

Maury Island Marine Park Restoration Baseline Documentation 2013



Compiled by:



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PROJECT DESCRIPTION

In the winter of 2012-13, shortly after King County (KC) and Washington State Department of Natural Resources (WADNR) started large scale restoration activities at Maury Island Marine Park, Vashon Nature Center LLC began working with KC, WADNR, and Friends of Maury Marine Park to organize a restoration monitoring effort. The purpose of the monitoring effort was threefold:

1) To establish baseline documentation of the site from which vegetation change could be measured through time;

2) To create experimental plots to answer specific questions that could help all parties involved learn how best to conduct restoration on this challenging site; and

3) To increase public knowledge and engagement in the restoration monitoring process by using citizen science volunteers to collect data. This effort was funded by a Community Partnership Grant through King County in conjunction with volunteer hours and in-kind service hours donated through Vashon Nature Center LLC. Washington Conservation Corps crews also participated in this effort as part of their restoration work on site.

The monitoring program was truly a team effort. In addition to support from the Community Partnership Grant, Vashon Nature Center LLC science advisors provided valuable guidance on monitoring methods and restoration techniques including 4 site visits. University of Washington scientists loaned a hemispherical lens and camera to the monitoring effort for recording canopy cover in madrone plots. A total of 12 local residents and local high school students volunteered for field data collection and data entry. Washington Conservation Corps crews put in countless hours of data collection as well. This project could not have been done without their work. Two monitoring sessions were conducted--one in the beginning of the growing season in May 2013 and one at the end of the growing season in September 2013. Follow up data collection was done in the intervening periods between May and September and between September and November.

The following report presents a summary of baseline documentation and results of the first season of monitoring at Maury Island Marine Park.

SITE DESCRIPTION

Maury Island Marine Park sits on the southern side of Maury Island in King County, WA (Figure 1). This portion of Vashon-Maury Island is characterized by sandy gravelly soils and drier, hotter conditions than Vashon Island proper. Maury Island Marine Park receives about 38 inches of rain per year as opposed to the adjacent Vashon Island which receives 45-49 inches of rain per year (King County 20007).

In addition, Maury Island Marine Park is situated within one of the largest madrone forests in the region. The origin of the large madrone forest complex is likely drier weather conditions, coupled with sandy soils, south-facing aspects, and a history of large fires that swept this area from the 1930-1950's. This used to be a popular camping spot for mainlanders and more than once campfires burned out of control (Bruce Haulman, pers. comm). In addition, parts of Maury Island Marine Park were previously mined for

gravel which has created many areas in the park that not only have the above mentioned dry, hot conditions but also have been largely stripped of a healthy soil profile. Many of these cleared and mined areas as well as some of the roadsides and open forested areas have been overtaken by scotch broom and blackberry. Disturbed areas also contain other non-native suites of species including many grasses and European derived herbaceous plants like plantain, dandelion, and common tansy (Appendix A—Full Plant List).



Figure 1. Restoration site location.

The combined human-use history and unique set of physical and climate characteristics of this site make for a very challenging restoration site but also create an important opportunity to preserve valuable habitat. The open madrone forests and sandy south-facing slopes represent a unique habitat both locally and regionally. This is the only place on the islands where rubber boa snakes have been seen and where western fence lizards abound (Perla pers. obs.). In addition, a King County DNRP study in 2007 revealed a unique suite of 68 bird species associated with the madrone forests in the park throughout the year representing a higher diversity than mixed-coniferous-deciduous forests that make up the bulk of island forest habitat (VanderHoof 2007). Butterflies, dragonflies, and damselflies are common in the warmer open areas and in high abundance as compared to many other areas on the island. Raptors are often seen in the area and probably hunt a variety of small mammals that use the site although no small mammal studies are known to have been conducted here. Connections to important nearshore and marine habitats are strong as run-off and sand erosion from the steep slopes is likely highly influential in adjacent shoreline dynamics. Adjacent nearshore habitats support salmon forage fish, provide seal haul out areas, and are regularly used by southern resident orcas. In addition, several small beach seeps and a small salt marsh area occur near the shoreline.

Monitoring restoration efforts at Maury Island Marine Park helps ensure that restoration maintains or improves ecological health within the park. In addition, lessons learned from monitoring may become important for guiding future restoration efforts in similar challenging restoration areas. For example, lessons learned at this site will be very applicable to the newly created Maury Island Natural Area which also includes madrone forests, old gravel mine areas, and similar physical conditions.

MONITORING DESCRIPTION

The 2013 monitoring plan created for Maury Island Marine Park concentrated on 5 main activities:

- 1) Establishing a representative network of long-term photo points that can be visited annually to develop a long-term and consistent record of vegetation change on site;
- 2) Establishing zones for different micro-habitat types on site and a method for rapid assessment of plant survival in different micro-habitats on site;
- 3) Measuring survival and growth of both planted and volunteer plants in response to different soil amendment treatments;
- 4) Comparing herbicide use with manual grubbing as a weed control method;
- 5) Measuring madrone seedling germination and survival and explore possible factors that could affect germination and survival.

Monitoring activities were designed to answer the following specific questions:

Specific monitoring question	Monitoring method
What does vegetation change due to restoration look like on a landscape scale overtime?	Long-term photo points
Which species are best suited to the site (experience lowest mortality/stress)?	Zone walk through and soil amendment plots
What volunteer plant species are present on the site?	Zone walk through and soil amendment plots
Are there any native plant species volunteers that should be encouraged?	Zone walk through and soil amendment plots
Does soil amendment affect plant survivability and stress level?	Soil Amendment Plots
Do different soil amendment treatments differ in ability to suppress or encourage volunteer plant colonization?	Soil Amendment Plots
Does soil amendment affect volunteer plant species composition in any way?	Soil Amendment Plots
What is the germination and survival rate for madrone seedlings?	Madrone plots
Does seeding produce higher germination and survival compared to background natural rates?	Madrone plots
What contributes to increased germination and survival of madrone seedlings? Differences in canopy cover, duff layer depth, and soil moisture were tested.	Madrone plots
How does herbicide use compare to manual grubbing in terms of time, effectiveness, and impact on native plant cover?	Herbicide plots

