North Creek Forest
Final Report Packet

University of Washington - Restoration Ecology Network

Capstone Course 2017-2018

Location: North Creek Forest, Bothell WA | 19978 112th Ave NE, Bothell WA 98011

Prepared for Friends of North Creek Forest and the City of Bothell

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Project Summary

This report details the restoration of Project Site 7 at North Creek Forest in Bothell, Washington implemented in 2017-2018 by five (5) students in the University of Washington Restoration Ecology Network (UW-REN) Capstone course. The UW-REN team was partnered with the City of Bothell and a community group, the Friends of North Creek Forest (FNCF), to restore Project Site 7. The Friends of North Creek Forest is a non-profit organization dedicated to improving the ecological function of North Creek Forest through conservation, education, and stewardship (FNCF). The City of Bothell is the landowner and ultimate authority over North Creek Forest. The UW-REN team designed and installed the restoration project between October 2017 and May 2018 with generous support from Sarah Witte (FNCF), Ashley Shattuck (FNCF), Tracey Perkosky (City of Bothell), Scott Purdy (City of Bothell), and our course instructors. North Creek Forest is 64 acres of preserved mixed-conifer forest and Project Site 7 was the seventh restoration site since 2011 under the UW-REN Capstone course, with the project site totaling 0.27 acres.

BEFORE AND AFTER

Figure 1: Left - photo of site looking west from August 2017 [image: Google maps]. Right - photo of site looking west after final work party on May 19, 2018.

Project Description

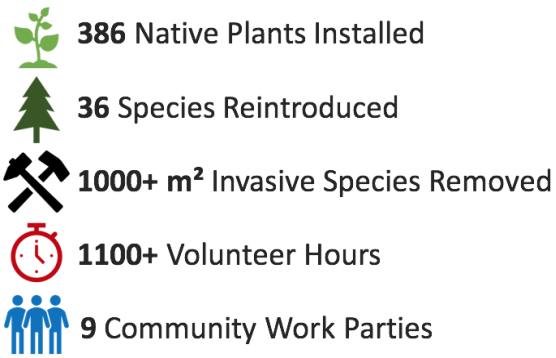
Prior to restoration, the ecological functions of Project Site 7 were impaired by a dominance of structurally and biologically-depauperate non-native vegetation such as Himalayan blackberry (*Rubus armeniacus*) and English ivy (*Hedera helix*). Ecological restoration of the site was needed to increase biodiversity and wildlife habitat, improving forest function by the renewal of the ecosystem's health (Higgs 1997). Restoration activities can provide opportunities to foster relationships between the surrounding communities and the forest, thereby building stewardship capacity for the North Creek Forest.

We had four main goals, or functional requirements, to address in order to successfully restore Project Site 7.

- **Goal 1:** Promote the establishment and dominance of native vegetation that reflects the surrounding upland forest and later matures into a typical Puget Sound region upland coniferous forest
- **Goal 2:** Improve habitat functions at North Creek Forest
- **Goal 3:** Improve forest resistance and resilience to human and natural disturbance
- **Goal 4:** Build stewardship capacity at North Creek Forest

With the assistance of our community partners and many dedicated volunteers, we removed almost all Himalayan blackberry and English ivy from Project Site 7. To prevent invasive species from returning, we planted native species that will shade out invasive species and provide habitat for wildlife. We spread roughly six (6) inches of wood chip mulch throughout the site and installed wood chip buffers to deter encroachment of Himalayan blackberry from the western and southern boundary.

Our team accomplished the following major feats:



Team Information

Figure 2: Left to right: Candice Magbag, Mahleah Grant, Kendra Potoshnik, Rebecca Bruemmer, and Johnathon Rutledge displaying the Friends of North Creek banner during the team's first work party on November 11, 2017.

Table 1: Team & Community Partners contact information

Name	Email	Project Role
Rebecca Bruemmer	rab713@uw.edu	Restoration Team Member
Mahleah Grant	grantm52@uw.edu	Restoration Team Member
Candice Magbag	cmagbag@uw.edu	Restoration Team Member
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Acknowledgements

We would like to express our gratitude to the following groups that made this project possible: Friends of North Creek Forest, City of Bothell, University of Washington Restoration Ecolomolk Network, SER-UW Nursery, Allstate, Target, Soundview Elementary, Girl Scouts, Dr. Amy Lambert's Introduction to Restoration class, Whale Scouts, Canyon Creek 3rd Grade Class, UW Wesley Club, High School Honors Society members, UW Bothell Community Based and Learning Research Students, Outdoor Wellness, our professors, friends, and family.

