WASHINGTON NATURAL HERITAGE PROGRAM

Evaluating Northern Puget Sound Area Sites for Establishing Populations of Golden Paintbrush (*Castilleja levisecta*)

Prepared for
U.S. Fish and Wildlife Service
Region 1

Prepared by
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and
Peter Dunwiddie

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The US Fish and Wildlife Service
Western Washington Fish and Wildlife Office
through Section 6 funding, Region 1

by

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Executive Summary

The U.S. Fish and Wildlife Service listed golden paintbrush (*Castilleja levisecta*) as threatened under the U.S. Endangered Species Act in 1999 and completed a Recovery Plan for the species in 2000. Recovery criteria include that there be at least 20 stable populations distributed throughout the historical range of the species. Because only eleven populations are currently known, and only three of these would likely meet the criteria for "stable," recovery will require that new populations be established. A step in establishing new populations is to evaluate and select sites with the greatest potential for supporting the species. In this report we evaluate 32 sites in the north Puget Sound area. Our evaluations were based on the assumption that matching the soils, topography, and vegetation characteristics of a potential outplanting site with the characteristics of existing sites provides a predictor for the potential success of a site. To give a more direct measure, experimental plantings were also made to use the response of outplants as an indicator of site suitability.

To evaluate their suitability for establishing new populations of golden paintbrush we visited 29 of these sites to document topographic characteristics, floristic composition, and vegetation condition and to collect soil samples for laboratory analysis. Evaluations are based on similarity to extant sites and the potential for protection under ownership and management prioritizing conservation of golden paintbrush.

With one notable exception, topographic position, vegetation, and site history are quite consistent among the extant populations of golden paintbrush: close to the marine shoreline, exposed to the south and west and fairly droughty conditions, vegetated with a mixture of non-native and remnant native prairie graminoids and forbs, often at the edge of encroaching shrubs and trees, and with no recent history of grazing. The one exception is also the largest northern population, and is possibly the largest population globally. It is atypical in its inland location, greater apparent moisture, and grazing by horses. This anomaly, especially because of its size and vigor, has brought our prior understanding of typical golden paintbrush habitat into question.

In this study, similarity in vegetation to extant sites is evaluated primarily on the basis of floristic composition; quantitative data were collected only on small sub-areas within sites that were reviewed. Native species composition (indicating intrinsic site characteristics), and the diversity of non-native species (indicating site history and likely competition with golden paintbrush), are evaluated. Soils are analyzed for chemical and physical characteristics. Lab results, as well as mapped soil types, are compared between extant and potential sites.

Other researchers have conducted extensive experimental planting with golden paintbrush, interpreting the response of outplants as a measure of site suitability. Because of the value of this experimentation in determining optimum sites for reintroduction of this species, we will include a summary of that work in this report.

After evaluating all of these variables, we rank eleven sites as having the highest potential as recovery sites, fourteen with moderate potential, and six as warranting further study. Nine sites are rejected as unlikely to be suitable. If the twenty populations required for recovery of the species were distributed across the historical range of the species, approximately ten would need to be within the study area of this project.

Acknowledgments

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I would especially like to acknowledge the support of the following individuals, who greatly facilitated the conduct of the work reported here: Ted Thomas and Judy Lantor of the U.S. Fish and Wildlife Service; Rob Fimbel of Washington State Parks; Wendy Coleman, Chris Davis, and Peter Dederich of the National Park Service; Peter Dunwiddie of The Nature Conservancy; Eliza Habegger of the San Juan County Land Bank; the owners of private land at Davis Point; Don Mason of the Island County planning department; and Judith Azreal, Linn Gould, and Therese Wenner.

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1. Introduction

The purpose of this study was to evaluate sites in the northern Puget Sound area of Washington State as potential sites for establishing new populations of *Castilleja levisecta* (golden paintbrush). A previous evaluation was done for sites in the southern Puget Sound area (Caplow and Chappell 2005), based on similarities of potential sites to the single occurrence of *C. levisecta* in that geographical area, at Rocky Prairie Natural Area Preserve. This report follows a similar, though generally more subjective approach, comparing thirty-two potential sites to nine extant occurrences of *C. levisecta* in the northern Puget Sound area. Comparisons were made on the basis of topographic setting, vegetation, soils, and protection potential. Experimental outplantings were also made to use the response of outplants as an indicator of site suitability.

1.1 Federal Listing and Recovery

Castilleja levisecta was listed as threatened under the U.S. Endangered Species Act in 1999, and a Recovery Plan for the species was completed in 2000 (USFWS 2000). The Recovery Plan requires that the following conditions, among others, must be met before delisting can be considered:

1. **There are at least 20 stable populations distributed throughout the historic range of the species. To be deemed stable, a population must maintain a five year running average population size of at least 1,000 individuals.**

2. **At least 15 of these populations are located on protected sites. In order for a site to be deemed protected, it must be either owned and/or managed by a government agency or private conservation organization that identifies maintenance of the species as the primary management objective for the site, or the site must be protected by a permanent conservation easement or covenant that commits present and future landowners to the conservation of the species.**

The Recovery Plan identified establishing viable populations within the historical range of *Castilleja levisecta* as an important component in the recovery of this species. The primary purpose of these efforts is to lessen the probability of extinction and encourage the recovery of a rare plant species through the establishment of new, self-sustaining populations (Pavlik 1996). Because only eleven populations are currently known, and only three of these would likely meet the criteria for "stable", it is necessary to locate additional sites for establishing new populations throughout the historical range of the species.

The Reintroduction Plan for *Castilleja levisecta* (Caplow 2004) described a process for identifying sites for potential reintroduction of this species, based on the success and/or failure of other plant reintroduction efforts with other species. As a general rule, reintroduction efforts for other plant species have been more successful when new sites match existing sites as closely as possible. Characteristics of soils, hydrology, geology, degree of disturbance, and vegetation have been used to compare and evaluate potential reintroduction sites (Heunneke et al. 1986).

Evaluation of southern Puget Sound sites was based primarily on the guidelines in Falk et al. (1996). However, there are difficulties in applying Falk's methods to *Castilleja levisecta*, particularly because this species' habitat requirements cannot be narrowly delineated. While similar in occurring in remnant prairie or prairie-like coastal grasslands, the extant occurrences of *C. levisecta* are quite variable with respect to vegetation (both native and non-native) and topography, and ambiguity exists about hydrological requirements. While Washington populations are generally on quite dry sites, historical collections from Oregon referred to moist habitats, quite unlike the extant northern occurrences. One northern occurrence was atypical among the northern sites in being away from the marine shoreline, reportedly somewhat moist in places, and grazed by horses. This anomaly, especially because of its size and vigor, has brought our prior understanding of typical habitat into question. This population is by far the largest known in the northern part of the range of the species, and possibly the largest known anywhere.

Relying solely on comparison with the few extant sites may have other limitations, particularly in a prairies species, whose habitats were most desirable for agriculture. Prairie habitats were among the earliest and most intensely impacted by European settlement and farming methods. It is possible that the surviving sites are marginal to the optimum habitat, remaining simply because they escaped the plow.

The variable response of experimental *C. levisecta* outplantings further illustrates the difficulty of identifying optimum habitat. Overall, success of outplantings in the southern Puget Sound area (Dunwiddie 2009a) did not correspond well with the assessment of Caplow and Chappell (2005), and plantings in both northern and southern Puget Sound area suggested that microsite characteristics were perhaps more significant than expected (Dunwiddie 2009a, 2009b).

Discerning the best recovery sites is also complicated by profound ecological changes that have occurred since European settlement. Historical prairies were maintained by periodic burning, not usually an element of the ecology of these sites now. Possibly more difficult to manage is the abundance of non-native species now present, particularly rhizomatous grasses. Natural reproduction by *C. levisecta* from seed seems to be extremely limited, in both naturally occurring populations and in experimental outplantings, and researchers do not at this point know what is preventing natural recruitment. It appears that competition from non-native weeds is a major factor. *C. levisecta* is hemiparasitic, and it is possible that haustoria establishment with host plants, little understood, is a variable. Anecdotal observations suggest that annual species are

unsuitable as hosts, and sites that have extensive cover of annual species may be poorly suited for introduction of *C. levisecta*.

1.2 Current and Historical Distribution of *Castilleja levisecta*

Historically, *Castilleja levisecta* was reported from more than 30 sites in the Puget Trough of Washington and British Columbia, and it was known from as far south as the Willamette Valley of Oregon (Hitchcock et al. 1959, Sheehan and Sprague 1984, Gamon 1995). At least fourteen historical sites were recorded in Island, San Juan, Clark, Pierce, King, Jefferson, and Skagit Counties (Gamon 1995). A 1984 assessment found that the plant had been extirpated from more than 20 historic sites, including all Oregon sites (Sheehan and Sprague 1984, Gamon 1995). Figure 1 is a map of all known extant and historical occurrences of *C. levisecta*, and Table 1 includes summary information about the occurrences in the northern Puget Sound area. Appendix A includes all available census data from all known wild populations of *C. levisecta*. Appendix B includes more detailed information about each extant northern Puget Sound area occurrence.

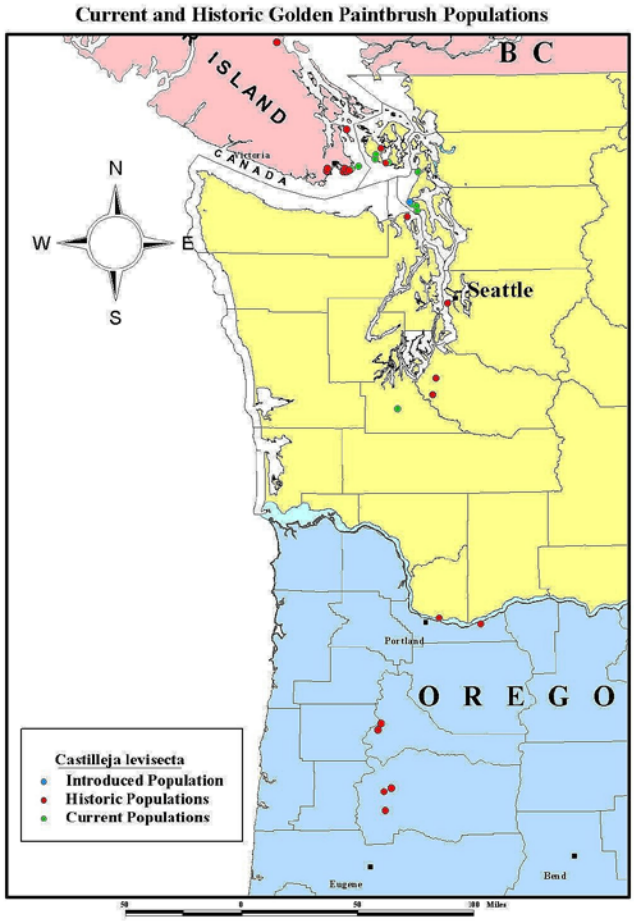

Figure 1. Map of historical and extant *Castilleja levisecta* occurrences

Table 1. Extant northern Washington *Castilleja levisecta* populations. If census was not made in 2009 the most recent count is given, with the year in parentheses.

Location	County	Island	Ownership	2009 count*
Naas/ Admiralty Inlet NAP	Island	Whidbey	Whidbey Camano Land Trust;WDNR conservation easement	241
Ft. Casey	Island	Whidbey	WA State Parks	1,497
West Beach	Island	Whidbey	Private	75
Ebey's Landing	Island	Whidbey	The Nature Conservancy	601 (in 2008)
Forbes Point	Island	Whidbey	U.S. Navy	71
Long Island	San Juan	Long	Private	154 (in 2002)
False Bay middle	San Juan	San Juan	Private	33
False Bay south	San Juan	San Juan	Private	407
San Juan Valley	San Juan	San Juan	Private	7,528 (in 2003)

*counts are of individual flowering plants

As shown in Figure 1 (above) two extant populations of *Castilleja levisecta* occur in British Columbia, Canada, on small islands near Victoria. Historically, *C. levisecta* was documented from nine sites on southeastern Vancouver Island, and on two adjacent islands. All but the two island populations have been extirpated or are of unknown status, believed to have been extirpated (Ryan and Douglas 1994). Figure 2 (below) shows all extant occurrences in northern Washington.

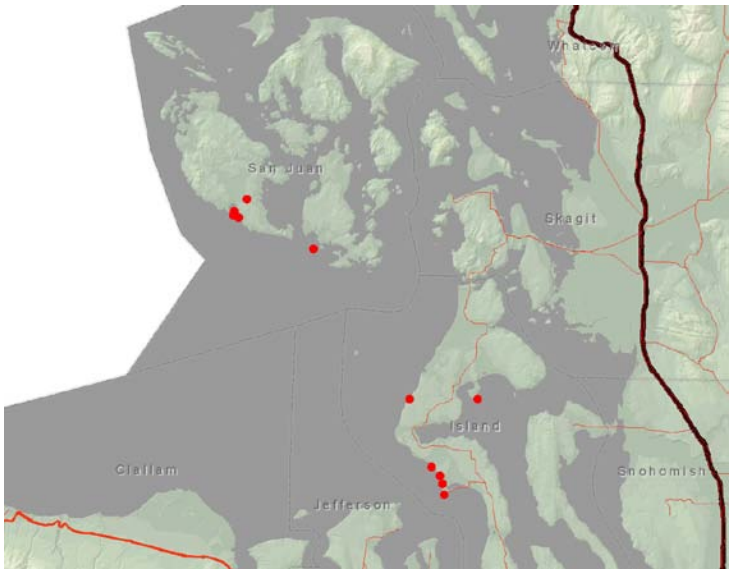

Figure 2. Map of northern extant *Castilleja levisecta* occurrences

2. Methods

2.1 Overall Approach to Site Evaluation

Thirty-two sites were evaluated as potential reintroduction sites for *Castilleja levisecta* in the northern portion of the Puget Sound area, within Washington State. Of these, twenty-nine sites were visited by Washington Natural Heritage Program (WNHP) staff. Boulder Island and Colville Island were visited in 2005 as part of a University of Washington and Nature Conservancy floristic study of small San Juan Islands. Experimental outplanting sites on Waldron and Shaw Islands will also be discussed here.

Generally this analysis followed the sequence of steps below, similar to the method presented in Caplow (2004) and Caplow and Chappell (2005):

1. Habitats of the natural populations of *Castilleja levisecta* were characterized on the basis of topographic characteristics, vegetation, soils, and potential for protection.

2. A list of potential sites to review in the northern Puget Sound area was prepared, based on consultation with the species technical team and the Northern Puget Sound Prairie Working Group.

3. Field reconnaissance was made of potential reintroduction sites to evaluate them for similarity to sites supporting natural *C. levisecta* populations.

4. A ranking process was developed and applied to a list of the most promising potential reintroduction sites, based on similarity to extant *C. levisecta* sites and on the potential for protection of the species.

2.2 Characterization of Extant *Castilleja levisecta* occurrences

Ten extant populations of *Castilleja levisecta* are known at the present time in Thurston, Island, and San Juan Counties in Washington. In 2004 the Washington Natural Heritage Program completed an initial characterization of geology, soils, topography, aspect, hydrology, associated species, and plant community types at all known *Castilleja levisecta* populations (Chappell and Caplow 2004), and we draw heavily on this earlier work in evaluating new sites at which to establish populations. At extant sites, we expanded the species lists and made observations of the topographic characteristics of these sites. In San Juan Valley, on San Juan Island, a population occurs in a quite different habitat. Because access is not currently available, our assessment of

this site was based on WNHP field notes from 2001 and on an initial report by Domico and Bradley (2000). Applegate (2006) examined vascular plant species in close association with *Castilleja levisecta* at the Naas/Admiralty Inlet Natural Area Preserve on Whidbey Island, and her work has also helped to characterize the habitat conditions under which this species is currently known.

The locations and general characteristics of extant sites are presented above in Table 1 and Figure 2.

2.3 Review of Potential Reintroduction Sites

Review of potential reintroduction sites was based primarily on one or more site visits to observe topographic conditions, record data on vegetation composition and condition, and collect soil samples for laboratory analysis.

We tried to visit as many sites as possible - extant, historical, outplanting, or potential - in the time available to us. Most site visits took place in 2007, 2008, and 2009. We visited Protection Island in 2006 and Boulder Island in 2005. These sites, as well as Colville Island, were visited by University of Washington and Nature Conservancy collecting forays in 2005 and 2007; they are included in this report because of their U.S. Fish and Wildlife Service ownership and their location close to the extant range of *Castilleja levisecta*.

In order to compare with extant sites, we collected information on the following characteristics:

- **Topographic characteristics**
- **Vegetation and species composition**
- **Soil characteristics**
- **Potential for protection**

The list of sites to be reviewed in this study, presented in Table 2, was generated through conversations with the *Castilleja levisecta* technical team, the Northern Puget Sound Prairie Working Group, and in review of public ownership in the arc of land around the eastern end of the Strait of Juan de Fuca. All known northern occurrences of *C. levisecta* occur in this general area. Review of sites on private land occurred when we had landowner permission to visit the property. Figure 3 is a map of the sites that we reviewed.

Topographic characteristics: Observations were made on the general characteristics of the site, including the proximity of the shoreline, slope, aspect, position of herbaceous vegetation relative to the forest or shrubland edge, apparent hydrology, and likely history of grazing.

Table 2. Sites evaluated for potential establishment of *Castilleja levisecta*. Sites are generally arranged from northwest to southeast.

Site	County	Island	Ownership
English Camp, Young Hill	San Juan	San Juan	National Park Service
Westside Scenic Preserve	San Juan	San Juan	San Juan County Land Bank
Kanaka Bay	San Juan	San Juan	Private
Middle False Bay	San Juan	San Juan	Private
Frazer Homestead Preserve	San Juan	San Juan	San Juan County Land Bank
American Camp	San Juan	San Juan	National Park Service
Cattle Point and Mount Finlayson	San Juan	San Juan	DNR, Federal
Pt. Disney, Waldron	San Juan	Waldron	TNC
Turtleback Preserve	San Juan	Orcas	San Juan County Land Bank
Mt. Constitution	San Juan	Orcas	State Parks
Cedar Rock Preserve	San Juan	Shaw	U.W.
Davis Point, Lopez	San Juan	Lopez	Private
Shark Reef	San Juan	Lopez	San Juan County Parks
Iceberg Point	San Juan	Lopez	BLM
Colville Point	San Juan	Lopez	BLM
Boulder Island	San Juan	Boulder	USFWS
Colville Island	San Juan	Colville	USFWS
Huckleberry Island	Skagit	Huckleberry	State Parks
Fishtown	Skagit	mainland	Private
Kiket Island	Skagit	Kiket	Private
Lighthouse Point, Deception Pass SP	Skagit	Fidalgo	State Parks
Rosario Head, Deception Pass SP	Skagit	Fidalgo	State Parks
Goose Rock, Deception Pass SP	Island	Whidbey	WA State Parks
Perego Lagoon, Ebey's Bluff	Island	Whidbey	TNC
National Park Service Overlook	Island	Whidbey	National Park Service
Sherman Farm Field	Island	Whidbey	TNC
Fort Ebey, gun placements	Island	Whidbey	State Parks
Fort Ebey, north end	Island	Whidbey	State Parks
Smith Prairie	Island	Whidbey	Pacific Rim (Au Sable) Institute
Protection Island	Jefferson	Mainland	USFWS
Kah Tai Prairie	Jefferson	Mainland	City of Port Townsend
Fort Flagler	Jefferson	Marrowstone	WA State Parks

Vegetation and species composition: Our approach to comparing vegetation between extant and potential sites was to first make general observations of the plant communities present. We determined that it would be very difficult within the scope of this reconnaissance to quantify

vegetation at the scale of each site that would accurately represent the diversity of microsites within a site. Consequently we did not collect quantitative data for sites overall, but in some cases we recorded percent cover of dominant species in smaller plots, subjectively chosen on the apparent similarity to extant occurrences of *Castilleja levisecta*, of a few square meters in area, that might serve as experimental planting sites. Our approach was to develop a floristic profile of each existing population, as complete as time allowed, for comparison with potential reintroduction sites and compare them as a measure of similarity. Outplanting experimentation in Oregon has suggested that predominance of non-native species, particularly annuals, was a fairly good predictor of low success with outplantings (Lawrence 2005, Lawrence and Kaye 2009).