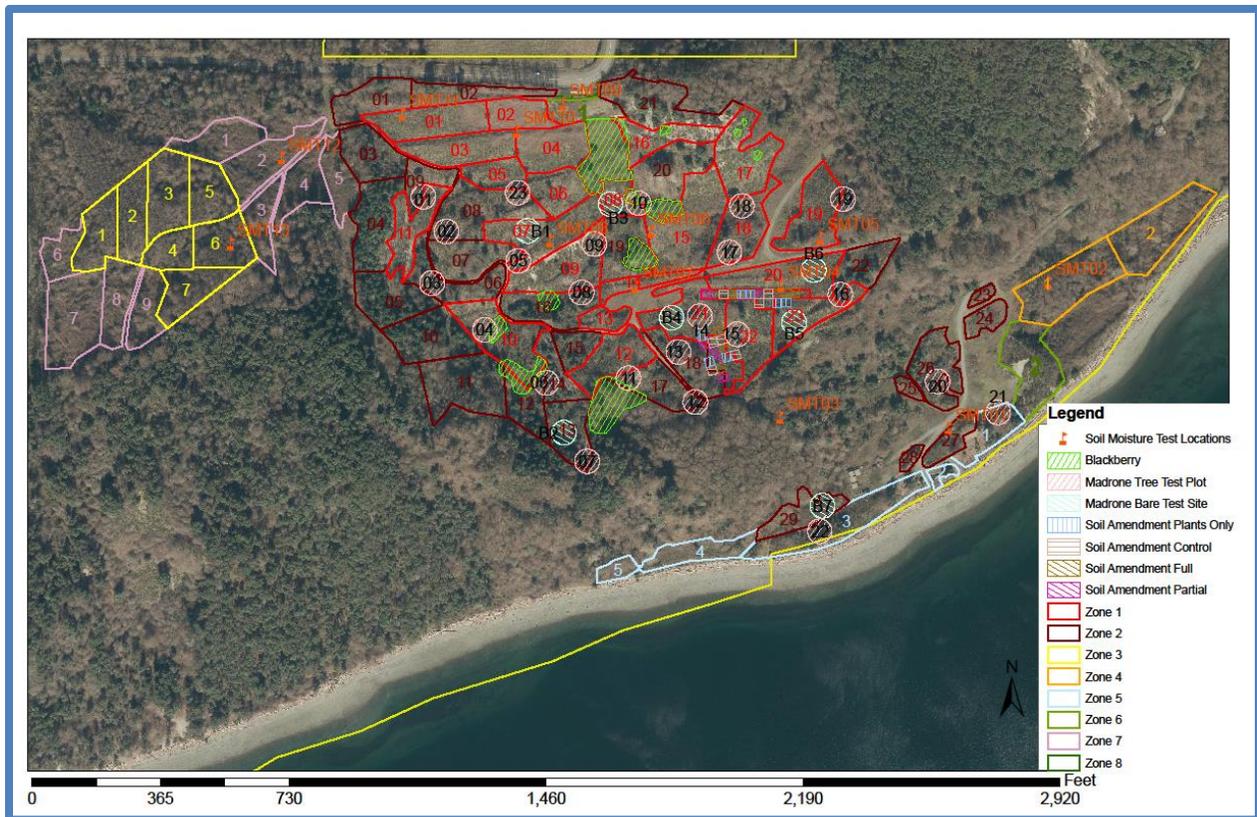


Figure 2. Maury Island Marine Park working restoration area. Monitoring zones and areas, soil amendment plots, and madrone plots are shown. Map created by: Washington Department of Natural Resources.

Protocols: Monitoring was done by local resident volunteers and WCC crews trained by Vashon Nature Center LLC. Twelve local residents participated in monitoring efforts and close to 40 WCC members. To standardize monitoring efforts Vashon Nature Center LLC wrote up guiding protocols that were given to each volunteer. These guiding documents were used to train volunteers in the field in 3 training sessions throughout the season for resident volunteers and 4 training sessions on different aspects of the protocols to WCC crew members.

Monitoring activities can be grouped into 5 different subjects which are briefly described below. Complete monitoring protocols are attached in Appendix B.

1. Long-term photo monitoring: Photos were taken at the beginning of the growing season (May 20-June 15, 2013). Within each zone photos were taken in each designated monitoring area (see table below). Photo points were marked with thick wooden stakes. Photographers took one photo in each of the cardinal directions. GPS coordinates were recorded as well. Three extra photo points were included that provide landscape views of the site for comparison overtime. It is intended that photos be repeated annually or bi-annually.



Local resident volunteers work with WADNR Restoration leader Bryan Massey to establish long-term photo point locations.

2. **Soil Amendment Plots:** 4 treatments were included—full amendment, partial amendment (only in planting hole), no amendment, and no planting. The same suite and configuration of plants were planted in each treatment except for the no planting treatment (see Appendix B for planting configuration). Plants were individually marked with metal tags and measured for height, width (in two directions). Mortality and stress were noted at time of measuring. At the end of the growing season mortality, stress, and size measurements were taken again for each plant and compared between treatments. Cover categories of bare ground, herb, shrub, planted, and non-planted volunteer species were estimated in both seasons.



WCC crews and local residents take a break together at a Vashon Nature Center LLC monitoring day. This day soil amendment plots were monitored after a day of training.

3. Madrone Plots: 23 circular plots with madrones in the center and 7 circular plots in the open were divided into 4 quarters each. 2 quarters were seeded with madrone seeds and 2 quarters were not. The quarters were selected randomly for seeding treatment. Volunteers measured the thickness of the duff layer in cm, took spherical densiometer measurements of the canopy in each quarter, took a hemispherical photo of canopy cover in each quarter and counted number of seedlings, saplings, and grown trees in the circular plot. Cover category of bare ground, grass/herb, shrub, and canopy were also estimated. Seedling counts were made in July as it was too hard to tell which seedlings were madrone at the beginning of the growing season. Seedling counts were made again in mid-September to calculate seedling survival throughout the growing season.



WCC crew members count madrone seedlings in one of the madrone plots.

4. Herbicide monitoring: in September 2013 parts of areas 4 and 5 in Zone 1 were designated as herbicide monitoring areas. An equal area of southern facing slope overgrown with blackberry was divided in half. A 3 foot buffer zone was placed between the two treatment areas. 28 1m diameter circular plots were marked within these areas (12 in area to be herbicide treated, 12 in area to be grubbed but no herbicide, 3 in buffer area between plots, 3 downslope of area to be treated with herbicide, 3 downslope of area to be grubbed but no herbicide, and 1 downslope of buffer area). Percent cover of each species growing in the plot was estimated. In addition a photo of the slope showing the entire monitoring area was taken from a ridge opposite the plots. If herbicide use continues the re-growth of these plots should be measured and compared at the end of next growing season (2014).

5. Zone walk through assessment: At the end of the growing season all areas designated as monitoring areas within each zone were walked by a Washington Conservation Core team trained in the protocol for zone walk through assessment by Vashon Nature Center staff. This assessment follows a standard sampling protocol found originally in Miller et al. (1996). WCC members walked through with lists of what was planted in their area and as they found each plant they marked it as alive, dead, stressed, or missing. In addition, as they walked through they added comments on other plants and animals that they were seeing and additional information that may be pertinent to management of the restoration area.

Monitoring dates: Two main monitoring efforts were conducted; one at the beginning of the growing season to establish initial conditions, and one at the end of the growing season to establish survival and growth success in one growing season. The kick off monitoring day in the early season was May 20th. The

end of season kick off day was September 11th. The table below shows what monitoring was done each season. Vashon Nature Center volunteers, King County and Washington DNR crews participated in the monitoring in both seasons.

