Titlow Park Restoration: Final Packet

University of Washington Restoration Ecology Network Capstone 2016-2017

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AT THE UNIVERSITY OF WASHINGTON, TACOMA

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Project Summary

Overview

This report describes the Titlow Park Restoration Project implemented in 2016-2017 for Metro Parks Tacoma. A team of five students in the University of Washington Restoration Ecology Network (UW-REN) Capstone course planned and completed the restoration between October 2016 and June 2017. This was made possible by the support of community partners, Mary Anderson and Richard Madison (Metro Parks Tacoma), passionate volunteers, and dedicated course instructors. The Titlow Park project is an extension of the Titlow Park Master Plan; a plan to sustain the parks' prestigious designation as one of five 'Signature Parks' in the city of Tacoma (Metro Parks 2010). The beach park has a unique history, and impressive array of important habitats that will be protected and repaired as a result of this, previous, and future restorations.

Before & After

Figure 1. (Left) Before photo of UW-REN restoration site at Titlow Park in October 2016.

Figure 2. (Right) After photo of UW-REN restoration in May 2017 in the same area (polygon) as Figure 1.

A Brief Summary of the Restoration Project

Titlow Park is located on the west side of Tacoma, Washington in south Puget Sound. It contains 74 acres, .26 acres of which was chosen as the restoration site based on need, community partner preference, and

team member input. Excessive non-native and invasive plant species have prevented much the forest from maturing into a temperate coastal, coniferous ecosystem. Without intervention, it is unlikely that the forest on and near the restoration site will undergo autogenic repair. The forest near the beach to the west of the park has served as a reference ecosystem due to healthy conifer forest conditions and proximity to the restoration site. In order to transition the impaired forest on the restoration site to a native-dominated forest and meet client preferences, four primary goals were established to guide the project:

- Goal 1: Facilitate an ecological succession toward a conifer-dominated forest cover.
- Goal 2: Create an environment conducive to the sustained health of the ephemeral stream system.
- Goal 3: Establish systems that encourage diverse native fauna populations that enhance both the project site and the surrounding area's productivity and food web.
- Goal 4: Exemplify and encourage community involvement to increase overall community well-being that will continue beyond the initial scope of this restoration project.

While the objectives and the details of the restoration shifted throughout the project due to varying circumstances, the team was able to accomplish:

- Removal of five different species of invasive plants from a 11,325 sq. ft. area.
- Restoration of a complex and sensitive ephemeral wetland.
- Installation of 16 different native species totaling 127 plants well suited for an ecological succession towards a coniferous forest.
- Increased animal activity within the site, where few signs were present prior.
- Furthered community involvement and interest through volunteer events and discussions with local residents and park visitors.

Team Photo

Figure 3. The 2016-2017 UW-REN Capstone team at the Titlow Park restoration site. From left to right: Tim Allcock, Krystal Hedrick, Amy Boucher, Professor Cynthia Updegrave, Regan Churchill, & Keith Bergeron.

Contact Information

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Cynthia Updegrave	CUPDEGRA@uw.edu	206-330-4917	UWT faculty advisor
Mary Anderson	MaryA@tacomaparks.com		Natural resources manager
Richard Madison	RichardM@tacomaparks.com	253-202-5978	Community outreach/ project coordinator

Acknowledgements

The University of Washington Restoration Ecology Network (UW-REN), Titlow Park Team, expresses great appreciation for your efforts and contributions towards making the restoration project at Titlow Park a success this year.

Richard Madison - Community Outreach & Special Projects Coordinator, and Megan Boerner - Volunteer Coordinator from Metro Parks; for organizing volunteers for our first work party, as well as being available to supply us with tools, mulch and advice.

Mary Anderson – Metro Parks, Natural Resources Manager; for providing us with suggestions regarding our concerns throughout the project, as well for insight regarding the details of planning.

William Collier, and Phoenix Cornwell - Previous UW-REN Graduates; for taking the time to share your experiences, as well the research you tirelessly conducted during your restoration project.

Cynthia Updegrave - UW-REN, Faculty Advisor; for imparting to us your knowledge, passion and appreciation for nature. Your attentiveness helped us approach the restoration site with an open mind,

ready to learn from the plants and soil, and looking for inter-connectedness amongst the ecology in the area.

Kern Ewing, Jim Fridley, and Warren Gold - UW-REN Professor's, and Shannon Ingerbright – Teaching Assistant; for the flexibility, you provided our team. It allowed us to use our time efficiently, maximize our knowledge, and be more productive on the restoration site.

Paul Prociv - Civic Engagement Specialist, University of Washington Tacoma, Center of Leadership Services (CSL); for advertising and sharing with the volunteers enrolled in the CSL Volunteer program.

James Gawel - University of Washington Tacoma, Environmental Science Program Professor; for sharing with his students the restoration work being done at Titlow. It attracted volunteers.

Project Earth – Registered Student Organization at University of Washington Tacoma; for recruiting volunteers.

As-Built Report

Background

Site Description

Location

Titlow Park is located on the west side of Tacoma, Washington just south of the Narrows Bridge in south Puget Sound (Fig. 4). The park contains 74 acres, which is broken up into three sections: North Forest, Central Forest, and Lagoon (Fig. 5). Residential neighborhoods surround the park, and there is a railroad on the western side that travels north to south along the beach. The park is one of five signature parks located in Tacoma, and is located within the Chambers-Clover watershed (Department of Ecology, 2016). The location of the restoration site is within the mid-eastern part of North Forest.

Figure 4. (Left) Vicinity map of Puget Sound Washington. The red dot indicates the western aspect of Tacoma, WA. (Google Maps 2016)

Figure 5. (Right) Titlow lagoon (A), North forest (B), and Central forest (C) (Metro Parks Tacoma 2010).

Site Selection

Students in the University of Washington's Restoration Ecology Network (UW-REN) have worked on various restoration projects in Titlow Park in the past. The restoration site for UW-REN students this year (2016-2017) was chosen based on a combination of community partner preference and student team member input. Collectively, it was thought to choose a new restoration site that would reduce the likelihood of invasive plant dispersal from nearby areas. Therefore, the new site borders the northern aspect of the 2015-2016 restoration site. The continuance of a previous restoration will hopefully decrease encroachment within the restoration sites, as well as increase native seed dispersal and establishment.

Site Description

The size of the restoration project site is .26 of an acre (Fig. 6). The eastern aspect of the site runs along 6th Avenue, while the most western corner touches the small service road that cuts through North forest. The northern aspect of the site borders a worn footpath, and there is wetland and woodland beyond. The southernmost aspect of the site borders the most northern aspect of the 2015-2016 restoration site. This area receives the most sunlight because the previous cohort removed invasive vegetation that obstructed view throughout the understory. The understory throughout the rest of the site is thick with native and non-native invasive species, and the canopy cover is approximately 90%. The entirety of the site is at an elevation of 33 meters, with an overall slope of 25% from east to west. Soil ranges from nearly dry to moist, and there is an ephemeral stream that runs through a large portion of the site.

Figure 6. Titlow restoration site; perimeter and acreage.

The dominant tree species is the *Fraxinus latifolia* (Oregon ash) and *Alnus rubra* (red alder). Both species are distributed regularly throughout the site. Many native species identified either on site or in the immediate vicinity include *A. rubra*, *F. latifolia*, *Rubus ursinus* (trailing blackberry), *Pteridium aquilinum* (bracken fern), *Polystichum munitum* (sword fern), *Taxus brevifolia*, (Pacific Yew), *Acer macrophyllum* (big leaf maple), *Arbutus menziesii* (Pacific madrone), *Pseudotsuga menziesii* (Douglas fir), and *Rubus spectabilis* (salmonberry) (MacKinnon & Pojar 2014) (Fig.7).

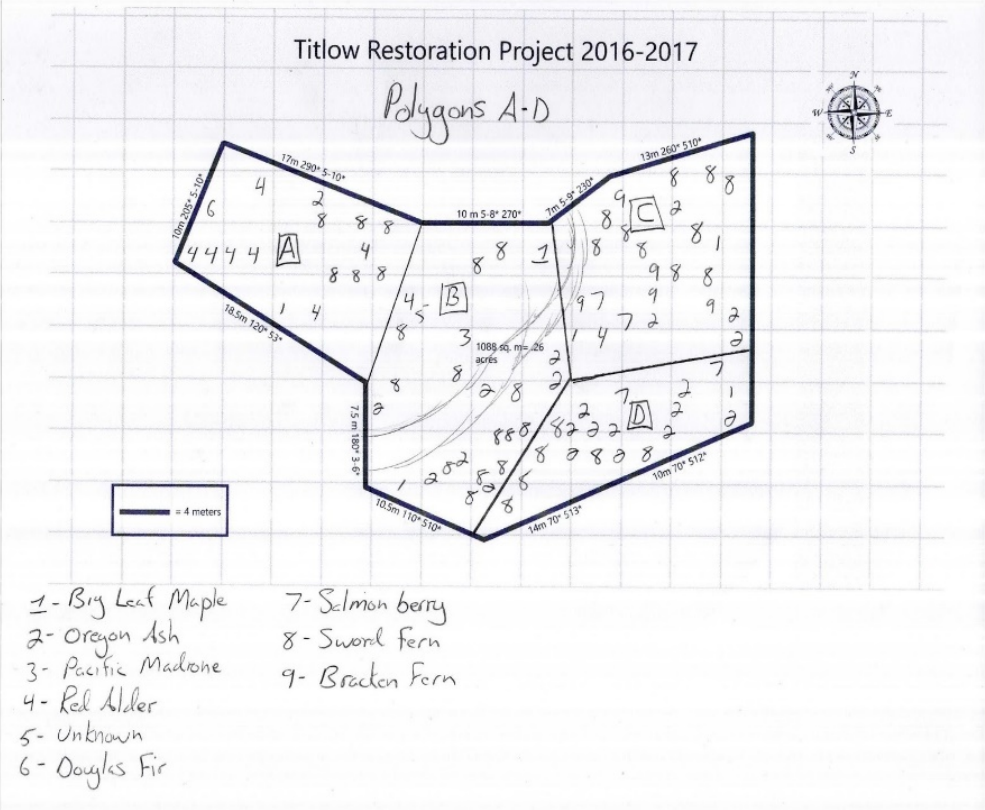

Figure 7. Specific native vegetative communities and features, Titlow restoration, 2016-2017

The ground is densely covered with *Hedera helix* (English ivy), and there is a significant *Rubus discolor* (Himalayan blackberry) presence. There are several *Crataegus monogyna* (English hawthorn) and a handful of *Ilex aquifolium* (English holly) (MacKinnon & Pojar, 2014). Invasive trees and shrubs are manageable at the site, but the English ivy will take considerable management to control. It does not appear that the ivy prefers one topography or soil conditions over any other, as it is fully integrated throughout the site and forest. *C. monogyna* and *I. aquifolium* appear to prefer shade and dryer soil conditions, as they are not present near the ephemeral stream (Fig. 8).