AS-BUILT REPORT

Text Revisions

Functional Requirements

Functional Requirement 1: Promote the establishment and dominance of native vegetation that reflects the surrounding upland forest and later matures into a typical Puget Sound region upland coniferous forest

- **F.R. 1-1:** Reduce the amount of invasive plant species at the project site and prevent their recurrence
    - **Task 1-1a**: Remove all *R. armeniacus* biomass from the project site.
        - **Approach**: *R. armeniacus* stalks will be cut with loppers, leaving approximately a 0.5 m stalk above the ground to indicate the location of each individual. The roots will then be removed using shovels to prevent reestablishment. Plant material will be removed from the project site for off-site composting, using trucks provided by the City of Bothell.
        - **Approach justification**: Removal of both above- and belowground biomass is crucial to prevent reestablishment, and cutting followed by removal of root crowns is the most effective method (King County 2016).

- **Task 1-1b**: Remove all *Hedera helix* (English ivy) biomass from the project site.
    - **Approach**: *H. helix* will be hand-pulled and transported offsite with trucks provided by the City of Bothell, where it will be composted.
    - **Approach justification**: *H. helix* does not have deep roots, so the mats will be rolled up or pulled by hand. Occasionally a shovel will be used to loosen the soil (King County 2016).
- **Task 1-1c**: Inhibit invasive plant regrowth from any roots or propagules left in the soil.
    - **Approach**: A 6 to 8 in layer of coarse wood chip mulch, donated by local tree service companies via ChipDrop.com, will be spread manually. The mulch is deposited in piles at the project site. It will be transported from the piles throughout the site with the use of wheelbarrows.
    - **Approach justification**: Mulch blocks sunlight from reaching the soil surface, preventing resprouting of *R. armeniacus* propagules and reducing regrowth from remaining root material (King County 2016).
- **Task 1-1d**: Create an evergreen upper canopy layer to prevent encroachment of *R. armeniacus*.
    - **Approach**: The tree species *Thuja plicata* (western redcedar), *Pseudotsuga menziesii* (Douglas-fir), *Picea sitchensis* (sitka spruce), and *Abies grandis* (grand fir) will be installed to create an evergreen upper canopy that shades out *R. armeniacus*.
    - **Approach justification**: Since *R. armeniacus* thrives in sunlight, tree species that create evergreen shade will deter it from the project site (King County 2016). These species will be planted after *R. armeniacus* is removed, which gives them the opportunity to establish and compete with *R. armeniacus*.

- **F.R. 1-2:** Increase the presence of a structurally and biologically diverse native plant community

- **Task 1-2a**: In each polygon, we will install a variety of groundcover, shrub, and tree species appropriate to the environmental conditions of the polygon to increase structural and biological diversity.
    - **Approach**: Plants will be purchased from the University of Washington Society for Ecological Restoration nursery and the King County Conservation District, using the funds allocated through the course budget (Table 11). Plants will be installed in the form of 0.5-, 1-, and 3-gal containers; bare-root; 4-in containers; salvage; and live stake.
    - **Approach justification**: Each form of plant material has its benefits. Bare-root, which is inexpensive and does not require much storage space, will be used for species such as *A. grandis* and *Arctostaphylos uva-ursi* (kinnikinnick). Container plants are large and can establish quickly if the roots are prepared properly. Species including *Alnus rubra* (red alder) and *P. sitchensis* will be purchased in containers. Live stakes, which will be used for species such as *Salix lucida* (Pacific willow) and *Oemleria cerasiformis* (Indian plum), are less expensive and easier to store than container plants (Chalker-Scott 2009).

AD1: Additional plants were acquired through salvage, including many live stakes of *S. lucida, R. armeniacus,* and *O. cerasiformis,* and several *P. menziesii* individuals.

Functional Requirement 2: Improve habitat functions at North Creek Forest

- **F.R. 2-1:** Provide nesting, resting, hiding, and hibernation habitat for native fauna
    - **Task 2-1a**: Install plant species that provide native bird habitat.
        - **Approach**: Install species that provide structural vegetation elements known to support local native forest bird inhabitants such as *Dryocopus pileatus* (pileated woodpecker), *Calypte anna* (Anna's hummingbird), and *Spinus tristis* (American goldfinch). This will include shrub and tree species such as *Corylus cornuta* (beaked hazelnut), *Symphoricarpos albus* (common snowberry), *A. rubra, A. grandis,* and *Pseudotsuga menziesii* (Douglas-fir) (USDA 2018) (Stinson 1995).