May-June 2013	September-November 2013
Soil Amendment plots: photos, measure and tag all plants, initial mortality, height, width, stress measurements, and cover measurements. Volunteer species lists and cover.	Soil Amendment Plots: photos, mortality, stress, height, width, cover. Volunteer species lists and cover.
Long-term photos: photo points marked with wood stakes within each zone, 4 photos taken at each photo point (one in each cardinal direction)	Long-term photos: Nothing (once a year).
Madrone plots: duff layers measured, spherical densiometer measurements of canopy, soil moisture, hemispherical photos of canopy, seedlings, saplings, trees counted (July)	Madrone plots: Counted seedlings.
Herbicide: nothing	Herbicide: established plots, photos, initial species and cover estimates completed.
Plant zone walk through assessment: nothing	Plant zone walk through assessment: mortality and stress of each planted plant measured, volunteer species list, management comments/suggestions, animal list.

Monitoring Set-up -- Zones: The entire restoration area was divided into 8 zones based on major physical differences in slope, aspect, and soil type. Each of these zones was further divided into smaller units called areas based on finer physical variations. Some zones had only 1 area and some zones had as many as 29 areas.

For monitoring purposes we sub-sampled each zone by randomly choosing areas until we had enough areas to encompass 15-20% of the planted plants in each zone. These became the designated monitoring areas and were used both for the long-term photo point locations and the zone walk through survivability assessment.

A description of the site zones, number of areas, and which areas were designated monitoring areas is shown in the table below:

Zone	Description	Number of areas	Monitoring areas
1	The bulk of this zone is south facing with no tree cover. Conditions are sunny and dry with poor, sandy soils. 12 acres.	23	2,6,8,19,22
2	This zone is south facing with tree cover. Soils are miscellaneous and areas are divided out based on this variation. 13 acres.	29	1,9,12,27,28,29
3	This zone is alder forest with an early	7	1

	successional understory. Conditions are shady, soils are dry-moist, and mixed clay-sand. 3.3 acres		
4	Alder forest with early successional understory. Shaded terrain with moist clay soil. 1.7 acres	2	1
5	This zone borders the beach. This is a sunny area with moist sandy soil and salt presence from proximity to the Puget Sound. 1.8 acres	5	1
6	These are view corridor sites and for management purposes were planted with shrubs. These areas are sunny, had no initial tree cover and miscellaneous soils. 1 acre.	2	Half of area 1
7	This zone is flat on an upper terrace. It is sunny and open with good soils. 4.2 acres	9	1,3
8	This zone is a management zone used to block human traffic from a steep slope. It is sunny, sandy, south facing, and steep. .06 acres	1	125 plants in area 1

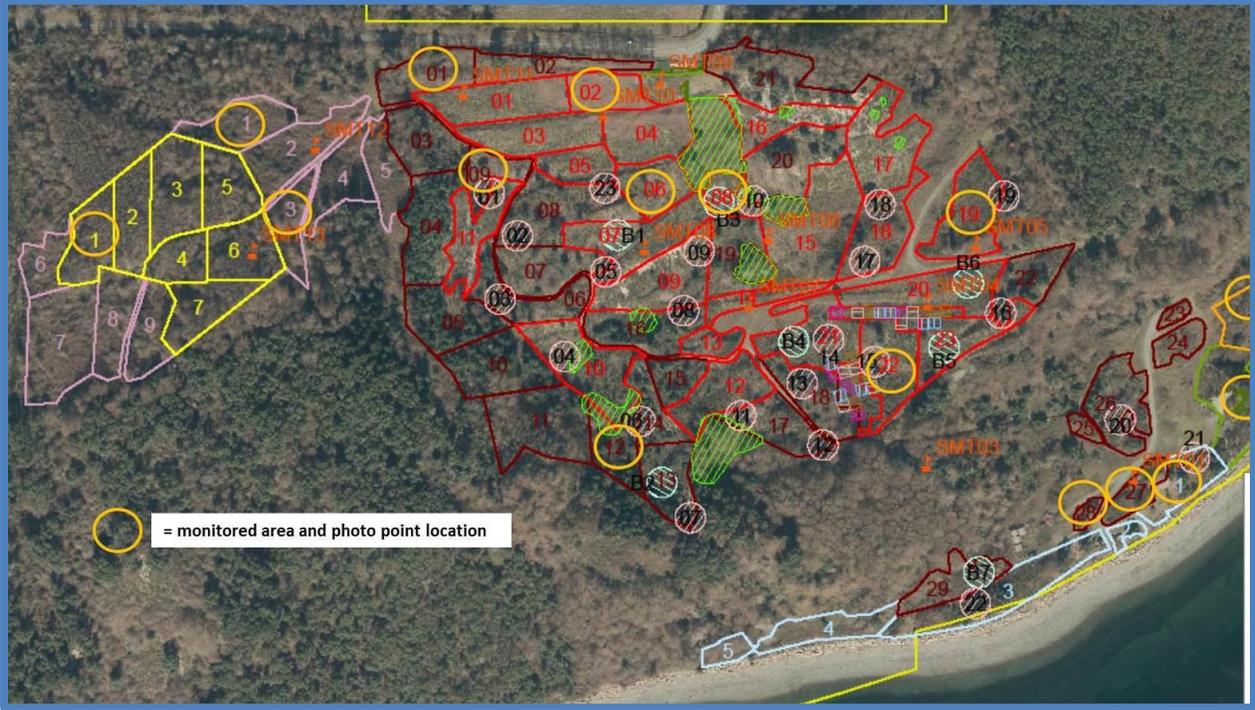


Figure 3. Map of working restoration site at Maury Island Marine Park showing all monitoring activities. Orange circles show areas within zones that were randomly selected to be monitoring areas receiving photo point documentation as well as plant survivability walk through surveys. These areas total 15-25% of the plants planted in each zone. Original map created by Washington Department of Natural Resources with additions by Vashon Nature Center LLC. Refer to figure 2 for full legend.

PHOTO DOCUMENTATION BASELINE PHOTOS:

Long-term photo documentation—101 long-term monitoring photos were taken. All 18 designated monitoring areas within zones were photographed as well as 3 extra sites that were good overall vantage points for the entire site. Photos are on file at Vashon Nature Center LLC and at Washington Department of Natural Resources.



Three examples of long-term photo monitoring points at Maury Marine Park. These photos are from left to right—zone 7, area 1; zone 3, area 1; and zone 2, area 9.

Soil Amendment Plot photos: Photos of every soil amendment plot were taken both at the beginning and at the end of the growing season. Photos are on file at Vashon Nature Center LLC and at Washington Department of Natural Resources.



An example of photos taken of soil amendment plots. This shows plot 3, a fully amended plot, in May 2013 and again in September 2013.

Madrone Hemispherical Canopy photos: Photos of the canopy in each quarter of each of the madrone plots that had madrone trees in them were taken to obtain a quantitative measurement of canopy cover. Photos were taken in June and July. Photos are on file at Vashon Nature Center LLC and also with Washington Department of Natural Resources. They are available on request.



An example of a hemispherical photo of canopy cover. This is madrone plot 18 southwest quarter of the plot.

Herbicide Monitoring photos: overall photos of the herbicide monitoring area were taken when the plots were set up in the end of September 2013. In addition, photos of individual sample plots within the area were taken. Photos are on file with Vashon Nature Center LLC. They are also available in the folder marked herbicide monitoring photos in the full zipfile version of this report.



Overall photo of the herbicide monitoring area on the left. A close up of one of the 1m diameter circular plots with flags marking center and outer diameters of the circle.