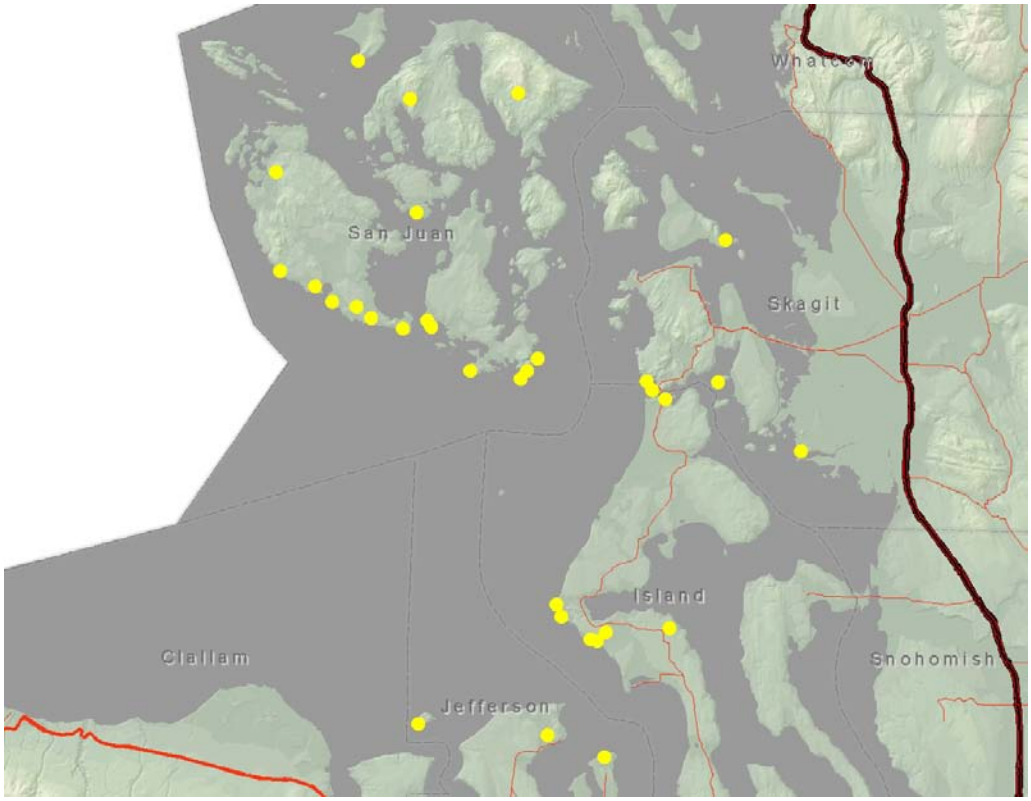

Figure 3. Map of sites evaluated for potential *Castilleja levisecta* establishment

Soil characteristics: Soil samples were collected according to the methodology used in Chappell and Caplow (2004): A 1x1 m plot was subjectively chosen central to the area being assessed. Five small holes were dug with a steel trowel, one at each of the corners and in the middle of the plot, and approximately 100 cm^3 of soil was taken from each hole, at a depth of approximately 15 cm below the surface. Gravel was not removed from the samples. The five sub-samples were

mixed to form a composite sample from each plot, and stored in plastic bags. Between one and four composite soil samples were collected at each of six sites. See Table 3 below.
Soil samples were sent to A&L Agricultural Laboratories for chemical and physical analysis. The lab tests were chosen on the basis of the analyses that were done at extant sites (Chappell and Caplow 2004) and on recommendations of colleagues working more closely with using soils to characterize sites (personal communications, Tom Kaye of Institute for Applied Ecology and Darlene Zabowski, soil scientist at the University of Washington). The following chemical and physical analyses were made:

- Organic matter
- Estimated nitrogen release
- Phosphorus (weak Bray and sodium bicarbonate-phosphorus)
- Extractable cations
- Cation exchange capacity
- Carbon to nitrogen ratio
- Zinc, manganese, iron, copper, and boron
- Texture

Table 3. Locations of soil collections from potential *Castilleja levisecta* outplanting sites

Potential *Castilleja levisecta* reintroduction sites		
date	**sample #**	**location**
20-May-08	CALE-1	San Juan Island, Frazer Homestead Preserve
20-May-08	CALE-2	San Juan Island, Westside Scenic Preserve
20-May-08	CALE-3	San Juan Island, Westside Scenic Preserve
20-May-08	CALE-4	San Juan Island, Cattle Point NRCA
21-May-08	CALE-5	Lopez Is., Iceberg Point
21-May-08	CALE-6	Lopez Is., Davis Point mowed area
17-Jun-08	CALE-7	Orcas Is, grassland on Mt. C, lower site just above trail
17-Jun-08	CALE-8	Orcas Is, grassland on Mt. C, site #2 to the east
18-Jun-08	CALE-9	Lopez Is., Iceberg Point, dry site east of *Sericocarpus rigidus*
18-Jun-08	CALE-10	Lopez Is., Iceberg Point, west end
18-Jun-08	CALE-11	Lopez Is., Iceberg Point, tall Fescue area
18-Jun-08	CALE-12	Lopez Is., Iceberg Point, area closer to the water west of the monument
20-May-09	CALE-13	San Juan Island, Frazer Homestead Preserve

Potential for protection: For practical reasons, access was generally more obtainable for public land, though we did evaluate promising private properties where access was granted. We would not generally anticipate undertaking establishment of a recovery population on private land, but these sites were evaluated because we understand that funds may be available for acquisition of land for conservation, and because of the potential for conservation easements and management agreements between privateland owners and public or private conservation organizations. The Recovery Plan for *Castilleja levisecta* (USFWS 2000) specifies that fifteen of the stable populations required for delisting be permanently protected, and the potential for eventual management that would convey legal and permanent protection of the species was a major consideration in evaluating sites as for potential establishment. In most cases the land that was reviewed was already publically owned, by federal, state, or county agencies, and had at least the potential for protection if outplanting efforts were conducted there.

2.4 Outplanting Experimentation

Extensive experimental planting with *Castilleja levisecta* has been done throughout the range of the species (Dunwiddie 2009a, 2009b, Lawrence 2005, Lawrence and Kaye 2009, Pearson and Dunwiddie 2006). One objective of this work, especially the most recent efforts by Dunwiddie (2009a, 2009b) was to use the response of outplants as an indicator of reintroduction site suitability. His basic approach was to select potential recovery sites, primarily on general similarity to extant *C. levisecta* sites and the potential for protection, plant an array of seedlings, and allow the vigor of the plants themselves to serve as an indicator of site suitability, both on the landscape scale as well as microsite scale. Dunwiddie evaluated a variety of variables, including site pre-treatments, associated vegetation, soil characteristics, and seed source. Much of this experimentation has occurred on public land, or on other sites where conservation of the species would be a management priority. Table 4 presents a summary of the number of seedlings planted at each site in 2006 and 2007. See Appendix C for a summary of compiled outplanting data from throughout the range of the species.

Table 4. Summary of *Castilleja levisecta* outplantings in the northern Puget Sound area. Numbers are plugs planted at each site. Augmentation plantings are not included.

outplanting site	**ownership**	**outplanting**	
		2006	**2007**
Smith Prairie, Whidbey Island	Au Sable Institute	100	-
Smith Prairie, Whidbey Island	Au Sable Institute	-	991
Cedar Rock Preserve, Shaw Island	University of Washington	-	140
Bitte Baer Preserve, Waldron Island	The Nature Conservancy	-	96
Prairie Overlook, Whidbey Island	National Park Service	216	-
Perego's Bluff, Whidbey Island	The Nature Conservancy	610*	-

*Other small outplantings were made here prior to 2006

2.5 Ranking Potential Sites for Establishing Populations

Our approach to ranking potential sites for establishing new *Castilleja levisecta* populations was subjective, because the variation among extant sites, differences in presence of non-native species as reflected in site history, and anomalous characteristics of the largest northern population (San Juan Valley) made quantitative comparison unfeasible. The challenge was made greater by our awareness that with the likelihood of pronounced climatic change, location of optimum habitat may shift. Our understanding of prairies overall is that they historically expanded and contracted in response to climatic change, vegetation succession and migration, and human activity. In general, our search image, consistent with most extant sites, was of a shoreline site with a strong component of native prairie species, a history of only moderate disturbance, a site at the edge of encroaching shrubs and trees (or possibly currently occupied by woody plants), and, most importantly for practical and long term reasons, sites that were publically owned or that had the potential for protection. At the same time, because the characteristics of the large San Juan Valley population differed from the norm for the other sites, we had to take a broader approach in evaluating the sites we considered. Our objective was to develop a list of between ten and fifteen of the most promising sites throughout the northern Puget Sound area for eventual stable populations of *Castilleja levisecta*. We compared associated species, topography and landscape position, and soil characteristics of sites being evaluated with extant *C. levisecta* populations. Ownership that would eventually allow for management of the species was given priority in our evaluation.

We did not attempt to produce an "index of similarity" for northern Puget Sound area sites, as Caplow and Chappell (2005) did for southern Puget Sound area sites, primarily because extant sites varied so markedly and the sites that we evaluated were often large and diverse. However, we did find it useful to create a table for compiling the subjective evaluations, based on topographic position, vegetation type and condition, floristic similarities, and the potential for protected status. The latter would include ownership or management that would identify maintenance of *Castilleja levisecta* as the primary management objective for the site. Using high, medium, or low to describe the apparent relative suitability of each site, with regard to each variable, rather than a quantitative value, better reflected the subjective nature of our evaluation. Table 5 provides a discussion of how we evaluated each of the variables.

Two floristic calculations are included in Table 11. The first is the percentage of all species present at each potential site that are native. This provides an indicator of site condition and disturbance. The second calculation is the percentage of the species in Table 7 (native species most common among the extant *Castelleja levisecta* populations) at each potential site. This provides an indicator of the vegetation native to the site, irrespective of disturbance history.

Table 5. Ranking criteria for potential northern *Castilleja levisecta* establishment sites. These explanations pertain to the values in Table 11.

Topographic characteristics		
High	Level or nearly coastal bluff, or level interior area historically in prairie; neither excessively xeric nor mesic conditions.	Because of the highly variable position of the extant sites, this variable was typically ranked high.
Medium	Either higher elevation than extant sites or outside of the arc of extant populations.	We evaluated sites higher in elevation than the extant sites, and also away from south and west sides of the arc of islands that face the Straits of Juan de Fuca.
Low	Appearing considerably drier than extant sites, with extreme drainage, or steep slopes.	Some extant populations, particularly at Ebey's landing, appear fairly vigorous, but their position on an eroding bank above salt water appears precarious.
Vegetation and species composition		
High	Dominated by native prairie forbs and graminoids, at edge of shrub cover.	Non-native species are likely present, but not a high proportion. Some of the best sites may have prominent shrub cover that can be controlled by mowing, releasing native forbs and graminoids.
Medium	Native species are prominent, but non-native species are dominant.	These are intermediate sites, with a history of fairly high disturbance, but with a strong component of native species present, and a recognizable native plant community.
Low	Native community is unrecognizable, site is nearly entirely non-native.	These sites would typically be previous agricultural fields with a high cover of non-native species, including annuals.
Potential for protection		
High	Conservation of *C. levisecta* has been identified as a management priority.	These sites include public or private Natural Area Preserves, Areas of Critical Environmental Concern, or other sites actively managed to give priority to conservation of *C. levisecta*.
Medium	Publically owned but with multiple management objectives, conservation of *C. levisecta*, as well as other use, such as recreation	Typically public park land, where conservation is one priority, but where there is an ongoing potential for disturbance by human use, or where multiple management objectives may conflict.
Low	Private land with no formal protection	These sites may be afforded some protection by owners, but the status at the present time is provisional and temporary

3. Results

3.1 Characteristics of extant *Castilleja levisecta* occurrences

Topographic characteristics: With the exception of the San Juan Valley population, the northern Puget Sound area occurrences of *Castilleja levisecta* are in similar landscape positions: at the edge of the marine shoreline, usually on relatively level ground (but sometimes extending down onto eroding banks), in open prairie habitat at the edge of encroaching of trees and shrubs. Native prairie species and varying cover of non-native plant species characterize the extant *C. levisecta* sites, which are all extremely patchy and encompass a range of plant associations (See Chappell 2006). None of the sites have current grazing by domestic livestock, though they are all likely to have had historical grazing by sheep and cattle. The discovery of the San Juan Valley population has broadened our concept of what might be suitable habitat for this species. This site is a mile from salt water, reportedly includes wetter areas, and is currently grazed by horses. This site is by far the largest northern occurrence of *C. levisecta*, and possibly the largest globally. Access to this private property was not obtained for this project; our assessment was based on previous WNHP staff visits (2001) and an initial report by Domico and Bradley (2000).

Vegetation and species composition: Remnant prairie species characterize the extant *C. levisecta* sites; they all also have varying coverage of non-native species. The sites are all extremely patchy. Table 6 (below) gives a floristic profile of extant *Castilleja levisecta* occurrences, listing the common species, both native and non-native, that were present at each site. Frequency and constancy data were calculated to derive the most common species present, in order to later compare with potential sites. Table 7 gives native species only, as an expression of the intrinsic characteristics of the site without the variable of non-native species. All species recorded at these sites are listed in Appendix D.

Soil characteristics: Extant San Juan island sites were in poorly drained to imperfectly drained soils of the basins and low glacial till plains on glaciated uplands, the Bellingham-Coveland-Bow association. The historical occurrence on Cattle Point would have been in somewhat excessively drained soils on glaciated uplands and outwash plains, the San Juan-Everett association. The now extirpated recent occurrence on Davis Point and the extant Long Island occurrence are on moderately well drained to well drained soils of the glacial till plains and rocky uplands (Schlots et al. 1962). So these broad categories do not shed much light on soil associations. Noteworthy, however, was that the coastal occurrences on San Juan were on the same soil type as in San Juan Valley, though these sites are topographically very different. Appendix B includes mapped soil types of extant *Castilleja levisecta* occurrences. Soils at extant sites were most often sandy loam or loamy sand. Ebey's landing was atypical in growing in sand, and Forbes Point (southeast plot) and the central False Bay site each had higher clay components (27 and 25 percent, respectively). Tables 8 and 9 give a summary of laboratory analyses of selected characteristics of soils from the northern extant sites in Washington, for the purpose of comparing with potential *C. levisecta* reintroduction sites (A&L Western Agricultural Laboratories 2009).

Table 6. Common plant species associated with *Castilleja levisecta* occurrences

Species name	origin	Frequency (out of 9)	Constancy (%)
Achillea millefolium var. *occidentalis*	native	9	100
Castilleja levisecta	native	9	100
Festuca rubra	native	8	89
Luzula comosa	native	8	89
Poa pratensis	introduced	8	89
Pteridium aquilinum var. pubescens	native	8	89
Rosa nutkana	native	8	89
Rubus ursinus ssp. *macropetalus*	native	8	89
Holcus lanatus	introduced	7	78
Hypochaeris radicata	introduced	7	78
Rumex acetosella	introduced	7	78
Sanicula crassicaulis var. *crassicaulis*	native	7	78
Symphoricarpos albus	native	7	78
Vicia hirsuta	introduced	7	78
Vicia sativa	introduced	7	78
Bromus carinatus	native	6	67
Fritillaria affinis var. *affinis (F. lanceolata)*	native	6	67
Plantago lanceolata	introduced	6	67
Taraxacum officinale	introduced	6	67
Agrostis spp.	introduced	5	56
Aira caryophyllea	introduced	5	56
Anthoxanthum odoratum	introduced	5	56
Bromus hordeaceus	introduced	5	56
Carex tumulicola	native	5	56
Lomatium nudicaule	native	5	56
Mahonia aquilifolium	native	5	56
Myosotis discolor	introduced	5	56
Solidago lepida var. *salebrosa*	native	5	56
Allium acuminatum	native	4	44
Cerastium arvense ssp. *strictum*	native	4	44
Erigeron speciosus var. *speciosus*	native	4	44
Galium aparine	native	4	44
Grindelia stricta var. *stricta*	native	4	44
Trifolium dubium	introduced	4	44
Vicia americana ssp. *americana*	native	4	44

Table 7. Common native plant species associated with *Castilleja levisecta* occurrences

Species name	origin	Frequency (out of 9)	Constancy (%)
Achillea millefolium var. *occidentalis*	native	9	100
Castilleja levisecta	native	9	100
Festuca rubra	native	8	89
Luzula comosa	native	8	89
Pteridium aquilinum var. *pubescens*	native	8	89
Rosa nutkana	native	8	89
Rubus ursinus ssp. *macropetalus*	native	8	89
Sanicula crassicaulis var. *crassicaulis*	native	7	78
Symphoricarpos albus	native	7	78
Bromus carinatus	native	6	67
Fritillaria affinis var. *affinis (F. lanceolata)*	native	6	67
Carex tumulicola	native	5	56
Lomatium nudicaule	native	5	56
Mahonia aquilifolium	native	5	56
Pseudotsuga menziesii	native	5	56
Solidago lepida var. *salebrosa*	native	5	56
Allium acuminatum	native	4	44
Cerastium arvense ssp. *strictum*	native	4	44
Erigeron speciosus var. *speciosus*	native	4	44
Galium aparine	native	4	44
Grindelia stricta var. *stricta*	native	4	44
Vicia americana ssp. *americana*	native	4	44

3.2 Characteristics of Potential Reintroduction Sites

The thirty-two sites that were evaluated in this study are listed above in Table 2. Descriptions and details of these sites are presented in Appendix E. Plant species present at each site are presented in Appendix F. Photos of selected sites are included in Appendix G.

The results of laboratory analysis of soil samples collected at potential *Castilleja levisecta* sites are summarized in Tables 8 and 9, with average and maximum and minimum values for the extant sites included for comparison. The complete soil reports for all samples collected are included in Appendix H.

Table 8. Chemical soil characteristics of potential *Castilleja levisecta* reintroduction sites, with summary values from extant sites in northern Washington. V=very, L=low, M=medium, H=high. Bold values are most common, values in parentheses occurred in one sample.