- **Approach justification**: These tree and shrub species provide native bird habitat that will increase the number of birds at the site (Leigh 1999). The project site is currently mostly occupied by *R. armeniacus* (Figure 3), which is useful to birds as nesting and feeding habitat (USDA 2018). However, having more varied species at the project site will provide a greater variety of habitat characteristics, such as plant species height and canopy cover, to cater to a larger number of native bird species.

  - **Task 2-1b**: Install species that provide native mammal habitat.

    - **Approach**: Install plant species known to provide habitat for native mammals *Polystichum munitum* (sword fern), *C. cornuta*, *Cornus sericea* (red osier dogwood), *Rubus spectabilis*, *A. circinatum, Picea sitchensis (*sitka spruce*), A. rubra, A. grandis, and P. menziesii*, in locations appropriate to each species' environmental tolerances.

    - **Approach justification**: *P. munitum* provides evergreen ground cover that enhances year-round cover and thermoregulation functions for small mammals. *C. sericea* and *Rubus spectabilis* (salmonberry) provide cover. *A. circinatum* provides cover for deer and other animals, as does *P. sitchensis. A. rubra, A. grandis,* and *P. menziesii* provide cover and nesting habitat (Leigh 1999).

- **F.R. 2-2:** Provide native food resources to increase frequency and distribution of native insects (particularly pollinators), birds, and mammals.

  - **Task 2-2a**: Provide food resources for native insects.

    - **Approach**: Install *R. spectabilis*, *Sambucus caerulea* (blue elderberry)*, A. rubra, Philadelphus lewisii* (mock-orange)*, R. nutkana, R. armeniacus, S. albus, Ribes sanguineum* (red-flowering currant)*,* and *A. uva-ursi.*

    - **Approach justification**: *R. nutkana, R. armeniacus, S. albus, R. sanguineum,* and *A. uva-ursi* provide food resources for native insects. *R. spectabilis* and *P. lewisii* provide food resources for bees and butterflies in particular (Leigh 1999).

AD2: *Sambucus racemosa* (red elderberry) was installed in place of *S. caerulea* due to lack of availability.

- Task 2-2b: Provide food resources for native birds.
  - **Approach**: Install native plants known to supply food resources for native birds, such as *C. cornuta, R. spectabilis*, *S. caerulea, Lonicera involucrata (*black twinberry)*, C. sericea* live stakes, *Rosa nutkana* (Nootka rose), and *A. rubra.*
  - **Approach justification**: Similarly to the justification for Task 2-1a, *R. armeniacus* does provide food resources for birds, but a variety of native plants will increase the diversity of food types available at the project site (Leigh 1999).

AD3: *C. sericea* was installed in the form of 1-gal pots instead of live stake, due to availability.

- Task 2-2c: Provide food resources for native mammals.
  - **Approach**: Install native plants known to provide food for native mammals, such as *L. involucrata*, *C. sericea*, *P. emarginata*, and *T. plicata*
  - **Approach justification**: Having a variety of food sources at the project site will help to attract multiple mammal species. For example, deer browse on *L. involucrata* leaves and twigs. Small mammals feed on *C. sericea,* and the fruit of *R. spectabilis* is also a source of food for mammals (Stinson 1995).

AD4: *P. emarginata* was not installed due to lack of availability.

- **F.R. 2-3**: Increase the presence of a structurally and biologically diverse native plant community, which supports FR 2 as well as FR 1
  - See FR 1-2

Functional Requirement 3: Improve forest resistance and resilience to human and natural disturbance

- **F.R. 3-1:** Increase the biodiversity of the project site, emphasizing diverse plant functions to improve resilience
  - Task 3-1a: Purchase and install plant species with a variety of physical and functional attributes, such as *T. plicata, R. spectabilis*, and *P. munitum*.

        - **Approach**: Purchase and install various types of species from local nurseries.
        - **Approach justification**: “Biodiversity increases the stability of ecosystem functions through time” (Cardinale 2012) and improves an ecosystem’s chances of recovering from a disturbance. Functional redundancy, or the presence of multiple species with similar structural or functional attributes, also increases resilience.

- **F.R. 3-2:** Reduce microsites offering abundant resources to invasive plant species
    - **Task 3-2a**: Reduce sunlight available to *R. armeniacus* by increasing canopy cover.
        - **Approach**: Install species that will create evergreen shade, such as *T. plicata* and *P. menziesii.*
        - **Approach justification**: *R. armeniacus* thrives in the sun (King County 2016), so the inclusion of shady plants at the project site will help to prevent it from returning and dominating the area again.
    - **Task 3-2b**: Reduce sunlight available to propagules of *R. armeniacus* and other invasive plant species.
        - **Approach**: Cover exposed soil at the project site with 6-8 inches of mulch.
        - **Approach justification**: Mulch prevent the growth of new shoots from propagules underground, such as seeds and stem fragments. *R. armeniacus* in particular is capable of growing from a stem fragment and retains a seed bank in the soil for several years (King County 2016). *H. helix* is shade tolerant (USDA 2018), so this approach will be more effective than task 3-2a in preventing its return.
- **F.R. 3-3:** Deter encroachment by vegetative spread onto the site of invasive species growing adjacent to the site
    - **Task 3-3a**: Prevent *R. armeniacus* propagules from reaching the soil at the edges of the project site
        - **Approach**: Mulch will be placed on most of the project site at a depth of 6-8 in. At the east, south, and west sides, where *R.*