SUMMARY AND NEXT STEPS:

Monitoring is an important and often overlooked component to a successful restoration program. It is how we learn and it is an essential step in the adaptive management and ecosystem management cycle. Without monitoring it is impossible to know whether our assumptions about restoration are indeed playing out on the landscape as we'd hoped. Monitoring also helps to create efficiency as restoration goes forward because mistakes are often noticed earlier and can be fixed before they develop into larger problems. Lastly, as we experienced in this initial monitoring effort, citizen science monitoring strengthens connections between restoration managers and the community and increases local resident's sense of stewardship of their local resources. It gives residents an avenue in which to contribute constructively in the adaptive management process.

We encourage future managers of this park to build on the baseline information presented here and to retake these measurements and photos to track change at this site through time.

Specifically, it would be beneficial to monitor the soil amendment plots for a second season as plant survival and growth can be quite different in the second growing season as roots grow below or out of soil amendment zones. Because the madrone forest is such an iconic and ecological resource on this site we encourage future monitoring of madrone plots, additional effort to grow madrone from seed on this site, and experimental designs that test for environmental factors that aid madrone regeneration and survival. If herbicide use is continued we also recommend continued monitoring of run-off. To continue building on this monitoring baseline it is necessary to integrate monitoring activities into the restoration budget as part of the regular cost of running a restoration program.

In addition to establishing a solid baseline set of information, this monitoring effort has answered specific questions about restoration techniques and plant survival and needs. This information has informed restoration decisions for year two of this project. The specific lessons learned are detailed in the companion report to this baseline report entitled: *Maury Island Marine Park First Year Monitoring Results 2013 (VNCb 2013)*.

All baseline data is kept on file at Vashon Nature Center LLC and with King County and Washington Department of Ecology. To request copies of photos and data use the contact information provided in Appendix C.

REFERENCES

Haulman, Bruce. 2013. Personal communication between author and Bruce Haulman of Vashon Maury Island Heritage Museum about the history of land use on Maury Island.

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Miller, T, Bertolotto C, Martin J and L Storm. 1996. Monitoring wetlands: A manual for training volunteers. Produced by Adopt a Beach. September 1996. 172 pp.

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APPENDIX A- LIST OF VOLUNTEER PLANT SPECIES

The following plant species were identified as naturally occurring volunteers in the Maury Island Marine Park restoration area. Species were identified through monitoring activities on site.

No.	Form	Genus	species	Common name	Native	Non-native	Perennial
1	Tree	<i>Alnus</i>	<i>rubra</i>	red alder	x		x
2	Tree	<i>Arbutus</i>	<i>menziesii</i>	madrona	x		x
3	Tree	<i>Populus</i>	<i>trichocarpa</i>	black cottonwood	x		x
4	Tree	<i>Pseudotsuga</i>	<i>menziesii</i>	douglas-fir	x		x
5	Tree/shrub	<i>Salix</i>	<i>sp</i>	willow sp.	x		x
6	Shrub	<i>Buddleja</i>	<i>dauidii</i>	Butterfly bush		x	x
7	Shrub	<i>Crataegus</i>	<i>douglasii</i>	douglas hawthorn	x		x
8	Shrub	<i>Cytisus</i>	<i>scoparius</i>	scotch broom		x	x
9	Shrub	<i>Gaultheria</i>	<i>shallon</i>	salal	x		x
10	Shrub	<i>Holodiscus</i>	<i>discolor</i>	oceanspray	x		x
11	Shrub/vine	<i>Lonicera</i>	<i>hispidula</i>	hairy honeysuckle	x		x
12	Shrub	<i>Mahonia</i>	<i>aquifolium</i>	tall oregon grape	x		x
13	Shrub	<i>Oemleria</i>	<i>cerasiformis</i>	osoberry	x		x
14	Shrub	<i>Rosa</i>	<i>nutkana</i>	nootka rose	x		x
15	Shrub	<i>Rosa</i>	<i>pisocarpa</i>	peafruit rose	x		x
16	Shrub	<i>Rubus</i>	<i>leucodermis</i>	blackcap raspberry	x		x
17	Shrub	<i>Rubus</i>	<i>parviflorus</i>	thimbleberry	x		x
18	Shrub	<i>Rubus</i>	<i>ursinus</i>	trailing blackberry	x		x
19	Shrub	<i>Sambucus</i>	<i>racemosa</i>	red elderberry	x		x
20	Shrub	<i>Symphoricarpos</i>	<i>alubus</i>	snowberry	x		x
21	Shrub	<i>Toxicodendron</i>	<i>diversilobum</i>	poison oak	x		x
22	Forb	<i>Achillea</i>	<i>millefolium</i>	yarrow	x		x
23	Forb	<i>Anaphalis</i>	<i>margaritacae</i>	pearly everlasting	x		x
24	Forb	<i>Artemisia</i>	<i>suksdorfii</i>	coastal mugwort	x		x
25	Forb	<i>Centaurea</i>	<i>sp</i>	Knapweed		x	x
26	Forb	<i>Chenopodium</i>	<i>album</i>	Lambs quarters		x	
27	Forb	<i>Cirsium</i>	<i>arvense</i>	canadian thistle		x	x
28	Forb	<i>Cirsium</i>	<i>vulgare</i>	bull thistle		x	x
29	Forb	<i>Claytonia</i>	<i>sibirica</i>	Miner's lettuce	x		
30	Forb	<i>Crepis</i>	<i>capillaris</i>	Smooth hawksbeard		x	
31	Forb	<i>Digitalis</i>	<i>purpurea</i>	foxglove	x		x
32	Forb	<i>Epilobium</i>	<i>angustifolium</i>	willowherb sp.	x		x
33	Forb	<i>Equisetum</i>	<i>sp</i>	horsetail	x		x
34	Forb	<i>Galium</i>	<i>aparine</i>	Cleavers	x		
35	Forb	<i>Geranium</i>	<i>robertianum</i>	herb Robert		x	

