniacus)*, reed canary grass (*Phalaris arundinacea)*, English holly (*Ilex aquifolium)*, and Enlish ivy (*Hedera helix)*. The presence of these invasive species inhibited the growth of native species and prevented succession of the site into a functioning system typical of Puget Sound lowlands. In order to facilitate the achievement of this successional target, the following goals and strategies were implemented in the 2010 restoration site.

4. Remove invasive species and install native species in order to promote the establishment of a native vegetation community typical of lowland Puget Sound conifer dominated forests and wetlands.

5. Promote community involvement in ongoing restoration through outreach to local community and schools.
6. Establish improved wildlife habitat through both plant selection and structural modifications to the site.

Figure 1: Location of Cotton Hill Park within Puget Sound area

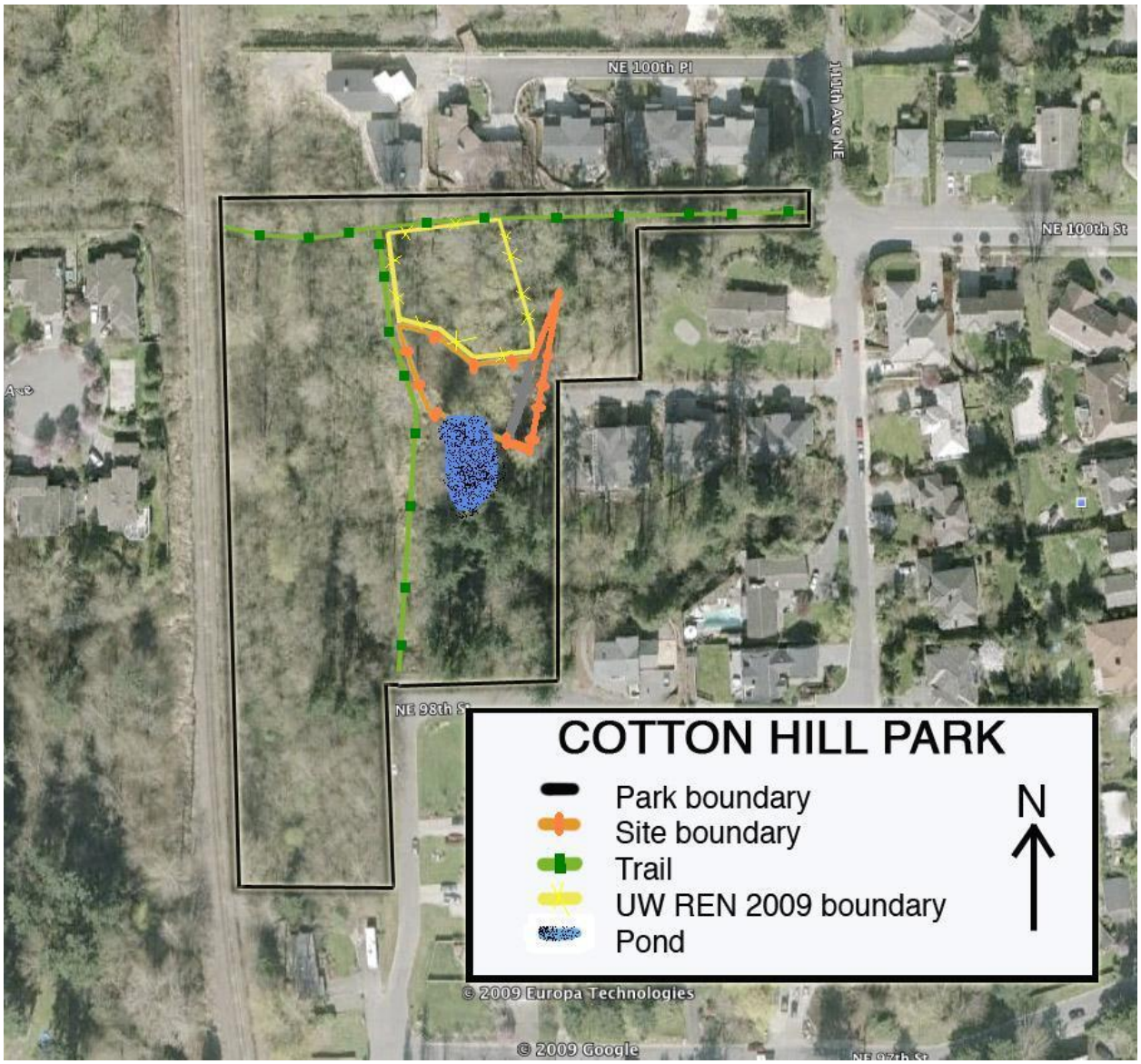


Figure 2: Map of Site Location within Cotton Hill Park

As-Built Description

The 2010 restoration site was divided up into four distinct polygons that received varying plantings and treatments according to the specific microclimates within each site. The following is a description of each polygon and its distinctive characteristics following restoration.

Polygon 1 forms a triangle in the northeastern portion of the site and occupies an area of about 1600ft^2. Its eastern border is along the base of the slope that continues up to the

nearby residences, and it shares its western border with the 2009 REN restoration site. Its northern point is a cottonwood tree located just to the south of the park's northern trail. Prior to restoration, Polygon 1 was dominated by Himalayan blackberry and several dense patches of English ivy. The vast majority of this invasive biomass was removed during restoration, and a 6" layer of mulch was applied to help prevent its return. A suite of native plants was then installed in Polygon 1 on roughly 1 meter centers. A mulch pathway that grants access to the restoration site from the main park trails passes through the southwestern portion of Polygon 1.

Polygon 2 lies in a transition zone between Polygons 1 and 3. Beginning on the western side of the site, it runs along the entire site from the main park trail east to the base of the wooded slope but does not extend very far north or south. Its northern border is composed of Polygon 1's southern border as well as the 2009 REN site's southern border. The total area of Polygon 2 is roughly 535ft^2. During the restoration, Himalayan blackberry and English holly were removed from Polygon 2 and a triangular hummock was constructed in its southeastern region in order to provide a drier microclimate within that portion of the polygon. Mulch was applied to much of this polygon in order to repress the re-growth of invasive species, and a suite of native plants was installed including sword fern, red alder, and redosier dogwood (*Cornus sericea*).

Polygon 3 has the highest moisture content of the three sites. It is triangular in shape and is bordered by Polygon 2 to the north, the seasonal pond to the southeast, and Polygon 4 to the southwest. It is approximately 1,440ft^2 in size. There is a large willow (*Salix* sp) shrub growing around a dead snag at the polygon's southeastern border, and a triangular hummock has been constructed in the northwestern portion of the polygon to create a drier microclimate within that area. During restoration, Himalayan blackberry and reed canary grass were removed, and a suite of native plants was installed to accompany the original native plants that had been growing with the blackberry which included salmonberry, sword fern, and red alder. Once the invasive species had been removed, a variety of wet-loving native species such as hooker willow (*Salix hookeriana*) and slough sedge (*Carex obnupta*) were installed to shade out and compete with future growth of reed canary grass and help establish a native understory. Mulch was applied only sparingly to Polygon 3 in order to avoid the mulch becoming incorporated into the moist soil.