armeniacus is directly next to the project site boundary, a 5 ft wide buffer will be created. The mulch for this buffer will be placed at a depth of 8+ inches, and no native plants will be installed. In addition, the *R. armeniacus* 6-8 ft west of the western border of the project site will be trimmed to a height of approximately 0.5 m.

- **Approach justification**: A thick layer of mulch will not only prevent sunlight from reaching propagules in the soil (Task 3-2b) but also prevent propagules from adjacent plants reaching the soil and establishing roots. Mulch thickness is critical to the success of a mulch treatment (Chalker-Scott 2009) so the mulch needs to be especially thick in areas where the project site is in danger of invasive species encroachment. The removal of *R. armeniacus* canes to a distance 6-8 ft west of the project site will delay the canes in growing over to the project site, where they can root.

AD5: Because *R. armeniacus* was removed from Polygon 3 and native plants were installed, there is no longer *R. armeniacus* at the eastern side of the site. *R. armeniacus* was trimmed to a height of 0.5m at the west side. There were enough available volunteers that it was able to be removed from most of the south side as well, with the exception of the eastern part of the south boundary, where *R. armeniacus* grows up into the cable lines and was therefore unsafe for the team or volunteers to remove.

Functional Requirement 4: Build stewardship capacity at North Creek Forest

- **F.R. 4-1:** Provide community education opportunities
  - **Task 4-1a**: Engage local high school students to increase education and stewardship.
    - **Approach**: Reach out to local high schools such as Inglemoor High School, North Creek High School, and Bothell High School and invite them to participate in volunteer work parties. Students will experience removing invasive plant species and/or installing native plant species to gain a firsthand understanding of the local coniferous forest ecology. Team members will teach the names and functions of the plants to be installed at the work party.
    - **Approach justification**: High school honor societies like the National Honor Society Valhalla at Inglemoor High School often

have community service requirements and have attended North Creek Forest events in the past.

- **F.R. 4-2:** Increase community engagement with North Creek Forest
  - **Task 4-2a**: Host community work parties every 1st and 3rd Saturday of the month, and reach out to local businesses for food donations.
    - **Approach**: The team and FNCF will publicize the events on Instagram, Facebook, VolunteerMatch, and the Friends of North Creek Forest website. The team will reach out to local businesses for food and coffee donations and gift cards. The team will arrive at the project site at 9:00am on the day of each work party to set up, and the work party will begin at 10:00am. Volunteers will be placed in small groups and will be given certain tasks such as trimming, digging, mulching, or planting. Each task will be explained in terms of safety demonstrations, why the task is needed, and the ultimate vision for the area the small group is working on. Volunteers are encouraged to tell their stories of how they connect with the forest. Small groups then rotate tasks, and a previous small group member can go through a brief explanation of what was done and why (UW REN/FNCF members are the ones to provide the safety demo). After the volunteers are finished at 1:00pm, the team will clean up until 2:00pm.
      If by chance the team encounters a large volunteer turnout, the volunteers will be split in half. One half will be split into smaller groups, as mentioned above, and do hands-on work on-site. The other half will be taken by one or two of the team members to learn more about the successes of the previous UW REN sites. The two big groups will then rotate.
    - **Approach justification**: Community work parties will allow community members to directly engage with our project and learn more about restoration practices. Encouraging volunteers to share their stories and rotating tasks opens up opportunities for volunteers to share what they learned while performing the different tasks.
      Splitting a large volunteer turnout in half will allow for better safety practices with hands-on work on-site (less crowded and less tools in use). Educating the volunteers by discussing and showcasing the successes of previous UW REN sites can help provide a better understanding of what our site aims to be in terms of

biodiversity and maturity. Moreover, the areas surrounding our site can help paint a picture of what our site used to be, the current progress of our site, and the goals for the future. In addition, awareness, outreach, and education about the forest occur when local businesses and communities are approached for snack and mulch donations.