Site		organic matter (%)		P (ppm)		K (ppm)		Mg (ppm)		Ca (ppm)		Na (ppm)		pH
Frazer Homestead Preserve		15.9	VH	29	H	167	L	280	L	1431	VL	34	VL	4.5
Westside Scenic Preserve		19.6	VH	29	H	213	L	713	H	2197	L	182	L	5.2
Westside Scenic Preserve		16.9	VH	26	H	175	L	558	M	3180	L	61	VL	5.5
Cattle Point NRCA		6.0	VH	31	H	209	M	240	M	1241	L	55	L	5.2
Iceberg Point		19.3	VH	26	H	304	M	905	VH	1781	L	269	H	6.1
Davis Point mowed area		17.5	VH	20	M	240	M	584	H	2381	L	81	L	5.7
Mt. Constitution, lower site		14.9	VH	21	M	65	M	68	L	490	VL	19	L	4.5
Mt. Constitution, site #2		13.8	VH	27	H	96	L	152	L	1461	L	25	VL	4.8
Iceberg Point, dry eastern site		19.9	VH	22	M	74	M	191	M	677	L	55	L	5
Iceberg Point, west end		7.1	VH	34	H	90	M	235	H	462	VL	110	H	4.9
Iceberg Point, tall Fescue area		17.1	VH	45	VH	341	M	680	H	1566	VL	119	L	5.0
Iceberg Point, close to water west of the monument		15.5	VH	39	H	302	M	831	VH	1523	VL	224	M	5.1
Frazer Homestead Preserve		17.9	VH	44	VH	136	L	410	M	1832	VL	48	VL	4.7
Average of potential sites		15.5		30		186		450		1556		99		5.1
Extant *C. levisecta* sites	Ave.	10.3	**VH** (L)	8.1	**VL**-L	132	L-**M** (H)	356	(L) M-**VH**	1126	**L**-VL (VH)	84.3	(VL) L-**M** (H)	6.0
	Min.	1.5		4		44		311		156		32		5.2
	Max.	24.4		17		378		725		3412		180		6.5

Table 9. Physical soil characteristics of potential *Castilleja levisecta* reintroduction sites

Site		% sand	% silt	% clay	soil texture
Frazer Homestead Preserve		71	14	15	sandy loam
Westside Scenic Preserve		71	18	11	sandy loam
Westside Scenic Preserve, upper site		77	10	13	sandy loam
Cattle Point NRCA		73	16	11	sandy loam
Iceberg Point		49	31	19	loam
Davis Point mowed area		57	26	17	sandy loam
Mt. Constitution, lower site		61	21	18	sandy loam
Mt. Constitution, site #2		64	19	17	sandy loam
Iceberg Point, dry eastern site		69	14	17	sandy loam
Iceberg Point, west end		62	21	18	sandy loam
Iceberg Point, tall Fescue area		64	19	17	sandy loam
Iceberg Point, area closer to the water west of the monument		67	21	12	sandy loam
Frazer Homestead Preserve		71	13	16	sandy loam
Soil sample mean values		66	19	15	
Extant *C. levisecta* sites	Ave.	69	19	12	
	Min.	43	4	5	
	Max.	91	30	27	

In general, as Tables 8 and 9 show, the soils of the potential sites were typically within the range of soils at extant sites. Organic matter was very high at all sites that were analyzed, as it was in most extant sites. Ebey's landing, with its high sand component, stood out as unusual among the extant sites in having low organic matter. In both extant and potential sites, potassium was usually in the middle range, with occasional outliers of low or high. Magnesium, calcium, and sodium tended to be variable in both extant and potential sites.

The percent of magnesium cation saturation was highly variable; extant sites were more often very high, but included one site with a low value and several with medium or high values. The potential sites also varied, but they most often had high or medium values.

The percent of calcium cation saturation was somewhat variable at extant sites, typically low or very low, most often low. Potential sites were similar in having low and very low saturation of calcium.

The percent of sodium saturation was highly variable in both extant and potential sites, including values ranging from very low to high. Extant sites were more often in the medium range, with several low, and potential sites more often in the low range, with several very low. Level of saturation of sodium cations did not appear to vary according to distance from saltwater; we had expected to find higher sodium close to salt water.

Texture of soil at each site examined was sandy loam, with loam at one of the Iceberg point sites.

3.3 Outplanting Experimentation Results

Overall, the results of outplanting experimentation were highly variable, confirming earlier impressions of the importance of microsite characteristics (see Dunwiddie 2009a, 2009b). Table 10 gives the percent survival and percent flowering of outplants at five locations in the northern Puget Sound area.

Some generalities about the characteristics of suitable outplanting sites can be derived from outplanting experimentation. Consistent with the work of Lawrence and Kaye (2009) in Oregon, a high percent cover of non-native annuals was a predictor of poor success in outplantings. In general, a high proportion of native forbs and graminoids, especially *Festuca roemeri*, was

Table 10. Summary of northern *Castilleja levisecta* experimental outplanting sites

outplanting site	outplanting		2007		2008		2009	
	2006	2007	survival (%)	flowering (%)	survival (%)	flowering (%)	survival (%)	flowering (%)
Smith Prairie, Whidbey Island	100	-	83	16	22	6	15	14
Smith Prairie, Whidbey Island	-	991	-	-	58	3	16	13
Cedar Rock Preserve, Shaw Island	-	140	-	-	26	0	-	-
Bitte Baer Preserve, Waldron Island	-	96	-	-	85	7	-	-
Prairie Overlook, Whidbey Island	216		62	9	16	2	9	5
Perego's Bluff, Whidbey Island	610		61	25	17	11	-	-

correlated with higher success. One surprising observation at Smith Prairie was the relatively high success in some plots in association with *Poa pratensis*, a non-native rhizomatous grass. We wonder if the *C. levisecta* was able to form haustorial connections with this species. One other noteworthy observation was the extremely high success of *C. levisecta* (in both survival and flowering) occurred in plots with high cover of mowed shrubs *Symphoricarpos albus* and *Rosa nutkana*. Because of the lower cover of non-native weeds in these plots, we speculate that shrubs do not cause the same kind of competitive stress as non-native weeds, or possibly that the *C. levisecta* was forming haustorial connections with the shrubs.

Dunwiddie (2009a) also made observations about soil characteristics, observing that *Castilleja levisecta* generally had greater survival and vigor in sites with higher soil nutrients, including higher magnesium, calcium, potassium, sodium, cation exchange capacity and pH.

4. Summary and Discussion

This study identified and ranked sites in the north Puget Sound area according to their potential as sites for establishing new populations of *Castilleja levisecta*. Table 11 presents information on the eleven sites that we judge to have the highest potential for establishing *C. levisecta* populations and the fifteen sites that we consider to have only a moderate potential.

In addition to the sites described in Table 11, the following sites had preliminary review, but more information is needed before we can evaluate their suitability for either augmentation or establishing new populations: Long Island, Kanaka Bay, Protection Island, West Beach (a small extant population, with potential habitat on adjacent publicly owned land), and Fort Flagler. An outplanting at Cedar Rock Reserve on Shaw Island was unsuccessful, though the failure may have been due to weather conditions or other variables independent of the site. We recommend that future review of these sites be made as research resources become available.

While our evaluation of suitable habitat for *Castilleja levisecta* has been subjective, and our understanding continues to be refined, we consider that the following sites do not appear to warrant the effort necessary to attempt to establish a recovery population of *Castilleja levisecta*. The following notes explain our rationale:

Shark Reef on Lopez Island has a narrow area of rocky bald habitat, between forest and cliffs along salt water. The area, for its small size, receives heavy impacts from public use, and the soils appear too shallow and limited to match well with extant populations.

Huckleberry Island is mostly forested, with very small patches of rocky bald vegetation between the forest and the cliffs. Access for planting, maintenance, and monitoring would be

very difficult, and the scale and conditions of the site do not appear to warrant use of it as a recovery population of *Castilleja levisecta*.

Fort Ebey State Park has a grassy bald at the north end that is small and heavily impacted by public use.

The Fishtown site in Skagit County is privately owned and heavily impacted by grazing.

Deception Pass State Park includes areas we reviewed at Rosario Head and Goose Rock. The non-forested parts of both of these sites appeared to have thin soils over bedrock, and to be impacted by too much public access to host suitable recovery populations.

Numerous sites with apparent potential for establishing new populations of this species have been identified and characterized; it is likely that additional sites in San Juan, Island, and Skagit counties will also be found to be suitable. As the discovery of the large *C. levisecta* population at San Juan Valley has reminded us, our knowledge of the existing distribution of the species and of the habitats under which it may thrive is incomplete. It is possible that future efforts will discover additional natural occurrences of this species and additional sites where outplanting would potentially be successful if protection of the land and the species can be assured.

This study was based on a number of assumptions, the strongest being that matching the soils, topography, and vegetation characteristics of a potential outplanting site with the characteristics of existing sites is a predictor for the success of reintroductions (Lawrence and Kaye 2009). While this is our best available measure, the success of ongoing outplanting experiments at the northern sites will yield a direct indicator of site suitability. In the long run, the ability to naturally reproduce, essential to establishing self-sustaining populations, will be the ultimate measure, both of the appropriateness of a site and of the management actions taken there. Natural populations of *Castilleja levisecta* are typically patchy in distribution, and microsite characteristics appear significant. Related to this irregular distribution is the observation that patches of plants at a site seem to increase and decrease independently over time; it may be that soil interactions are present that we are unaware of. Likewise, interactions with herbivores, particularly voles, may be more complex than we know. While herbivory is obviously detrimental, initial observations suggest that *Castilleja levisecta* seedling establishment, an apparent weak link in natural reproduction, may be more successful in the bare soil on the floors of vole tunnels under the duff than in surrounding areas.

We speculate that competition from invasive non-native species is a major limiting factor and that the absence of periodic fire has changed soil chemistry and allowed buildup of litter and the increase of woody plant encroachment. The interactions between soil microbes and the plants is poorly understood, as is host specificity in forming haustorial connections (Heckard 1962). We suggest that working to understand these processes, especially how they affect reproduction, will ultimately increase the potential for recovery of *Castilleja levisecta*.

Table 11. Ranked potential *Castilleja levisecta* recovery populations in the north Puget Sound area, including extant sites as well as sites with potential for establishing new populations. High, medium, and low values reflect degree of similarity to extant *C. levisecta* occurrences.

Site	Site status	Topo-graphic similarity to extant sites	Similarity of vegetation to extant sites	Percent of species that are native	Percent of species in Table 7 that are present	Protection potential
Sites with the highest potential for recovery populations						
Naas/Admiralty Inlet NAP	Extant, planting site	high	high	61	71	high
Fort Casey State Park	Extant, planting site	high	high	50	86	medium
Forbes Point	Extant, planting site	high	medium	41	62	high
Iceberg Point	potential	high	high	72	57	high
Westside Scenic Preserve	potential	high	low/ medium	39	29	medium
Davis Point, Lopez	historical	high	medium	65	57	low
Combined populations on False Bay	Extant, planting site	high	medium	68	38	low/ medium
American Camp	planting	high	medium	55	62	high
Pt. Disney, Waldron	planting	medium	medium	-	-	high
Boulder Island	potential	high	high	-	57	high
San Juan Valley	extant	high	high	74	38	low
Sites with a moderate potential for recovery populations						
Ebey's Landing	extant	medium	high	56	67	high
English Camp, Young Hill	potential	medium	medium	66	33	medium
Frazer Homestead Preserve	potential	medium	Low/ medium	53	38	medium/ high
Cattle Point and Mount Finlayson	potential	medium	medium	48	29	high
Mt. Constitution	potential	medium	medium	64	29	high
Turtleback Preserve	potential	medium	medium	69	52	high
Colville Point	potential	medium	medium	75	29	high
Colville Island	potential	medium	low	-	38	high
Lighthouse Point, Fidalgo	historical	medium	medium	-	-	high
Kiket Island	potential	medium	high	58	43	low
Perego Lagoon, Ebey's Bluff	planting	medium	medium/ low	57	95	high
National Park Service Overlook	planting	medium	low	26	24	high
Sherman Farm Field	planting	medium	low	-	-	high
Fort Ebey, gun placements		high	low	-	-	medium
Smith Prairie	planting	medium	medium/ high	55	52	high
Kah Tai Prairie	planting	medium	high	49	64	medium

5. Literature Cited

A&L Western Agricultural Laboratories. 2009. Soil analysis reports from 13 samples collected from sites evaluated for potential for establishing *Castilleja levisecta* populations.

Applegate, R. 2006. Vascular plant and *Castilleja levisecta* inventory at Naas Natural Area Preserve, Whidbey Island, WA. Report prepared for the Whidbey Camano Land Trust.

Caplow, F. 2004. Reintroduction plan for golden paintbrush (*Castilleja levisecta*). Washington Natural Heritage Program, Dept. of Natural Resources, Olympia, WA. http://www.dnr.wa.gov/nhp/refdesk/pubs/paintbrushreintroduction.pdf

Caplow, F. and C.B. Chappell. 2005. South Puget Sound site evaluations for reintroduction of golden paintbrush. Washington Natural Heritage Program, Dept. of Natural Resources, Olympia, WA.

Chappell, C.B. 2006. Plant associations of balds and bluffs of western Washington. Washington Natural Heritage Program, Department of Natural Resources. Natural Heritage Report 2006-02.

Chappell, C.B. and Caplow, F. 2004. Site characteristics of golden paintbrush populations. Washington Natural Heritage Program, Dept. of Natural Resources, Olympia, WA.

Domico, T. and J. Bradley. 2000. A new colony of golden paintbrush (*Castilleja levisecta*) recorded on San Juan Island. Report to Washington Natural Heritage Program, Dept. of Natural Resources by Puget Sound BioSurvey and Island Ecological Services.

Dunwiddie, P.W. 2009a. Evaluating suitability of prairies for golden paintbrush (*Castilleja levisecta*) recovery by experimental outplanting in south Puget Sound. Final Report, 15March, 2009. 11 pages. Unpublished report by The Nature Conservancy.

Dunwiddie, P.W. 2009b. Evaluating suitability of prairies for golden paintbrush (*Castilleja levisecta*) recovery by experimental outplanting in north Puget Sound. Final Report, 30March, 2009. 8 pages. Unpublished report by The Nature Conservancy.

Dunwiddie, P.W. 2009c. *Castilleja levisecta* outplanting monitoring data, file name 2008-2009 CALE Site Assessment Summary_20090623_PWD.xls

Dunwiddie, P.W. and J. Arnett. 2009. Towards recovery of golden paintbrush (*Castilleja levisecta*): monitoring and outplanting site selection. Presentation to Northwest Scientific Association, March 27, 2009.

Falk, D.A., Millar, C.J., and Olwell, M., editors. 1996. *Restoring Diversity*. Island Press, Washington D.C.

Gamon, J. 1995. Report on the status of *Castilleja levisecta* Greenman. Unpublished report, Washington Natural Heritage Program, Dept. of Natural Resources, Olympia, WA.

Heckard, L.R. 1962. Root parasitism in *Castilleja*. Bot. Gaz. 124:21-29.

Heunneke, L.F., Holsinger, K., and Palmer, M.E. 1986. Plant population biology and the management of viable plant populations. In: B.A. Wilcox, Brussard, P.F., and Marlot, B.G., editors. *Management of viable populations: theory, applications, and case studies*. Stanford University, Palo Alto, CA.

Hitchcock, C.L., Cronquist, A., Ownbey, M., and Thompson, J.W. 1959. *Vascular plants of the Pacific Northwest, Part 4: Ericaceae through Campanulaceae*. University of Washington Press, Seattle, WA.

Klungland, M.W. and M. McArthur. 1989. Soil survey of Skagit County area, Washington. U.S. Department of Agriculture, Soil Conservation Service.

Lawrence, B.A. 2005. Studies to facilitate reintroduction of golden paintbrush (*Castilleja levisecta*) to the WillametteValley, Oregon. Unpublished MS thesis, Oregon State University, Corvallis, OR.

Lawrence, B.A. and T.N. Kaye. 2009. Reintroduction of *Castilleja levisecta*: effects of ecological similarity, source population genetics, and habitat quality. Restoration Ecology Research Article, no volume given, 11 pp.

Ness, A.O. 1958. Soil survey of Island County, Washington. USDA Soil Conservation Service.

Pavlik, B. 1996b. Defining and measuring success. In: Falk, D.A., Millar, C.J. and Olwell, M., editors. *Restoring diversity*. Island Press, Washington D.C. pp. 127-156.

Pearson, S.F., and Dunwiddie, P. 2006. Experimental seeding and outplanting of golden paintbrush (*Castilleja levisecta*) at Glacial Heritage, Mima Mounds, and Rocky Prairie, Thurston County, WA. Final report on file with Washington Natural Heritage Program, Olympia, WA.

Pischalko, M. and R. Holmes. 2005. 2005 Population census of *Castilleja levisecta* at Rocky Prairie. Department of Natural Resources report.

Ryan, M. and Douglas, G.W. 1994. Status report on the golden paintbrush *Castilleja levisecta* Greenm. Unpublished, draft report prepared by the British Columbia Ministry of Environment, Lands and Parks. Victoria, B.C.

Schlots, F.E., A.O Ness, J.J. Rasmussen, C.J. McMurphy, L.L. Main, and R.J. Richards. 1962. Soil survey of San Juan County, WA. U.S.D.A. Soil Conservation Service in cooperation with the Washington Agricultural Experiment Station.

Sheehan, M. and Sprague, N. 1984. Report on the status of *Castilleja levisecta*. Unpublished report submitted to the U.S. Fish and Wildlife Service, Portland, Oregon.

Springer, S. 2009. Partial monitoring of *Castilleja levisecta* outplanting at Pt. Disney, Waldron Island. Email sent to Washington Natural Heritage Program October 8, 2009.

U.S. Fish and Wildlife Service. 2000. Recovery plan for golden paintbrush (*Castilleja levisecta*). U.S. Fish and Wildlife Service, Portland, OR.

Wilderman, D. 2007. Summary report-NFWF *Castilleja levisecta* experimental introduction project. WNHP files.

Wilderman, D. 2007. Summary of Rocky Prairie, Mima Mounds, and Glacial Heritage *Castilleja levisecta* outplanting monitoring, email August 7, 2007.

Appendix A: Compiled population census data for all *Castilleja levisecta* occurrences (naturally occurring populations). Data in this table are the numbers of naturally occurring flowering individuals.