Polygon 4 is the "people polygon", as it borders the park's main trail and will have the most interaction with people and dogs. It is located along the southwestern edge of the site and it is the smallest of the four polygons with a total area of 354ft^2. Much like the other polygons, Himalayan blackberry was removed from this polygon during restoration. A thick layer of mulch was applied to prevent the re-growth of invasive species, and a suite of native

plants including vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), bitter cherry (*Prunus emarginata*), and western redcedar (*Thuja plicata*) were installed.

Maintenance Tasks

Plant Care

Watering

Why: In our Mediterranean climate, summers are dry and young plants will dry out if not watered regularly for the first 3 years.

Where: All new plants within the entire site with special attention to Polygons 1 and 4 (the drier polygons).

When: Once a week from June through September unless temperatures reach 90 degrees for longer than two consecutive days, in which case watering should occur ASAP.

Resources & Tools: Buckets, wheelbarrows, hose, water from the stream near entrance of park.

How: Buckets will be needed to get water from the stream at entrance of park and will need to be carried into the site. Fill buckets with water than place in wheelbarrow to carry to site. Give each plant a 1/4 of the bucket unless they are showing signs of water stress, in which case give them 1/2 the bucket. Water the plants slowly, allowing all of the water to infiltrate through the soil into the root ball of the plant.

Mulching

Why: Mulching helps to suppress invasive weeds that will compete with native plants, and it provides insulation, nutrients, and moisture retention.

Where: Polygons 1 and 4 will need regular mulching. Polygons 2 and 3 will not require mulching because they are effected by the seasonal pond and will become to wet during the winter months.

When: Mulching should take place for 3 years and occur in the early spring before invasive species begin to emerge.

Resources & Tools: Buckets, wheelbarrow, pitch fork

How: Load wheelbarrows full of mulch using pitchfork. Bring wheelbarrow to site. If there is an open area where native plants will not be damaged, you can dump the wheelbarrow out, otherwise, fill the buckets with mulch and carry into areas that require mulching. Be careful not to spill too much mulch on the gravel path.

Weeding

Why: Invasive species can out compete native plants which will not allow them to reach full growth potential or can lead to their death.

Where: Entire site

When: Weeding should occur starting in mid-spring once invasives have emerged. It will be much easier to keep up with regular weeding than it will be to allow weeds to become more established. Continue regular weeding throughout the growing season.

Resources & Tools: Shovel, pruner, Pulaski/digging tool, gloves, tarp

How:
-To remove Himalayan blackberry, first cut all of the biomass higher than one foot off of the ground. Next, use a shovel or other digging tool to loosen the soil around the base of the plant, then extract the root ball (affectionately known as 'the alien baby') and place all of the removed material on a compost pile or a tarp to be removed from the site altogether.
-To remove English ivy from a tree, cut the vines on the trunk so that the portion in the tree will die. Next, cut the vines on the ground and remove as much of the root matter as possible using digging tools or pruners. Be careful not to damage the trunk or the roots of the tree.
-To remove English ivy from the ground, dig or pull as much of the root material out of the ground as possible without harming native plants or tree roots. Place all of the removed material on a compost pile or a tarp to be removed from the site altogether.
-To remove reed canary grass, simply pull or dig as much of the root material out of the ground as possible. In subsequent years, shade from the native plantings should force out the reed canary grass, but in the meantime it is important to prevent it from competing with the native plantings on site.
-Contact City of Kirkland for removal of biomass.

Community Outreach

Large Work Parties

Why: To foster community awareness and stewardship and aid in continued removal of invasive species.

Where: On site in Cotton Hill Park.

When: Twice a year in relation to special events, such as the Martin Luther King, Jr. Day of Service, Arbor Day, or Earth Day.

Resources & Tools: Internet, local newspaper, Green Kirkland, Earth Corps

How: Invite volunteers to two large work parties each year using the established Green Kirkland volunteer database and posting event information on the Kirkland Highlands Neighborhood website. Alert the local newspaper, the Kirkland Reporter, of the event both before and after. At the event, have volunteers sign in using the City of Kirkland volunteer sign in sheet (Insert).

Small Work Parties

Why: To foster community awareness and stewardship and aid in continued removal of invasive species.

Where: On site in Cotton Hill Park.

When: Every other month.

Resources & Tools: Internet, Green Kirkland

How: Invite volunteers to small work parties every other month using the established Green Kirkland volunteer database and by posting event information on the Kirkland Highlands Neighborhood website. At the event, have volunteers sign in using the City of Kirkland volunteer sign in sheet (Insert).

Education at Kirkland Junior High

Why: To foster a sense of community interest and stewardship amongst local youth while meeting school requirements.

Where: Kirkland Junior High and Cotton Hill Park

When: Once annually. Most likely between the months of April and June when the Kirkland Junior High 7th grade science curriculum focuses on Populations & Ecosystems.

Resources & Tools: Susan Crauer and Kathy Colombo at Kirkland Junior High, Karen Story (Highlands Neighborhood Assn), Curriculum Materials (Appendix A & D)

How: Have Kirkland Junior High science teacher(s) lead their students on a field trip to Cotton Hill Park to collect baseline data for monitoring percent cover in the 2010 site. Provide this compiled data to Karen Story to aid in stewardship of the site. Have teacher(s) of participating classes fill out Cotton Hill Ecology Education Survey (Appendix A). UW-REN students and the KJH teachers should have the opportunity to collaborate on a lesson plan presentation on ecology and restoration.

Promotion of Wildlife Habitat

Brush Pile Creation

Why: Wildlife such as birds, small mammals and amphibians rely on shelter such as piles of brush to remain safe from predators, forage for food, mate, and engage in other important activities.

Where: Throughout the site, but not where there are living native plants present.

When: Throughout the year, whenever new brush falls onto the site.

Resources and Tools: Branches and brush from canopy trees. Saws can be used to customize the size of material.

How: When new brush falls onto the site, collect it and use it to form a pile in a bare spot within the site. If placing brush onto an already existing pile, place it gently so as not to harm anything that might already be living in the pile.

Yearly Maintenance Schedule

Task	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*July*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*
Watering				**1**	**2**	**4***	**4***	**4***	**4***	**2**		
Mulching			**1**									
Weeding			**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		
Large Work Parties	**1**			**1**								
Small Work Parties		**1**				**1**		**1**		**1**		**1**
Education at KJH					**1**							
Brush Pile Maintenance	**1**		**1**		**1**		**1**		**1**		**1**	

Table Key:
Numbers in the table represent the recommended number of times per month that a task should be performed.