- **Task 4-2b**: Develop a long term maintenance and monitoring plan that utilizes long-term volunteer stewards
    - **Approach**: Seek out consistent volunteers and give them the opportunity to engage with the City of Bothell as a volunteer site steward that can be counted on when the city needs assistance with maintenance tasks that can be supported by community members. The team will create a Stewardship Plan (see **Design for the Future**) in April and May that will be shared with volunteer site stewards and our community partners. FNCF will spearhead the continued maintenance of the project site for at least three years.
        - **Approach justification**: Individuals who have been consistent volunteers throughout the progression of the restoration are likely to become invested and therefore return in the future to help maintain and monitor the site for years to come.

SPECIFIC WORK PLANS

Many on-site activities will involve community volunteers. For details on safety, logistics, and organization of such events, please see the Logistical Considerations section on page 21 and the section on Outreach Efforts on page 30.

Site Preparation

Current Conditions

Polygon 1

A) Environmental Conditions

Polygon 1 (~~69.7 m^2~~) is the northernmost polygon and runs adjacent to the neighboring monoculture grass lawn. This polygon serves as a weak buffer between the aforementioned lawn and the forest of mixed deciduous trees of Polygon 2. The soil texture is of sandy clay loam that is well-drained, with the polygon resting on a 0-12% slope (Table 1). During the fall and winter seasons, the ground is covered by approximately 2 ft of leaf litter due to accumulated fallen leaves from the *Ulmus* species (elm) located on the adjacent lawn being leaf-blown by human activity onto the polygon.

AD6: Upon complete removal of invasive vegetation, Polygon 1 was re-delineated, thus increasing its surface area from 69.7 m^2 to 88.5 m^2.

B) Vegetation

a. Herbaceous vegetation

No herbaceous vegetation present in this polygon.

b. Shrubs

Some native *Rubus ursinus* (trailing blackberry) was observed in a relatively low density. Approximately 70% of this polygon is covered in *H. helix* (Table 2), a non-native species. The presence of *R. armeniacus*, also non-native, is low but protruding inward from the southern boundary of the polygon and has yet to become established (Figure 3).

c. Trees

There are no trees rooted in Polygon 1; however, the canopy in this polygon is created by *P. menziesii*, *P. sitchensis*, and an unknown *Acer* species (maple) just north of the project site boundary.

Polygon 2

A) Environmental Conditions

Polygon 2 (~~517.9 m^2~~) is situated between Polygon 1 and Polygon 5. It has an easterly slope aspect and ranging from 2-12% (Table 1). This polygon contains an upper and lower canopy layer due to the slope gradient. The unknown deciduous trees dominate the polygon and are accompanied by ~~*Malus fusca* (Pacific crabapple)~~, the remnants of a planted orchard (Figure 4). These factors result in 0-25% insolation at the ground level for Polygon 2, increasing in winter months with loss of non-native unknown deciduous tree leaves. The soil texture is characterized as loamy sand and is well drained.

AD7: Upon complete removal of invasive vegetation, Polygon 2 was re-delineated, thus increasing its surface area from 517.9 m^2 to 562 m^2.

AD8: The *Malus fusca* was misidentified and determined to be a non-native *Malus* species, not *M. fusca*.

B) Vegetation

a. Herbaceous vegetation

Pteridium aquilinum (bracken fern) are native ferns found in relatively low abundance in this polygon (Figure 4).

b. Shrubs

Non-native *R. armeniacus* is observed with high presence across Polygon 2, which has grown into the canopy layer (Figure 3). Some *H. helix* has crept in from Polygon 1.

c. Trees

Growing into the canopy are two non-native *Ilex aquifolium* (English holly) trees and scattered throughout the polygon are unknown, non-native deciduous trees (Figure 3). ~~*Crataegus douglasii* (black hawthorn) is a native species~~ found present within the polygon, but the highest abundance of native tree species observed is ~~*M. fusca*~~ (Figure 4).

AD9: These unknown non-native deciduous trees were determined to be in the *Prunus* genus.

AD10: Upon closer inspection in the spring, the team has determined the three (3) trees to be *Crataegus monogyna* (English hawthorn), a non-native species listed as Class C under Washington State Noxious Weed Control Board (NWCB 2016).

AD11: See AD8 above.

Polygon 3

A) Environmental Conditions

Polygon 3 (~~58.0 m^2~~) is the south-easternmost polygon. It has 0% slope; however, water from the rest of the site flows downhill to Polygon 3. The soil is a well-drained sandy loam that remains moist due to water flowing down from the forest. It has 75-100% ground insolation, making it the part of our project site with the most sun exposure.

AD12: Upon complete removal of invasive vegetation, Polygon 3 was re-delineated thus increasing its surface area from 58.0 m^2 to 144.5 m^2.