36	Forb	<i>Hypericum</i>	<i>perforatum</i>	st. john's wort		x	x
37	Forb	<i>Hypochaeris</i>	<i>glabra</i>	smooth cat's ear		x	
38	Forb	<i>Hypochaeris</i>	<i>radicata</i>	hairy cat's ear		x?	x
39	Forb	<i>Lamium</i>	<i>purpureum</i>	Purple dead nettle		x	
40	Forb	<i>Ligustrum</i>	<i>sp</i>	privet sp.		x	x
41	Forb	<i>Lupinus</i>	<i>sp</i>	lupine sp.	x?		x
42	Forb	<i>Marah</i>	<i>oreganus</i>	Manroot	x		x
43	Forb	<i>Mysotosis</i>	<i>laxa</i>	Forget me not	x		
44	Forb	<i>Plantago</i>	<i>lanceolata</i>	english plantain		x	x
45	Forb	<i>Plantago</i>	<i>major</i>	common plantain		x	x
46	Forb	<i>Polygonum</i>	<i>sp</i>	polygonum		x	x
47	Forb	<i>Rumex</i>	<i>acetosella</i>	sheep sorrel		x	x
48	Forb	<i>Rumex</i>	<i>crispus</i>	curly dock		x	x
49	Forb	<i>Senecio</i>	<i>vulgaris</i>	Common groundsel		x	
50	Forb	<i>Solanum</i>	<i>nigrum</i>	Black nightshade		x	
51	Forb	<i>Sonchus</i>	<i>asper</i>	spiny sow thistle		x	
52	Forb	<i>Stellaria</i>	<i>media</i>	Chickweed		x	
53	Forb	<i>Tanacetum</i>	<i>vulgare</i>	common tansy		x	x
54	Forb	<i>Taraxacum</i>	<i>officinale</i>	dandelion		x	x
55	Forb	<i>Trifolium</i>	<i>repens</i>	white clover		x	x
56	Forb	<i>Urtica</i>	<i>dioica</i>	stinging nettle	x		x
57	Forb	<i>Vicia</i>	<i>americana</i>	american vetch	x		x
58	Grass	<i>Agrostis</i>	<i>sp</i>	Agrostis sp			
59	Grass	<i>Avena</i>	<i>sp</i>	Avena sp			
60	Grass	<i>Cynosurus</i>	<i>echinatus</i>	Hedgehog dogtail		x	
61	Grass	<i>Fescue</i>	<i>sp</i>	Fescue sp common velvet			
62	Grass	<i>Holcus</i>	<i>lanatua</i>	grass		x	x
63	Grass	<i>Trisetum</i>	<i>sp</i>	Trisetum?			
64	Fern	<i>Polypodium</i>	<i>glychyrrhiza</i>	Licorice fern	x		x
65	Fern	<i>Polystichum</i>	<i>munitum</i>	sword fern	x		x
66	Fern	<i>Pteridium</i>	<i>aquilinum</i>	bracken fern	x		x

The list on the following page is a list of plants occurring at MIMP before restoration began. It was generated by repeated walk throughs of Maury Marine Park in 1997-98. This list was prepared by Jay and Rayna Holtz, Helen Meeker, Mark McCann, and Pat Collier for the Vashon Wildlife Study.

Maury Island Regional Park Vegetation

HM=Helen Meeker, *MM*=Mark McCann, *PC*=Pat Collier, *JRH*=Jay & Rayna Holtz

Trees

western hemlock	<i>Tsuga heterophylla</i>	6/8/97HM,MM,PC,JRH
Douglas fir	<i>Pseudotsuga menziesii</i>	6/8/97HM,MM,PC,JRH
red alder	<i>Alnus rubra</i>	8/30/98JRH
bigleaf maple	<i>Acer macrophyllum</i>	6/8/97HM,MM,PC,JRH
black cottonwood	<i>Populus balsamifera</i> ssp. <i>Trichocarpa</i>	8/30/98JRH
bitter cherry	<i>Prunus emarginata</i>	6/8/97HM,MM,PC,JRH
Pacific madrone	<i>Arbutus menziesii</i>	6/8/97HM,MM,PC,JRH

Shrubs and Small Trees

salal	<i>Gaultheria shallon</i>	6/8/97HM,MM,PC,JRH
hairy honeysuckle	<i>Lonicera hispidula</i>	6/8/97HM,MM,PC,JRH
red elderberry	<i>Sambucus racemosa</i>	6/8/97HM,MM,PC,JRH
common snowberry	<i>Symphoricarpos albus</i>	6/8/97HM,MM,PC,JRH
oceanspray	<i>Holodiscus discolor</i>	6/8/97HM,MM,PC,JRH
baldhip rose	<i>Rosa gymnocarpa</i>	6/8/97HM,MM,PC,JRH
black raspberry (blackcap)	<i>Rubus leucodermis</i>	6/8/97HM,MM,PC,JRH
thimbleberry	<i>Rubus parviflorus</i>	6/8/97HM,MM,PC,JRH
Himalayan blackberry	<i>Rubus discolor</i>	6/8/97HM,MM,PC,JRH
Scotch broom	<i>Cytisus scoparius</i>	6/8/97HM,MM,PC,JRH
Scouler's willow	<i>Salix scouleriana</i>	6/8/97HM,MM,PC,JRH
ceanothus	<i>Ceanothus velutinus velutinus?</i>	6/8/97HM,MM,PC,JRH
beaked hazelnut	<i>Corylus cornuta</i> var. <i>californica</i>	6/8/97HM,MM,PC,JRH
tall Oregon-grape	<i>Mahonia aquifolium</i>	6/8/97HM,MM,PC,JRH
poison oak	<i>Rhus diversiloba</i> (<i>Toxicodendron diversilobum</i>)	6/8/97HM,MM,PC,JRH
butterfly bush	<i>Buddleia davidii</i>	6/8/97HM,MM,PC,JRH

Wildflowers

dockweed <i>sp.</i>	<i>Polygonum (lapathifolium?)</i>	6/8/97HM,MM,PC,JRH
sheep sorrel	<i>Rumex acetosella</i>	8/30/98JRH
curled dock	<i>Rumex crispus</i>	6/8/97HM,MM,PC,JRH
beach pea	<i>Lathyrus japonicus</i>	6/8/97HM,MM,PC,JRH
tufted vetch (bird vetch)	<i>Vicia cracca</i>	6/8/97HM,MM,PC,JRH
giant vetch	<i>Vicia gigantea</i>	6/8/97HM,MM,PC,JRH
lupine <i>sp.</i>	<i>Lupinus ?</i>	6/8/97HM,MM,PC,JRH
fireweed	<i>Epilobium angustifolium</i>	6/8/97HM,MM,PC,JRH
wild carrot (Queen Anne's Lace)	<i>Daucus carota</i>	8/30/98JRH
yellow parentucellia	<i>Parentucellia viscosa</i>	6/8/97HM,MM,PC,JRH
yellow monkey-flower	<i>Mimulus guttatus</i>	6/8/97HM,MM,PC,JRH
smooth hawkbeard	<i>Crepis capillaris</i>	8/30/98JRH

hairy cat's-ear	<i>Hypochaeris radicata</i>	6/8/97HM,MM,PC,JRH
bitter lettuce (wall lettuce?)	<i>(Lactuca muralis?)</i>	6/8/97HM,MM,PC,JRH
silver burweed	<i>Ambrosia chamissonis</i>	6/8/97HM,MM,PC,JRH
(Suksdorf's?) mugwort	<i>Artemisia suksdorfii?</i>	6/8/97HM,MM,PC,JRH
yarrow	<i>Achillea millefolium</i>	6/8/97HM,MM,PC,JRH
pineapple weed	<i>Matricaria discoidea</i>	6/8/97HM,MM,PC,JRH
common tansy	<i>Tanacetum vulgare</i>	6/8/97HM,MM,PC,JRH
entire-leaved gumweed	<i>Grindelia integrifolia</i>	6/8/97HM,MM,PC,JRH
pearly everlasting	<i>Anaphalis margaritacea</i>	6/8/97HM,MM,PC,JRH
bull thistle	<i>Cirsium vulgare</i>	6/8/97HM,MM,PC,JRH
common St. John's wort	<i>Hypericum perforatum</i>	6/8/97HM,MM,PC,JRH
manroot (bigroot/wild cucumber)	<i>Marah oreganus</i>	6/8/97HM,MM,PC,JRH
ribwort (English plantain)	<i>Plantago lanceolata</i>	6/8/97HM,MM,PC,JRH
common plantain	<i>Plantago major</i>	8/30/98JRH
Grasses		
dunegrass	<i>Elymus mollis</i>	6/8/97HM,MM,PC,JRH
common velvet-grass	<i>Holcus lanatus</i>	6/8/97HM,MM,PC,JRH
Ferns		
bracken fern	<i>Pteridium aquilinum</i>	6/8/97HM,MM,PC,JRH
sword fern	<i>Polystichum munitum</i>	6/8/97HM,MM,PC,JRH
Horsetails		
common horsetail	<i>Equisetum arvense</i>	6/8/97HM,MM,PC,JRH
scouring rush	<i>Equisetum hyemale</i>	8/30/98JRH