*Consecutive days above 90° with no rain will necessitate more frequent watering.

Baseline Data

May 8, 2010

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
1-A	EQAR	1	0	0.1	n	G	x
	OECE	1	0	2.5	n	S	x
	POBA	1	0	60	n	C	x
	PREM	1	0	10	n	C	x
	RONU	2	0	7	n	S	x
	RUSP	1	0	5	n	S	x
	SYAL	3	0	15	n	S	x
Totals	**Native**	10	0	99.6			
	Non-native	0	0	0			
Totals	**Ground**	1	0	0.1			
	Shrub	7	0	29.5			
	Canopy	2	0	70			

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
2-B	ALRU	1	0	1	n	S	x
	COSE	2	0	5	n	S	x
	EQAR	6	0	0.5	n	G	x
	OECE	2	0	2	n	S	x
	POMU	3	0	10	n	G	x
	RUAR	1	0	0.5	n	S	
	RUSP	1	0	0.5	n	S	x
	SALU	1	0	10	n	C	x
Totals	**Native**	15	0	19			
	Non-native	2	0	0.5			
Totals	**Ground**	9	0	10.5			
	Shrub	7	0	9			
	Canopy	1	0	10			

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
3-C	CAOB	1	0	2	n	G	x
	COSE	1	0	0.1	n	S	x
	LOIN	1	0	0.1	n	S	x
	PHAR	10	0	3	n	G	
	PHCA	1	0	3	n	S	x
	RARE	10	0	15	n	G	
	ROPI	2	0	5	n	S	x
	RUAR	1	0	0.1	n	S	
	SAHO	3	0	10	n	S	x
Totals	**Native**	9	0	20.2			
	Non-native	21	0	18.1			
Totals	**Ground**	21	0	20			
	Shrub	9	0	18.3			
	Canopy	0	0	0			

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
4-D	GASH	1	1	0.5	n	G	x
	PHAR	10	0	0.5	n	G	
	POBA	1	0	30	n	C	X
	POMU	4	0	10	n	G	X
	RARE	3	0	0.5	n	G	
	RUAR	1	0	0.5	n	S	
	THPL	1	0	0.5	n	S	X
Totals	**Native**	7	1	41			
	Non-native	14	0	1.5			
Totals	**Ground**	18	1	11.5			
	Shrub	2	0	1			
	Canopy	4	0	30			

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
Hum. #1	PSME	1	0	0.1	n	G	X
	RONU	1	0	2.5	n	S	X
Totals	**Native**	2	0	2.6			
	Non-native	0	0	0			
Totals	**Ground**	1	0	0.1			
	Shrub	1	0	2.5			
	Canopy	0	0	0			

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?
Hum. #2	CAOL	2	0	0.1	n	G	X
	EQAR	5	0	1	n	G	X
	PSME	2	1	3	n	S	X
Totals	**Native**	9	0	4.1			
	Non-native	0	0	0			
Totals	**Ground**	7	0	1.1			
	Shrub	2	0	3			
	Canopy	0	0	0			

Monitoring Map

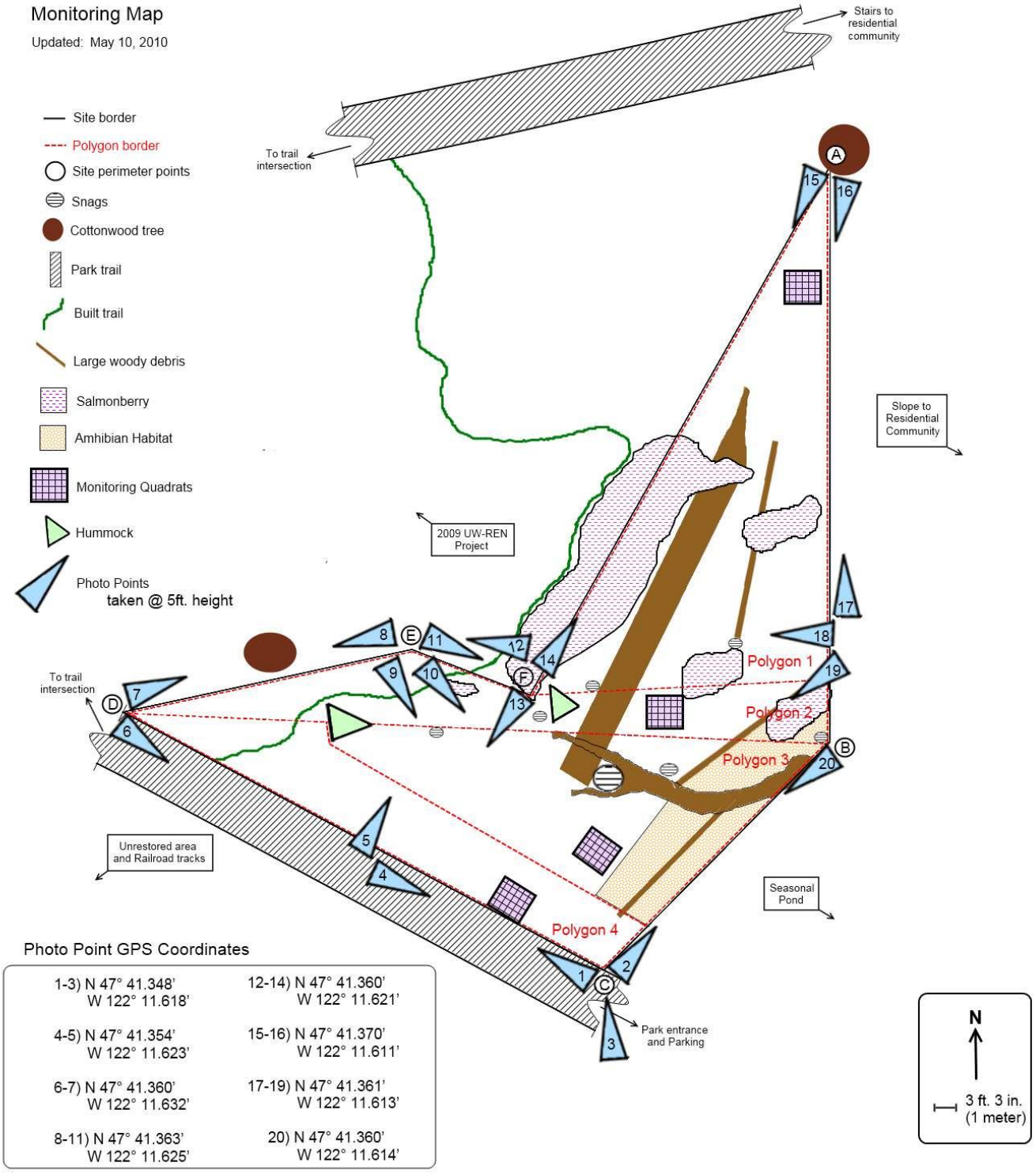


Photo Point GPS Coordinates

1-3) N 47° 41.348' W 122° 11.618'	12-14) N 47° 41.360' W 122° 11.621'
4-5) N 47° 41.354' W 122° 11.623'	15-16) N 47° 41.370' W 122° 11.611'
6-7) N 47° 41.360' W 122° 11.632'	17-19) N 47° 41.361' W 122° 11.613'
8-11) N 47° 41.363' W 122° 11.625'	20) N 47° 41.360' W 122° 11.614'

Monitoring Methods

GOAL 1: Promote the establishment of a diverse community of native vegetation typical of lowland Puget Sound riparian conifer dominated forests and wetlands.