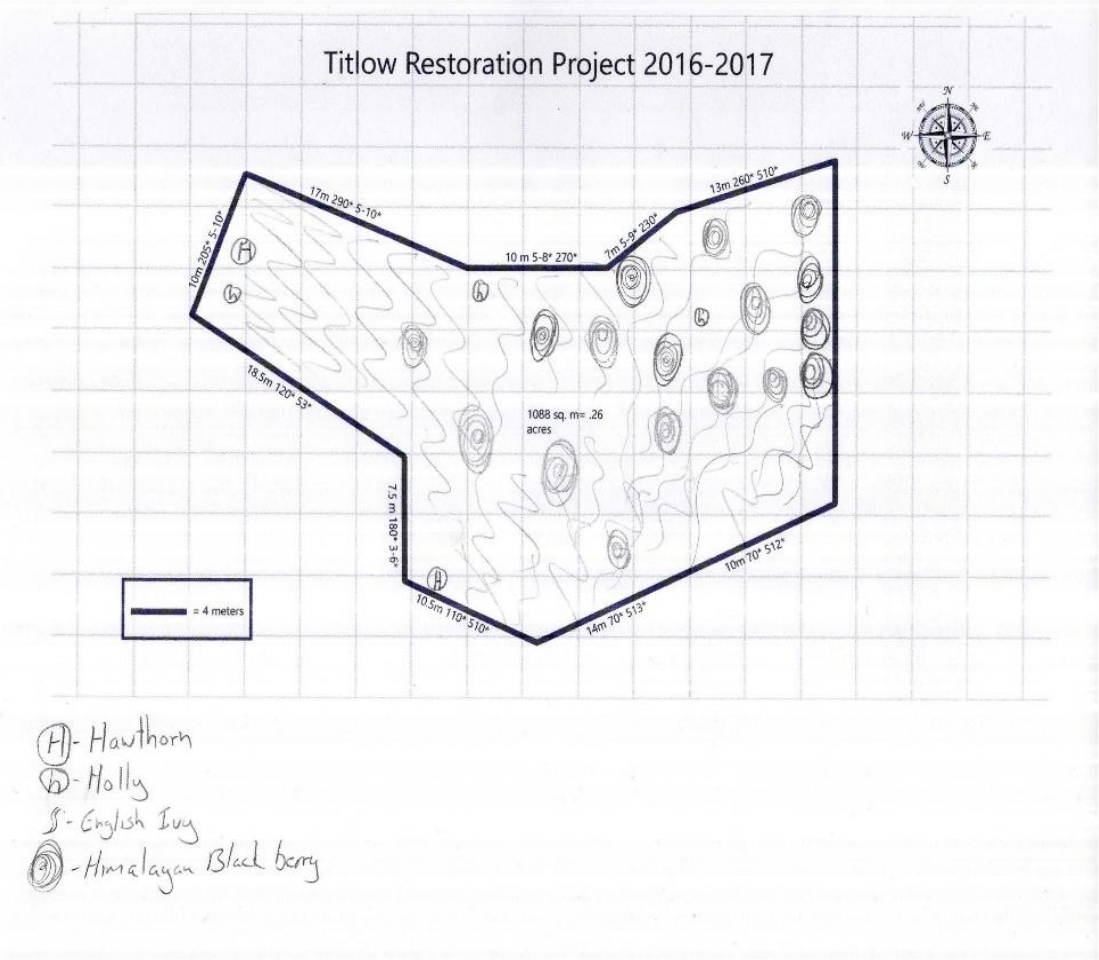

Figure 8. Titlow restoration distribution of exotic species (general clumps and/or specific individuals), 2016-2017 restoration.

Restoration Needs & Opportunities

The substantial presence of invasive species at Titlow Park clearly inhibits the ability for the environment to mature into a coniferous forest system. *H. helix* and *R. discolor* thrive in the temperate coastal environment of Washington, but removal of these species and addition of coniferous trees and other native vegetation would encourage the establishment of more diverse flora and fauna. The banks of the ephemeral stream could be enhanced by planting species that support and augment the native vegetation. Continued work within Titlow Park would further increase awareness of important local and Pacific Northwest restoration work, and volunteer events would help to educate the public regarding invasive species identification and removal.

Tasks & Approaches

Goal	Objective	Details
Goal 1		Facilitate an ecological succession toward a conifer-dominated forest cover.
	Objective 1a	Remove invasive plant species and establish methods for future control.
		Task 1a-1: Remove above ground *Hedera helix* (English ivy) biomass
		Approach: In all polygons where they are present, *H. helix* will be manually removed using hands, small and large bypass loppers, and shovels when needed. Approximately 3ft life rings will be cut around trees on the site when ivy is present. Biomass will be piled roadside for pickup by Metro Parks.
		Approach justification: *H. helix* changes the natural succession of forests. Rapid growing out-competes native flora for water and nutrients and can sometimes contribute to unnatural erosion. When the plant climbs trees, it adds significant weight. This can weaken and cause some trees to fall. As *H. helix* envelopes a tree, it blocks air and microorganisms from the trunk and in the summer, shades out deciduous foliage (King County Noxious Weed Control Program [KCNWCP] 2004).
		Task 1a-2: Remove all *Rubus armeniacus* (Himalayan blackberry) above and below ground biomass
		Approach: In all polygons where they are present, *R. armeniacus* canes will be cut to approximately 1/2ft from the ground with pruners or loppers so that the rootwad can be located and removed at a later time. Rootwads will be manually removed using clawed mattocks or shovels.
		Approach justification: *R. armeniacus* out-competes native understory species and prevents the establishment of native trees. When it becomes dense thickets, *R. armeniacus* can block native fauna from access to food and water sources. It also overtakes large areas, preventing people from enjoying what could be or has been a diverse and beautiful landscape (King County 2017).
		Task 1a-3: Locate and identify *Ilex aquifolium* (English holly), *Crataegus monogyna* (Common hawthorn), and *Prunus laurocerasus* (English laurel) for removal
		Approach: Using plant identification literature, identify *I. aquifolium*, *C. monogyna*, and *P. laurocerasus* and tag using brightly colored marking tape. Allow children to tag plants for removal during volunteer events.
		Approach justification: The identification on these plants using marking tape was suggested by the client. It is the intention of Metro Parks to professionally remove the larger species from the restoration site. By allowing children to tag plants during volunteer events Goal 4, Objective 4c, Task 4c-1 is simultaneously accomplished.
		Task 1a-4: Invasives management

		Approach: Vulnerable vegetation will be tagged using marking tape so as to not smother with mulch. In all polygons, where slope allows, 8-10 in of mulch will be applied to the site using wheelbarrows, yard carts, or shovels. Burlap will be used in place of mulch where slope could contribute to movement of mulch into the ephemeral stream during periods of heavy rainfall or runoff.
		Approach justification: There are many reasons for mulching in restoration projects. The advantages that fit within the context of this project are reducing erosion, protecting against further invasion from invasive species, reducing soil temperatures during summer months, allowing micro-organisms to colonize the project site, and indicating to the public that there are efforts to restore the area. There are also disadvantages to mulching. In cases of steep slopes or wet areas, as in Polygon B, mulch can slide off the slope or destroy sensitive wetland. To avoid these dangers, an alternative has been chosen. Biodegradable burlap will be used in very select areas in order to benefit from the advantages of mulch while avoiding the disadvantages (USDA 2016).
		Task 1a-5: Plant *Gaultheria shallon* (Salal)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
		Task 1a-6: Plant *Rubus ursinus* (Trailing blackberry)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 1a-7: Plant *Rubus parviflorus* (Thimbleberry)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no

		deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
Goal 1		Facilitate an ecological succession toward a conifer-dominated forest cover.
	Objective 1b	Reintroduce fir and western red cedar as a primary canopy species.
		Task 1b-1: Plant *Abies grandis* (Grand fir)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
		Task 1b-2: Plant *Pseudotsuga menziesii* (Douglas fir)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
		Task 1b-3: Plant *Thuja plicata* (Western red cedar)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be

		backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
Goal 2		Create an environment conducive to the sustained health of the ephemeral stream system.
	Objective 2a	Support existing water tolerant plant species and supplement with native water tolerant plants
		Task 2a-1: Plant *Physocarpus capitatus* (Pacific ninebark)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 2a-2: Plant *Carex deweyana* (Dewey's Sedge)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil. Dewey's sedge tolerates drier conditions than most sedges, but may need moist conditions if planted in full sun (King County 2016).
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
		Task 2a-3: Plant *Anthyium filix-femina* (Lady fern)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be

		formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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Goal 2		Create an environment conducive to the sustained health of the ephemeral stream system.
	Objective 2b	Create a buffer of native understory species along the boundary of the ephemeral stream and the rest of the project site.
		Task 2b-1: Plant *Cornus sericea* (Red-osier dogwood)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 2b-2: Plant *Mahonia aquifolium* (Tall Oregon grape)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 2b-3: Plant *Physocarpus capitatus* (Pacific ninebark)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be

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		Task 2b-4: Live stake *Symphoricarpos albus* (Common snowberry)
		Approach: Live stakes of *S. albus* will be collected from within Titlow Park, prepared, and planted in the moist soil near the ephemeral stream.
		Approach justification: By collecting live stakes on site, the team would be saving money and utilizing natural resources on hand.
		Task 2b-5: Plant *Polystichum munitum* (Sword fern)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 2b-6: Plant *Pteridium aquilinum* (Bracken fern)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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Goal 3		Establish systems that encourage diverse native fauna populations that enhance both the project site and the surrounding area's productivity and food web.
	Objective 3a	Install a diverse community of native understory plant species that provide food sources and habitats throughout varying conditions.