	1980	**1983**	**1984**	**1985**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Rocky Prairie	-	**15,634**	-	-	-	-	-	2,942	-	-	5,864	-	-	5,493	-	-	7,056	-	-	9,392	-
Naas/ Admiralty Inlet	-	-	**1,200+**	**2,700**	**273**	-	383	306	-	367	277	97	97	98	122	59	120	94	86	148	241
Ft. Casey	**400**	-	-	-	**120**	-	224	109	-	179	175/ 164	151/ 164	166	185	307	235	260	760	1,544	1,713	1,497
West Beach	-	-	-	-	**496**	**107**	557	1,255	543	559	797/ 762	463/ 355	167/ 175	53	54	82	130	189	69	97	75
Ebey's Landing	-	-	-	-	**4,000 (est)**	-	-	1,625	-	-	1,079	7,627	-	?	-	-	669	214	747	601	-
Forbes Point	-	-	-	-	-	-	1,346		-	-	1,572	1,882	1,834	711	765	532	123	260	105	247	51
Long Island	-	-	-	-	-	-	-	22	-	179	43	87	-	154	-	-	-	-	-	-	-
Davis Point	-	-	-	-	-	**1**	5	4	-	-	0	-	-	0	-	-	-	-	0	-	-
False Bay north	-	-	-	-	-	-	-	100+	-	-	<100?	-	-	-	-	10-15	-	-	-	-	-
False Bay middle	-	-	-	-	-	-	128	50	-	-	-	-	-	50 (est)	-	50 (est)	-	54	40	42	33
False Bay south	-	-	-	-	-	-	-	12+	-	100-200	-	-	-	200+	-	-	-	312	401	453 (70)	407
San Juan Valley	-	-	-	-	-	-	-	-	-	-	-	4,021	-	-	7,528	-	-	-	-	in-creas-ing	thriv-ing
Trial Island	-	-	-	-	-	**2,560**	-	-	-	-	-	-	-	2,150	-	-	-	3,192	in-crease	-	-
Alpha Islet	-	-	-	-	-	**1,000 (est)**	-	-	-	-	953	-	-	800	-	1,333	-	165	major de-crease	-	-

Appendix B: Compiled information on northern extant *Castilleja levisecta* occurrences

Extant northern Washington *Castilleja levisecta* Populations.						
location	**County**	**Island**	**Ownership**	**2009 count***	**comments**	**mapped soil type**
Naas/ Admiralty Inlet	Island	Whidbey	Whidbey Camano Land Trust;WDNR conservation easement	241	Managed with golden paintbrush as conservation priority; active management for the species, intensive and highly successful augmentation planting, habitat expansion. Natural population has increased for past four years.	Hoypus coarse loamy sand
Ft. Casey	Island	Whidbey	WA State Parks	1497	Managed for multiple use, including recreation. Golden paintbrush management is a conservation priority. Active augmentation planting, site management for golden paintbrush. Natural population has increased for the past five years.	Hoypus loamy sand
West Beach	Island	Whidbey	Private	75	Landowners manage for the species by mowing in the fall; the population has varied moderately for the past five years, averaging slightly over 100 plants.	Bozarth fine sandy loam
Ebey's Landing	Island	Whidbey	The Nature Conservancy	601 (2008)	Steep site that has suffered major losses, due to fire and slope erosion, from high counts of several thousands until 2000.	Rough broken land
Forbes Point	Island	Whidbey	U.S. Navy	71	Most of the site is within a fence, but plants outside the fence appear to be doing better than those inside. The natural population has declined dramatically from over 1,800 in 2000 and 2001.	Casey loam
Long Island	San Juan	Long	Private	154 (2002)	We have not been allowed access since 2002 to monitor.	San Juan gravelly sandy loam

False Bay middle site	San Juan	San Juan	Private	33	This small population has declined slowly since monitoring began in 1995. A small outplanting was made in 2008. The property is currently for sale.	Bow silt loam
False Bay south	San Juan	San Juan	Private	407	This population occupies a small area, but has been increasing steadily (with very small drop in 2009) since discovered in 1996 when plants appeared after shrub mowing. Owners are enthusiastic about the species. Augmentation plantings were made in 2007 and 2008.	Rock land
San Juan Valley	San Juan	San Juan	Private	7,528 (2003)	This very large population has an atypical habitat. It is the largest northern population, the only on not immediately adjacent to salt water, and the only known population anywhere that has current grazing activity. The owner does not currently allow access for monitoring or seed collection.	Coveland gravelly silt loam
* Population count is the total number of flowering individuals						

Appendix C: Compiled data from *Castilleja levisecta* experimental outplantings

Location	State	Type or Source of Planting	2005 flowering plants (total plants)	2006 flowering plants (total plants)	2007 flowering plants (total plants)	2008 flowering plants (total plants)	2009 flowering plants (total plants)
North Puget Sound							
San Juan Island, False Bay middle	WA	Outplants in January 2008 Count?					(3)
San Juan Island, False Bay middle	WA	145 (147?) plants January 14, 2009					(15)
San Juan Island, False Bay between south and middle	WA	290 (294?) plants January 14, 2009					60 (71)
San Juan Island, False Bay South	WA	34 plugs winter 2007-2008				0 (21)	6 (8)
San Juan Island, False Bay South	WA	490 plants January 14, 2009 in 5 patches: N-1:, N-2: , N-3: , N-4, N-5.					14 (145)
American Camp	WA	Approx. 400 outplants planned for late fall, 2009					
Cedar Rock Preserve, Shaw Island	WA	Experimental planting, Nov. 30 and Dec. 2-3, 2007. 140 plugs in 14 plots				0 (36)	
Waldron Island, Pt. Disney, Bitte Baer Preserve	WA	Experimental planting November 15 & 16, 2007. A total of 96 plants, 4 in each of 24 plots				7 (82)	13 (16)+ (not all plots monitored)
Whidbey Island, Forbes Point	WA	Augmentation planting, Wayne December 7, 2002		12	11	15	3
Whidbey Island, Forbes Point	WA	Augmentation planting, TNC 2004 "A"		47	44	124	3
Whidbey Island, Forbes Point	WA	Augmentation planting, TNC 2004 "B"					26 (43)

Whidbey Island, Forbes Point	WA	Augmentation planting , TNC 2005 "A"		12	1	6	3
Whidbey Island, Forbes Point	WA	Augmentation planting , TNC 2005 "B"					6 (11)
Whidbey Island, Forbes Point	WA	Augmentation planting , TNC 2007, Planting "A"					16
Whidbey Island, Forbes Point	WA	Augmentation planting , TNC 2007 Planting "B" . 1050 plugs in two sites, "A" and "B"				18 (257)	20
Whidbey Island, Perego's Bluff	WA	Experimental planting by Wayne in 2001, 2003		15	-		-
Whidbey Island, Perego's Bluff	WA	November 17, 2006; 605 plugs, Ebey's Landing seed			154	68	-
Whidbey Island, Sherman Farm Field	WA	Experimental planting by Swenerton in 2002		29	-		-
Whidbey Island, NPS Ebey overlook	WA	November 17, 2006; 216 plugs from Ebey's Landing seed			20 (114)	12 (32); 4 (30)	
Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #1, approx. 1,000 (1,200?) plugs planted Nov. 11, 2005		(684)	305	449	489 (604)
Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #2, 310 seedlings planted January 12, 2007			54	not counted, similar to Plot #3	173 (223)
Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #3, 297 seedlings planted January 12, 2007		-	67	186 (240)	108 (236)
Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #4 (previously #2), 558 seedlings from 4th Corner planted November 17, 2007				37 (442)	121 (191)
Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #5 (previously # 1) 175 seedlings from Jarishes and 228 seedlings from 4th Corner (total 403) planted November 17, 2007				45 (327)	118 (260)

Whidbey Island, Naas/Admiralty Inlet Preserve	WA	Augmentation Plot #6, 573 seedlings planted in November 2008					47 (325)
Whidbey Island, Fort Casey	WA	Augmentation planting, 2003 (212)		117	Approx. 375 (552)	232	163
Whidbey Island, Fort Casey	WA	Augmentation planting 2004 (1,044)					
Whidbey Island, Fort Casey	WA	Augmentation planting 2005 (1,070)					
Whidbey Island, Fort Casey	WA	Augmentation planting Jan. 8, 2007 (870)					
Whidbey Island, Fort Casey	WA	Augmentation planting planned for Nov. 17, 2007 (1,000) (I don't know if this was eventually planted)					
Whidbey Island, Smith Prairie, Pacific Rim Institute (Au Sable)	WA	Experimental planting by Swenerton in 2002		4	-		
Whidbey Island, Smith Prairie, Pacific Rim Institute (Au Sable)	WA	November 17, 2006 out-planting, 100 plugs, Ebey's Landing seed		-	16 (83)	6 (22)	14 (15)
Whidbey Island, Smith Prairie, Pacific Rim Institute (Au Sable)	WA	November 19, 2007 out-planting, 991 plugs				25 (579)	129
Kah Tai prairie, Port Townsend	WA	Experimental planting by Lawrence in 2004, seed from multiple sources. Between 246-251 seedlings (114-121 in spring, 130 in fall) were planted	214 (115 from spring planting, 99 from fall planting)	16 (25)	18		14
South Sound -Thurston							
Rocky Prairie NAP	WA	Augmentation planting by Jarish in 2004. A 2005 monitoring report refers 144 plants put out, 72 each in areas 1 and 4.	31	46 (88)	(27)	not recorded; all plants present were included in wild plant count	

Rocky Prairie NAP	WA	Experimental seeding and planting by Pearson and Dunwiddie. 2006 report refers to 18,000 seeds and 72 plugs planted in 2004. Likely the same plants, or some of them, referred to Jarish above.					
West Rocky Prairie	WA	904 plugs outplanted in Fall 2007, Dunwiddie, test plants and non-test plants				51(764)	88(339)
Mima Mounds Natural Area Preserve	WA	Experimental planting by Dunwiddie and Pearson, 168 plugs in 2003		73 (322)	(154)		
Mima Mounds Natural Area Preserve	WA	Experimental planting by Dunwiddie and Pearson, 180 plugs in 2004					
Mima Mounds Natural Area Preserve	WA	Experimental seeding and planting by Dunwiddie and Pearson, 2001-2005. 111,000 seeds	8 (52)				
Mima Mounds Natural Area Preserve	WA	Experimental seeding and planting by Dunwiddie and Pearson, 300 plugs in 2005					
Mima Mounds Natural Area Preserve	WA	Experimental planting by Dunwiddie, 885 plugs in 2007				47(796)	72(298)
Mima Mounds Natural Area Preserve	WA	Experimental planting by Dunwiddie, 1324 plugs in 2008					
Mima Mounds Natural Area Preserve	WA	Experimental planting by Dunwiddie, plugs in 2009					
Glacial Heritage Preserve	WA	Experimental seeding and planting by Dunwiddie and Pearson, 2001-2005, 111,000 seeds		99 (307)	(47)		
Glacial Heritage Preserve	WA	Experimental planting by Dunwiddie and Pearson, 168 plugs in 2003					
Glacial Heritage Preserve	WA	Experimental planting by Dunwiddie and Pearson, 180 plugs in 2004					

Glacial Heritage Preserve	WA	Experimental seeding and planting by Dunwiddie and Pearson, 300 plugs in 2005					
Glacial Heritage Preserve	WA	Experimental planting by Dunwiddie, 929 plugs in October 31, 2007				88(855)	77(270)
Glacial Heritage Preserve	WA	Experimental planting by Dunwiddie, 1300 plugs in 2008					1(816)
Morgan	WA	938 plugs outplanted in Fall 2007, Dunwiddie, test and non-test plants				74(781)	140(404)
Morgan	WA	1325 plugs outplanted in Fall 2008, Dunwiddie					6(721)
Wolf Haven	WA	919 plugs outplanted in Fall 2007, Dunwiddie				30 (666)	55(186)
Wolf Haven	WA	1325 plugs outplanted in Fall 2008, Dunwiddie					4(768)
Scatter Creek south	WA	903 plugs outplanted in Fall 2007, Dunwiddie				41(719)	121(429)
Oregon							
Baskett Slough NWR, Baskett Slough #1	OR	Experimental planting by Lawrence in 2004	277	35	-	-	
Baskett Slough NWR, Baskett Butte #2	OR	Experimental planting by Lawrence in 2004 *=remaining plants from Whidbey I. seed	54*	38	-	4	
Baskett Slough NWR, Baskett Butte #3	OR	Experimental planting by Lawrence in 2004	112*	8	-	0	
Finley NWR, Bell Fountain Prairie	OR	Experimental planting by Lawrence in 2004	235	52	6 or more	32	61
Finley NWR, Pigeon Butte	OR	Experimental planting by Lawrence in 2004	120*	6	9	6	5
Heritage Seedling, Salem	OR	Experimental planting by Lawrence in 2004	299	25	-		
Cardwell Hills	OR	Planting is planned for 2010					

Sources: Domico and Bradley 2000; Dunwiddie 2009a, 2009b, 2009c; Dunwiddie and Arnett 2009; Springer 2009; Washington Natural Heritage Program field monitoring records.

Appendix D: Plant Species present at northern extant *Castilleja levisecta* occurrences.

Sources:

Naas/Admiralty Inlet NAP, Fort Casey SP, Forbes Point: C=Chappell and Caplow 2004; w=Whidbey Camano Land Trust list 2006, A=Arnett 22June2007
Ebey's Bluff (TNC property on Hill Road): C=Chappell and Caplow 2004; X=Washington Native Plant Society compiled list.
West Beach: C=Chappell and Caplow 2004; A=Arnett 22June2007, 22May2008
San Juan Valley, San Juan Island; DB=Terry Domico and John Bradley report, Aug. 2000; FC=Caplow notes, May 20, 2002

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Abies grandis	native		w	X							2	22
Abronia latifolia	native			X							1	11
Achillea millefolium var. *occidentalis*	native	C	C, w	C	C	C	X	DB	C	c	9	100
Agastache urticifolia	native			X							1	11
Agrostis spp.	introduced	w	C,w	x	A					C	5	56
Aira caryophyllea	introduced	C	A	C	C		X				5	56
Aira praecox	introduced	C		X						C	3	33
Allium acuminatum	native			X					C	C	3	33
Ambrosia chamissonis	native			X							1	11
Amelanchier alnifolia	native			X			X				2	22
Amsinckia menziesii	native			X				DB			2	22
Amsinckia retrorsa	native			X							1	11
Amsinckia spectabilis	native			X							1	11
Anaphalis margaritacea	native	w		X							2	22
Anthemis cotula	introduced			X							1	11
Anthoxanthum odoratum	introduced	w	C,w	x		C, A				C	5	56

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Anthriscus caucalis (=A. scandicina)	introduced			x	C						2	22
Aphanes arvensis	introduced	w									1	11
Aphanes occidentalis	native			X							1	11
Arabidopsis thaliana	introduced			X							1	11
Arabis glabra	native			X							1	11
Arctium minus	introduced			X							1	11
Argentina egedii ssp. *egedii (=Potentilla pacifica)*	native			X							1	11
Armeria maritima	native			X							1	11
Arrhenatherum elatius	introduced	w		X							2	22
Artemisia borealis var. *scouleriana*	native			C							1	11
Artemisia suksdorfii	native	w									1	11
Atriplex patula	introduced			X							1	11
Avena fatua	introduced			X							1	11
Bellis perennis	introduced	w									1	11
Berberis aquifolium	native	w		X							2	22
Brassica campestris	introduced	w		X							2	22
Brodiaea coronaria ssp. *coronaria*	native	w		X							2	22
Bromus carinatus	native	C	C,w		C, A	C	X			C	6	67
Bromus hordeaceus	introduced	C		C	C		X			C	5	56
Bromus rigidus	introduced	C		C							2	22
Bromus sitchensis	native			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Cakile maritima	introduced			X							1	11
Calandrinia ciliata	native			X							1	11
Camassia leichtlinii ssp. *suksdorfii*	native								C	C	2	22
Camassia quamash	native			X						C	2	22
Capsella bursa-pastoris	introduced			X							1	11
Cardamine hirsuta	introduced			X							1	11
Cardamine oligosperma	native			X							1	11
Carex inops ssp. *inops*	native			X							1	11
Carex lyngbeyi	native			X							1	11
Carex macrocephala	native			X							1	11
Carex obnupta	native										1	11
Carex rossii	native					C			C	C	3	33
Carex tumulicola	native		C,w	X	C	C	X				5	56
Castilleja levisecta	native	C	C, w	C, A	C	C	X	DB, FC	C	C	9	100
Castilleja miniata	native		C, w	C							2	22
Cerastium arvense ssp. *strictum*	native	w		C					C	C	4	44
Cerastium glomeratum (=C. viscosum)	introduced	C		X	C						3	33
Cerastium vulgatum	introduced	w		X							2	22
Chenopodium album	introduced			X							1	11
Cirsium arvense	introduced	w		X	C						3	33

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Cirsium brevistylum	native	C			C						2	22
Cirsium vulgare	introduced	C		X	C						3	33
Claytonia perfoliata ssp. *perfoliata (=Montia perfoliata)*	native			X							1	11
Claytonia rubra	native			X							1	11
Claytonia siberica	native			X							1	11
Clinopodium douglasii (=Satureja)	native	C		X							2	22
Collinsia parviflora	native			X							1	11
Coniosilenum pacificum	native			X							1	11
Conium maculatum	introduced			X							1	11
Conyza canadensis	introduced			X							1	11
Coronopus didymus	introduced			X							1	11
Crataegus douglasii var. suksdorfii	native	w						FC			2	22
Crataegus monogyna	introduced							DB			1	11
Crepis sp.	introduced	w		X							2	22
Cuscuta salina	native			X							1	11
Cynosurus echinatus	introduced								C		1	11
Cytisus scoparius	introduced			X							1	11
Danthonia californica	native									C	1	11
Daucus carota	introduced		C, w	C	C						3	33
Daucus pusillis	native			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Deschampsia caespitosa	native								C		1	11
Distichlis spicata	native			X							1	11
Dodecatheon hendersonii ssp. *hendersonii*	native							FC			1	11
Dodecatheon pulchellum	native									C	1	11
Draba verna	native			X							1	11
Elymus glaucus	native	w					X			C	3	33
Elymus repens (=Agropyron repens, Elytrigia repens)	introduced	w		X							2	22
Equisetum hymale	native			X							1	11
Equisetum telmateia	native			X							1	11
Equisetum variegatum var. variegatum	native			X							1	11
Erigeron speciosus var. speciosus	native	w	C, w	C		C					4	44
Eriophyllum lantaum var. *lanatum*	native			C						C	2	22
Erodium cicutarium	introduced			X							1	11
Eschscholtzia californica	introduced			X							1	11
Festuca bromoides	introduced			X							1	11
Festuca occidentalis	native			X							1	11
Festuca roemeri	native			X							1	11
Festuca rubra	native	C	C,w	C	C	C	X		C	C	8	89

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Festuca sp.	native							FC			1	11
Fragaria sp.	native							DB, FC			1	11
Fragaria vesca ssp. *bracteata*	native		C, w								1	11
Fragaria virginiana	native					C,A			C	C	3	33
Fritillaria affinis var. affinis (F. lanceolata)	native		w	X		C		FC	C	C	6	67
Galium aparine	native	C		X	C					C	4	44
Gaultheria shallon	native			X							1	11
Geranium dissectum	introduced	w			C						2	22
Geranium molle	introduced			X							1	11
Geum macrophyllum	native			X							1	11
Gnaphalium purpureum	native			X							1	11
Grindelia stricta var. *stricta*	native	C		C					C	C	4	44
Heracleum maximum	native	C	C, w								2	22
Hesperis matronalis	introduced			X							1	11
Heterotheca villosa (=Chrysopsis villosa)	native			X							1	11
Holcus lanatus	introduced	C	C,w	X	C, A	C, A		DB	C		7	78
Holodiscus discolor	native			X							1	11
Honkenya peploides	native			X							1	11
Hordeum brachyantherum	native			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Hordeum murinum	introduced			X							1	11
Hypericum perforatum	introduced			X							1	11
Hypochaeris radicata	introduced	C	C, w	C	C			DB	C	C	7	78
Juncus articulatus	native							DB			1	11
Juncus bufonius	introduced			X							1	11
Juncus effusus	native and introduced							DB			1	11
Koeleria macrantha	native			C			X				2	22
Lactuca serriola	introduced			X							1	11
Lamium purpureum	introduced			X							1	11
Lathyrus japonicus	native	w		X							2	22
Lepidium densiflorum	native			X							1	11
Lepidium virginicum	native			X							1	11
Leucanthemum vulgare (=Chrysanthemum leucanthemum)	introduced	w	w	X							3	33
Leymus mollis ssp. *mollis*	native	C		X		C					3	33
Lithophragma parviflora	native			X							1	11
Lolium multiflora	introduced			X							1	11
Lolium perenne	introduced	w					X				2	22
Lomatium dissectum var. *dissectum*	native								C		1	11
Lomatium nudicaule	native	C		X		C			C	C	5	56