Objective 1.1: Remove and suppress invasive species within the proposed site.

BENCHMARK 1.1a: At least 50% reduction of Himalayan blackberry (*Rubus armeniacus),* relative to pre-treatment conditions, should be evident one year after removal of above and belowground biomass.

Monitoring method 1.1a: Estimate the percent cover of Himalayan blackberry in the monitoring plots during mid-spring (late April to mid May) after plants have started to emerge. Compare data to the baseline data that was collected in May 2010. Use the monitoring form attached in Appendix C to record all data.

BENCHMARK 1.1b: At least 75% reduction of English ivy (*Hedera helix)*, relative to pre-treatment conditions, should be evident one year after pulling, mulching, and planting.

Monitoring method 1.1b: Follow same procedure as method 1.1a for English Ivy.

BENCHMARK 1.1c: At least 95% reduction of English holly (*Ilex aquifolium),* relative to pre-treatment conditions, should be evident one year after cutting and digging above and belowground biomass.

Monitoring method 1.1c: Follow same procedure as method 1.1a for English Holly

BENCHMARK 1.1d: At least 25% reduction of reed canary grass (*Phalaris arundinacea),* relative to pre-treatment conditions, should be evident one year after removal of above ground biomass and live staking of willow and dogwood.

Monitoring method 1.1d: Follow same procedure as method 1.1a for reed canary grass.

BENCHMARK 1.2 The site should have presence of different canopy layers including ground layers, shrubs, and large trees with a 40% cover in 3-5 years.

Monitoring method 1.2 Estimate the percent cover of all plants in each monitoring plot. Record data on attached from Appendix C and compare to the baseline data.

GOAL 2: Promote long-term community/volunteer interest, participation, and stewardship in and of Cotton Hill Park.

Objective 2.1: Enlist existing community member involvement in the restoration process.

BENCHMARK 2.1a: Volunteer attendance at large work parties (held twice a year in relation to special events) of 40-70 volunteers on a regular basis.

Monitoring Method 2.1a: Use the City of Kirkland volunteer sign-in sheets to track volunteer participation (Insert).

BENCHMARK 2.1b: Volunteer attendance at small work parties (held every other month when a large work party is not held) of 5-15 volunteers on a regular basis.

Monitoring Method 2.1b: Use the City of Kirkland volunteer sign-in sheets to track volunteer participation (Insert).

Objective 2.2: Perform community outreach to increase existing volunteer base through education.

BENCHMARK 2.2: At least one class of local students participates in school-related activities at or related to Cotton Hill Park.

Monitoring Method 2.2: Have teacher(s) of participating classes fill out Cotton Hill Ecology Education Survey (Appendix A).

GOAL 3: Encourage increased wildlife habitation of Cotton Hill Park.

Objective 3.1: Enhance existing wildlife habitat with native plant species that will provide food and nesting sources to bird and amphibian species.

BENCHMARK 3.1a: Increased presence of amphibian species observed within the next three growing seasons.

Monitoring Method 3.1a: Use the Monitoring Map (Figure 3, Appendix C) and the attached Observation Data Sheet (Table 2, Appendix C) every two growing seasons or as needed between March and early April, estimate the percentage of existing amphibian species (e.g. Pacific Chorus Frogs and Long Toed Salamander). Visually inspect the site especially near the vernal ponds and record any amphibian presence. When turning over logs or other woody debris, it is important to alternate logs every other season in order to not disturb the area too much as it could impact their habitat. Be gentle and be sure to put everything back the way it was found.

BENCHMARK 3.1b: Fruit production will increase by at least 40% within the next three growing seasons.

Monitoring Method 3.1b: In early spring 2012, estimate and record the percentages of berry species (Table 3, Appendix C) within the project site using the Quadrat Monitoring Sheet (Appendix C) to compare the newly recorded data with the baseline data (taken on May 2010) to measure any increases in fruit production.

BENCHMARK 3.1c: At least one bird nest and several bird sightings were observed nearby the project site. Increases in diverse native vegetation would support the existing birds and further support new coming birds.

Monitoring Method 3.1c: Observe and take inventory of bird sightings within the project site after the first three growing seasons (June through August) to see whether or not the diverse native vegetation are being used/eaten by the existing birds. Use the attached Observation Data Sheet (Table 2, Appendix C).

Objective 3.2: Install habitat structures to increase habitation potential.

BENCHMARK 3.2a: A year after installation of habitat structures, check the site where woody debris has been placed for presence/absence of amphibian species. The presence of amphibian species would be a success for this benchmark.

Monitoring Method 3.2: See monitoring method 3.1a.

Successional Management Prescriptions

The successional goal for this site is to establish a healthy conifer dominated forest. The conifer species that are best suited to the moist conditions of this site are western redcedar and

Sitka spruce. Western hemlocks should be successful in the drier region of the site (Polygon 1). All of these species require shady conditions to become established; hence they are later successional species. Deciduous trees, such as red alders which reach heights up to 25m, provide suitable shady conditions when the canopy cover is 80% or more. This degree of cover can be expected by the eighth year after planting (WSDOT). This combined with shade from shrub species, such as willows, salmonberry, redosier dogwood, pacific ninebark, Indian plum and vine maple will provide appropriate conditions for groundcover species of the desired forest type. Western redcedars, Sitka spruce, western hemlocks, and several groundcover species have been planted in areas with more shade.

To maintain the trajectory, supplemental planting of conifers and groundcover species will be required once the 80% canopy cover has been reached. Species to be planted include western redcedars and Sitka spruce, especially in Polygons 2 and 3, and groundcover options include salal, sword fern, western trillium (*Trillium ovatum*), coastal strawberry (*Fragaria chiloensis*), fringecup (*Tellima grandiflora*), redwood sorrel (*Oxalis oregana*), Pacific bleeding heart (*Dicentra formosa*), and false lily-of-the-valley (*Maianthemum dilatatum*). Groundcover spacing should be 2ft o.c. It may be necessary to thin the shrub species to allow room for the conifers to grow. This can be done by cutting live stakes (branches .5-1in thick, 2-3ft long) from Pacific ninebark, dogwood, Indian plum and willows. These should then be planted before leaf out (winter to early spring). We recommend planting these stakes around the perimeter of the pond so as to continue the suppression of reed canary grass.