B) Vegetation

a. Herbaceous vegetation

No herbaceous vegetation present in this polygon.

b. Shrubs

Non-native *R. armeniacus* is present in abundance in this polygon (Table 2). No existing native vegetation was observed in this polygon.

c. Trees

No trees are present in this polygon. Current canopy cover is due to the *R. armeniacus* layer or from the *A. rubra* from the adjacent polygon, Polygon 4 (Figure 4).

Polygon 4

A) Environmental Conditions

Polygon 4 (~~87.0 m^2~~) is located at the southern end of the site within Polygon 5. It was designated separately from Polygon 5 because of the *A. rubra* that creates a canopy in Polygon 4. It has a 2-3% slope, a few rodent channels, and surface organic material of leaf litter and woody detritus. The soil is of a clay loam texture and contains numerous pebbles up to three inches in diameter.

AD13: Upon complete removal of invasive vegetation, Polygon 4 was re-delineated thus increasing its surface area from 87.0 m^2 to 101.8 m^2.

B) Vegetation

a. Herbaceous vegetation

P. aquilinum is present in low abundance.

b. Shrubs

Non-native *R. armeniacus* creates a mid-tall shrub canopy layer and appears to prevent other species from being established.

c. Trees

Polygon 4 contains the upper canopy of the project site, comprised of *A. rubra* that range from 30-40 feet in height.

Polygon 5

A) Environmental Conditions

Polygon 5 (~~210.4 m^2~~) has the most rodent burrows, resulting in uneven terrain, and the largest gap in the canopy layer. It has the steepest slope of the polygons (9%) and there is some large woody debris. The soil there has been characterized as sandy clay loam, and retains moisture well.

AD14: Upon complete removal of invasive vegetation, Polygon 5 was re-delineated thus reducing surface area from 210 m^2 to 196.3 m^2.

B) Vegetation

a. Herbaceous vegetation

P. munitum was observed in low abundance (Figure 4). *P. aquilinum* was also observed in low abundance (Figure 4).

b. Shrubs

Non-native *R. armeniacus* is present in high abundance (Figure 3).

c. Trees

No trees present in this polygon.

Site Preparation Activities

Invasive Species Removal: *R. armeniacus* removal activities will consist of identical operations in each polygon. In addition, Polygons 1 and 2 will require identical operations for the removal of *H. helix* (Figure 5).

Both *R. armeniacus* and *H. helix* will require the use of gloves and clothing that protects the skin. Thorns are present on *R. armeniacus,* and *H. helix* contains a sap which has been known to elicit allergic reactions (King County 2014).

R. armeniacus will be removed by cutting the above ground canes to approximately 0.5 m in height and digging up the root bulb with shovels (King County 2014). The removed fragments and root bulb are to be placed onto a collection tarp for relocation to the city truck for removal. All unearthed soil will be returned to the hole created by removal and lightly compacted by hand to prevent erosion. Care should be taken with these light compaction methods so the soil pore spaces are not eliminated (as they are essential to plant health). To further control erosion following invasive removal, we will cover the impacted areas with 6-8-inches of coarse wood chip mulch before moving on to the next area for invasive removal. Upon completion, all areas affected by removal activities will be covered with 6-8-inches of mulch. This not only serves to prevent erosion, but also deters the spread or return of the invasive species (King County 2014).

H. helix will be removed by hand-pulling and utilizing a shovel to dig up the root structure. Once loose, the mat of ivy can then be rolled up (Shaw 2017) and placed onto the collection tarp for relocation to the city truck where it will then be removed to an off-site composting location. Utilizing loppers or pruners, sections climbing up trees or shrubs, and along downed woody debris will be severed from the root structure. The removed fragments will be placed onto a collection tarp for relocation to the city truck and eventual removal.

Care will be taken to ensure the removal of all root and stem fragments possible, as these do possess the ability to develop new roots and shoots (King County 2014). Replacing the soil, tamping it down, and covering it with mulch will proceed as described above for *R. armeniacus* removal.

Plant Staging: Prior to volunteer work party events that include plant installation, the team will “stage” plants by placing them at the location of installation. Installed plants will be marked with flagging tape to ensure visibility. This will prevent accidental removal of the installed plants or accidental burial during mulching.

Polygon 1

The northern boundary of Polygon 1 coincides with the northern boundary of our project site. North of this line, there are two deciduous trees whose leaf litter is blown into Polygon 1 by the City of Bothell maintenance crews as per operational instruction. By request, we will be leaving the leaf litter ~~in place~~ to serve as an organic input for the soil beneath it. The team will be responsible for the removal of *H. helix* covering an area of 65 m^2 within the northwestern portion of this polygon.