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Lomatium utriculatum	native			C						C	2	22
Lonicera hispidula	native			X							1	11
Lonicera involucrata	native							DB			1	11
Lotus denticulatus	native	C									1	11
Lotus micranthus	introduced								C		1	11
Lotus unifoliatus (L. purshianus)	native	w									1	11
Lupinus arboreus	introduced			X							1	11
Lupinus bicolor	native			X					C		2	22
Lupinus littoralis	native			C							1	11
Lupinus microcarpus (L. densiflorus var. *densiflorus)*	native	C									1	11
Lupinus microcarpus var. *scopulorum*	native	w									1	11
Lupinus polyphyllus var. *polyphyllus*	native					A					1	11
Lupinus rivularis	native			X							1	11
Luzula comosa	native	C	C,w	C	C		X	FC	C	C	8	89
Lycopus uniflorus	native			X							1	11
Lynchnis alba	introduced			X							1	11
Mahonia aquilifolium	native	w		C	C				C	C	5	56
Maianthemum dilatatum	native			X							1	11
Maianthemum stellatum (=Smilacina stellata)	native			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Marrubium vulgare	introduced			X							1	11
Matricaria chamomilla	introduced			X							1	11
Matricaria matricariodes	introduced	w		X							2	22
Medicago lupulina	introduced			X							1	11
Medicago sativa	introduced			X							1	11
Melica subulata	native			X							1	11
Myosotis discolor	introduced	C	C, w	X		C		DB			5	56
Nepeta cataria	introduced			X							1	11
Oemleria cerasiformis	native			X							1	11
Opuntia fragilis	native			X							1	11
Orobanche uniflora	native									C	1	11
Osmorhiza chilensis	native			X							1	11
Papaver somniferum	introduced			X							1	11
Parentucellia viscosa	native		w								1	11
Perideridia gairdneri	native	w									1	11
Phyllospadix scouleri	native			X							1	11
Picea sitchensis	native			X							1	11
Pinus contorta	native							DB, FC			1	11
Plantago lanceolata	introduced	C	C, w	C	C, A	C				C	6	67
Plantago major	introduced			X							1	11
Plantago maritima var. *juncoides*	native			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Platanthera elegans	native		w								1	11
Poa annua	introduced	w		X							2	22
Poa bulbosa	introduced			X						C	2	22
Poa cf. palustris	introduced	w									1	11
Poa confinis	native									C	1	11
Poa macrantha	native			X							1	11
Poa pratensis	introduced	C	C,w	C	C	C	X		C	C	8	89
Poa trivialis	introduced			X							1	11
Polygonum aviculare	introduced			X							1	11
Polygonum paronychia	naitve			X							1	11
Polypodium glycyrrhiza	native			X							1	11
Polypodium hesperium	native			X							1	11
Polypogon monspeilensis	introduced			X							1	11
Polysticum lonchitis	native	C		X							2	22
Polysticum munitum	native	C		X							2	22
Prunella vulgaris	native and introduced	w	w								2	22
Pseudognaphalium stramineum (=Gnaphalium chilense)	native			X							1	11
Pseudotsuga menziesii	native		w	X		A	X	FC			5	56
Pteridium aquilinum var. pubescens	native	w	w	x	C	C, A		DB	C	C	8	89
Puccinelia nuttalliana	native			X							1	11
Pyrus fusca	native			X							1	11
Quercus garryana	native							FC			1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Ranunculus californicus	native									C	1	11
Ranunculus occidentalis var. occidentalis	native		C,w	X							2	22
Ranunculus repens	introduced			X							1	11
Ranunculus sp.	introduced/ native							FC			1	11
Rhododendron macrophyllum	native			X							1	11
Ribes divaricatum	native	w		X							2	22
Ribes lacustre	native			X							1	11
Rosa nutkana	native	C	C, w	X	C	C		DB	C	C	8	89
Rosa rugosa	introduced			X							1	11
Rubus armeniacus (R. discolor)	introduced	w									1	11
Rubus parviflorus	native	w									1	11
Rubus spectabilis	native	w		X				DB			3	33
Rubus ursinus ssp. *macropetalus*	native	C	C, w	X	C	C	X		C	C	8	89
Rumex acetosella	introduced	C	C,w	A	C	C			C	C	7	78
Rumex crispus	introduced	w		X							2	22
Rumex obtusifolius	introduced	w									1	11
Rumex occidentalis	native			X							1	11
Rumex triangulivalvis (R. salicifolius)	native	w		X							2	22
Ruppia maritima	native			X							1	11
Sagina apetala	introduced			X							1	11
Sagina procumbens	introduced			X							1	11

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Salicornai virginica	native			X							1	11
Salix scouleriana	native			X							1	11
Sambucus racemosa var. racemosa (=Sambucus racemosa var. *arborescens)*	native	w		X							2	22
Sanicula arctopoides	native									C	1	11
Sanicula bipinnatifida	native			X					C		2	22
Sanicula crassicaulis var. *crassicaulis*	native	C	C,w	X	C	C			C	C	7	78
Schedonorus arundinaceus (Festuca arundinacea)	introduced	w		X	C, A						3	33
Scirpus americanus	native			X							1	11
Senecio jacobaea	introduced			X				DB			2	22
Senecio sylvaticus	introduced			X							1	11
Senecio vulgaris	introduced			X							1	11
Sherardia arvensis	introduced									C	1	11
Sidalcea hendersonii	native			X							1	11
Silene gallica	introduced			A							1	11
Silene latifolia ssp. *alba (=Lychnis alba)*	introduced			A							1	11
Silene menziesii ssp. menziesii	native			C							1	11
Silene scouleri	native			X					C		2	22

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Sisymbrium altissimum	introduced			X							1	11
Sisymbrium officinale	introduced			X							1	11
Sisyrinchium angustifolium	introduced							DB, FC			1	11
Sisyrinchium idahoense (var. *segetum most likely,* var. *idahoense possible)*	native		A								1	11
Sisyrinchium sp.	native	w									1	11
Solidago lepida var. *salebrosa*	native	C	C,w	C		C		DB			5	56
Soliva sessilis	introduced	w									1	11
Sonchus arvensis	introduced			X							1	11
Sonchus asper	introduced	w		X							2	22
Sonchus oleraceus	introduced			X							1	11
Sonchus sp.	introduced	C									1	11
Spergularia canadensis	native			X							1	11
Spergularia rubra	introduced	w		X							2	22
Spergularia salina (=S. marina)	introduced			X							1	11
Spiraea douglasii	native							DB			1	11
Spiranthes romanzoffiana	native		w								1	11
Stachys chamissonis var. cooleyae (=S. cooleyae)	native			X							1	11
Stellaria crispa	introduced			X							1	11
Stellaria media	introduced	w		X							2	22

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Symphoricarpus albus	native	C	w	X	X		X	FC		C	7	78
Symphyotrichum chilense (=Aster chilensis)	native		w								1	11
Tanacetum vulgare	introduced			X							1	11
Taraxacum officinale	introduced	C	C,w	X	C	C		DB			6	67
Taxus brevifolia	native			X							1	11
Tellima grandiflora	native			X							1	11
Thuja plicata	native			X							1	11
Tiarella trifoliata	native			X							1	11
Tragopogon dubius	introduced			X							1	11
Tragopogon porrifolius	introduced			X							1	11
Trifolium arvense	introduced			X							1	11
Trifolium dubium	introduced	C	C,w, A	X	C						4	44
Trifolium hybridum	introduced			X							1	11
Trifolium microcephalum	native										1	11
Trifolium microdon	native			X							1	11
Trifolium pratense	introduced	C		X	X						3	33
Trifolium procumbens	introduced	w	A	X							3	33
Trifolium repens	introduced	C		X	C						3	33
Trifolium subterraneum	introduced	w									1	11
Trifolium willdenowii (=Trifolium tridentatum)	native	w		x					C		3	33

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Triglochin maritimum	native			X							1	11
Triphysaria pusilla (=Orthocarpus pusillis)	native	w		X				FC			3	33
Trisetum canescens	native			X							1	11
Trisetum cernuum	native			X							1	11
Triteleia grandiflora (WA Flora Checklist recognizes var. *howellii, FNA does not. Brodiaea howellii)*	native									C	1	11
Triteleia hyacinthina (=Brodiaea hyacinthina)	native	w		X					C		3	33
Tsuga heterophylla	native			X							1	11
Ulex europaeus	introduced			X							1	11
Urtica dioica var. *gracillis*	native	w		X							2	22
Vaccinium ovatum	native			X							1	11
Vaccinium parvifolium	native			X							1	11
Veronica arvensis	introduced			x							1	11
Veronica hederaefolia	introduced			X							1	11
Vicia americana ssp. americana	native	C	C,w	X					C		4	44
Vicia cracca	introduced			X							1	11
Vicia gigantea	native	w		X							2	22
Vicia hirsuta	introduced	C	C,w	C	C	C, A			C	C	7	78
Vicia sativa	introduced	C	C,w	C	C	C			C	C	7	78

Current species name	origin	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Forbes Point	West Beach	False Bay	San Juan Valley	Alpha Islet	Trial Island	Frequency (out of 9)	Constancy (%)
Vicia villosa	introduced			X	C						2	22
Vinca major	introduced			X							1	11
Viola adunca	native			X				DB			2	22
Vulpia bromoides	introduced	C			C					C	3	33
Zigadenus venenosus var. venenosus	native			X					C	C	3	33
Zostera marina	native			X							1	11

Appendix E: Characteristics of potential *Castilleja levisecta* reintroduction sites

Potential *Castilleja levisecta* Reintroduction Sites - North Puget Sound area				
Sites generally arranged from northwest to southeast				
Site	**Site visit date(s)**	**Ownership**	**Notes**	**mapped soil types**
English Camp, Young Hill, San Juan Island, San Juan County	May 20, 2009	National Park Service	Rocky balds and oak grasslands. Balds quite weedy, annual grasses, *Rumex acetosella, Hypericum perforatum*	Rock land, steep
Westside Scenic Preserve, San Juan Island, San Juan County	May 20, 2008	San Juan County Land Bank	Rich but shallow soils among rock outcrops immediately along the coast. Areas with shrub cover seem very similar to extant populations on San Juan Island. 15 acres.	Roche gravelly loam, 3 to 8% slopes
Kanaka Bay, San Juan Island, San Juan County	May 20, 2009	Private	Historic occurrence; precise location not known. Site had thin soils, high weed cover, not a highly promising site. Larger properties to the west look more promising.	Bow stony silt loam, 3 to 8% slopes
False Bay, between southern and middle extant sites, San Juan Island, San Juan County		Private	A small outplanting was done here in 2008. Close to extant population on adjacent ownership.	Bow stony silt loam, 0 to 3% slopes
Frazer Homestead Preserve, San Juan Island, San Juan County	May 20, 2008; May 20, 2009	San Juan County Land Bank	A more interior site, where cattle have been grazing. Heavily impacted, but may be a place to experimentally examine effects of grazing. Many non-native grasses, hawthorn, but also strong native component.	Coveland gravelly silt loam, 3-8% slopes and San Juan stony loam, moderately deep, 8-30% slopes
American Camp, San Juan Island, San Juan County	July 13, 2007; May 20, 2008; June 18, 2008	National Park Service	Two areas have been considered, one with relatively intact native vegetation and one site where habitat restoration efforts are underway, especially attempts to reestablish fescue communities.	San Juan stony sandy loam, 3-15% slopes

Cattle Point, incl. Mount Finlayson, San Juan Island, San Juan County	March 20 and 21, 2007; May 20, 2008; June 18, 2009	DNR, Federal	Very dry site with sandy soils, the precise location of historical *Castilleja levisecta* is not known. This site, also fairly weedy, may be drier than optimum.	San Juan gravelly sandy loam, 8-30% slopes, and San Juan gravelly sandy loam, 0-8% slope
Pt. Disney, Waldron Island, San Juan County		TNC	Current experimental site	Rock land, steep
Grassy slopes on Mt. Constitution, Moran State Park, Orcas Island, San Juan County	June 18, 2008	State Parks	Higher elevation than known sites, and farther from water than known populations in the islands.	Rock land, steep
Turtleback Mountain Preserve, Orcas Island, San Juan County	July 23, 2008; May 21, 2009	San Juan County Land Bank	Rocky balds and scattered trees, not very similar to extant site, but microsites may have suitable conditions. Abundant weeds in grassy balds.	Rock land, steep
Madrona Point, Orcas Island, San Juan County		Lummi Tribe	Tribal member inquired about feasibility of introducing golden paintbrush here. The site is closed now to the public, the person who called did not respond to calls about access.	Roche-Rock outcrop complex, 30-70% slopes
Cedar Rock Preserve, Shaw Island, San Juan County		University of Washington	Site not visited. Experimental planting failed.	
Davis Point, Lopez Island, San Juan County	May 21, 2008	Private	Historic occurrence; plants have not been seen here since 1996. The historical presence of the species suggests that it includes suitable habitat if management is appropriate.	Coveland silt loam, 0 to 3% slopes, rock outcrops
Shark Reef, Lopez Island, San Juan County	June 17, 2008	San Juan County Parks	Small site, heavily used by the public, shallow soil over rock outcrops.	Rock outcrops
Iceberg Point, Lopez Island, San Juan County	May 21, 2008; June 17, 2008	BLM Area of Critical Environmental Concern	Diverse site, with several locations similar to extant Castilleja populations.	Rock land, steep

Colville Point, Lopez Island, San Juan County	July 24, 2008	BLM Area of Critical Environmental Concern	Diverse site, with several locations similar to extant Castilleja populations, though much smaller than Iceberg Point.	Rock land, steep
Boulder Island, San Juan County		USFWS	Logistics difficult, protected. High quality native vegetation, similar to existing population on a small island.	rock outcrops
Colville Island, San Juan County		USFWS	Quite weedy, access would be difficult	rock outcrops
Huckleberry Island, Skagit County	June 16, 2008	State Parks	Mostly forested, access is difficult, limited habitat.	Whistle-Fidalgo-Rock outcrop complex, 30-65% slopes
Fishtown, north Fork of the Skagit River, Skagit County	April 22, 2009	Private	Unprotected private land, heavily impacted by grazing.	Tacoma silt loam
Kiket Island, Skagit County	June 16, 2008	Private	The point to the west is a fairly high quality herbaceous community	Coveland gravelly loam, 0-3% slopes
Lighthouse Point, Deception Pass State Park, Skagit County		State Parks	Historic occurrence. Very narrow band of promising vegetation between the forest and rock outcrops along the water's edge.	Fildago-Lithic Xerochrepts-Rock outcrop complex, 3-30% slopes
Rosario Head, Deception Pass State Park, Fidalgo Island, Skagit County	April 22, 2009	State Parks	State Parks has inquired about this site. Rocky headland with shallow soils, appears to include little habitat for *Castilleja levisecta.*	Fildago-Lithic Xerochrepts-Rock outcrop complex, 3-30% slopes
Goose Rock, Deception Pass State Park, Whidbey Island, Island County	March 13, 21, 2007; April 22, 2009	WA State Parks	Generally thin soils, limited habitat	Rough stony land
Perego Lagoon, Ebey's Bluff, Whidbey Island, Island County	May 24, 2007	TNC	Current experimental site above the lagoon, success has been very patchy. Site may be too dry.	Rough broken land
National Park Service Overlook, Coupeville, Whidbey Island, Island County		National Park Service	Current experimental site, reportedly fairly weedy, *Castilleja levisecta* planted into *Festuca roemeri*	Snakelum coarse sandy loam 0-5% slopes

Sherman Farm Field, Whidbey Island, Island County	May 24, 2007	TNC	Current experimental site	San Juan coarse sandy loam 5-15% slopes
Gun emplacements, Fort Ebey State Park, Whidbey Island, Island County	May 21, 2007	State Parks	Fairly weedy, but areas of more gradual slope along the west-facing escarpment are potential sites.	Rough broken land
Fort Ebey, small prairie remnants to the north, Island County	June 20, 2008	State Parks	Small patches of native vegetation facing the water near the north end of the park	Casey fine sandy loam and Keystone coarse sandy loam; 15-30% slopes
Smith Prairie, Pacific Rim (Au Sable) Institute, Whidbey Island, Island County	May 24, 2007	Pacific Rim (Au Sable) Institute	Experimental *C. levisecta* outplanting	San Juan coarse sandy loam 5-15% slopes
Protection Island, Jefferson County	May 3, 2006	USFWS	Protected, hard to access, potential conflict with nesting auklets	Townsend fine sandy loam, 0-15% slopes
Kah Tai Prairie, Port Townsend, Jefferson County	May 24, 2007	City of Port Townsend	Current experimental site. Very limited prairie remnant surrounded by golf course.	San Juan gravelly sandy loam 0-8% slopes
Fort Flagler, Marrowstone Island, Jefferson County	April 23, 2009	WA State Parks	Only a cursory examination: further study of this site is recommended.	Townsend fine sandy loam, 0-15% slopes, Whidbey gravelly sandy loam, 0-15% slopes

Appendix F: Plant species recorded at potential *Castilleja levisecta* reintroduction sites

San Juan Island sites							
Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Acer macrophyllum							A
Achillea millefolium var. *occidentalis*			X				
Adenocaulon bicolor							A
Agropyron repens		AC					
Agrostis spp.	A	AC		A			
Aira caryophyllea	A	AC	X	A	A	AL	A
Aira praecox							A
Allium acuminatum		AC					
Alnus rubra				A			A
Amelanchier alnifolia			X				A
Amsinckia menziesii		AC					
Anthoxanthum odoratum				A			A
Arbutus menziesii					A		A
Armeria maritima		AC					
Arrhenatherum elatius						AL	
Bellis perennis				A			A
Berberis aquifolium	AL				A		A
Brassica campestris	AL	AC					
Brodiaea coronaria ssp. *coronaria*	A						
Bromus carinatus			X				
Bromus hordeaceus ssp. hordeaceus (Bromus mollis)	A	AL, AC	X	A	A		A
Bromus rigidus	AL, a	AC					
Bromus sitchensis		AC					
Bromus species						AL	
Bromus sterillis							A
Camassia leichtlinii ssp. *suksdorfii*					A		A
Camassia quamash					A		A
Camassia sp.				AL			

Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Camissonia contorta, but pl prostrate, sparsely glandular, fr. sessile 1x20mm, petals ca 4mm		AC					
Cardamine cf. *oligosperma*						AL	
Cardamine hirsuta	AL	AL					
Cardamine oligosperma				A			A
Carex aurea				A			
Carex inops ssp. *inops*	A	AL, AC		A			
Carex spp.				AL, A			
Carex tumulicola		AC	X				
Carex; short rhiz., multiple head		AC					
Castilleja levisecta			X				
Cerastium arvense ssp. *strictum*		AL, AC		A	A		A
Cerastium glomeratum (=C. viscosum)				AL, A		AL	
Cirsium arvense	AL	AC					
Cirsium vulgare	A	AC		A			A
Claytonia perfoliata ssp. *perfoliata (=Montia perfoliata)*				A			A
Clinopodium douglasii (Satureja douglasii)							A
Collinsia parviflora							A
Corallorhiza maculata							A
Corallorhiza maculata - white corolla							A
Corallorhiza striata							A
Cotoneaster sp.						AL	
Crassula connata						AL	
Crataegus douglasii				A			
Crataegus monogyna	A	AC		A	A	AL	
Crepis capillaris	A	AC					
Cynosurus echinatus	A						A
Cystopteris fragilis							A
Cytisus scoparius					A		
Dactylis glomerata	A	AC	X	AL, A	A	AL	A
Danthonia californica	A	AC					
Daucus carota	A				A		

Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Digitalis purpurea							A
Distichlis spicata		AC					
Dodecatheon hendersonii ssp. *hendersonii*					A		A
Dodecatheon pulchellum		AC					
Elymus glaucus		AC	X				
Erodium cicutarium		AC		A			
Erythronium oreganum							A
Eschscholtzia californica	A						
*Euphorbia (*mole plant)						AL	
Festuca cf. *roemeri*				A			
Festuca occidentalis							A
Festuca roemeri					A		
Festuca rubra	A	AC	X	AL		AL	A
Fragaria vesca	A						
Fragaria virginiana ssp. *platypetala*				A		AL	
Fritillaria affinis (F. lanceolata)	A	AC			A		A
Galium aparine		AC		A		AL	A
Galium boreale		AC					
Gaultheria shallon							A
Geranium dissectum		AC					
Geranium molle				A	A		A
Geranium robertianum						AL	
Grindelia stricta var. *stricta*		AC					
Heracleum lanatum	AL						
Heuchera micrantha var. *micrantha*							A
Holcus lanatus	A	AC		A	A	AL	
Holodiscus discolor		AC			A		A
Hypericum perforatum	A				A		A
Hypochaeris glabra							A
Hypochaeris radicata	A	AC		AL, A	A		A
Juncus balticus		AC					
Juniperus maritima (J. scopulorum misapplied)							A

Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Koeleria macrantha			X				
Lactuca muralis							A
Lathyrus nevadensis var. *pilosellus* (calyx sparsely pub)							A
Leontodon sp.		AC					
Lepidium sp. *(*perennial)		A					
Lepidium virginicum		AL, AC					A
Lepidium, heterophyllum? densiflorum? (perennial)		AC					
Linanthus bicolor var. bicolor							A
Lithophragma parviflora					A		
Lolium perenne	A	AC	X				
Lomatium nudicaule		AL, AC					
Lonicera hispidula							A
Lotus micranthus					A		
Lotus unifoliatus (L. purshianus)						AL	
Lupinus bicolor	A	AL, AC			A		A
Lupinus littoralis		AC					
Luzula comosa		AL	X	AL			
Luzula comosa/multiflora				A	A		A
Luzula multiflora ssp. *multiflora*		AC					
Lychnis coronaria							A
Malus fusca				A			
Marah oreganus							A
Melica subulata							A
Moehringia macrophylla							A
Montia parvifolia							A
Myosotis discolor	AL	AC		A	A	AL	A
Nemophila parviflora							A
Osmorhiza chilensis							A
Picea sitchensis	A						
Pinus contorta	A						
Plantago lanceolata		AC		AL, A			A
Plectritis congesta							A

Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Poa annua		AC					A
Poa bulbosa						AL	A
Poa pratensis	A	AL, AC	X	AL	A	AL	
Polypodium glycyrrhiza							A
Polypogon monspeilensis		AC					
Polysticum munitum							A
Prunella vulgaris				A			
Prunus sp. - non-native					A		A
Pseudotsuga menziesii	A	AC	X	A	A		A
Pteridium aquilinum var. *pubescens*	AL, a	AL, AC		A		AL	A
Quercus garryana							A
Ranunculus occidentalis var. *occidentalis*		AL, AC		A	A		A
Ranunculus spp, some *R. californicus* characteristics		AL					
Ribes divaricatum	AL						
Rosa gymnocarpa	AL						A
Rosa nutkana	A	AC		AL, A		AL	A
Rubus armeniacus (R. discolor)	A	AC		A	A	AL	
Rubus leucodermis					A		
Rubus parviflorus					A		
Rubus spectabilis		AC					
Rubus ursinus ssp. *macropetalus*	AL	AC	X	A		AL	A
Rumex acetosella	A	AC		A	A	AL	A
Salix hookeriana		AC					
Salix scouleriana							A
Sambucus racemosa var. *racemosa (=Sambucus racemosa* var. *arborescens)*				A			
Sanicula crassicaulis		AC		A	A		A
Saxifraga integrifolia var. *integrifolia*					A		
Schedonorus arundinaceus (Festuca arundinacea)		AC		AL, A	A		
Sedum spathulifolium							A
Selaginella wallacei							A
Senecio jacobaea		AC		A			
Senecio vulgaris							A
Shepherdia canadensis				A			
Sherardia arvensis					A		A
*Sisyrinchium idahoense (*var. *segetum* most likely, var. *idahoense* possible)		AC		A		AL	
Sonchus asper	A	AC					
Spergularia macrotheca		AC					

Species name	Cattle Point NRCA	American Camp	False Bay	Frazer Homestead	Kanaka Bay	Westside Scenic Preserve	Young Hill
Stellaria media				A			A
Symphoricarpos albus var. *laevigatus*	AL	AC	X	AL, A		AL	A
Taraxacum officinale		AC		A	A		A
Teesdalia nudicaulis		AC					
Tragopogon dubius		AC					
Tragopogon porrifolius						AL	
Trientalis borealis ssp. *latifolia (=T. latifolia)*							A
Trifolium dubium	A	AC		A	A		A
Trifolium microcephalum	A						
Trifolium microdon				A	A	AL	A
Trifolium subterraneum				AL		AL	
Trifolium willdenowii (=Trifolium tridentatum)	A						A
Triphysaria pusilla (=Orthocarpus pusillis)	A	AL, AC		AL, A			
Triteleia grandiflora (WA Flora Checklist recognizes var. *howellii, FNA does not. Brodiaea howellii)*	A	AC					
Triteleia hyacinthina (=Brodiaea hyacinthina)	A						
Urtica dioica ssp. *gracilis*	AL			A			A
Veronica arvensis							A
Vicia americana		AC					
Vicia hirsuta	A	AC		A	A	AL	A
Vicia sativa	AL, A	AL, AC		A	A	AL	A
Vulpia bromoides	A			AL			
Vulpia sp.				A			
Zigadenus venenosus var. *venenosus*	A	AL, AC		AL			A

Sources:

Cattle Point NRCA, AL=Joe Arnett, Judy Lantor, 20May2008; A=Joe Arnett 18June2008
American Camp, San Juan Island, AL=Joe Arnett and Judy Lantor, 20May2009; AC= Joe Arnett and Wendy Coleman 18June2008
San Juan Valley, San Juan Island; DB=Terry Domico and John Bradley report, Aug. 2000; FC=Caplow notes, May 20, 2002
Frazer Homestead Preserve, SJCLB: AL= Joe Arnett and Judy Lantor 20May2008;A=Joe Arnett, 20May2009
Kanaka Bay, San Juan Is.: A=Joe Arnett 20May2009
West Side Preserve, San Juan Is, SJCLB, AL=Joe Arnett, Judy Lantor May 20, 2008
Young Hill, San Juan: A=Joe Arnett, 20May2009

Whidbey Island sites									
Species name	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Ebeys Landing	Ebey's Prairie NPS turn-out	Fort Ebey, bluff at north end of the park	Forbes Point	West Beach	Pacific Rim Institute at Smith Prairie
Achillea millefolium				W	IE	A			X
Achillea millefolium var. *occidentalis*	C	C, w	C				C	C	
Agastache urticifolia			X	W					
Agropyron repens				w					
Agrostis alba			X	w					
Agrostis capillaris (=A. tenuis)	w		X	W					X
Agrostis exarata					IE				
Agrostis gigantea				W					
Agrostis spp.	w	C,w	x			A	A		
Aira caryophyllea	C	A	C	w	IE	A	C		X
Aira praecox	C		X	w	IE				X
Allium acuminatum			X	W		A			
Allium cernuum					IE				
Ambrosia chamissonis			X	W					
Amelanchier alnifolia			X	w					
Amsinckia menziesii			X						
Amsinckia menziesii var. *intermedia*			X	W					
Amsinckia menziesii var. *menziesii*			X	W					
Amsinckia retrorsa			X	w					
Amsinckia sp.									X
Amsinckia spectabilis			X	W					
Anaphalis margaritacea	w		X	W					
Anthemis cotula			X	w					
Anthoxanthum odoratum	w	C,w	x	w				C, A	x
Anthriscus caucalis (=A. scandicina)			x	w	IE		C		x
Aphanes arvensis	w			W					
Aphanes occidentalis (Alchemilla)			X	w					
Arabidopsis thaliana			X	w					X
Arabis glabra			X	w					
Arctium minus			X	W					
Argentina egedii ssp. *egedii (=Potentilla pacifica)*			X	W					
Armeria maritima			X	W					

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Arrhenatherum elatius	w		X	w					
Artemisia borealis var. *scouleriana*			C						
Artemisia campestris			X	W					
Artemisia suksdorfii	w								
Atriplex patula			X	W					
Avena fatua			X	w					
Barberea orthoceras									X
Bellis perennis	w								
Berberis aquifolium	w		X	w		A			X
Brassica sp.				W					
Brassica campestris	w		X	w	IE				
Brodiaea coronaria ssp. *coronaria*	w		X	W	IE	A			X
Bromus carinatus	C	C,w					C, A	C	
Bromus hordeaceus ssp. *hordeaceus (Bromus mollis)*	C		C, X	w	IE	A	C		
Bromus rigidus	C		C	w		A			
Bromus sitchensis			X	w	IE	A			X
Bromus tectorum				w	IE				
Cakile edentula				W					
Cakile maritima			X	W					
Calandrinia ciliata			X	w					
Camassia quamash			X	W					X
Capsella bursa-pastoris			X	W	IE				
Cardamine hirsuta			X	w					
Cardamine oligosperma			X	w					
Cardamine pennsylvanica									X
Carex inops ssp. *inops*			X	W					
Carex lyngbeyi			X	w					
Carex macrocephala			X	w					
Carex pensylvanica									X
Carex rossii								C	
Carex tumulicola		C,w	X	w		A	C	C	X

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Castilleja levisecta	C	C, w	C, A	w			C	C	
Castilleja miniata		C, w	C						
Cerastium arvense ssp. *strictum*	w		C	W	IE	A			X
Cerastium glomeratum (=C. viscosum)	C		X	w		A	C		
Cerastium vulgatum	w		X	w					X
Chenopodium album			X	W					
Cirsium arvense	w		X	W	IE		C		X
Cirsium brevistylum	C						C		
Cirsium vulgare	C		X	W	IE	A	C		X
Claytonia parviflora (C. perfoliata var*. parviflora, Montia perfoliata* (in part), *M. perfoliata* var. *parvilfora)*				w					
Claytonia perfoliata ssp. *perfoliata (=Montia perfoliata)*			X	W					
Claytonia rubra			X	w					
Claytonia siberica			X	w					X
Clinopodium douglasia			X	w					
Clinopodium douglasii (=Satureja)	C		X	W		A			
Collinsia parviflora			X						
Coniosilenum pacificum			X	W					
Conium maculatum			X	W					X
Convolvulus sepium					IE				
Conyza canadensis			X	w					
Corallorhiza maculata									X
Coronopus didymus			X	w					X
Crataegus douglasii	w								
Crataegus suksdorfii	w								
Crepis capillaris			X	w	IE				
Crepis modocensis									X
Crepis sp.	w		X						

Cuscuta salina			X	W					
Species name	Ft. Casey	Naas/ Admiralty	Ebey's Bluff, TNC	Ebeys Landing	Ebey's Prairie NPS turn-out	Fort Ebey, bluff at north end of the park	Forbes Point	West Beach	Pacific Rim Institute at Smith Prairie
Cytisus scoparius			X	W					X
Dactylis glomerata	C	C,w	C	W	IE		C	C, a	X
Danthonia californica						A			X
Daphne laureola									X
Daucus carota		C, w	C	W			C		
Daucus pusillis			X	W					
Distichlis spicata			X	W					
Dodecatheon hendersonii ssp. *hendersonii*									X
Draba verna (or *Erophila verna)*			X	W					
Elymus glaucus	w								
Elymus mollis			X			A			
Elymus repens (=Agropyron repens, Elytrigia repens)	w		X		IE				
Equisetum hymale			X	w					
Equisetum telmateia			X	w					
Equisetum variegatum var. variegatum			X	W					
Erigeron speciosus var. *speciosus*	w	C, w	C					C	x
Eriophyllum lantaum var. *lanatum*			C, X	W		A			X
Erodium cicutarium			X	W	IE	A			X
Eschscholtzia californica			X	w					
Festuca bromoides			X	w					
Festuca occidentalis			X	w					X
Festuca roemeri			X	w					X
Festuca rubra	C	C,w	C	W		A	C	C	
Festuca scabrella					IE				
Fragaria vesca ssp. *bracteata* (some may be recognized as ssp. *crinita)*		C, w							
Fragaria virginiana ssp. *platypetala*								C, A	x
Fritillaria affinis (F. lanceolata)		w	X	W		A		C	x

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Galium aparine	C		X	W	IE	A	C		X
Galium triflorum									X
Gaultheria shallon			X	W					
Geranium dissectum	w						C		
Geranium molle			X	W	IE				
Geum macrophyllum			X	w					
Gnaphalium chilense				w					
Gnaphalium purpureum			X	w					
Grindelia integrifolia			X	W					
Grindelia stricta var. *stricta*	C		C			A			
Heracleum maximum	C	C, w							
Hesperis matronalis			X	W					
Heterotheca villosa (=Chrysopsis villosa)			X	W					
Hieracium sp.									X
Holcus lanatus	C	C,w	X	W		A	C, A	C, A	X
Holodiscus discolor			X	W					
Honkenya peploides			X	W					
Hordeum brachyantherum			X	w					
Hordeum murinum			X	w					
Hypericum perforatum			X	W					
Hypochaeris glabra				W, A					
Hypochaeris radicata	C	C, w	C	W	IE	A	C		X
Ipomopsis aggregata									X
Juncus bufonius			X	w					
Koeleria macrantha			C						
Lactuca serriola			X	W	IE				
Lamium purpureum			X	w					X
Lathyrus japonicus	w		X	W					
Lepidium densiflorum			X	W					
Lepidium virginicum			X	W					

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Leucanthemum vulgare (=Chrysanthemum leucanthemum)	w	w	X	W	IE				
Leymus mollis ssp. *mollis*	C		X	W				C	
Linanthus bicolor var. *bicolor*						A			
Lithophragma parviflora			X	W	IE				X
Lolium multiflora			X	w					
Lolium perenne	w								
Lomatium nudicaule	C		X	W		A		C	X
Lomatium utriculatum			C	W					X
Lonicera hispidula			X	W					
Lotus denticulatus	C								
Lotus unifoliatus (L. purshianus)	w								
Lupinus arboreus			X	W					
Lupinus bicolor			X	W		A			
Lupinus littoralis			C	W					
Lupinus microcarpus (L. densiflorus var. *densiflorus)*	C								
Lupinus microcarpus var. scopulorum	w								
Lupinus polyphyllus var. *polyphyllus*								A	
Lupinus rivularis			X	w					
Luzula campestris			X	w					X
Luzula comosa	C	C,w	C	w			C		
Lycopus uniflorus			X	W					
Lynchnis alba			X	w					
Mahonia aquilifolium	w		C	W	IE		C		
Maianthemum dilatatum			X	W					
Maianthemum stellatum (=Smilacina stellata)			X	w					
Malus fusca				w					
Marrubium vulgare			X	W	IE				

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Matricaria chamomilla			X	w					
Matricaria discoidea (=M. matricarioides)				W	IE				
Matricaria matricariodes	w		X	w		A			
Medicago lupulina			X	w					X
Medicago sativa			X	W	IE				
Melica subulata			X	w					
Microseris laciniata ssp. laciniata									x
Montia parvifolia									X
Myosotis discolor	C	C, w	X	W		A		C	X
Nepeta cataria			X	w					
Oemleria cerasiformis			X	w					
Opuntia fragilis			X	W					
Orobanche uniflora									X
Orobanche uniflora var. minuta									X
Osmorhiza chilensis			X	w					
Papaver argemone									X
Papaver somniferum			X	w					
Parentucellia viscosa		w							
Perideridia gairdneri	w								
Phalaris arundinacea									X
Phyllospadix scouleri			X	w					
Picea sitchensis			X	w		A			
Piperia elegans ssp. elegans (=Habenaria greenei)						A			
Plantago lanceolata	C	C, w	C	W	IE	A	C, A	C	X
Plantago major			X	w					
Plantago maritima var. *juncoides*			X	W					
Platanthera elegans		w							
Poa annua	w		X	w	IE				X
Poa bulbosa			X	W					

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Poa cf. palustris	w								
Poa compressa									X
Poa howellii									X
Poa macrantha			X	W					
Poa palustris									X
Poa pratensis	C	C,w	C		IE	A	C	C	X
Poa trivialis			X	w					
Polygonum aviculare			X	w					
Polygonum paronychia			X	W					
Polypodium glycyrrhiza			X	ww					
Polypodium hesperium			X						
Polypogon monspeilensis			X	w					
Polysticum lonchitis	C		X						
Polysticum munitum	C		X	w					
Prunella vulgaris	w	w							
Pseudognaphalium stramineum (=Gnaphalium chilense)			X						
Pseudotsuga menziesii		w	X	W		A		A	
Pteridium aquilinum var. pubescens	w	w	x	W		A	C	C, A	X
Puccinelia nuttalliana			X	w					
Pyrus fusca			X						
Ranunculus occidentalis var. occidentalis		C,w	X	w					X
Ranunculus repens			X	w					
Raphanus sativus									X
Rhododendron macrophyllum			X	w					
Ribes divaricatum	w		X	W					
Ribes lacustre			X	W					
Rosa nutkana	C	C, w	X	W	IE	A	C	C	X
Rosa rugosa			X	W					
Rubus armeniacus (R. discolor)	w				IE				X

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Rubus parviflorus	w								
Rubus spectabilis	w		X	w					
Rubus ursinus ssp. *macropetalus*	C	C, w	X	w		A	C	C	
Rumex acetosella	C	C,w	A	W	IE	A	C	C	X
Rumex crispus	w		X	W	IE				
Rumex obtusifolius	w								
Rumex occidentalis			X	w					
Rumex triangulivalvis (R. salicifolius)	w		X	W					
Ruppia maritima			X	w					
Sagina apetala			X	w		A			
Sagina procumbens			X	w					
Salicornai virginica			X	W					
Salix scouleriana			X	w					
Sambucus racemosa var. racemosa (=Sambucus racemosa var. *arborescens)*	w		X	W					
Sanicula bipinnatifida			X	W	IE				X
Sanicula crassicaulis			X	W		A			X
Sanicula crassicaulis var. *crassicaulis*	C	C,w	X				C	C	X
Sanicula crassicaulis var. *tripartita*	C	C,w	X				C	C	X
Schedonorus arundinaceus (Festuca arundinacea)	w		X	W	IE		C, A		
Scirpus americanus			X	w					
Senecio jacobaea			X	W					
Senecio sylvaticus			X	w					X
Senecio vulgaris			X	w					
Sidalcea hendersonii			X	w					
Sidalcea hirtipes				W					
Silene gallica			A	w					
Silene latifolia ssp. *alba (=Lychnis alba)*			A	W					