fn:MauryIslandRegionalParkVegetation8/30/98

APPENDIX B- Volunteer Monitoring Handbook

The following material appeared in the volunteer handbook given to Vashon Nature Center citizen science volunteers. It includes protocols and data sheets for all monitoring activities.

VOLUNTEER HANDBOOK FOR MAURY ISLAND MARINE PARK 2013

Thank you for your participation! You are part of an ambitious and large scale restoration project that will take many years to develop and evolve. Part of the evolution of this project will depend on the valuable information that you are helping us collect on plant survival, growth, and germination as well as site conditions. You are helping us to develop a baseline for the start of this project that will record initial conditions. This enables us to measure change through time and learn lessons about how best to tackle restoration on this difficult site. This is important and time consuming work. It takes a village to grow a restored ecosystem. We hope you enjoy working with like-minded people and meeting new friends as you monitor this park together. We thank you for your interest and willingness to contribute.

Please be aware that there are risks associated with field work at Maury Island Marine Park. Some of the risks you may encounter at this site include steep, slippery, and uneven terrain, cross country travel through brushy vegetation, and soils that may have high arsenic levels. We cannot anticipate or list all the challenges and hazards that are here. For this reason please use your common sense and respect your own limits. You are not required to do anything so choose your activities wisely based on your own sense of what you can safely handle. By participating you are agreeing to take responsibility for your own safety and not to hold Vashon Nature Center LLC responsible for your actions. Have a fun and safe time and thank you for helping us monitor the health of plants!

<u>Volunteer Name</u>	<u>Email</u>	<u>Phone Number</u>

PROTOCOLS

Long-term photo points:

Long-term photo points will be established and permanently marked in sample areas for each of the 8 zones. In addition photos at 3 landscape view locations taken before clearing and planting took place will be continued. Photo frequency: year 1—once at beginning of growing season. Subsequent years annually or bi-annually as funding allows.

Equipment: Data sheet, pen, GPS and camera or GPS camera, compass, site map, stakes for marking photo points (1st time only).

Sampling protocol:

1. Panoramic long-term photos: Go to previously identified 3 photo points. Take photos in all directions. Record bearings on sheet, record GPS location of photo point, mark with wood stakes if not already marked, include description of photo point location.
2. Zone-area photos: Look up sample areas listed for each zone on data sheet named long-term photo record sheet. Locate on map. Locate center of area and mark with stake. Take photos in all 4 cardinal directions and record bearings along which photos were taken. Record location on map, record GPS location, include description of photo point on data sheet log.

Datasheets:

LONG-TERM PHOTO RECORD SHEET

page 1 of 2

Name of photographer:

Date:

Time:

Weather:

Equipment: data sheet, pen, VNC camera, photo point map

photo #'s
on camera
roll (ie. 1-3)

photo #'s on camera roll (ie. 1-3)	4 Compass bearings	Zone #	Area #	Description	GPS X, Y
		1	2		
		1	6		
		1	8		
		1	19		
		1	22		
		2	1		
		2	9		

		2	12		
		2	27		
		2	28		
		2	29		
		3	1		
		4	1		
		5	1		
		6	1		
		7	1		
		7	3		
		8	1		

Panoramic Long-term Photo Points

		P1			
--	--	----	--	--	--

		P2			
		P3			
		P4			
		P5			
		P6			
		extra			

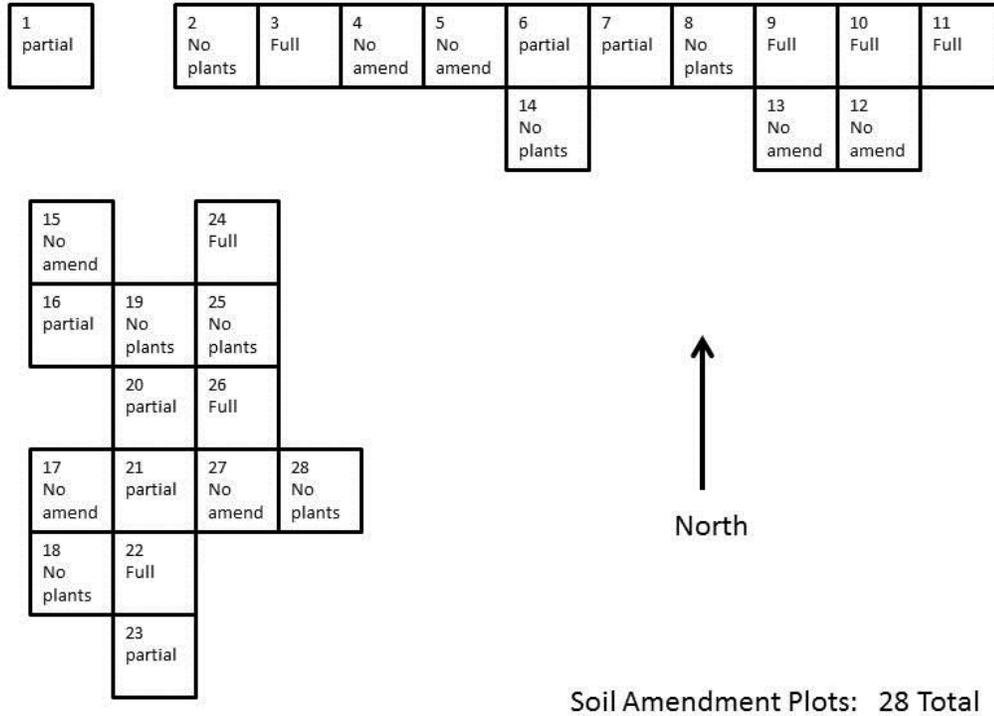
Notes:

Page 2 of 2

Soil Amendments: 28 plots. 4 controls have no plants, 4 controls are planted with no amendment, 4 partial amendment, 4 full amendment.