		Task 3a-1: Plant *Taxus brevifolia* (Pacific yew)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 3a-2: Plant *Amelanchier alnifolia* (Serviceberry)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 3a-3: Plant *Gaultheria shallon* (Salal)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 3a-4: Plant *Rosa nutkana* (Nootka rose)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be

		backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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		Task 3a-5: Plant *Rosa gymnocarpa* (Baldhip rose)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
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Goal 3		Establish systems that encourage diverse native fauna populations that enhance both the project site and the surrounding area's productivity and food web.
	Objective 3b	Build and install structures that will attract targeted bird species, bats, and primary pollinators.
		Task 3b-1: Research bat structures
		Approach: The cost of bat boxes will be researched by looking online and determining which bat boxes would be best for the site. The boxes have been included in the budget in the event we are unable to establish community partnerships to build and/or donate wildlife structures. While seeking an opportunity to collaborate with the community, efforts will be put forth to identify the best location to house bat boxes. Local high schools and the UWT Wildlife club will be contacted to see if there is interest for them to do this project and donate to Titlow Park. Telephone calls and emails will be sent to local high schools and UWT student clubs to determine interest in donation.
		Approach justification: Research is needed because bats are particular about their homes (WDFW 2016). Involving the community in a project like this would increase community engagement and foster young minds to care for natural areas and the wildlife in them.
		Task 3b-2: Install bird and bat structures
		Approach: Wildlife structures will be constructed and/or purchased and installed on the site. The client will need to be contacted to determine if

		there are restrictions or preference for specific boxes. A location will need to be scouted to determine the best location for the bat boxes specifically. More than likely a post will need to be installed, which may be done by the client. The location of boxes will need to be exposed to the sun most of the day.
		Approach justification: Since cement may have to be used if a post is dug, the client needs to be contacted in advance. An email will be sent to inquire about wildlife structures. The area will need to be scouted for the best placement of the boxes. Bats are very sensitive and want things a certain way. There are low cost boxes, however, they are small. Bats don't like small areas to roost in. They also they like being in the sun, therefore, placing the boxes on a post will be better than placing them in a tree (WDFW 2016).
Goal 4		Exemplify and encourage community involvement to increase overall community well-being that will continue beyond the initial scope of this restoration project.
	Objective 4a	Increase the line of sight to the parking area from 6th Avenue to discourage undesirable activity.
		Task 4a-1: Remove invasive vegetation and thin obstructive thicket
		Approach: Invasives will be removed (see Goal 1, Objective 1a), and the alder/hazelnut thicket will be carefully cleared of any branches or vegetation that obstructs the removal of invasive species or severely blocks line of sight to the parking area.
		Approach justification: This topic was discussed with the client, and this method was agreed upon as the best option.
Goal 4		Exemplify and encourage community involvement to increase overall community well-being that will continue beyond the initial scope of this restoration project.
	Objective 4b	Incorporate beautification to the ecological restoration efforts to enhance the community aesthetic.
		Task 4b-1: Plant *Lonicera ciliosa* (Orange honeysuckle)
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).

		Task 4b-2: Plant *Rosa nutkana*
		Approach: As much container material as possible will be removed using hands or a bucket of water. A hole will be dug using a shovel that is no deeper than the root system, and at least twice as wide. A mound will be formed in the hole to support the root crown, and then the hole will be backfilled with the same dirt that was removed from the hole. Container soil may be used only as a top dressing over disturbed soil.
		Approach justification: Removing container media and preparing the planting hole as a shallow bowl shape have been shown to improve root establishment. Roots grow more successfully when the planting hole is similar in size and shape to actual root systems, and container media is not uniform in composition and texture to the natural soil and can impede root development outside of the planting hole (Chalker-Scott 2009).
Goal 4		Exemplify and encourage community involvement to increase overall community well-being that will continue beyond the initial scope of this restoration project.
	Objective 4c	Actively engage community organizations to encourage involvement and maintenance of the both the project site and park as a whole.
		Task 4c-1: Engage the community.
		Approach: Plan a work party for Martin Luther King Day and 2/20/2017. Email Richard at Metro Parks about potential collaborated work party crew. Flyers need to be created 2 weeks in advance. There will be scavenger hunts with the kids as well to encourage families to come out and connect their families with the park.
		Approach justification: Making flyers two weeks before will allow more time to advertise. Collaborating with other organizations and the client will increase community participation.
		Task 4c-2: Reach out to Friends of Titlow Park
		Approach: Contact Richard at Metro Parks to request contact information for Friends of Titlow group.
		Approach justification: It is important that the team connects with this group, because Friends of Titlow are the best hope to maintain the area as park stewards after restoration is complete.
		Task 4c-3: Contact local schools
		Approach: Reach out to Phoenix (part of the 2015-2016 cohort), and ask her for her points of contact at local schools.
		Approach justification: Previous cohort members are an excellent source of information regarding community engagement.

AD1: Task 1a-4 was altered somewhat. The most sensitive areas on the site, such as those with flowing water in Polygon B, were left uncovered and burlap was laid to the water's edge. At the request of the client, mulch was then applied so as to cover the burlap.

AD2: Task 1a-6 was not completed due to difficulties with plant purchase. In addition, *Rubus ursinus* has been seen doing well throughout the site since removal of *Rubus armeniacus*.

AD3: Task 2b-4; live stakes of *Symphoricarpos albus* were not collected. However, five plants were ordered and planted. In addition, the removal of invasives and spring weather have revealed a plentiful snowberry population throughout the site.

AD4: Task 2b-6; *Pteridium aquilinum* was not purchased. However, the removal of invasives and spring weather have revealed a plentiful bracken fern population throughout the site.

AD5: Task 3a-1; *Taxus brevifolia* were not purchased due to ordering complications. However, there seems to be enough suitable habitat for a variety of animals throughout the site, and due to spacing requirements, it would have been difficult to find a suitable location on the site for the trees.

AD6: Task 3b-2; we were unable to build or install structures to attract the various target species due to difficulties with finding volunteer labor. The installation of a bat box especially proved too much of a challenge regarding appropriate placement and proper installation.

AD7: Task 4c-2; actively connecting with community organizations, specifically Friends of Titlow, did not manifest due to organizational and scheduling issues within their ranks. However, team members intend to continue to improve on stewardship for the restoration site after the course is complete.

Specific Work Plans

Site Preparation Plan

Current Conditions:

The Titlow Park restoration site was subdivided into 4 polygons that were designated A, B, C, and D. They were selected based on a combination of slope, canopy cover, hydrology, and soil type (Table 1).

Table 1. Current environmental conditions in Polygon A, B, C, and D.

	Polygon A	Polygon B	Polygon C	Polygon D
Polygon Area (m^2)	224	386	276	202

Soil Texture	O-horizon: loamy clay; A-horizon: increase in sand at 6 in.	O-horizon: darker loam; A-horizon: sandy clay with gravel at 8 in.	O- & A-horizon: dark loamy sand	O-horizon: dark loamy sand; A-horizon: increase in sand results in sandy loam
Soil Moisture	Moist	Moist	Moderate	Low-Moderate
Slope (average)	25% decline east to west	20% decline east to west	24% decline increases to 34% east to west, then 22% decline to west border	30% east to west; 30% east to southwest near SW border
Light Availability	Minimal overall; moderate in winter (canopy approx. 70% alder)	Minimal overall; moderate in winter (canopy approx. 60% ash)	Moderate overall, including winter (canopy approx. 65% ash)	Moderate overall; moderate-high in winter (canopy approx. 91% alder)
Present Vegetation (approx.)	44% alder, 38% sword fern, 6% maple, 6% ash, 6% fir	54% sword fern, 29% ash, 9% maple, 4% madrone, 4% alder	42% sword fern, 21% bracken fern, 17% ash, 8% maple, 8% salmonberry, 4% alder	53% alder, 32% sword fern, 10% salmonberry, 5% maple
Nonnative Vegetation	English ivy, Himalayan blackberry, hawthorn, holly	English ivy, Himalayan blackberry, hawthorn, holly, laurel	English ivy, Himalayan blackberry	English ivy, Himalayan blackberry
Human Impacts	Worn footpath on NW border	Trampled plants bordering stream	Runoff possible	Foot traffic in cleared areas; runoff possible
Other Considerations	4% incline between midpoint & SW corner	Ephemeral stream; blowdowns present & copious	Depressions & blowdowns present	Dense ash thicket 2/3 northern portion of polygon

Polygon A receives very little sunlight and is relatively level. It has an average east to west slope of 4% with a steeper incline of approximately 25% between the midpoint and the southwest corner. Soil samples from polygon A were compacted and a lighter brown color with a predominance of loamy clay at the O horizon. There was an increase of sand at about 6 inches into the A horizon. The ground cover on Polygon A is carpeted with *H. helix*, with occasional *Crataegus monogyna*

(English hawthorn) on northern and southern borders. A single *Ilex aquifolium* is in the northeastern corner while some sparse patches of *R. discolor* can be found along the southern border (Fig. 9).