AD15: Leaf litter was left in place only on the eastern half (44.25 m^2) as per direction from community partner, the City of Bothell.

Polygon 2

This polygon will receive site preparation removal treatments for *H. helix* and *R. armeniacus*, as well as the mulching treatment that follows. Preparation methods are described above near the start of the Site Preparation section.

In addition, this polygon contains two non-native plant species with invasive habits warranting future maintenance. To combat *I. aquifolium*, it is recommended that an herbicide be injected by a licensed applicator (King County 2014) coordinated through the city of Bothell. The second non-native species is unknown but most likely a fruiting deciduous tree. Continued attempts should be made to identify the species so that a formalized plan of action can be originated.

Polygon 3

Polygon 3 will not be receiving any site preparation activities, as it is to remain a thicket of *R. armeniacus*. The City of Bothell has requested that the team utilize the present state of this polygon as a natural way to deter entry to the site by reducing any appearance of access trails. In addition, the soil will be protected from increased compaction and the future plantings will be less likely to become trampled.

AD16: On April 13, 2018, the City of Bothell authorized work on Polygon 3, based on successful progress on the rest of the site. Polygon 3 received site preparation treatments of *R. armeniacus* removal on and mulching.

Polygons 4 and 5

These polygons will receive site preparation treatments of *R. armeniacus* removal and mulching as described above near the start of the Site Preparation section.

Logistical Considerations

Access paths: The only proper site access for the project site is from 112th Ave NE (Figure 6). The project site is visible directly from the paved street; however, public access into the site during restoration is deterred by caution tape and blockades comprised of branches and downed wood blocking entrances that may appear as trails. These structures are carefully built to prevent people from walking into the site when work parties are not in session. Upon the end of the UW REN team's term (June of 2018), to block access into the site as the site develops, the eastern edge of Polygon 2 and all of Polygon 3 will remain as patches of blackberry in order to maintain the appearance of an unapproachable thicket. Our Stewardship Plan (see **Design for the**

Future) will outline future work regarding the removal of the blackberry patches after the groundcover and understory becomes more established.

AD17: On April 13, 2018, the City of Bothell approved removal of the blackberry thicket at the eastern edge of Polygon 2 and all of Polygon 3.

Staging areas: Materials will be delivered right on site, with a mulch pile located to the east of the blackberry patch in Polygon 2, close to the road. As needed, additional mulch can be stockpiled 167 meters further north along 112th Ave NE, adjacent to the road (Figure 6). Debris generated by volunteer work parties will be disposed ~~day-of~~ by dumping the debris into a truck provided by the City of Bothell. The truck will be parked along 112th Ave NE, adjacent to the site (Figure 6) for easy and safe access when disposing of the debris. Tools are stored in a locked tool shed located at the end of 112th Ave NE and are transported by the team to the site during work parties (Figure 6).

AD18: Debris generated by volunteer work parties will be disposed by dumping the debris into the truck provided by the CIty of Bothell when time allows.

Two (2) canopy tents (shelters) will be set up side-by-side on the day of work parties, adjacent to the site, on 112th Ave NE. These canopies will serve as the checkpoint for volunteers. The sign-in sheet and waiver forms are stationed at one table while another table is where the coffee, water, and snacks will be placed. A garbage bin, compost bin, and recycling bin are located near the refreshments table; refuse generated and disposed in the bins are taken care of by FNCF at the end of each work party.

Safety and Planning: Work parties are suited for volunteers ages 12 and above, with adult supervision required for those between ages 12 to 17. Work parties are led by the UW REN team of five (5), with at least two (2) to three (3) members from FNCF present. We aim for a 1:5 ratio of UW REN team/FNCF member to volunteers.

AD19: Direct adult supervision is required for those between the ages of 12 to 17.

AD20: Liability waivers will need to be filled out by each volunteer.

The team will meet the Friday before every work party to discuss plans and prepare the site; which includes a site walk-through, site evaluation for volunteer safety, mulching of any rodent channels and burrows, materials check, and an outlined timeline for the following day. The team discusses possible outcomes of certain situations; such as planning what to do if five (5) volunteers attend, 10 volunteers, 20, and so on.

On the day of work parties, the team and one (1) member of FNCF will arrive at the site by 9:00am. The tools will be transported from the tool shed to the site and the canopies and tables set up. At 9:40am, the team will meet to go over roles and conduct safety briefing. Volunteers are greeted upon arrival and signed-in. Around 10:00am, the team

will begin introductions and go over work party grouping, tasks, and goals. The Safety Talk will be given prior to any tools being distributed.