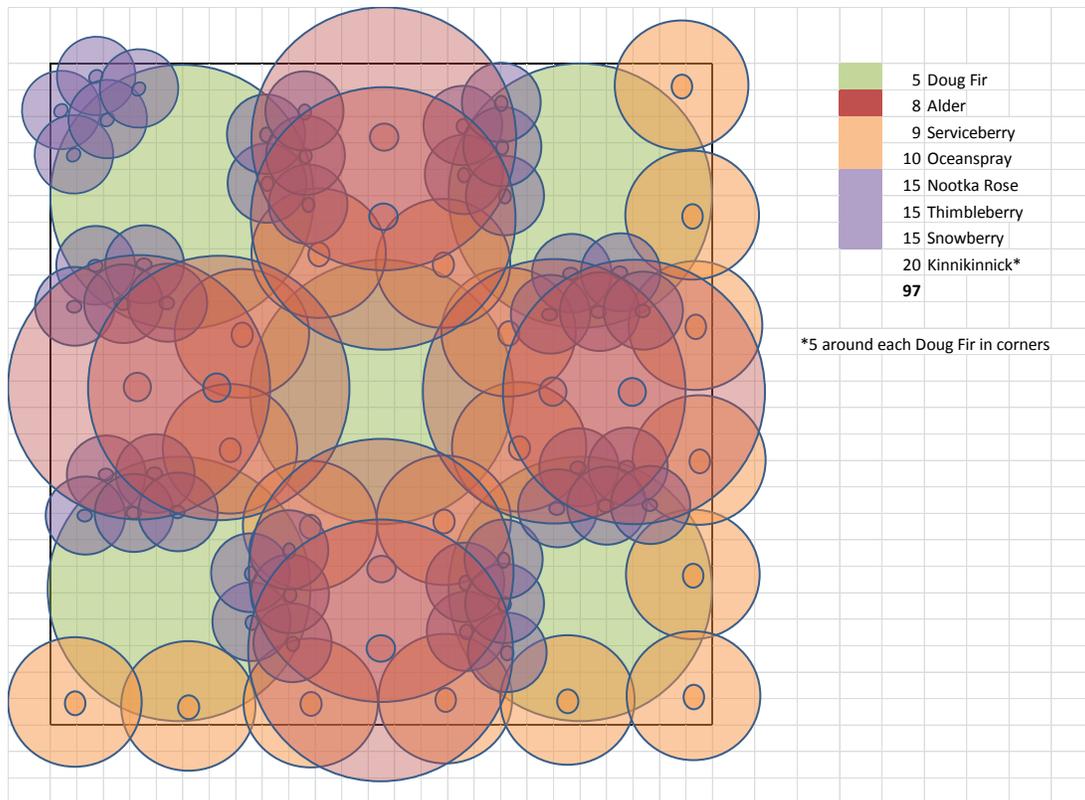
Equipment: plant list, camera, measuring tape, data sheets, clipboard, pen, calipers for DRC, plant tags (first time). Map below shows configuration of plots and identifies which plot got which treatment.

Questions we are answering: What is the effect of soil amendment on both planted plants and naturally regenerating vegetation? Does soil amendment result in an increase in growth of planted plants? (Plant height, width, DRC, % cover) Does soil amendment result in an increase in growth of volunteer plants? (% cover) Does soil amendment result in higher survival of planted plants? (# living, dead, stressed)



The above map shows the configuration of the 28 soil amendment plots on site. Each plot is listed with the amendment treatment it experienced.

Below is a photo of the planting configuration in each plot. This may help narrow down questions about plant identification especially in cases where plants are dormant and only stems are available for identification.



Sampling Protocol: The following measurements will be taken twice-once in May and once in September. Plants are tagged so individuals can be tracked through time.

1. 2 datasheets needed: Soil Amendment Plot Cover Estimates, Individual Plant data.
2. Photograph the entire plot. Stand at the midpoint of the north edge of the plot facing into plot.
3. Walk to the first plant and record plant ID number and species on the Individual Plant datasheet. Plants are numbered as Plot number-plant number. (i.e. plant 6 in plot 8 will be marked with a metal tag reading-- 8-06.)
4. Measure and record for each plant entry: height from ground to tallest point (gather all limbs of the plant together, stretch upward, and grip them at the top so that branches that stretch wide are pointed upwards as well as the mainstem. Record the tallest measurement). Record widest width and width perpendicular to widest. For trees measure and record diameter above the root crown using the calipers (root crown is located just above soil level where root crown gives way to stem). Measure only the living parts of a plant. If the plant has stems that are dead and contain dried buds and no leaves do not measure those parts in the overall height and width measurements. Include stems with no leaves but green buds as these are still living.
5. Record whether plant appears living, dead, or stressed (list cause of stress if applicable for example herbivory, drought). A plant is considered dead if: there are no green leaves on the plant and the buds have withered and dried, all needles are orange or falling off, the plant comes up out of the ground easily when tugged and does not adhere to the soil, the plant stems are brittle when bended. If a plant has no leaves but the buds are firm and pliable and green the plant is dormant but still alive. A plant is considered stressed if more than one third of its leaves

are discolored or fallen, has obvious signs of herbivory, is sprouting mostly from the root crown with dead branches above.

- Estimate % cover using cover class (0-6) for each species over the entire plot including volunteer species. Also include % cover estimates for: bare ground, total cover, cover of volunteers only, and cover of planted plants only. Record the information on the Soil Amendment Plot Cover Estimates data sheet.

Datasheets:

Soil Amendment Plot Cover Estimates

Name:

Date:

Plot Number

Treatment (circle one): not planted, no amendment, local amendment, broadcast
photo # on camera:

Photo?	Y	N	Totals:	Cover class
Species name	Cover class	Notes	Bare ground	
			volunteer	
			planted	
			Comments:	

cover class: 0=less than 1%, 1=1%-5%, 2=6-10%, 3=11-25%, 4=26-50%, 5=51-75%, 6=76-100%

Individual Plant Data: Soil Amendment Plots

Name:

Plot #:

Date:

Equipment: Data sheets, pen/pencil, map, meter tape, dbh tape, camera, plant guide, plant tags (first time), calipers.

Treatment (circle one): not planted, no amendment, local amendment, broadcast

Plant ID	Species	Alive	Dead	Stressed	Cause?	Height (cm)	Widest width (cm)	Perpendicular width (cm)	DRC (cm)
	Doug fir								
	Doug fir								
	Doug fir								
	Doug fir								

	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								
	Kinnikinnick								

Madrone Study: 29 circular plots—6 open, 23 with madrone canopy—30 foot radius. Each plot is divided into quarters on a N-S, E-W axis. 2 quarters were picked randomly to seed, 2 quarters have no seed. Seeded quarters are marked in the field and are clockwise of each rebar marker that has white painted on it.

Equipment: compass, data sheets, measuring tape, camera, densiometer, ruler.

Questions: Do madrone seeds germinate better under existing tree canopies compared to out in the open? (Germination canopy vs. open plots); How do seeded madrones compare to natural regeneration rates of madrones after an area has been cleared? (Compare madrone regeneration in seeded vs. unseeded plots)

Sampling Protocol:

Data sheet name: Madrone baseline, and Madrone seed.