Invasive species present the greatest challenge to achieving the desired successional trajectory. The year-round shade of a conifer dominated forest will likely provide sustainable control once the forest is established. In the meantime invasive species, especially reed canary grass, will likely persist for many years; however, reductions should be expected as shade increases and as native shrubs and groundcovers provide competition (SNP 2006). Shrub species have been planted especially densely around the pond where reed canary grass is pervasive. It is recommended that the pond area be targeted in future restoration efforts because the reed canary grass will continue to be a threat until the seed supply is gone.

Annual removal of invasives will be a necessary maintenance task. Removal should be followed by mulching (at least 4”), and supplemental groundcover planting. Supplemental planting should also be performed in areas where shade and competition have effectively suppressed invasives (SNP 2006). Additional resources for maintaining the trajectory can be found in Appendix E.

Appendix A: Education Packet

Lesson Plan Outline

Introduction – use of PowerPoint (available on accompanying CD)

Pass out "Ecosystem Vocabulary" worksheet

- Introduce team members
- Site location
- Project goals

Ecosystem Segment

- Terminology
  - Ecosystem
    - Interactions between biotic and abiotic elements
  - Abiotic
    - Non-living things in the environment
      - Rocks
      - Climate
      - Water
  - Biotic
    - Living (or previously living) things in the environment
      - Plants
      - Animals
      - Woody debris
      - Bacteria
  - Primary Consumers
    - Consumes plants
  - Decomposers
    - Consumes dead material
  - Producers
    - Uses photosynthesis to create basic sugars
  - Secondary Consumers
    - Consumes biota that consumes plants
- Ecosystem Diagram
  - Point out biotic and abiotic parts
  - Examples of interactions
    - "Decomposers break down dead things, such as leaves, and make soil which contains nutrients that plants can use. Decomposers are an example of a biotic part of the ecosystem. Soil is an example of an abiotic part of the ecosystem."
  - Ecosystems can be everywhere

- Deserts
- Oceans
- Mountains

Group Forming Activity

Draw paper from a hat with ecosystem elements written on it. Students divide into ecosystem groups. **Have groups briefly discuss how they relate to each other and where they fit in ecosystem**. UWREN team members should actively help groups with these connections.

Human Effects on Ecosystem Segment

- Pollution from factories, runoff, cars
- Urban development, urban sprawl
- Destruction of habitat, deforestation
- Introduction of foreign plant species

Native and Non-native Segment

Pass out "Plant Observations Worksheet"

Each person is given a worksheet where they list physical characteristics or draw pictures that differentiate plant species from each other. Give basic verbal directions and examples of "Physical Characteristics" (show examples on PowerPoint) in addition to directions on the worksheet:

- Look at the plant species on your table, they will be labeled
- As a group, agree on a list of physical differences you can see between these species
- Write or draw these differences on the worksheet
- Groups can move from table to table to seeall the species

UWREN members - go between groups to clarify and help groups that are stuck. **If time, discuss difference between non-native and invasive species.**

Conclusion

- Before and after photos of our specific project (show on PowerPoint)
- How students are involved
  - Fieldtrip
  - Projects A
    - Drawing team – make an album of species found on site
    - Photography Team – take pictures from photo points (Appendix B)
    - Video team – document projects happening on site
    - Habitat team – build amphibian habitat
    - Hummock team – install plant species in hummocks
    - Eco-art – create art using natural materials to be installed on site
    - Baseline team – collect and build a report documenting vegetative cover data

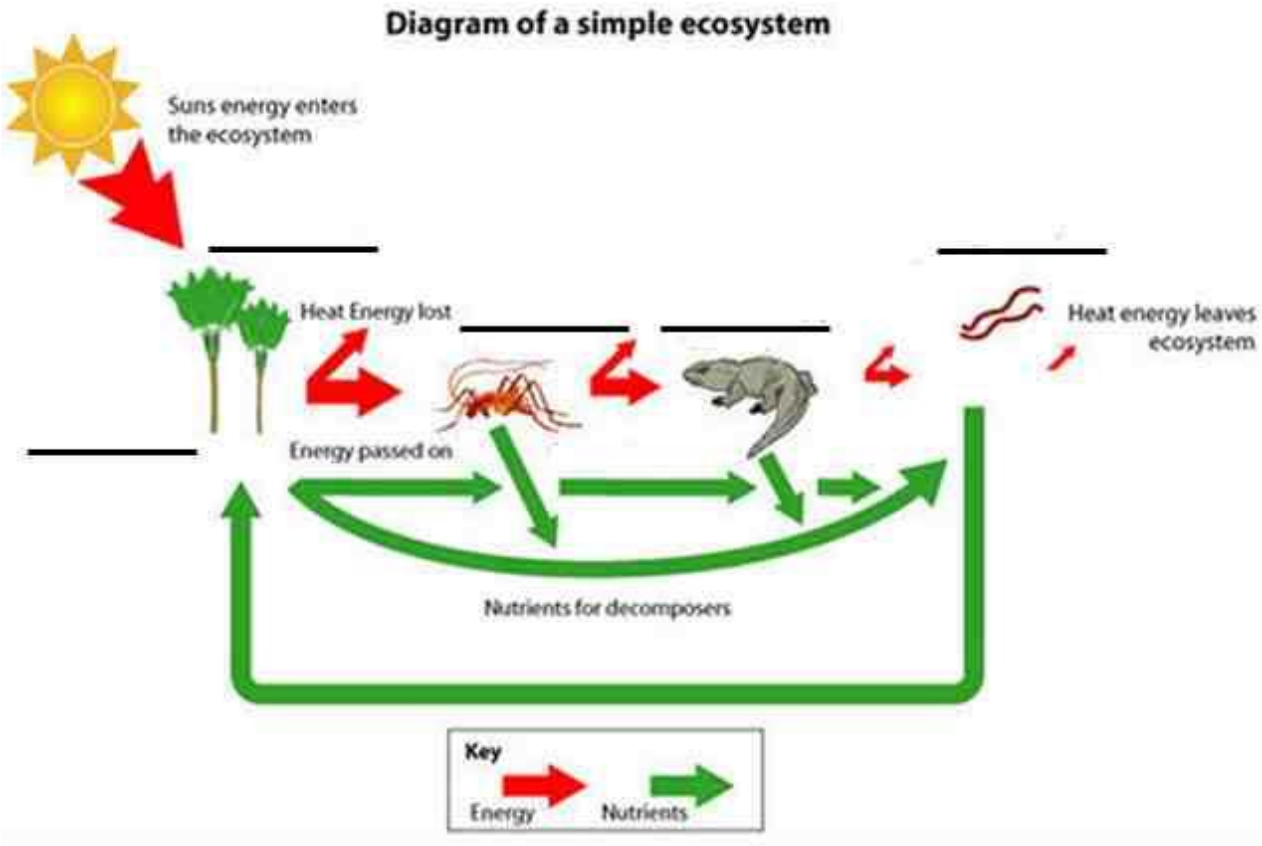
Names_____

Plant Observations Worksheet

Indicate in the Characteristic Differences column physical characteristics that differentiate that species from the other species being observed or draw what characteristics make each plant unique.