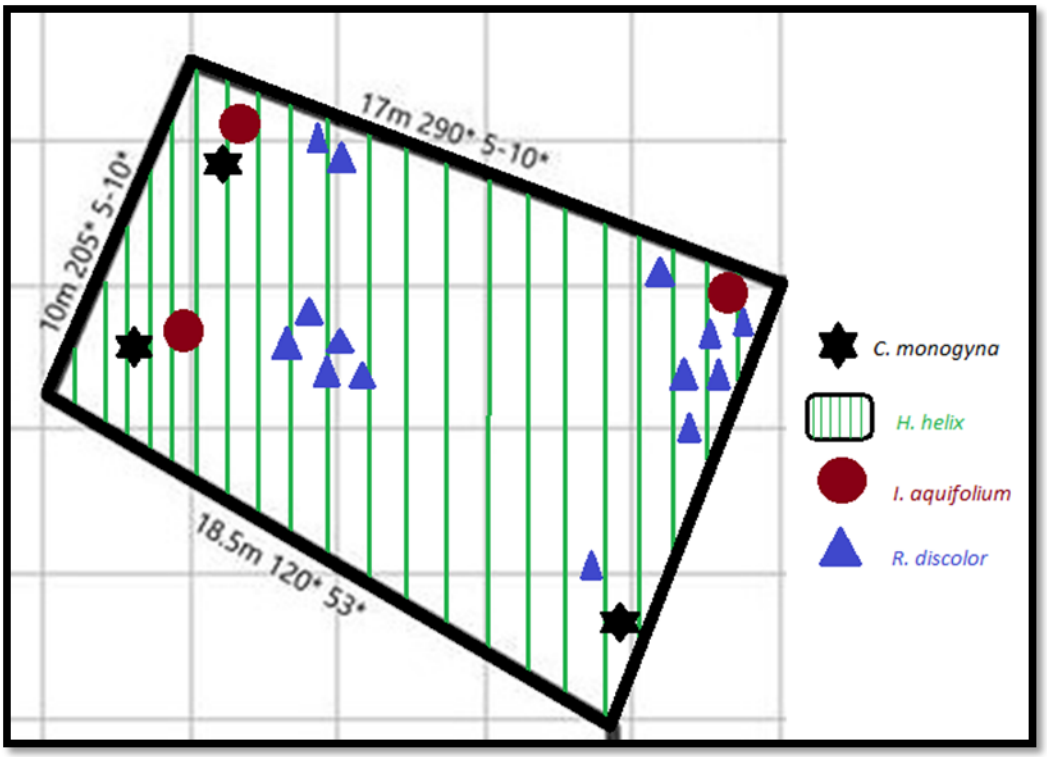

Figure 9. Titlow restoration, Polygon A invasive vegetation.

AD8: After removing the carpet of *Hedera helix* and the heavy rains of winter saturated the soils, we discovered an underground hydrological system that enters the polygon from the northeast and the northwest. These two flows meet about midpoint of the polygon A and continues south towards the driveway, crossing last year's restoration site where the water pools at the bottom of the slope (Fig 10.)

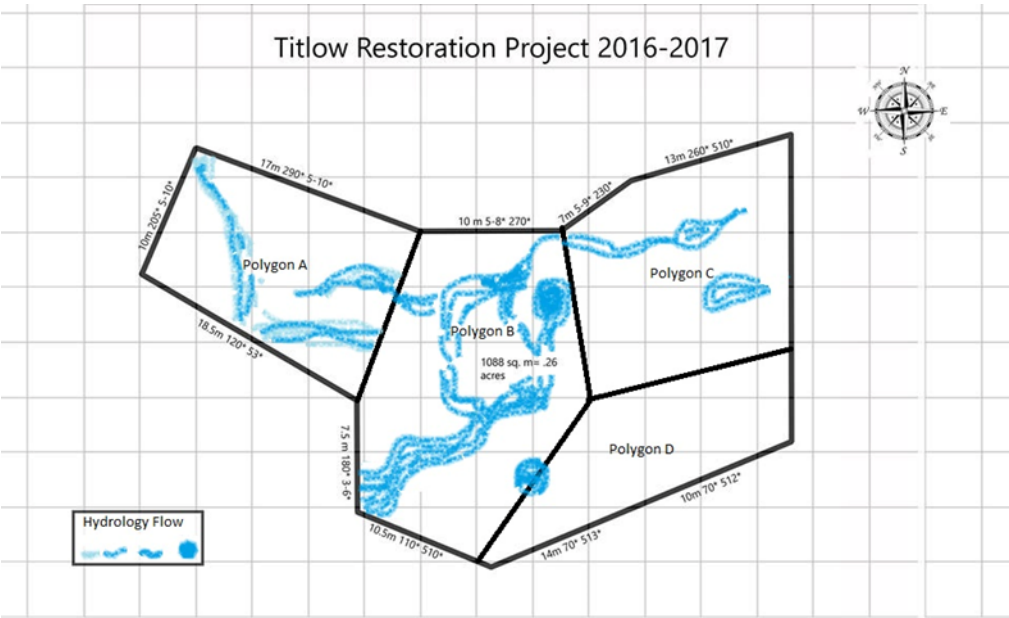

Figure 10. Hydrological connectivity on Titlow restoration site.

Polygon B contains an ephemeral stream that flows east to west. This area has a high canopy density. It has an average slope of 20% running east to west. Blowdowns divide the eastern third of this polygon with two stretching along the northwestern corner with a perpendicular blowdown running north to south. Another north to south blowdown can be found along the western border of this polygon. The polygon had dark colored loam through the O horizon. A light colored sandy clay intermixed with gravel was found at eight inches into the A horizon. Runoff enters the site from the north and flows south by southwest through the polygon, eventually ending up in the saltwater lagoon southwest of the plot. This polygon has the least amount of *H. helix*, and so the species of primary concern are *Prunus laurocerasus* (English laurel), *C. monogyna*, *I. aquifolium*, and *R. discolor*. They all dot the perimeter around the ephemeral stream. *H. helix* is mainly found in an arc around the ephemeral str0eam and enveloping native trees, with its highest concentrations along the eastern boundary (Fig. 11).

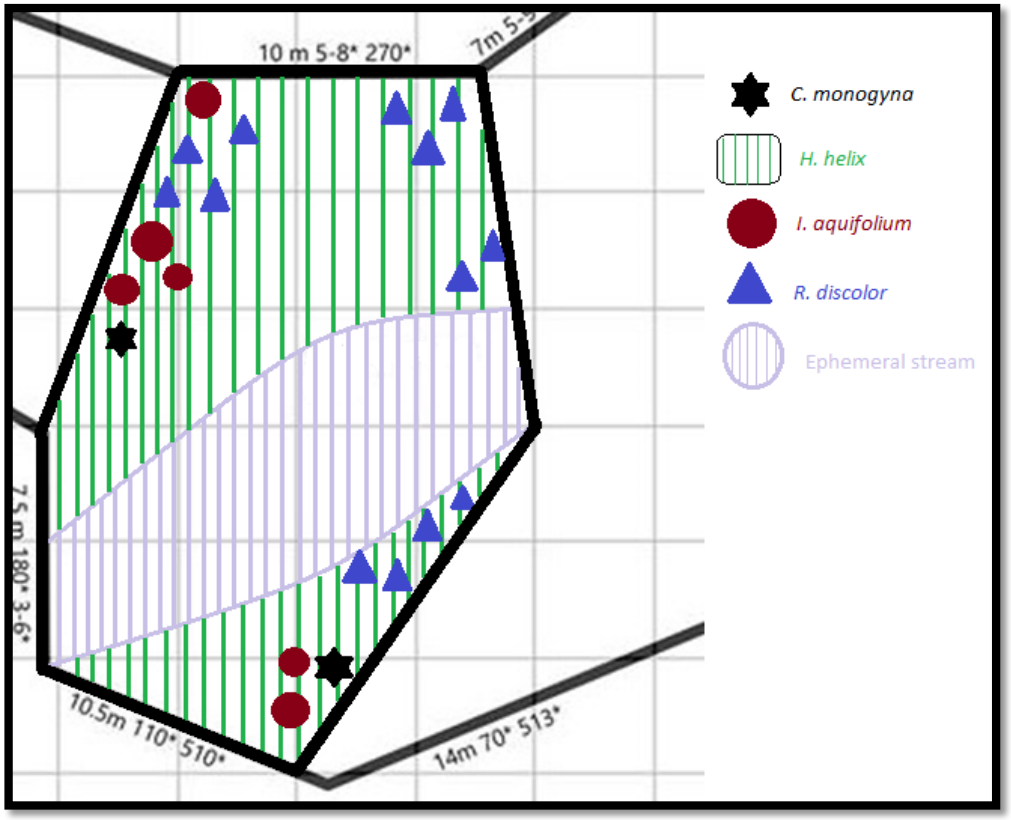

Figure 11. Titlow restoration, Polygon B invasive vegetation.