1. Identify and count total number of madrone seedlings (less than 1" diameter stem), saplings (less than 3.5" DBH), and trees (>3.5"DBH) in each quarter. For trees that span quarters estimate %age of the tree falling in each quarter. Record on the Madrone seed data sheet.
2. Visually estimate cover class of each quarter for bare ground, madrone seedlings, saplings, trees, and then by species for other plants. Record on the Madrone baseline datasheet.
3. Use a spherical densiometer to measure canopy cover of each quarter at 1m, 5m, 10m from the center of the plot along a transect that divides the quarter in half. Take these measurements once at the beginning of the first growing season. Record on the Madrone baseline datasheet.
4. Duff measurement (5 random measurements per quadrant estimating the depth in cm of organic layer—depth to solid soil). Take these measurements once at the beginning of the first growing season. Record on the Madrone baseline datasheet.

Hemispherical photos protocol:

1. Place the tripod and camera on a transect down the middle of the quadrant 4 m from circle center . Make sure lens peripheral cover is on. Make sure the pink marker on the hemispherical

lens is pointed to the north direction and the tripod is set to .75m from the ground and levelled. Take 2 photos for each quarter = 8 photos/plot. The person pressing the camera button to take the photo must be below the camera lens to avoid being photographed as part of the canopy! Record photo number, plot quarter and plot number in the rite in rain notebook.

- Avoid taking photos in heavy sunlight. Take photos before 10 am in the morning or on cloudy days.

Datasheets:

Madrone Baseline Measurements

Name:

Date:

Baseline measurement: use a spherical densiometer to measure canopy cover of each quarter at 1m, 5m, 10m from the center of the plot along a transect that divides the quarter in half. Quarter #1 is clockwise to the north marker (marked with rebar) 2 is clockwise to 1 and so on.

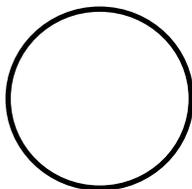
Equipment: spherical densiometer, compass, data sheets, madrone plot map, meter tape, ruler

Plot #	Open	Canopy
Densiometer		
Point	Quarter # 1,2,3,4	
1 m		
5 m		
10 m		

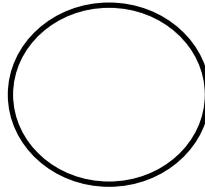
Plot #	Open	Canopy
Densiometer		
Point	Quarter # 1,2,3,4	
1 m		
5 m		
10 m		

Draw Plot and mark quarters with number:

Plot#



Plot #



NOTES/COMMENTS:

Note existing trees and shrubs in above circle plot diagrams. Notice North arrow points up.

madrone page 1 of 4

Plot #:		Duff layer:			Plot #:			
	Quarter #	Quarter #	Quarter #	Quarter #	Quarter #	Quarter #	Quarter #	Quarter #
	1	2	3	4	1	2	3	4
duff depth 1 (cm)								

duff depth 2 (cm)								
duff depth 3 (cm)								
duff depth 4 (cm)								
duff depth 5 (cm)								

Notes: is there anything else you think should be recorded that would influence madrone seedling germination or that makes this plot unique compared to others? Any maintenance needs? Animal sightings?

Madrone Seed Plots

Name:

Date:

Equipment: compass, madrone map, camera, data sheets, pen/pencil

Plot #	Quarter #	Treatment (circle)	(circle)
	1	Canopy Open	Seeded No seed

Number of madrone:			Strata cover	Cover class (0-6)
seedlings	saplings	trees	Bare ground	
			Madrone seedlings	
			Herb/grass	
			Shrub (woody)	
			Tree (over 20 ft)	

Photo of quarter

Y N

NOTES:

Plant Survival

Question: How do different species of planted plants perform in different areas of the site? Zone walk through.

Sampling protocol: The site is divided into 8 planting zones based on wide variation in habitat types. Zones are further divided into areas based on microhabitats w/in each zone. 1-3 areas were randomly picked as samples from each zone so that the total number of plants in the combined areas equals at least 15% of the plants planted in the zone. The two attached pages show which areas in which zone to monitor and how many plants of each species were planted in these areas. You will need to have these

two pages plus the site map to locate the study areas and fill in the number planted column on the data sheet.

Frequency: Conducted at the end of the growing season only for each sample area chosen within each zone.

NOTE: Attempt to find all the plants in each area listed as areas within zones were chosen until 15% of the plants in the entire zone were included. There are two zones that had only one area. In this case visit the suggested number of plants in the designated area that make 15% of the plants planted.

1. For each plant encountered list species and record live, dead, stressed. NOTE: Some dead plants will not be identifiable to species. Record these under the UNID row of the data sheet.
Stressed vs. dead: stressed is anything with some life to it meaning it bends and doesn't snap when bent, there are a few leaves on the bottom or top of the plant, there are no leaves on the plant but it appears to have a healthy root system (i.e. anchored firmly in the soil) and live buds (full and pliable not withered and dried). Be generous, if there is any life call it stressed rather than dead.
Stressed vs. alive: stressed= huge color change compared to healthy examples of the same species, evidence of severe browsing (no top, branches munched), missing at least one third of the leaves. Remember to compare it to the others that you are observing (one red alder to numerous others in that area).

After walking through a zone answer the following questions:

- a. Are there volunteer species? Are any volunteers native?
- b. Are there invasives present?
- c. What kind of invasives? Circle: scotch broom, blackberry, other (list)
- d. List the common and scientific names of any of the volunteer species you know and estimate cover class. Native volunteers as well as non-native.
- e. Did you observe any animals during your survey? If so please list.
- f. Did you notice anything else that may help us manage or maintain this area better? Note any management that you know about - i.e. area watered 3 times this summer, or no watering occurred in this area, area sprayed for blackberries in July 2013, plants mulched or not, compost used to not. Anything that we can informally learn from these observations is great.
- g. Note amount of shade and source (existing native vegetation, sprouting up weeds, etc. Approximately how much of the area is shaded?

Zone	Sample Areas	Plants	Zone	Sample Areas	Plants	Zone	Sample Areas	Plants	Zone	Sample Areas	Plants
1	2	652	2	1	592	3	1	482	4	1	1103
	6	275		9	494		2	0			
	22	989		12	638						
				27	298						
				28	118						
				29	589						
	Sample total	1916		Sample total	2729		Sample total	482		Sample total	1103
	Planted total	11172		Planted total	15095		Planted total	3474		Planted total	2539
	%	17.15002		%	18.07883		%	13.87449626		%*	43.4423
											* do 381 plants in area 1 for 15%

Zone	Sample Areas	Plants	Zone	Sample Areas	Plants	Zone	Sample Areas	Plants	Zone	Sample Areas	Plants
5	1	344	6	1	470	7	1	514	8	1	125
							3	475			0
											0
											0
											0
											0
	Sample total	344		Sample total	470		Sample total	989		Sample total	125
	Planted total	1614		Planted total	1364		Planted total	5634		Planted total	752
	%	21.31351		%*	34.45748		%	17.55414		%	16.62234
					* Do half of area 1						

On the day of monitoring you will be given a custom data sheet with each species planted in the area and the number of plants in each species that were planted. Use this as a guide so that you know if you are finding the expected number of plants.

Have questions? Don't guess please call!!! Bianca Perla, Vashon Nature Center LLC. 206-755-5798, Bianca.vnc@gmail.com

THANK YOU for your work!!!! What we learn from this monitoring will help the plants and animals that live in the park, and benefit the people who will visit and enjoy these native plantings for years to come.

APPENDIX C—Contact information

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