Species Name	Status	Characteristic Differences
Himalayan blackberry (*Rubus armeniacus*)	Non-native and Invasive	
trailing blackberry (*Rubus ursinus*)	Native	
salmonberry (*Rubus spectabilis*)	Native and can be Invasive	
reed canary grass (*Phalaris arundinacea*)	Non-native and Invasive	
small-fruited bulrush (*Carex stipata*)	Native	
common cattail (*Typha latifolia*)	Native and can be Invasive	
English ivy (*Hedera helix*)	Non-native and Invasive	
salal (*Gaultheria shallon*)	Native	
herb-Robert (aka: “stinky Bob”) (*Geranium robertium*)	Non-native	
field horsetail (*Equisetum arvense*)	Native can be Invasive	

Name_____ Date_____



abiotic :_____

biotic:_____

primary consumer:_____

decomposer:_____

ecosystem:_____

producer:_____

secondary consumer:_____

photosynthesis:_____

Group Forming Exercise

Earthworm
(Decomposer)

Actinobacteria
(Decomposer)

Nematode
(Decomposer)

Truffle fungus
(Decomposer)

Bacteria
(Decomposer)

Shelf fungus
(Decomposer)

Small-fruited bulrush
(Producer)

Salmonberry
(Producer)

Salal
(Producer)

Trailing blackberry
(Producer)

Sword fern
(Producer)

Douglas fir
(Producer)

Red-winged blackbird
(Primary Consumer)

Douglas squirrel
(Primary Consumer)

Grasshopper
(Primary Consumer)

Painted lady butterfly
(Primary Consumer)

Elk
(Primary Consumer)

Pika
(Primary Consumer)

Stream
(Water)

Lake
(Water)

River
(Water)

Group Forming Exercise

Pond
(Water)

Rain
(Water)

Creek
(Water)

Sun
(Energy)

Sun
(Energy)

Sun
(Energy)

Sun
(Energy)

Sun
(Energy)

Sun
(Energy)

Grizzly Bear
(Secondary Consumer)

Horse fly
(Secondary Consumer)

Spotted bat
(Secondary Consumer)

Spotted Owl
(Secondary Consumer)

Pacific tree frog
(Secondary Consumer)

Long-toed salamander
(Secondary consumer)

Cotton Hill Ecology Education Survey

This survey is designed to gauge the level of participation and interest of educators in the Kirkland community who have used the curriculum materials created by the University of Washington- Restoration Ecology Network students of 2010 in their classrooms. The survey is designed to be filled out annually by teachers who have worked in Cotton Hill Park with students.

1. Did you use the UW-REN curriculum to collect monitoring data with your students at Cotton Hill Park this academic year?

Yes No

If No:

1a. Why did you choose not to use this activity?

If Yes:

1b. What did you like best about the activity and curriculum?

1c. What would you change about the activity or curriculum?

1d. How did your students benefit from the experience? What did they learn or take home from it?

2. Will you implement this activity or something similar in the future?

Yes No

2a. Why did you choose yes or no?

3. Would you like future UW-REN students to contact you to update or supplement the monitoring data collection activity?

Yes No

If Yes:

3a: Please provide your contact info:

Thank you! Please send the survey to Karen Story: karen@tinyisland.com

Appendix B: Photo Points

Photo Point 1: 299° NNW; Park trail that delineates western border and large cottonwood indicating NW border. Beyond is the UWREN 2009 site.

Photo Point 3: 0° N; View across the site to Point A. In foreground are portions of Polygon 4 and Polygon 3.

Photo Point 2: 224° SSW; Southeastern boundary. A leaning Pacific willow propped by a snag is center. Saturated Polygon 3 is in the foreground.

Photo Point 4: 140° SSE; Park trail delineates western border. Hummock 1 is in the lower left corner. Large log at center-left transects the center of the site.

Photo Point 5: 40° NNE; Cross-site view with built mulch path in the foreground, along with Hummock 1.

Photo Point 6: 140° SSE; Park trail retreating to the parking lot. Large cottonwood marking border between the 2009 and 2010 sites is seen on the right.

Photo Point 7: 77° ENE @ 5 ft. height; from the trail looking towards the large cottonwood (Opposite of 8).

Photo Point 8: 257° WSW; looking back towards the trail, large cottonwood tree on the right (Opposite of 7).

Photo Point 9: 160° SSE; Hummock 1 is in the foreground. Point A is in the distance.

Photo Point 11: 110° ESE; Point D in the distance, on the built mulch trail. Clump of Salmonberry center-left. (Opposite of 12)

Photo Point 10: 120° ESE; Looking into the center of site. Leaning Pacific willow propped by cottonwood is seen center-left.

Photo Point 12: 290° WNW; Looking back at the trail from Point F. Hummock 1 is center-left. (Opposite of 11)

Photo Point 13: 230° WSW; At Point F, looking towards the trail.

Photo Point 15: 210° SSW; At Point A, the built trail traverses from center to bottom right. (Opposite of 14)

Photo Point 14: 30° NNE; Salmonberry on the right, 2009 site on the left and Point A in the distance.

Photo Point 16: 180° S; Along the length of Polygon 1. English ivy just off site . (Opposite of 17)

Photo Point 17: 0° N; Point A cotton wood in the distance. Prunus spp. In the foreground. (Opposite of 16)

Photo Point 19: 225° SW; Polygons 2 and 3. This fallen log rests on top of the leaning willow in the center of site. Salmonberry, Indian plum and willow species.

Photo Point 18: 265° WSW; Leaning willow is in the upper left corner. This large log transects the center of site.

Photo Point 20: 224° SSW; Along the South eastern border, looking toward Point C. Willow stakes are just beginning to sprout leaves.

Appendix C: Monitoring

Table 1: Existing Amphibian & frog species found on site:

Common / Scientific Names		Habitats
Pacific Chorus (Tree) frogs (*Pseudacris regilla*) **Characteristics:** - Grow up to 2 inches long - Bright green to brown, reddish or gray (Change color to match background) - Have a dark mark along nostrils and shoulders - Some have dark stripes and spots on back		- Ponds, streams, lakes, riparian habitat as well as woodlands, grassland, chaparral, pasture land, and even urban areas including back yard ponds - Other covers such as logs, rocks, and brush piles - Tadpoles feed on algae as their main food sources
Long-Toed Salamander *(Ambystoma macrodactylum*) - When mature, 4.1-8.9 cm long - Have mottled black, brown and yellow pigmentation		- Habitat ranging from wet rainforests and cold mountain meadows to dry sagebrush prairie. - In the breeding season, large, shallow lakes and ponds with boggy edges and no predatory fish are best.