To the northeast, Polygon C runs parallel to 6th Avenue and receives a fair amount of sunlight. There is a large amount of dead *Rubus discolor* along the eastern edge. Once removed, much more light will reach the understory. There are several moss and ivy covered blowdowns, and the canopy is thick. Polygon C has the most variance in slope. Starting from 6th Ave and working west the slope begins with a 20% average decline until two large depressions increase this decline to an average of 34%. From here the slope decreases to an average of a 22% decline until it reaches the border of polygon B. Notable features other than the two depressions mentioned above are a large blowdown running east to west along most of the northern border. Another blowdown lying north to south cuts across the eastern tip of the polygon. The soil sample from Polygon C was taken at the greatest elevation in the project area, directly up-slope from Polygon B. Dark colored loamy sand was found through both the O and A horizons and had a moisture content slightly lower than that of polygons A and B. Overall, this polygon has been completely overrun with *H. helix*, and there is no native groundcover that is easily observable (Fig. 12).

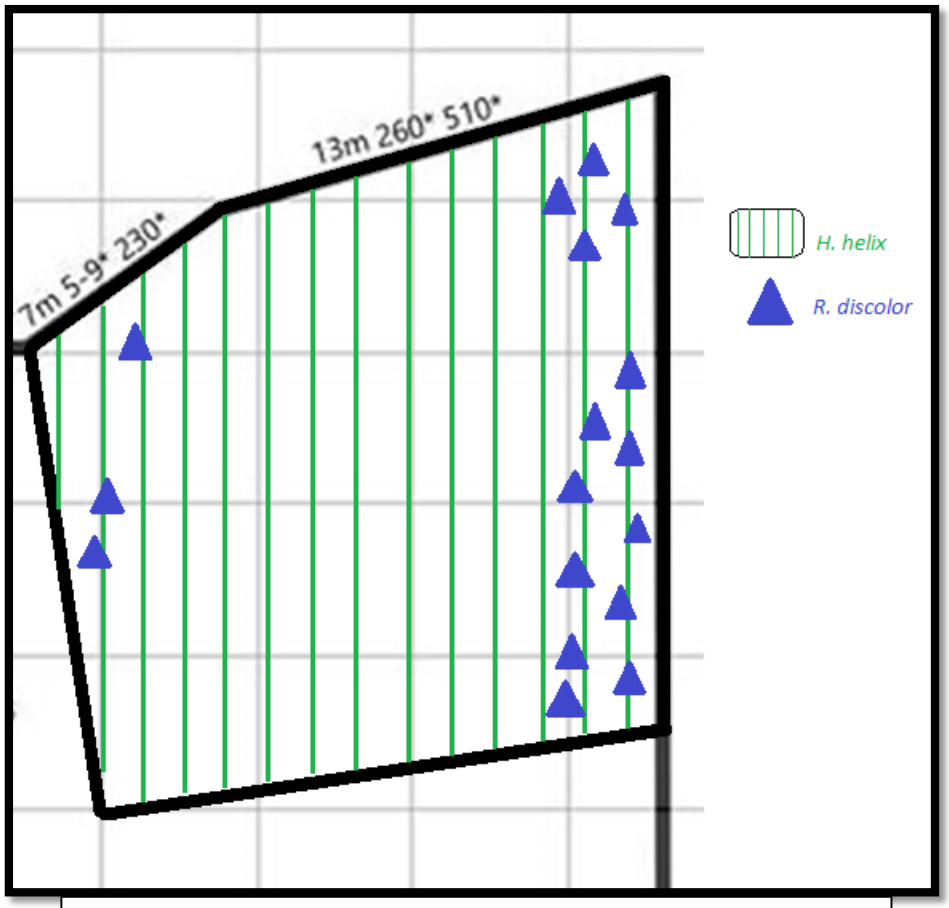

Figure 12. Titlow restoration, Polygon C invasive vegetation.

Hedera helix has already taken over many of the larger trees, and there is a noticeable weakening in one section of a trunk offshoot on the large *Acer macrophyllum* (Big leaf maple) in the northwestern quadrant. Sporadic shoots of *R. discolor* were spotted in various areas, but appear to be struggling to establish.

The most southern of all of the polygons, Polygon D is bordering the previous Titlow Park restoration project. Polygon D receives the most sunlight, due to efforts in clearing away blackberry. The low angle of the sun during fall, winter, and spring will provide unrestricted sunlight, while the nearby *Acer macrophyllum* provide shade during the hot dry summers. The shade will help protect new plants from drying out. Finally, Polygon D has an average slope of 30% runs east to west with a slight west by southwest aspect along the southern border. The most notable feature is a dense *Alnus rubra* thicket that encompasses two thirds of the northern portion of the polygon mixed with *Corylus* trees. Polygon D receives the most direct sunlight so the soil samples were noticeably less moist. It consisted of dark loamy sand in the O horizon with an increase of

lighter colored sand through the A horizon to become a consistent sandy loam. *H. helix* is most abundant along the eastern boundary that borders 6th Avenue, within the thicket, and climbing up a large *A. macrophyllum*. In addition, *Rubus discolor* is has also been found along the road and within the thicket (Fig. 13).

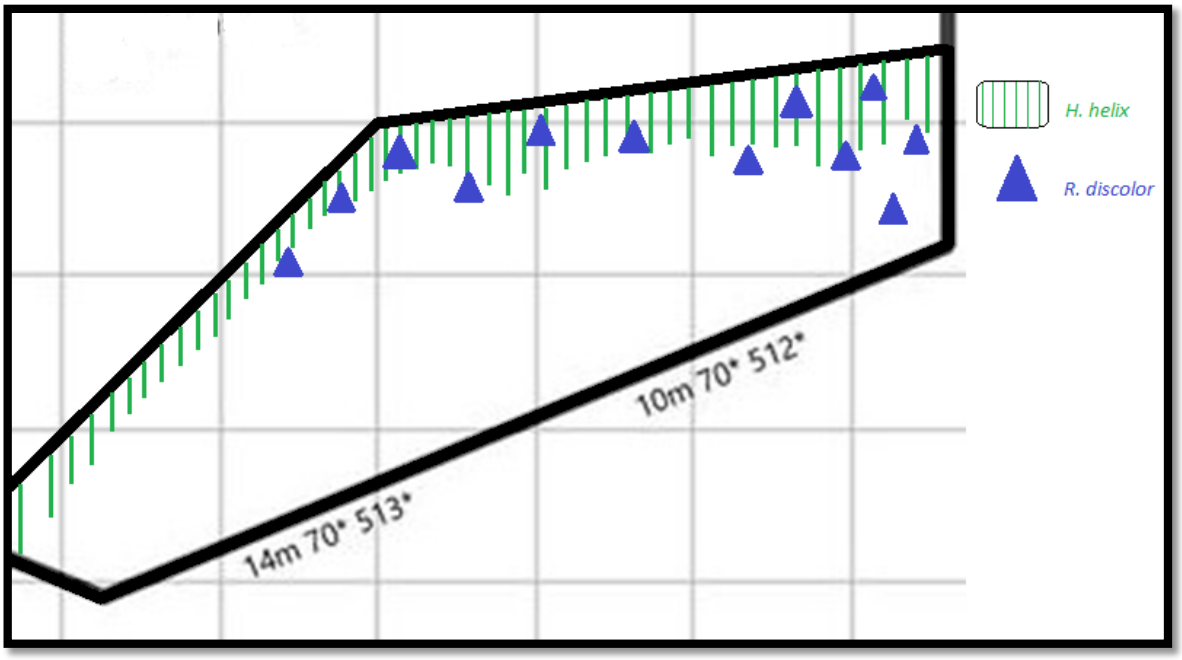

Figure 13. Titlow restoration, Polygon D invasive vegetation.

Site Preparation Activities:

The site has been overrun by various invasive species. Below is a description of how those species will be removed and the justifications to do so. Each polygon has a significant amount of *Hedera helix* and its removal is of the utmost importance. Other invasive species are found in some polygons but not others. Despite some polygons having unique features, these species will be removed in the manner either best suited to their elimination or through specific instructions from Metro Parks.

In Polygon A, the *Hedera helix* will be mechanically removed with loppers, hand shears, and hand pulling when found growing in thick mats along the ground, and when wrapped around blowdowns and tree trunks. Removal has been deemed necessary because it changes the natural succession of forests. Rapid growth allows *H. helix* to out-compete native flora for water and nutrients, and can sometimes contribute to unnatural erosion. In addition, when *H. helix* climbs trees, it adds significant weight. This can weaken and bring an older tree down. As it envelopes a tree, it blocks

air and microorganisms from the trunk and in the summer, shades out deciduous foliage (KCNWCP 2004). This process will be mimicked in Polygon B, Polygon C, and Polygon D.

Also in Polygon A, B, C, and D, *Rubus discolor* will be mechanically removed by cutting the stalks off at knee level with either hand shears or loppers for easier management due to their thorns. Once this has been achieved, their stalks will be traced to the ground and their roots will be dug by hand using either a shovel or root puller. This plant removal technique was deemed necessary because the species outcompetes native understory species and prevents the establishment of native trees. As it becomes dense thickets, *R. discolor* can block native fauna from access to food and water sources (King County 2016). It also overtakes large areas, preventing people from enjoying what could be or has been a diverse and beautiful landscape.

Crataegus monogyna will be tagged for removal by Metro Parks at the instruction of the client. This species can outcompete native understory species for water and nutrients and disrupt the movements of large animal species (King County 2017), and will be removed from Polygon A and B. *Ilex aquifolium* will be tagged for removal by Metro Parks, also at the instruction of our client. This species will be removed because it will outcompete native understory and tall shrub species for nutrients and water. If left unimpeded, it can form dense thickets (KCNWCP 2008). *I. aquifolium* will be removed from Polygon A and B. Finally, *Prunus laurocerasus* will be tagged for removal by Metro Parks at the instruction of the client. This species will be removed because it is fast growing and tolerant of disturbance. If allowed to establish, it will outcompete native tree saplings and understory species, eventually overtaking canopy trees (King County 2016). The noxious plant will be removed from the only location on site, Polygon B.