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Silene menziesii ssp. menziesii			C						
Silene scouleri			X	W					
Sisymbrium altissimum			X	w					X
Sisymbrium officinale			X	W	IE				X
*Sisyrinchium idahoense (*var. *segetum most likely,* var. *idahoense possible)*		A							
Sisyrinchium sp.	w								
Solidago canadensis			X	W					X
Solidago lepida var. *salebrosa (S. canadensis* var. *salebrosa)*	C	C,w	C					C	X
Solidago simplex var. simplex (S. spathulata)									X
Soliva sessilis	w								
Sonchus arvensis			X	W					
Sonchus asper	w		X	W					
Sonchus oleraceus			X	w		A			
Sonchus sp.	C								
Spergularia canadensis			X	w					
Spergularia rubra	w		X	w					
Spergularia salina (=S. marina)			X	W					
Spiranthes romanzoffiana		w							
Stachys chamissonis var. cooleyae (=S. cooleyae)			X	W					
Stellaria crispa			X	w					
Stellaria media	w		X	w	IE				
Symphoricarpos albus	C	w	X	W	IE		X		X
Symphoricarpos albus var. *laevigatus*	X						C		
Symphyotrichum chilense (=Aster chilensis)		w							
Tanacetum vulgare			X	W					
Taraxacum officinale	C	C,w	X	W	IE	A	C	C	
Taxus brevifolia			X	w					

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Tellima grandiflora			X	w					
Thuja plicata			X	w					
Tiarella trifoliata			X	w					
Tragopogon dubius			X	W					X
Tragopogon porrifolius			X	W					
Trientalis borealis ssp. *latifolia (=T. latifolia)*				W					X
Trifolium agrarium									X
Trifolium arvense			X	w	IE				
Trifolium dubium	C	C,w, A	X	W	IE	A	C		
Trifolium hybridum			X	w					
Trifolium microdon			X	w					
Trifolium pratense	C		X	W			X		
Trifolium procumbens	w	A	X	w					
Trifolium repens	C		X	w			C		
Trifolium subterraneum	w								
Trifolium willdenowii (=Trifolium tridentatum)	w		x	W					
Triglochin maritimum			X	W					
Triphysaria pusilla (=Orthocarpus pusillis)	w		X	W		A			X
Trisetum canescens			X						
Trisetum cernuum			X	w					
Triteleia grandiflora (WA Flora Checklist recognizes var. *howellii, FNA does not. Brodiaea howellii)*									X
Triteleia hyacinthina (=Brodiaea hyacinthina)	w		X	w					X
Tsuga heterophylla			X	W					
Ulex europaeus			X	W					
Urtica dioica ssp. *gracillis*	w		X	W	IE				
Vaccinium ovatum			X	w					

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Vaccinium parvifolium			X	w					
Valerianella locusta									X
Veronica arvensis			x	w		A			
Veronica hederaefolia			X	W					
Veronica sp.									X
Vicia americana				w		A			
Vicia americana ssp. *americana*	C	C,w	X						X
Vicia cracca			X	W					
Vicia gigantea	w		X	w					
Vicia hirsuta	C	C,w	C	w	IE		C	C, A	
Vicia sativa	C	C,w	C	W	IE	A	C	C	X
Vicia species					IE				
Vicia villosa			X	W			C		X
Vinca major			X	w					
Viola adunca			X	W					
Vulpia bromoides	C				IE	A	C		
Zigadenus venenosus var. venenosus			X	w		A			X
Zostera marina			X	w					

Pacific Rim Institute at Smith Prairie: x= WNPS list, Steve Byler, April 2002; Fred Weinman May 2002
Hertitage Forest bluff w=WCLT (likely source)
Naas/Admiralty Inlet NAP: C=Chappell and Caplow 2004; w=Whidbey Camano Land Trust list 2006, A=Arnett 22June2007
Ebey's Bluff (TNC property on Hill Road): C=Chappell and Caplow 2004;
NPS Prairie Turnout: IE= Island Ecological, Coupeville
Ebeys Landing to Peregos Lagoon: W=WNPS field trips (C. Antieau, leader April 1992, Art Kermoade leader June 1992, additions by Jum duemmel, Marie Hitchman, and Harold Mitchell June 2002, UW herbarium collections 2004, A. Dursh, M. Hoff, A. Kermoade, H.G. Mitchell, P. Youngman, revised 19April2000);
Fort Ebey, bluff at north end of the park, A=Joe Arnett20June2008
West Beach: C=Chappell and Caplow 2004; A=Arnett 22June2007, 22May2008

Jefferson and Skagit County potential reintroduction sites						
Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Acer macrophyllum		W			A	
Achillea millefolium		W	A			A+
Achillea millefolium var. *occidentalis*	w			A		
Achnatherum occidentale (=Stipa occidentale)		W				
Adenocaulon bicolor		W				
Agropyron repens	w					
Aira caryophyllea	w	W		A		
Aira praecox			A	A		
Allium acuminatum		W		A		A+
Allium cernuum		W		A		A+
Allium sp.					A	
Alnus rubra		W			A	
Ambrosia chamissonis		W		A		A+
Amelanchier alnifolia		W	A	A	A	
Ammophila arenaria		W				
Amsinckia sp.		W				
Anaphalis margaritacea		W				
Anthoxanthum odoratum					A	
Anthriscus caucalis (=A. scandicina)	w					
Aphanes arvensis		W		A	A	
Apocynum androsaemifolium					A	
Arabidopsis thaliana		W				
Arabis glabra		W		A		
Arbutus menziesii		W	A		A	A+
Arctium minus		W				
Arctostaphylos uva-ursi		W				
Arenaria stricta		W				
Argentina egedii ssp. *egedii (=Potentilla pacifica)*		W				
Armeria maritima		W		A		
Arrhenatherum elatius		W				
Artemisia absinthium	w					
Artemisia campestris		W	A			
Artemisia suksdorfii		W				
Aspidotis densa		W				
Asplenium trichomanes		W				
Aster species		W				
Athyrium filix-femina		W			A	
Atriplex cf. dioica						A+
Atriplex patula		W				
Atriplex sp.				A		
Barberea orthoceras		W				

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Bellis perennis		W	A		A	
Berberis aquifolium	w	W	A	A	A	A+
Berberis nervosa		W				
Blechnum spicant		W				
Brassica rapa	w					
Brodiaea coronaria ssp. *coronaria*	w	W				
Bromus carinatus		W				A+
Bromus hordeaceus ssp. hordeaceus (Bromus mollis)	w	W		A		A+
Bromus pacificus		W				
Bromus rigidus	w					
Bromus sitchensis						A+
Bromus sterillis		W				
Bromus tectorum	w	W				A+
Bromus vulgaris		W				
Cakile edentula		W				
Cakile maritima		W				A+
Calypso bulbosa		W				
Camassia quamash	w	W	A	A		
Camassia sp.					A	A+
Campanula rotundifolia		W				A+
Capsella bursa-pastoris	w	W				
Cardamine cf. oligosperma			A			
Cardamine hirsuta	w					
Cardamine oligosperma		W			A	A+
Carex inops ssp. *inops*	w					
Carex macrocephala		W				
Carex obnupta		W				
Carex tumulicola	w					
Castilleja hispida		W				A+
Cerastium arvense ssp. *strictum*	w	W		A	A	
Cerastium glomeratum (=C. viscosum)	w			A	A	A+
Cerastium nutans		W				
Cerastium vulgatum		W				
Chimaphila umbellata		W				
Cicuta douglasii		W				
Circaea alpina		W			A	
Cirsium arvense	w	W				A+
Cirsium brevistylum		W				
Cirsium vulgare	w	W			A	
Claytonia exigua ssp. exigua		W				
Claytonia perfoliata ssp. *perfoliata (=Montia perfoliata)*	w	W	A	A	A	A+

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Claytonia rubra						A+
Claytonia siberica	w	W			A	
Clinopodium douglasia (Satureja douglasii)		W				A+
Collinsia parviflora		W			A	A+
Collomia heterophylla		W				
Comandra umbellata		W				
Coniosilenum pacificum		W				A+
Conium maculatum		W				
Convolvulus soldanella		W				
Corallorhiza maculata		W				
Corallorhiza mertensiana		W				
Corallorhiza striata		W				
Cornus sericea (=C. stolonifera)		W				
Corylus cornuta					A	
Crataegus douglasii var. douglasii					A	
Crataegus monogyna	w					
Crepis atrabarba		W				
Cystopteris ?						A+
Cytisus scoparius	w	W				
Dactylis glomerata	w	W	A			
Danthonia californica	w	W		A		
Daucus pusillis		W				
Delphinium menziesii	w	W				
Delphinium menziesii var. menziesii				A		
Digitalis purpurea						A+
Distichlis spicata		W		A		A+
Draba verna (or Erophila verna)	w	W	A			
Drosera rotundifolia		W				
Dryopteris expansa		W				
Eleocharis palustris		W				
Elodea canadensis		W				
Elymus glaucus				A	A	
Elymus mollis		W				
Empetrum nigrum		W				
Epilobium angustifolium		W				
Epilobium ciliatum ssp. watsonii		W				A+
Epilobium minutum		W				
Equisetum arvense						A+
Equisetum fluviatale		W				
Equisetum hymale		W				
Equisetum telmateia		W				
Erigeron speciosus var. *speciosus*	w					

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Eriophyllum lanatum	w	W	A			A+
Erodium cicutarium	w	W	A		A	
Erythronium oreganum		W			A	A+
Eschscholtzia californica	w					
Festuca bromoides		W				
Festuca cf. roemeri					A	
Festuca occidentalis		W				A+
Festuca roemeri	w	W				
Festuca rubra		W		A		A+
Festuca sp.			A			
Festuca subulata		W				
Festuca subuliflora		W				
Fragarai chiloensis		W				
Fragaria vesca			A		A	
Fragaria virginiana ssp. platypetala		W				
Fritillaria affinis	w					
Fritillaria affinis var. *affinis (F. lanceolata)*		W				
Galium aparine		W	A	A	A	A+
Galium triflorum		W				
Gamochaeta?						A+
Gaultheria shallon		W	A			A+
Geranium molle	w	W			A	A+
Geranium robertianum		W			A	
Geum macrophyllum		W			A	
Geum trifllorum	w					
Gilia capitata		W				
Glehnia leiocarpa		W				
Goodyera oblongifolia		W	A			
Grindelia integrifolia		W			A	
Grindelia stricta var. *stricta*			A	A		A+
Hedera helix		W	A			
Heracleum lanatum		W				
Heterotheca villosa (=Chrysopsis villosa)		W				
Heuchera micrantha var. *micrantha*		W		A		
Hieracium albiflorum		W				A+
Hieracium scouleri (S. cynoglossoides)	w					
Hippurus vulgaris		W				
Holcus lanatus	w	W		A	A	
Holodiscus discolor		W	A	A	A	A+
Honkenya peploides		W				
Hordeum brachyantherum						A+
Hypericum perforatum	w					

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Hypochaeris glabra		W				
Hypochaeris radicata	w		A	A	A	A+
Ilex aquifolium		W			A	A+
Juncus articulatus		W				
Juncus balticus		W				
Juncus effusus		W			A	
Juncus ensifolius		W				
Juniperus communis		W				
Juniperus maritima (J. scopulorum misapplied)		W			A	A+
Kalmia occidentalis		W				
Koeleria cristata		W				
Koeleria macrantha						A+
Lactuca muralis		W			A	A+
Lamium purpureum	w	W		A	A	
Lasthenia minor		W				
Lathyrus japonicus		W				
Lathyrus littoralis		W				
Lathyrus nevadensis		W				
Ledum groenlandicum		W				
Lemna minor		W				
Lemna trisulca		W				
Leontidon autumnalis		W				
Lepidium virginicum		W				
Leucanthemum vulgare (=Chrysanthemum leucanthemum)	w	W				
Leymus mollis ssp. *mollis*						A+
Lilium columbianum		W				
Linanthus bicolor var. bicolor		W			A	
Linnaea borealis		W				
Listera caurina		W				
Listera cordata		W				
Lithophragma parviflora	w	W			A	
Lomatium martindali		W				
Lomatium nudicaule	w	W			A	
Lomatium utriculatum	w	W	A	A	A	
Lonicera ciliosa		W	A		A	A+
Lonicera hispidula		W				
Lonicera involucrata		W				
Lotus corniculatus					A	
Lotus micranthus		W		A		
Lupinus albicaulis	w					
Lupinus arboreus	w					
Lupinus bicolor		W				

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Lupinus cf. bicolor			A			
Lupinus littoralis		W				
Lupinus polycarpus	w					
Luzula campestris		W				
Luzula comosa				A		
Luzula comosa/multiflora					A	
Luzula multiflora ssp. multiflora	w					
Luzula parviflora		W				
Luzula sp.			A			A+
Lysichiton americanum		W			A	
Lysimachia thrysiflora		W				
Madia madioides		W				
Madia sativa var. sativa		W				
Maianthemum dilatatum		W	A			
Malus fusca				A	A	A+
Malus, cultivated				A		
Marrubium vulgare					A	
Matricaria discoidea (=M. matricarioides)		W				
Meconella oregana		W				
Melica subulata var. *subulata*		W				
Melilotus alba	w	W				
Mentha arvensis		W				
Menyanthes trifoliata		W				
Mimulus alsinoides		W				A+
Mimulus guttatus		W			A	A+
Mimulus moschatus		W				
Monotropa uniflora		W				
Montia linearis		W				
Montia parvifolia		W				
Myosotis discolor		W		A		A+
Myosotis laxa		W				
Myosotis micrantha		W				A+
Myriophyllum spicatum		W				
Nemophila parviflora						A+
Nemophila pedunculata		W				
Nuphar polysepalum		W				
Oemleria cerasiformis		W		A	A	
Oenanthe sarmentosa		W				
Olsynium douglasii	w	W				
Orobanche uniflora	w	W			A	
Orobanche uniflora var. minuta	w	W			A	
Osmorhiza chilensis		W	A		A	

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Parentucellia viscosa		W				
Paxistima myrsinites (=Pachistima myrsinites)		W				A+
Petisites frigidus		W				
Phlox gracilis (=Microsteris gracilis)		W				
Physocarpus capitatus		W				
Picea sitchensis		W				
Pinus contorta		W				
Pinus monticola		W				
Piperia elegans ssp. elegans (=Habenaria greenei)				A		
Pityrogramma triangularis		W				
Plantago lanceolata	w	W	A	A	A	A+
Plantago major		W				
Plantago maritima var. *juncoides*		W		A		
Platanthera elegans		W				
Platanthera sp.			A			
Plectritis congesta		W			A	A+
Poa annua		W	A	A	A	A+
Poa bulbosa		W	A			
Poa macrantha		W				
Poa palustris		W				
Poa pratensis	w			A	A	
Polygonum amphibium		W				
Polygonum fowleri		W				
Polygonum paronychia		W				
Polygonum spergulariaeforme		W				
Polypodium glycyrrhiza		W	A	A	A	
Polypodium hesperium		W				
Polysticum lonchitis		W				
Polysticum munitum		W				A+
Populus balsamifera ssp. *trichocarpa*		W				
Potamogeton foliosus		W				
Potamogeton gramineus		W				
Potamogeton zosteriformis		W				
Potenilla palustris		W				
Potentilla gracilis	w					
Prunella vulgaris	w	W				
Prunus emarginata		W				A+
Prunus laurocerasus		W				
Prunus sp. - non-native					A	
Pseudotsuga menziesii		W	A	A	A	A+
Pteridium aquilinum var. pubescens	w	W				
Pterospora andromedea		W				

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Pyrola asarifolia		W				
Pyrus fusca		W				
Ranunculus occidentalis var. occidentalis	w	W	A		A	
Ranunculus repens		W			A	
Ranunculus sceleratus		W				
Ranunculus sp.				A		
Ranunculus uncinatus		W				
Rhamnus purshiana		W		A		
Rhododendron macrophyllum		W				
Ribes divaricatum		W			A	
Ribes lacustre		W				
Ribes sanguineum		W				A+
Rorippa islandica		W				
Rosa eglanteria					A	
Rosa gymnocarpa	w	W	A		A	
Rosa nutkana	w	W		A	A	
Rubus armeniacus (R. discolor)	w	W	A		A	A+
Rubus laciniatus		W			A	
Rubus leucodermis		W				A+
Rubus parviflorus		W				
Rubus spectabilis		W				
Rubus ursinus ssp. *macropetalus*	w	W		A		A+
Rumex acetosella	w	W	A	A	A	A+
Rumex crispus		W		A		
Rumex tenuifolius	w					
Sagina occidentalis		W				
Salicornai virginica		W		A		
Salix hookeriana		W				
Salix lucida (=S. lasiandra)		W				
Salix scouleriana		W				A+
Salix sitchensis		W			A	
Sambucus racemosa var. racemosa (=Sambucus racemosa var. *arborescens)*		W				
Sanicula bipinnatifida	w	W			A	
Sanicula crassicaulis		W	A	A	A	A+
Saxifraga caespitosa		W				
Saxifraga ferruginea		W				
Saxifraga integrifolia	w	W				
Saxifraga integrifolia var. *integrifolia*					A	
Scirpus maritimus		W				
Scutellaria galericulata		W				
Sedum lanceolatum		W			A	A+
Sedum spathulifolium		W		A		

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Selaginella wallacei		W	A		A	A+
Senecio sylvaticus		W				
Senecio vulgaris	w	W				A+
Shepherdia canadensis		W				
Sherardia arvensis					A	
Silene gallica		W				
Sisymbrium californicum		W				
Sisymbrium officinale		W				
Sisyrinchium angustifolium		W				
Sium suave		W				
Solanum dulcamara	w	W				
Solidago canadensis	w	W				
Solidago simplex var. simplex (S. spathulata)	w					
Sonchus arvensis				A		
Sonchus asper		W		A	A	
Sonchus oleraceus		W				A+
Sonchus sp.					A	
Sonchus uliginosus		W				
Sparganium angustifolium		W				
Sparganium emersum		W				
Spergularia rubra		W				
Spiraea douglasii		W				
Spiranthes romanzoffiana		W				
Stachys chamissonis var. cooleyae (=S. cooleyae)		W				
Stellaria media	w	W				A+
Stellaria nitens		W				
Stipa lemmonii	w					
Streptopus amplexifolius		W				
Symphoricarpos albus	w	W			A	
Tanacetum vulgare		W				
Taraxacum officinale	w		A		A	A+
Taxus brevifolia		W				A+
Tellima grandiflora		W				
Thuja plicata		W			A	A+
Tiarella trifoliata		W				
Tragopogon dubius	w					
Tragopogon mirus	w					
Tragopogon porrifolius	w					
Trientalis borealis ssp. *latifolia (=T. latifolia)*		W			A	A+
Trifolium dubium		W		A	A	A+
Trifolium hybridum		W				
Trifolium microcephalum		W		A		A+