Table 2: Amphibians/Birds Observation Data Sheet:

Please make a copy of this before filling it out.

Dates	Observation Times	What kinds of Species?	Polygons	How did you find them? (Vision, auditory, sign)	Where did you find them? (Rock, log, bare ground, etc)	What was the condition when you find them? (Dry, moist, Wet)
05/05/10	30mins	Pacific Chorus Frogs	2	Vision	Under logs that run across Polygon #2	Dry/Moist

Other Observations:

Table 3: Berry Species

Please make copies for reference during the monitoring

Common Names	**Scientific Names**	**Nursery Abbreviation**
Bitter cherry	*Prunus emarginata*	PREM
Coastal strawberry	*Fragaria chiloensis*	FRCH
Huckleberry	*Vaccinium parvifolium*	VAPA
Indian plum	*Oemleria cerasiformis*	OECE
Salmonberry	*Rubus spectabilis*	RUSP
Snowberry	*Symphoricarpos albus*	SYAL
Trailing blackberry	*Rubus ursinus*	RUUR
Twinberry	*Lonicera involucrata*	LOIN

Quadrat Monitoring Worksheet

PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?

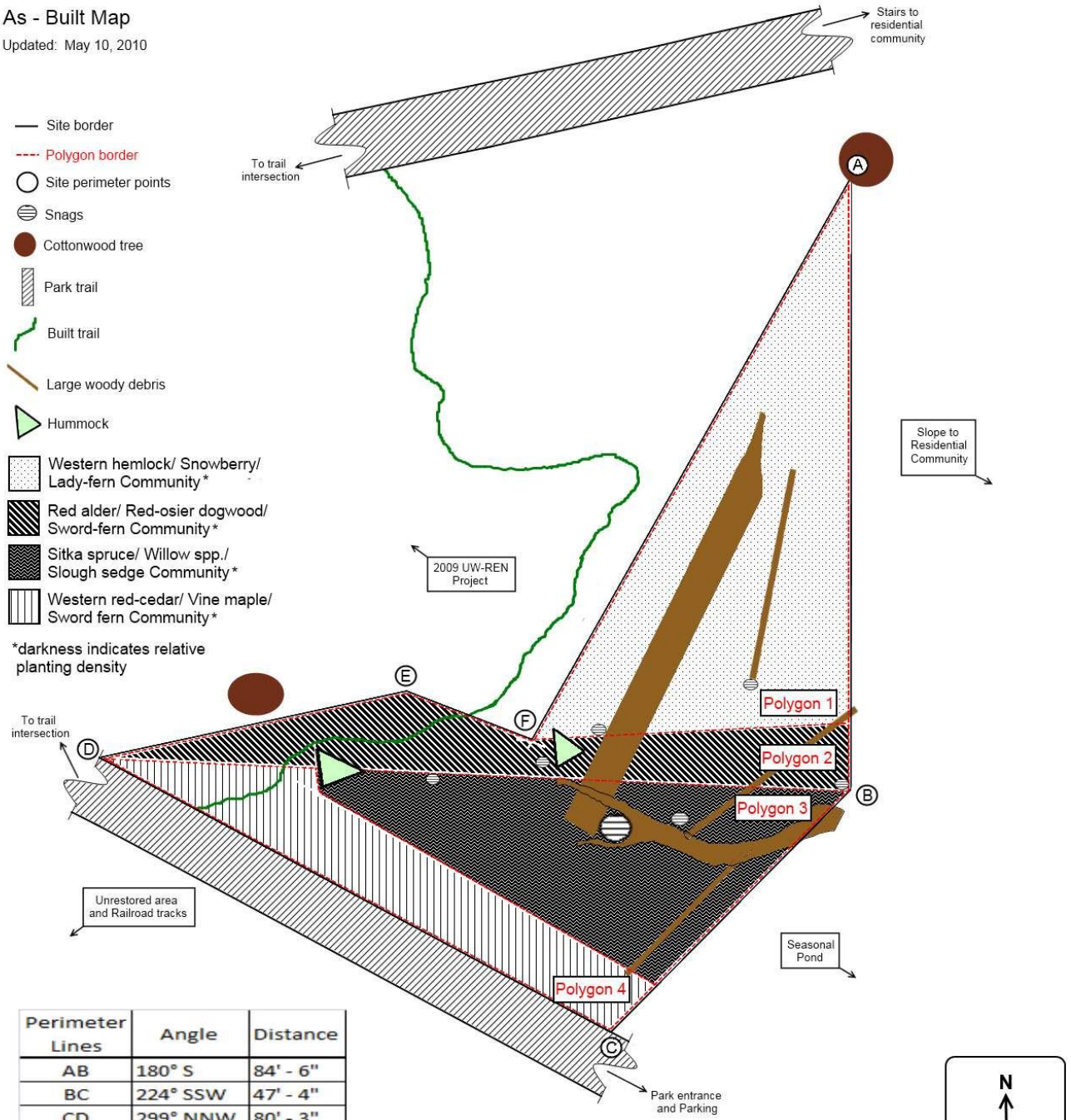
PLOT	SPECIES	#LIVE	#DEAD	%COVER	RECRUIT?	LAYER	NATIVE?