Logistical Considerations:

Metro Parks has stressed the importance of community engagement and strengthening the park's reputation, while not disrupting the visitor experience. Regarding that, park visitors and surrounding neighbors have made a point of engaging us in conversation about the restoration project with positive feedback, encouragement, and spontaneous volunteering. The parking area has ample space for both visitors, project workers, and volunteers. Additional parking on the street is allowed and there is a large, main parking lot less than a mile south along 6th Avenue (Fig. 14).

To prevent trampling and related disturbances from project workers and volunteers, three marked entrance and exit points have been established and noted on Figure 14. During volunteer work parties, these were marked with a pink ribbon attached to trees and stakes, where necessary, providing clear safe routes through the site. To further prevent human disturbance, we focused the planting of *C. sericea* and *P. caputatus* around the border of the ephemeral wetland within Polygon B. As these mature, they will provide an esthetically pleasing barrier to the more sensitive areas within the site.

With the delivered mulch occupying valuable parking spaces, we've made it a priority to establish staging areas between the sidewalk along 6th Ave. and the eastern boundary of Polygon C. A sign-in table with refreshments and educational materials will be located at the end of the parking lot beside the gate for all work parties. Trash bags for both garbage and recycling can be found beside the sign in table. Any removed plant material has a designated drop off point on the other side of the parking lot directly across from the sign-in table. Restrooms are located off the aforementioned main parking lot for the park.

Figure 14. Titlow restoration logistics map.

Planting Plan

Polygon A

Polygon A will include two *Taxis brevifolia* at six foot centers along the northern border of the polygon. Although this species is rare for the area, a young specimen has been found just outside the northern border of this polygon (Objective 3a). The aim for this inclusion is to bolster the survival rate of, and increase the successional diversity of this type of tree. Although the *T. brevifolia* matures relatively slowly, it is shade tolerant and does well in moist soils (Bolsinger & Jaramillo 2016). Additionally, this tree has been found to be abundant in warm, drier environments (Bolsinger & Jaramillo 2016). This will be beneficial in case current trends in climate change continue. Also, to be installed in Polygon A are four *Thuja plicata* at seven foot centers (Objective 1b). *T. plicata* does well in shaded areas in a variety of soils, and is commonly found in stands along with *Pseudotsuga menziesii* and *Abies grandis* (Alban 1969). Due to established plants and other obstacles, four individuals will be planted in a zig zag pattern at seven foot centers from north to

south. Ten *Gaultheria shallon* will be planted in Polygon A at two foot centers. *G. shallon* is a shade tolerant shrub that is adapted to the dry summers of western Washington. They grow slowly, but are evergreen shrubs that favor partial sun to full shade. They can tolerate seasonal inundation, and provide food for the wildlife (Objective 3a) (Washington Native Plant Society [WNPS] 2015). Three *Rubus parviliforus* will be installed as a pollinator and berry producer post *Rubus discolor* removal (Fig. 15).

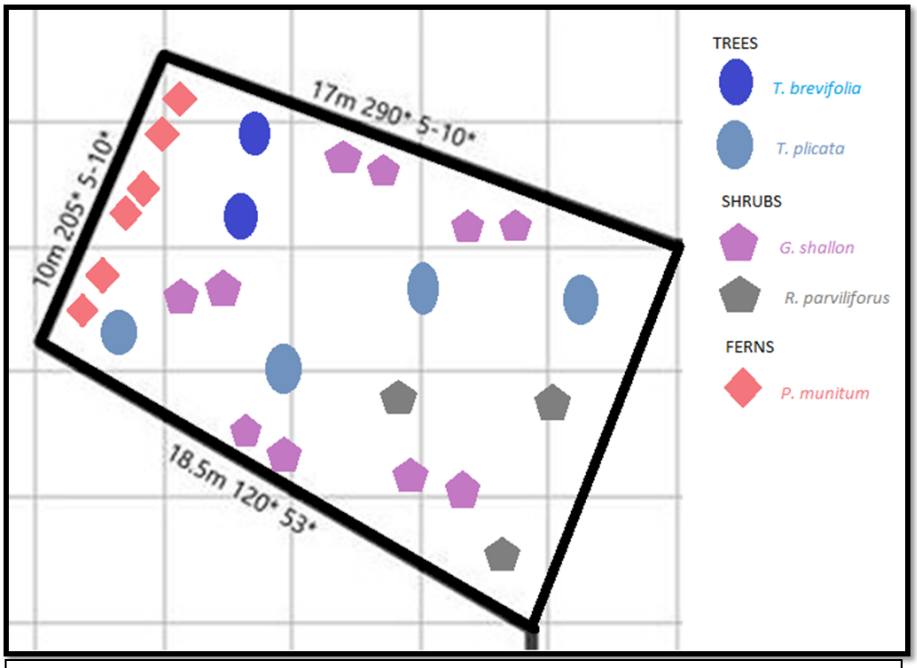

Figure 15. Titlow Park 2016-2017 planting map for Polygon A.

Polygon B

For Polygon B, the canopy trees will consist of two *P. menzeisii* and two *T. plicata* (Objective 1b). This polygon has an ephemeral stream that bisects the section, flowing from northeast to southwest. *Carex deweyana* is partly shade tolerant and prefers moist soil, and will be bunch planted along the ephemeral stream to resist erosion and create a strong root bed (Objective 2a). Six *Rubus ursinus* and two *Mahonia aquifolium* will replace the invasive *Rubus discolor* and *Ilex aquifolium* that have been removed (Objective 1a). *Polystichum munitum* and *Anthyium filix-femina* will be planted at two foot centers to bolster the present populations (Objective 2a). In addition, 4 *Cornus sericea* will be planted at one foot centers in four quadrants of the polygon as it is a freely spreading shrub with many stems, and produces copious amounts of organic material through deciduous leaves (Objective 3a) (MacKinnon & Pojar 2014). Four *Physocarpus capitatus* will provide bird habitat along the upper portion of the ephemeral stream and provide erosion control (Objective 3a). Polygon B will also have two *T. plicata* planted at six foot centers along the southwestern border to

compliment the *T. plicata* planted last year in the adjacent area (Objective 1b) (Fig. 16). The soil is the wettest in this polygon, as well as being mostly shaded by existing canopy.

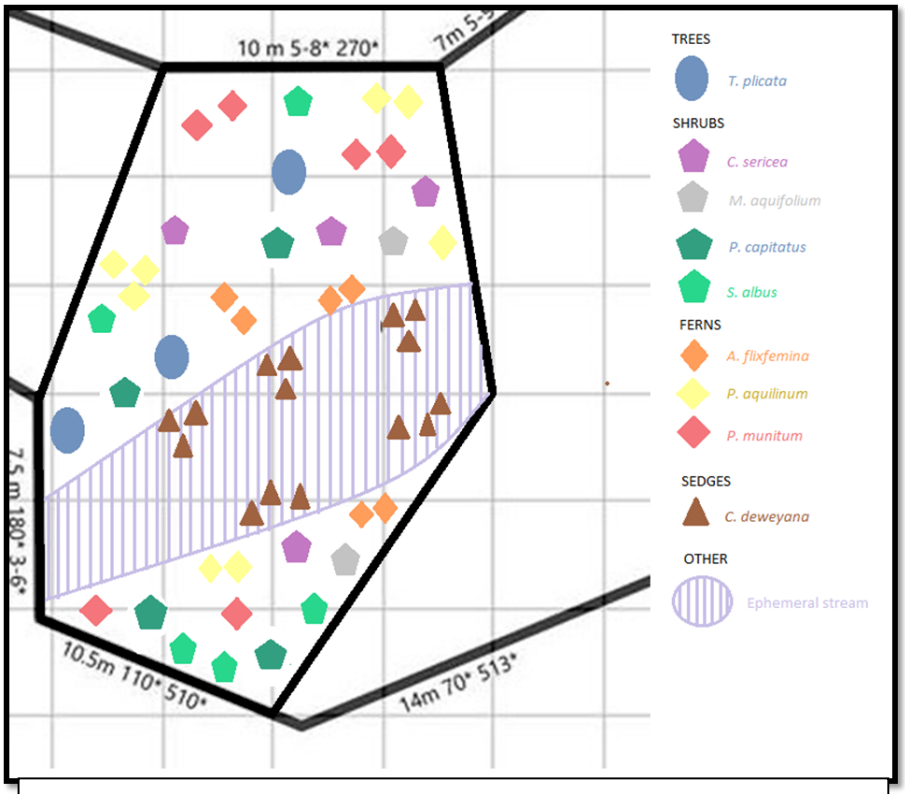

Figure 16. Titlow Park 2016-2017 planting map for Polygon B.