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Trifolium oliganthum						A+
Trifolium pratense	w	W				
Trifolium procumbens		W		A		
Trifolium repens		W				
Trifolium subterraneum		W			A	
Trifolium willdenowii (=Trifolium tridentatum)		W		A		
Trifolium wormskioldii		W				
Triglochin maritimum		W				
Triphysaria attenuatus		W				
Triphysaria pusilla (=Orthocarpus pusillis)	w	W	A	A	A	A+
Triphysaria pusilla (=Orthocarpus pusillis), some green plants			A			
Trisetum cernuum		W				
Triteleia hyacinthina (=Brodiaea hyacinthina)		W	A	A		A+
Tsuga heterophylla		W			A	
Typha latifolia		W			A	
Urtica dioica ssp. *gracillis*		W			A	A+
Vaccinium alaskense		W				
Vaccinium ovatum		W				A+
Vaccinium parvifolium		W			A	A+
Vaccinium uliginosum		W				
Valerianella locusta	w					
Valerianella sp.		W				
Verbascum thapsus		W				
Veronica anagallis-aquatica		W				
Veronica arvensis		W		A		
Veronica chamaedrys	w					
Veronica scutellata		W				
Veronica sp.			A			A+
Vicia americana	w			A		A+
Vicia americana ssp. *americana*		W				
Vicia cracca				A		
Vicia gigantea		W	A			
Vicia hirsuta	w	W		A		
Vicia sativa	w	W	A	A	A	A+
Vicia species				A		
Vicia tetrasperma		W				
Vinca major	w					
Viola adunca		W			A	
Vulpia bromoides				A		A+
Vulpia microstachys	w					
Vulpia myuros		W				
Zigadenus venenosus var. venenosus	w	W		A		A+

Species name	Kah Tai Prairie	Deception Pass SP	Rosaria Head, Deception Pass SP	Kiket Island	Fishtown area	Huckleberry Island
Zostera marina		W				

Kah Tai Prairie w= Washington Native Plant Society list
Deception Pass SP W=Washington Native Plant Society list
Rosaria Head A= Joe Arnett, 22April2009
Kiket Island A =Joe Arnett, Rob Fimbel, David Giblin 16June2008
Fishtown area: A= Joe Arnett 22April2009
Huckleberry Island A+=Joe Arnett, Peter Dunwiddie, David Giblin, Rob Fimbel 16June2008

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Acer macrophyllum						1
Achillea millefolium	A		AL		A	1
Achillea millefolium var. lanulosa			NA	NA		
Adenocaulon bicolor			NA	NA		A
Agrostis capillaris (=A. tenuis)						1
Agrostis pallens						1
Aira caryophyllea	A	AL	AL		A	1
Aira praecox	A	AL	NA		A	1
Allium acuminatum	A	AL	AL, NA			1
Allium cernuum						1
Alnus rubra			NA	NA		1
Amelanchier alnifolia			NA			1
Amsinckia menziesii			A			
Anaphalis margaritacea			NA			
Antennaria neglecta			A			
Anthoxanthum odoratum		AL				1
Aphanes arvensis		AL				
Aphanes occidentalis (Alchemilla)			NA			
Arabis hirsuta						1
Arbutus menziesii				NA		1
Arenaria serpyllifolia					A	
Argentina egedii ssp. *egedii (=Potentilla pacifica)*		AL				
Armeria maritima		AL	AL, NA	A, NA		
Arrhenatherum elatius						1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Artemisia suksdorfii			NA			
Aspidotis densa						1
Athyrium filix-femina						1
Atriplex patula			NA			
Bellis perennis			AL			
Berberis aquifolium			NA		A	1
Berberis nervosa						1
Blechnum spicant						1
Brassica campestris			NA			
Brodiaea coronaria ssp. *coronaria*		AL	A			1
Bromus carinatus						1
Bromus diandrus						1
Bromus hordeaceus ssp. hordeaceus (Bromus mollis)	A	AL	AL, NA		A	1
Bromus pacificus			NA			1
Bromus rigidus	A	AL	AL,NA	NA	A	
Bromus sterillis			AL			1
Bromus tectorum	A		NA		A	1
Bromus vulgaris						1
Calandrinia ciliata		AL				1
Callitriche sp.						1
Calypso bulbosa			NA	NA		A
Camassia leichtlinii ssp. *suksdorfii*		AL	AL, NA			1
Camassia sp.	A					
Campanula scouleri						1
Cardamine hirsuta						1
Cardamine nuttallii var nuttallii						1
Cardamine oligosperma			NA			1
Carex arcta			NA			
Carex bebbii (may be mis-ID of C. feta)						1
Carex brevicaulis			NA			
Carex cf. tumilicola			A	A		
Carex inops ssp. *inops*		AL	A		A	1
Carex obnupta		AL		NA		1
Carex pachystachya						1
Carex pensylvanica var. vespertina			NA			
Carex rossii						1
Carex spp.			NA			
Carex tumulicola		AL	A			
Carex vesicaria						1
Carex: androgynous, did not readily key					A	
Carex: multiple head, caespitose, gynaecandrous (imm)		AL				

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Castilleja attenuata						1
Castilleja hispida				NA		
Centaurea sp						1
Cerastium arvense ssp. *strictum*	A	AL	AL, NA	NA	A	1
Cerastium glomeratum (=C. viscosum)		AL			A	1
Cerastium semidecandrum	A					
Cerastium vulgatum					A	
Cirsium arvense		AL	A, NA			1
Cirsium brevistylum						1
Cirsium vulgare		AL	AL, NA		A	1
Clarkia amoena ssp. caurina (best fit)					A	
Clarkia amoena ssp. lindleyi						1
Claytonia perfoliata ssp. *perfoliata (=Montia perfoliata)*			NA	NA	A	1
Claytonia siberica			NA			1
Clematis vitalba						1
Clinopodium douglasii (=Satureja)	A	AL	A, NA	A, NA	A	1
Collinsia parviflora			NA		A	1
Collomia heterophylla						1
Coniosilenum pacificum			NA			
Corallorhiza maculata				A		1
Crataegus monogyna			NA			1
Crepis sp.						
Cryptogramma acrosticoides						1
Cynosurus echinatus						1
Cystopteris fragilis						1
Cytisus scoparius						1
Dactylis glomerata		AL	AL, NA	NA	A	1
Danthonia californica	A		A		A	1
Daucus carota						1
Delphinium menziesii			A, NA		A	1
Delphinium menziesii var. menziesii			NA			
Dianthus armeria			AL			
Digitalis purpurea					A	1
Dipsaucus fullonum						1
Distichlis spicata		AL	A,NA			
Dodecatheon hendersonii ssp. *hendersonii*						1
Dodecatheon pulchellum var. pulchellum			NA			
Dryopteris arguta						A
Eleocharis palustris						1
Elymus glaucus			A			1
Elymus repens (=Agropyron repens, Elytrigia repens)						1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Epilobium ciliatum ssp. watsonii						1
Equisetum arvense						1
Equisetum hymale						1
Equisetum telmateia						1
Eriophyllum lanatum	A	AL	A		A	
Eriophyllum lantaum var. *lanatum*			NA	NA		1
Erodium cicutarium		AL	NA	NA		1
Erythronium oreganum						1
Festuca bromoides			NA			
Festuca occidentalis						1
Festuca roemeri						1
Festuca rubra	A	AL	AL	A	A	1
Fragaria vesca					A	
Fragaria vesca ssp. *bracteata (some may be recognized as ssp. crinita)*			NA	NA		1
Fragaria virginiana ssp. platypetala		AL	NA			1
Fritillaria affinis (F. lanceolata)	A	AL	AL, NA			1
Galium aparine			A		A	1
Galium trifidum		AL				1
Galium triflorum						1
Galium, triflorum? Immature					A	
Gaultheria shallon	A	AL	NA	A, na		1
Geranium dissectum		AL				A
Geranium molle	A	AL	NA		A	1
Geranium robertianum						1
Geum macrophyllum		AL				1
Glyceria sp.						1
Gnaphalium purpureum			A, NA			
Gnaphalium sp.						1
Goodyera oblongifolia			NA	A, NA		
Grindelia integrifolia			AL, NA	A		
Grindelia integrifolia var. macrophylla				NA		
Grindelia stricta var. *stricta*	A	AL				
Hedera helix						1
Heuchera micrantha var. diversifolia			NA			
Heuchera micrantha var. *micrantha*	A					
Hieracium albiflorum			NA	A, NA		
Holcus lanatus	A	AL	AL, NA	A		1
Holodiscus discolor	A		NA	NA		1
Hypericum perforatum						1
Hypochaeris glabra						1
Hypochaeris radicata	A	AL	AL, NA	A, NA		1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Ilex aquifolium					A	1
Juncus balticus		AL	AL			
Juncus effusus				A, NA		1
Juncus ensifolius						1
Juniperus maritima (J. scopulorum misapplied)						1
Koeleria cristata					A	
Lactuca muralis			A	NA	A	A
Lactuca serriola						1
Lamiastrum galeobdolon						1
Lamium purpureum						1
Lapsana communis						A
Lathyrus japonicus		AL				
Lathyrus nevadensis		AL			A	
Lathyrus nevadensis var. pilosellus (calyx sparsely pub)			NA			A
Lemna minor						1
Leontodon nudicaulis			A			
Lepidium virginicum		AL	A, NA			
Leptosiphon minimus						1
Leucanthemum vulgare (=Chrysanthemum leucanthemum)						1
Leymus mollis ssp. *mollis*		AL				
Linanthus bicolor var. *minimus* - tube 12 mm, some with shorter tube, less bicolored	A					
Linanthus bicolor var. *minor:* white, yellow throat, tube 1 cm		AL				
Linnaea borealis	A		NA	A, NA		1
Listera cordata				NA		
Lithophragma micrantha		AL				
Lithophragma parviflora			NA			1
Lolium perenne	A					
Lomatium nudicaule		AL	A, NA			
Lomatium utriculatum			AL, NA		A	1
Lonicera ciliosa			NA	NA		1
Lonicera hispidula			NA	NA		1
Lonicera involucrata						1
Lotus corniculatus			A			
Lotus denticulatus			A			
Lotus micranthus			A		A	1
Lotus sp.		AL				
Lupinus bicolor	A		AL, NA			1
Lupinus microcarpus var. scopulorum			A, NA			

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Luzula comosa	A	AL	AL, A		A	1
Luzula multiflora ssp. *multiflora*			NA			
Lysichitum americanum						1
Madia madioides			NA	A, NA		
Madia sativa var. *sativa*	A		A			
Maianthemum dilatatum			NA	NA		
Maianthemum stellatum (=Smilacina stellata)						1
Malus fusca		AL	NA			1
Marah oreganus					A	1
Melica sp.					A	
Melica subulata						1
Mentha arvensis						1
Microsteris gracilis var. *gracilis*						1
Mimulus alsinoides			A			1
Mimulus guttatus						1
Moehringia macrophylla						1
Montia parvifolia						1
Myosotis discolor	A	AL	A, NA		A	1
Narcissus pseudonarcissus						1
Nemophila parviflora					A	1
Oenanthe sarmentosa						1
Opuntia fragilis			A, NA			
Orobanche californica var. californica			A			
Orobanche uniflora						1
Orobanche uniflora var. minuta			NA			
Osmorhiza berteroi						1
Osmorhiza chilensis			NA	NA		
Oxytropis campestris var. gracilis			AL, NA			
Parentucellia viscosa	A		NA			
Pentagramma triangularis						1
Perideridia gairdneri						1
Phalaris arundinacea						1
Philadelphus lewisii						1
Picea sitchensis		AL	AL, NA	NA		1
Pinus contorta	A	AL	AL			1
Pinus contorta var. latifolia			NA	NA		
Plagiobothrys cf. scouleri			AL			
Plantago cf. elongata (taprooted)		AL	AL, NA			
Plantago lanceolata	A	AL	AL, NA	NA		1
Plantago major						A
Plantago maritima var. *juncoides*			AL, NA	A		
Platanthera elegans						1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Platanthera sp.			NA	NA		
Plectritis congesta						1
Poa annua	A		NA	NA		A
Poa bulbosa	A					1
Poa palustris						1
Poa pratensis	A	AL	A, NA	A	A	1
Poa secunda						A
Polemonium pulcherrimum var. *pulcherrimum*			NA			
Polypodium glycyrrhiza						1
Polypodium hesperium						1
Polypodium sp.				NA		
Polypogon monspeilensis			A			
Polysticum lonchitis						1
Polysticum munitum			NA	NA		1
Potamogeton natans						1
Prunella vulgaris						1
Prunella vulgaris ssp. *vulgaris*			A			
Prunus avium				NA		
Prunus emarginata						1
Pseudotsuga menziesii	A		AL, NA	A, NA		1
Psilocarphus elatior			AL			
Pteridium aquilinum var. *pubescens*	A	AL	AL, NA	NA	A	1
Pyrola sp						1
Quercus garryana						1
Ranunculus aquatilis						1
Ranunculus californicus			AL, NA			
Ranunculus occidentalis var. *occidentalis*		AL	AL, NA			1
Ranunculus repens						1
Ranunculus uncinatus			NA	NA		
Ribes divaricatum			NA	NA		1
Ribes lacustre			NA			1
Ribes sanguineum			NA	NA		1
Rosa eglanteria						1
Rosa gymnocarpa	A		NA	NA		1
Rosa nutkana	A	AL	AL, NA	NA	A	1
Rubus armeniacus (R. discolor)						1
Rubus laciniatus						1
Rubus leucodermis					A	1
Rubus spectabilis		AL				1
Rubus ursinus ssp. *macropetalus*		AL	A, NA	NA		1
Rumex acetosella	A	AL	AL, NA	NA	A	1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Rumex crispus						1
Sagina apetala	A		A			
Sagina occidentalis			AL			
Sagina sp.		AL				
Salix hookeriana			NA			
Salix lucida (=S. lasiandra)						1
Salix scouleriana		AL	NA	NA		1
Salix sitchensis						1
Sambucus racemosa var. racemosa (=Sambucus racemosa var. *arborescens)*						1
Sanicula bipinnatifida	A		AL, NA			1
Sanicula crassicaulis	A	AL				1
Sanicula crassicaulis var. *crassicaulis*			NA	NA		
Sanicula crassicaulis var. *tripartita*			NA			
Saxifraga caespitosa						1
Saxifraga integrifolia						1
Schedonorus arundinaceus (Festuca arundinacea)	A		AL			1
Scirpus microcarpus						1
Sedum lanceolatum		AL	A	A		
Sedum lanceolatum var. lanceolatum			NA			
Sedum spathulifolium	A	AL	NA			1
Selaginella wallacei	A	AL	NA	NA	A	1
Senecio jacobaea						1
Senecio vulgaris			NA	NA		
Sericocarpus rigidus (=Aster curtus)			A			
Shepherdia canadensis		AL	NA	NA		1
Sherardia arvensis	A	AL	A, NA			1
Silene gallica	A		A, NA	NA		
Sisyrinchium angustifolium			NA			
Sisyrinchium sp.			A			
Solanum dulcamara						1
Sonchus asper			AL			1
Sonchus oleraceus	A			A		
Sorbus sp.						1
Sparganium emersum						1
Spergularia macrotheca			AL, NA			
Spiraea douglasii						1
Spiranthes romanzoffiana						1
Stachys chamissonis var. cooleyae (=S. cooleyae)						1
Stellaria longipes			NA			
Stellaria media			NA			1

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Stipa occidentalis					A	
Symphoricarpos albus	A	AL	AL			1
Symphoricarpos albus var. *laevigatus*			NA	NA		
Taraxacum officinale		AL	AL, NA	NA		1
Taxus brevifolia						
Teesdalia nudicaulis					A	
Tellima grandiflora			NA			1
Thuja plicata				A, NA		1
Tiarella trifoliata						1
Torilis arvensis						1
Trientalis borealis ssp. *latifolia (=T. latifolia)*			NA	A, NA	A	1
Trifolium dubium	A	AL	AL, NA	NA		1
Trifolium microcephalum	A	AL			A	
Trifolium microdon	A		NA	NA	A	A
Trifolium oliganthum			NA		A	A
Trifolium procumbens			A			
Trifolium repens			NA	NA		1
Trifolium subterraneum		AL				A
Trifolium variegatum: slightly small, heads 6-7 mm, all glab, calyx equally cleft with subulate tip			AL			
Trifolium willdenowii (=Trifolium tridentatum)	A		AL			1
Trifolium willdenowii (=Trifolium tridentatum), head ar. 12mm, 12 fls., close to T. oliganthum					A	
Triphysaria pusilla (=Orthocarpus pusillis)	A	AL	AL, NA		A	A
Trisetum canescens						1
Triteleia grandiflora (WA Flora Checklist recognizes var. *howellii, FNA does not. Brodiaea howellii)*						
Triteleia hyacinthina (=Brodiaea hyacinthina)						1
Tsuga heterophylla			NA	A, NA		1
Typha latifolia						1
Urtica dioica ssp. *gracillis*		AL	A, NA	NA	A	1
Verbascum thapsus						1
Veronica americana						1
Veronica arvensis			NA			
Veronica serpyllifolia	A					
Vicia americana			A, NA		A	
Vicia americana var. truncata			NA			
Vicia gigantea			AL, NA	NA		
Vicia hirsuta		AL	AL, NA	NA		A

Lopez and Orcas Island Potential Reintroduction Sites	Lopez Island sites				Orcas Island sites	
	Shark Reef	Davis Point	Iceberg Point	Point Colville	Mount Constitution, Moran State Park	Turtleback Mountain Preserve
Vicia sativa	A	AL	AL, NA	NA	A	
Vicia sativa ssp. *sativa*						1
Viola adunca					A	
Viola adunca var. adunca			AL			
Viola howellii			NA			
Vulpia bromoides	A	AL	A		A	1
Vulpia myuros						1
Yabea microcarpa						
Zigadenus venenosus var. venenosus	A	AL	AL, NA		A	1

Orcas Is: Turtleback Mt preserve, 1=list from Eliza Habegger, San Juan County Land Bank; A=Joe Arnett23July2008
Orcas Is: Mt. Constitution, Moran State Park: A=Joe Arnett June 18, 2008
Shark Reef, Lopez Is., A=Joe Arnett 17June2008
Davis Point, Lopez Is., AL=Joe Arnett, Judy Lantor 21 May2008
Lopez Is: Iceberg Point.AL=Joe Arnett, Judy Lantor, 21May2008; A=Arnett 17JuNE2008; NA=Dorothy Naas and Mildred Arnot 1994 & 1995
Lopez Island: Point Colville, Joe Arnett, 24July2009; NA=Dorothy Naas and Mildred Arnot, 1994 & 1995

Appendix G: Photographs of potential *Castilleja levisecta* reintroduction sites

Iceberg Point, Lopez Island

Davis Point, Lopez Island

Westside Scenic Preserve, San Juan Island

English Camp, Young Hill, San Juan Island

Frazer Homestead Preserve, San Juan Island

American Camp, San Juan Island

Point Disney, Waldron Island

Turtleback Preserve, Orcas Island

Point Colville, Lopez Island (Castle Island in the background, Cattle Point in the distance)

Perego Lagoon, Ebey's Landing, Whidbey Island

Appendix H

Analysis of soils from potential *Castilleja levisecta* reintroduction sites