Plant List with Codes

Species Code	Common Name	Scientific Name	Polygon	Native?
ACCI	vine maple	*Acer circinatum*	4	x
ALRU	red alder	*Alnus rubra*	2	x
ATFE	common lady-fern	*Athyrium felix-femina*	1	x
CAOB	slough sedge	*Carex obnupta*	3	x
CAOL	little western bitter-cress	*Cardomine oligosperma*	2, 3	x
COSE	red-osier dogwood	*Cornus sericea*	2, 3	x
CRDO	black hawthorn	*Crataegis douglasii*	1	x
DIFO	bleeding heart	*Dicentra formosa*	1, 4, Hum.	x
EQAR	field horsetail	*Equisetum arvense*	1, 2, 3, 4	x
FRCH	coastal strawberry	*Fragaria chiloensis*	Hum.	x
FRLA	Oregon ash	*Fraxinus latifolia*	3	x
GASH	salal	*Gaultheria shallon*	4	x
GERO	herb-Robert	*Geranium robertianum*	2, 3, 4	
GLEL	tall mannagrass	*Glyceria elata*	3	x
HEHE	English ivy	*Hedra helix*	1	
HODI	ocean spray	*Holodiscus discolor*	1	x
LICO	tiger lily	*Lilium columbianum*	1, Hum.	x
LOIN	twinberry	*Lonicera involucrata*	3	x
MANE	Cascade Oregon grape	*Mahonia nervosa*	1	x
OECE	Indian plum	*Oemleria cerasiformis*	1	x
OXOR	redwood sorrel	*Oxalis oregana*	2, 3, 4	x
PHAR	reed canary grass	*Phalaris arundinacea*	3, 4	
PHCA	Pacific ninebark	*Physocarpus capitatus*	2, 3, 4	x
PHLE	mock orange	*Philadelphus leisii*	1	x
PISI	Sitka spruce	*Picea sitchensis*	3	x
POBA	black cottonwood	*Populus balsamifera*	1, 4	x
POMU	sword fern	*Polystichum munitum*	2, 4	x
PREM	bitter cherry	Prunus emarginata	2	x
PRLA	cherry laurel	*Prunus laurocerasus*	4	
PSME	Douglas fir	Pseudotsuga menziesii	Hum.	x
RARE	creeping buttercup	*Ranunculus repens*	3	
RONU	nootka rose	*Rosa nutkana*	1, Hum.	x
ROPI	swamp rose	*Rosa pisocarpa*	3	x
RUAP	salmonberry	*Rubus spectabilis*	2, 3, 4	x
RUAR	Himalayan blackberry	*Rubus armeniacus*	1, 2, 3, 4	
SAHO	hooker willow	*Salix hookerana*	3	x
SALU	Pacific willow	*Salix lucida*	3	x
SASI	Sitka willow	*Salix sitchensis*	3	x
SCMI	small-fruited bulrush	*Scirpus microcarpus*	3	x
SPDO	hardhack	*Spirea douglasii*	3	x
SYAL	common snowberry	*Symphoricarpos albus*	1	x
TEGR	fringecup	*Tellima grandiflora*	1	x
THPL	western red cedar	*Thuja plicata*	4	x
TITR	foam flower	*Tiarella trifoliata*	1	x
TROV	western trillium	*Trillium ovatum*	4	x
TSHE	western hemlock	Tsuga heterophylla	1	x
VAOV	evergreen huckleberry	*Vaccinium ovatum*	4	x
VAPA	red huckleberry	*Vaccinium parvifolium*	4	x

*Red indicates non-native/invasive species

As-Built Map



Perimeter Lines	Angle	Distance
AB	180° S	84' - 6"
BC	224° SSW	47' - 4"
CD	299° NNW	80' - 3"
DE	77° ENE	43' - 10"
EF	111° ESE	19' - 0"
FA	30° NNE	90' - 0"
BD	274° WNW	

Appendix D: Contacts

Project Partners

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Warren Gold: wgold@uw.edu
Rodney Pond: fishmael@uw.edu

Appendix E: Reference Links

Project Partners

- Arbor Day Foundation, Tree City USA: http://www.arborday.org/programs/treeCityUSA/index.cfm
- Cascade Land Conservancy, Green Kirkland Partnership: http://www.cascadeland.org/stewardship/green-cities/green-kirkland-partnership
- City of Kirkland: http://www.ci.kirkland.wa.us/
- Highlands Neighborhood Association: http://www.kirklandhighlands.org/
- Kirkland Junior High: http://www.lwsd.org/school/KIJH/Pages/default.aspx

Education and Restoration

- University of Washington: http://www.washington.edu/
- University of Washington Restoration Ecology Network: http://depts.washington.edu/uwren/
- Society for Ecological Restoration International: http://www.ser.org/
- Sound Native Plants: http://soundnativeplants.com/infosheets.htm
- Ecoart Workshops and Curriculum: http://www.ecoartalacarte.com/home.html
- Ecoart Resources: http://www.artsforchange.org/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=10
- Washington Native Plant Society: http://www.wnps.org/education/resources/middleschool.html
- Plant Identification Signs: http://www.davidarthur.us/

Plant Resources

- King Conservation District: http://www.kingcd.org/pro_native.htm
- King County Plant Salvage: http://www.kingcounty.gov/environment/stewardship/volunteer/plant-salvage-program.aspx
- Pacific Natives: http://www.pacificnatives.com/
- Snohomish County Native Plant Nursery: http://www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/SWM/Work_Areas/Outreach/Native_Plants/Holding_Facility.htm
- Sound Native Plants: http://www.soundnativeplants.com

Appendix F: Literature Cited

[SNP] Weed control – Reed canarygrass 2006. Sound Native Plants, 2006. [Internet]. [cited 2010 May8]. Available from: http://soundnativeplants.com/PDF/Reed%20Canarygrass.pdf

[SNP] Weed control – English ivy, 2005. Sound Native Plants, 2006. [Internet]. [cited 2010 May 8]. Available from: http://soundnativeplants.com/PDF/English%20ivy.pdf

[WSDOT] Washington State Department of Transportation. Benchmarks for Forested and Scrub-Shrub Mitigation Wetlands. p. 38

Volunteer Roster and Service Agreement For the City of Kirkland

Welcome to the City of Kirkland! We are pleased that you have chosen to volunteer. By signing below, you agree to volunteer your services to the City of Kirkland and to perform only the services agreed to by the City.

I agree to the following:

- That if I drive a vehicle to the volunteer site or during the course of my volunteer work, my personal vehicle insurance provides coverage;
- That I shall not appear for volunteer service under the influence of alcohol or illegal drugs;
- That if no City personnel is present during the event, then I am to call 911 in the event of any emergency during the volunteer event, and that any injuries incurred during the event shall be reported to the City within two working days of the injury;
- That if I find anything hazardous or suspected to be hazardous, I shall not touch it, but shall notify City personnel as soon as possible. I shall not pick up syringes, broken glass or other sharp materials, or exceptionally large, heavy or unyielding objects;
- **That any photographs, videotapes, motions pictures or recordings taken may be used for publicity purposes for the City;**

And I further agree as follows:

- That the City will include my hours of volunteer service in the State Labor and Industries medical coverage for volunteer workers, as recorded below. **Parents: Because Labor and Industries does not cover those under the age of 14, if your child is under the age of 14 and is injured while volunteering, your own personal medical insurance will provide coverage. Adults: If you sign for a minor under 14, you must stay to supervise that minor for the duration of the event.**
- That I am fully aware that the work associated with being a City volunteer involves certain risks. That volunteer work may involve difficult conditions, uneven terrain, unanticipated natural hazards, use of equipment, and/or strenuous manual labor, and I am dressed appropriately for this. Knowing this, I agree to hold the City of Kirkland and their officials, employees, and other associated parties harmless from all claims arising out of, or in any way connected to, my volunteer duties. Further, volunteers assume liability for any non-participants who accompany them.

Park: _____ **Project Location:** _____ **Date of Event:** _____ **Event Duration:** _____

Organizer/s: _____ **Activity (please circle): Invasive Removal / Planting / Mulching / Watering / Other** _____ **Notes (if applicable):** _____

Volunteer Name (Please Print Clearly)	Please Initial	Parent/Adult Signature for Minors (if under 18 yrs)	Mailing Address (Street, City, Zip Code)	Email Address (Please print clearly)	Phone Number	Group Name (if applicable) e.g., Service Club, Environmental, Neighborhood, School, Business, Faith	Number Of Hours Worked