Polygon C

Polygon C has moderately moist soils, is shaded, and includes most of the slopes in the site. Therefore, we have selected two *Abies grandis*, two *T. plicata* and two *P. menzeisii* interspersed at seven foot centers in a zig zag pattern from east to west (Objective 1b). *A. grandis* grows rapidly and will help out-compete invasive species (USDA 2016). It is also known to do well on slopes containing both wet and dry soils with adequate seepage (Foiles 1965). *P. menziesii* was chosen because it also grows rapidly and is suited in moist to dry soils (Objective 1b) (Hermann & Lavendar 1990). It is also found abundantly in the region. Also in Polygon C, two *Amelanchier alnifolia* will be planted. They grow with ease and transplant readily. *A. alnifolia* is a great food source for wildlife (Objective 3a). They provide food for various bird species, mammals, and insect or butterfly larvae (WNPS 2015). They also have attractive white flowers in the spring and golden leaves in fall. *A. alnifolia* requires full sun to partial shade and prefers moist, well-drained soils, but is noted for being adapted to a variety of soils, as well as drought resistant (Dickert 2010). However, research from Clemson University recommends not planting under high stress conditions (Dickert 2010). It may be more appropriate to plant this in an area that was not heavily covered by *H. helix*, such as the area adjacent to polygon D (on the 2016 cohort's restoration site).

Lonicera ciliosa is a climbing, widely branching vine species that will replace *H. helix* as a pollinator (Objective 3a) (MacKinnon & Pojar, 2014). Polygon C will receive six *L. ciliosa* shrubs planted at one foot centers near existing and established coniferous and deciduous tree species (Fig. 17).

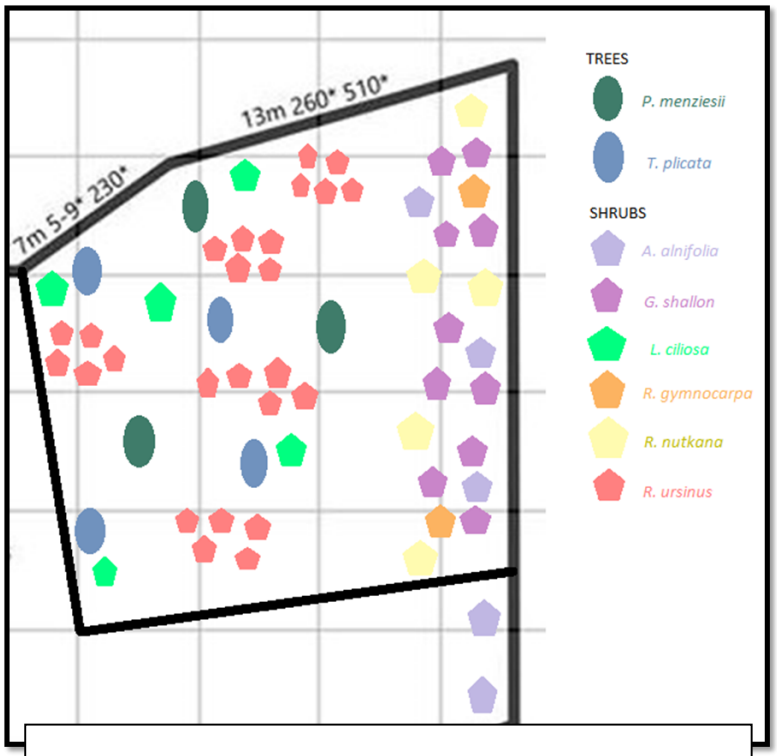

Figure 17. Titlow Park 2016-2017 planting map for Polygon C.

Polygon D

This polygon is the least shaded area of the site and has the driest soil. *Mahonia aquifolium* will be an appropriate addition to this polygon as it is commonly found in drier, more open sites (MacKinnon & Pojar 2014) and is currently found in the park (Objective 1a). Due to established *C. cornuta* and *A. rubra* thickets that encompass most of the area within this polygon, only three *P. menziensii* will be installed here (Objective 1b). These trees will be planted along the southern border at six foot centers. The area adjacent to this polygon previously had *P. menziensii* and *A. grandis* planted in it during last years' planting. Six *Cornus sericea* will be planted at one foot centers in four quadrants of the polygon as it is a freely spreading shrub with many stems, and produces copious amounts of organic material through deciduous leaves (Objective 3a) (MacKinnon & Pojar 2014). Polygon D will also receive six *L. ciliosa* shrubs planted at one foot centers near existing and established coniferous and deciduous tree species. They will act as climbing vine pollinators in place of the removed *H. helix* (MacKinnon & Pojar, 2014) (Objective 3a). Six *L. ciliosa* and two *Rosa nutkana* were chosen to bring color and fragrance to the area, and because they will be appealing to passing

foot traffic during spring and early summer months (Objective 4b) (Fig. 18). *L. ciliosa* can withstand drought, but also enjoy moisture. They are native to the Pacific Northwest, and are attractive to people, animals, and birds (WNPS 2016). They often attract bees and butterflies, thus bringing more beauty to the site by means of attracting an array of wildlife. *L. ciliosa* and *R. nutkana* are found in coniferous forests and along forest edges.

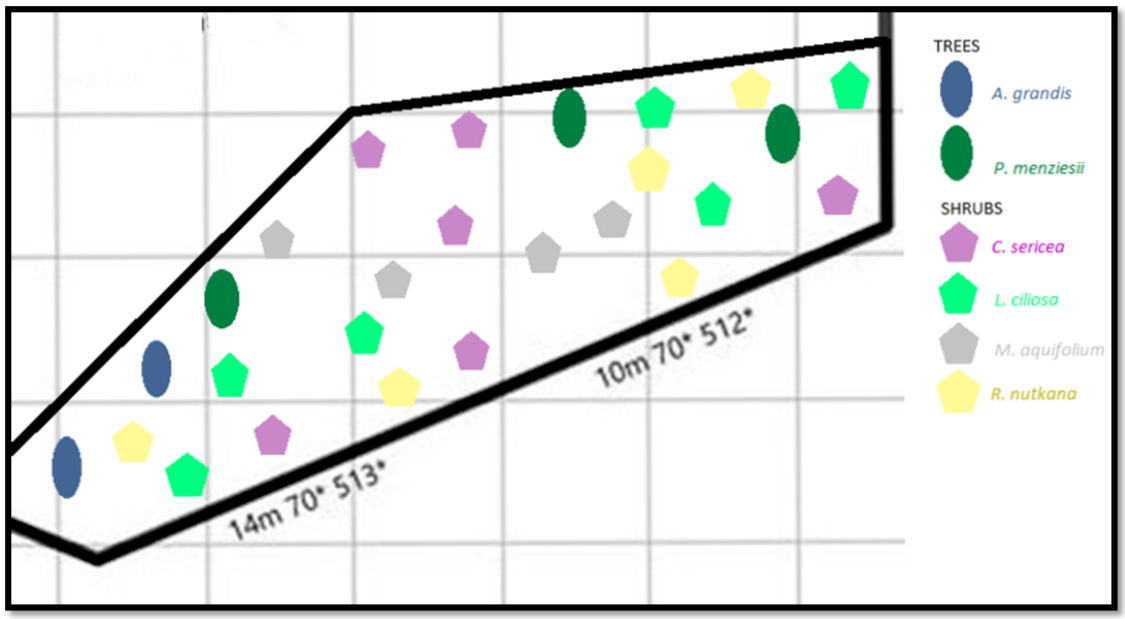

Figure 18. Titlow Park 2016-2017 planting map for Polygon D.

Budget Plan

Labor Budget

Tasks	Project Budget		Project To-Date (as of 2/3/2016)	
	Team (hours)	Volunteers (hours)	Team (hours)	Volunteers (hours)
Prepare Site				
Remove English Ivy above ground	158	108	36	68

Financial Budget

		Project Total Budget						Project To-Date (as of 2/3/2017)					
Expeditures	UW (labor)	UW (cash)	Client	In-Kind (non-labor)	In-Kind (labor)	Total	UW (labor)	UW (cash)	Client	In-Kind (non-labor)	In-Kind (labor)	Total
Prepare Site												
Remove English Ivy above ground	$ 3,950.00				$ 1,028.00		$ 950.00				$ 1,020.00	
Remove H. blackberry	$ 250.00											
Locate and Tag invasive trees, Hawthorn, Holly, Laural	$ 25.00				$ 15.00		$ 25.00				$ 15.00	
Contact Metro Parks to notify them of invasive	$ 25.00											
Prune thicket	$ 100.00				$ 30.00							
SUBTOTAL	**$ 4,350.00**	**$ -**	**$ -**	**$ -**	**$ 1,073.00**	**$ 5,423.00**	**$ 975.00**		**$ -**	**$ -**	**$ 1,035.00**	**$ 2,010.00**
Invasive Weed Control												
Determine how much mulch	$ 25.00						$ 25.00					

Work Timeline

	February					March					April				May			
1a Facilitate Conifer Canopy	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
1a-1 Remove Hedera helix				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1a-2 Remove Rubus discolor			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1a-3 Tag Ilex aquifolium, crataegus monogyna & Laurus nobilis for removal			X															
1a-4 Install mulch					X													
1a-5 Plant Gaultheria shallon								X										
1a-6 Plant Rubus ursinus								X										
1a-7 Plant Rubus parviflorus								X										
1b Reintroduce Canopy Species	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
1b-1 Plant Abies grandis								X										
1b-2 Plant Pseudotsuga menziesii								X										
1b-3 Plant Thuja plicata								X										
2a Support water tolerant plants	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
2a-1 Plant Physocarpus capitatus								X										
2a-2 Plant Carex deweyana								X										
2a-3 Plant Anthyium flixfemina								X										
2b Create buffer for stream	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
2b-1 Plant Cornus sericea								X										
2b-2 Plant Mahonia aquifolium								X										
2b-3 Plant Physocarpus vapitatus								X										
2b-4 Plant Symphoricarpos albus								X										
2b-5 Plant Polystichum munitum								X										
2b-6 Plant Pteridium aquilinum								X										
3a Food & Habitat Understory	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
3a-1 Plant Taxus brevifolia								X										
3a-2 Plant Amelanchier alnifolia								X										
3a-3 Plant Gaultheria shallon								X										
3a-4 Plant Rosa nutkkana								X										
3a-5 Plant Rosa woodsii								X										
3b Build/Install Structures	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
3b-1 Aquire bird/bat houses												NOT	OMPLETED					
3b2 Install bird/bat houses												NOT	OMPLETED					
4b Increase lot visability	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
4a-1 Remove line-of-sight veg.							X											
4a-2 Prune Thicket							X											
4b-1 Plant Lonicera ciliosa								X										
4b-2 Plant Rosa nutkkana								X										
4c Engage Community	27-2	3-9	10-16	17-23	24-2	3-9	10-16	17-23	24-30	31-6	7-13	14-20	21-27	28-4	4-11	11-18	19-25	26-1
4c-1 Work Parties			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4c-2 Meet with friends of titlow												X						
4c-3 Contact Schools											X							

Planned: Done: X Not Done: X Done Early: X

Design for the Future

Stewardship Expectations and Development Plan

Titlow Park has a group of citizen stewards, *Friends of Titlow*. UW-REN team members will attend *Friends of Titlow* meetings, as well as present the restoration project publicly. Titlow Park has three staff members who will be helping to water newly planted plants in order to help them survive the summer. In an ideal world that would be enough, but to give the site the best chance to succeed the community and schools will be engaged. This will hopefully result in the Titlow volunteer base expanding. To attract volunteers, several strategies will be used. First, there is a goal to get children excited about restoration. If children are excited about helping the environment, parents may follow. To do this at a restoration work party, there are several activities for the children. For example, invasive species scavenger hunts with candy rewards is an exciting activity for children. Another strategy is to reach out to high schools that require community service hours for graduation. There has been in the past, and plans to in the future, get local businesses (doughnut shop, grocers, etc.) to donate fruit, juice, and doughnuts for work parties. The hope is that this will encourage return visitors for future work parties, which in turn will hopefully give volunteers a sense of ownership of the project.

Project Design and Stewardship

The overarching goal of this project is to restore a section of Titlow Park in a way that allows for the natural succession to a conifer forest over an approximate time span of 50 years. All the plants selected were found to be endemic to the Park and have done well resisting invasion when established. The project has been designed to require, aside from occasional watering, as little maintenance as possible. After removing the invasive species as thoroughly as possible our team and volunteers have installed the selected native plants and laid down 8-10 inches of mulch throughout the site. In the future, there will be diligent scans of restoration sites to watch for tenacious weeds, and when within Tacoma Parks capacity, the invasive species will be removed or treated. Mulch, along with the returning foliage, will hopefully be adequate to shade out any returning *R. discolor* and *H. helix* during the summer. Each successive UW-REN restoration site will require less and less maintenance as planted species grow and shade out the areas during the winter that have, in the past, facilitated the growth of *R. discolor* and *H. helix* if subsequent restoration sites are adjacent to this and the previous year's.

Lessons Learned

The overall lessons learned with the financial budgets, labor budget, and planting plan were seen while reconciling the budgets and planting plan versus what was actually purchased and planted.

Financial Budget

- Our monetary budget from the UW-REN Program was $600.00. We also applied for a $500.00 grant from the Tacoma Garden Club, which we didn't receive. Initially, our budget for plants was projected at $544.57. Our final purchase on plants was $364.59.

Our plant order with SER-UW Nursery initially was, $233.23. However, they did not have trailing blackberry. This turned out to be good, because after removal of the invasive plants on our site, many native plants, along with trailing blackberry were found. In addition, the SER-UW Nursery did not have the Pacific yew we initially ordered, nor could we find a place to purchase them from at a reasonable cost. Therefore, we did not purchase any Pacific yew for the site. The honeysuckle ordered from Watershed Garden Works in Longview, WA were not healthy at all. For the inconvenience this imposed on us, Watershed Garden Works did not charge us for the few honeysuckle they did have. Although we did not purchase all the plants we budgeted for; we had just the right amount of plants and trees for the site after the removal of the invasive species.

- Financial lessons learned:
  - Managing a project efficiently is directly connected to managing the budget. As students learning how to do this first hand, we had pitfalls and struggles. However, with each workshop and team meeting, our skills were refined.
  - Best accounting practices and file management. Reconciliation of plant orders was good practice and taught us the importance of good records management. Reconciliation of the budget in a manner that reflects what is taking place on ground makes for the project manage smoothly with the influx in changes. The budget and project management workshops helped refine these skills, as well as the feedback received from team meetings.

Labor Budget

- We struggled with recruiting volunteers, which is why we were deficient on our volunteer labor hours. Also, we struggled at times to keep track of our study hours and work hours. This is reflected under our research and writing of reports on our labor budget. In addition, plant care was hard to track because while we were at the site some people would be working on removal, some would be working on mulching, and some on watering. The labor budget looks under what was budgeted. The number of hours put into our site and our reports are reflected in the quality of our work.
  - Labor lessons learned:
    - It is vital to try different methods of volunteer recruitment. While we tried a few modes of recruitment, such as social media and posters, there has been recent successes using modes like recruitment aps or websites. However, we were excellently prepared for the volunteers we did recruit.
    - More precise records would help to track some aspects of labor, such as plant care. The forms that we developed as part of our maintenance plan for Metro Parks is a good example of improving organization.

Planting Plan

- The original planting plan certainly deviates from our final plantings. During our main planting party after the plants arrived on-site, the locations of some species changed depending on a few factors. Primarily, the unexpected complexity of the hydrology on the

site altered the originals plans. For example, western red cedar prefers wetter soils. Therefore, the original locations for the trees changed as our understanding of the hydrology developed.

- In addition, the locations of plants changed based on the realities of spacing in the field. Choosing the plant positions based on our knowledge of the site from the one season in which we thoroughly examined conditions was bound to result in variation during planting. This is because the reality of the site varies ever so slightly from our calculated interpretations of what the site should be.
- The availability of plants also influences the final planting locations. Every time we could not locate a plant we wanted, such as the Pacific yew, the planting plan changed somewhat.
- Finally, there are feelings and aesthetic considerations during planting that often influenced the final locations of plants. One example of this is in our placement of red-osier dogwood. While in the field, on our site, we decided to consider the curvature of the ephemeral stream. Now, the plants will accentuate one of the most unique features of our site.
    - Planting plan lessons learned:
        - Ideally, the site is thoroughly examined in a few different seasons, or during changing weather patterns. This would help to better understand the aspects of the site that are difficult to see. Runoff and groundwater require more effort in order to gain a thorough understanding of environmental conditions.
        - Do not get too attached to your planting plan, because it will change. There are so many elements that influence where the plants will be planted. We can only prepare ourselves to a certain point, and in a way, the restoration site ultimately chooses the location of its plants (Fig. 19).

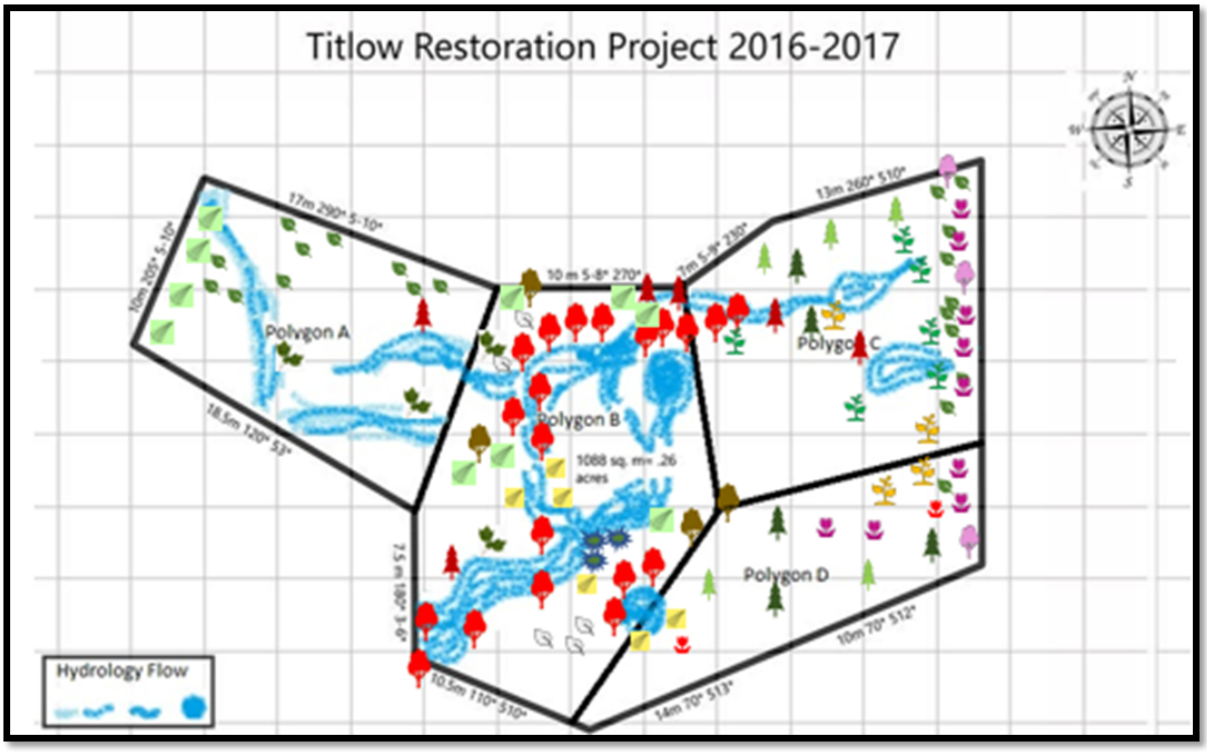

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Figure 19. Titlow Park restoration plant installation map.

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