Parking: Vehicles can be parked along 112th Ave NE, excluding the area directly east of the project site. Vehicles will not be parked in the neighboring apartment complex. Although the adjacent house to the north is now a part of North Creek Forest, vehicles will not be parked in the household's driveway.

Water will be provided by FNCF or the team (acquired through donations) during work parties. A portable restroom is located 150 meters north of the project site that is present at all times, managed by the City of Bothell.

PLANTING PLAN

Polygon 1

During the initial site assessment, an abandoned vehicle was discovered uphill from the western boundary of the site. Due to safety concerns, the City of Bothell plans to remove the vehicle in dry conditions, aiming for summer of 2018. Removal will require a path from the vehicle to 112th Ave NE, which will include majority of Polygon 1. This timeline will result in Polygon 1 only receiving invasive removal preparations (see **Site Preparation Activities)** and no immediate plans for planting. Future plans for planting will be outlined in the Stewardship Plan (see **Design for the Future**).

AD21: The eastern section of Polygon 1 has been roped off by the City of Bothell to prevent plant installation in the instance the area will be needed as a pathway for the removal of the abandoned vehicle. The western section of Polygon 1 was open for planting.

AD22: As per the guidance of our community partner, FNCF, *Acer macrophyllum* (bigleaf maple), *Oemleria cerasiformis* (Indian plum), *Salix sitchensis* (sitka willow), and *Thuja plicata* (western redcedar) were planted as tree and shrub species to meet the functional requirement of improving forest resilience to human and natural disturbances (FR 3).

AD23: *Oemleria cerasiformis* (Indian plum) was planted with 0.5-1 m spacing to increase the density of native vegetation.

Polygon 2

A mixture of trees for the canopy layer, shrubs for understory, and herbaceous plants for ground cover will be installed to increase presence of structurally and biologically diverse native plant community (FR 1-2). In consideration of maintenance and ultimately, effects of climate change, the team is focusing on planting more *drought-tolerant* species. A heavily mulched wood-chip buffer will be installed along the ~~Eastern~~ boundary of Polygon 2 to deter encroachment of *R. armeniacus* ~~from Polygon 3, which will remain in order to avoid the appearance of trails in Project Site 7~~ (FR 3-3) (Figure 7). In addition, a wood-chip mulch buffer will be installed on the Western boundary of Polygon 2 to deter encroachment by vegetative spread onto the project site of invasive species growing adjacent to the site (FR 3-3) (Figure 7).

AD24: An additional benefit of the wood chip mulch layer is its ability to provide maneuverable space for maintenance activities. The remaining Himalayan blackberry in Polygon 2 was removed per request of the City of Bothell during the 4-21-18 work party.

For the ground cover layer, ~~ten (10)~~ *P. munitum* will be installed from ½--gallon pots throughout Polygon 2 to help stabilize the slope (Table 3). We plan to ~~retrieve *P. munitum* from salvage events to reduce costs and~~ increase density of ground cover to deter encroachment of *R. armeniacus* (FR 1-1). Roots of this species form a dense, fibrous mass that will assist in stabilization of soil and it is summer-drought tolerant (Leigh 1999). This evergreen ground cover will provide native food to deer and produce a year-round cover for ground-dwelling animals (FR 2-2) (Leigh 1999). four (4) ½-gal pots of *Tellima grandiflora* (fringecup) will be planted throughout Polygon 2 (Table 3). ~~The wood chip buffer will also serve as a path for stewards to provide maintenance for project site 7 with ease.~~

In the shrub layer, ~~five (5)~~ *R. spectabilis* live stakes will be randomly planted throughout Polygon 2 (Table 3) to provide cover and forage for native fauna and is an important source of nectar for bees, butterflies and hummingbirds (FR 2-1, 2-2) (Leigh 1999). ~~14~~ *Oemleria cerasiformis* (indian plum) will be installed on the edge of Polygon 2 to provide food for birds and small mammals (FR 2-2) (Leigh 1999).Ten (10) *S. ~~caerulea~~* in bare-root form will be planted throughout Polygon 2 (Figure 7, Table 3) due to the soil binding properties (FR 1-2) and to provide native food resources to increase frequency and distribution of native insects, birds and mammals (FR 2-2) (Leigh 1999). Ten (10) *Philadelphus lewisii* bare-root will be planted in Polygon 2 (Figure 7, Table 3) to provide food to small mammals and attract native pollinators (FR 2-2). ~~Ten (10)~~ *Ribes sanguineum* in bare-root form will be planted in Polygon 2 to provide native fauna habitat for nesting, resting and hiding as well as increase presence of biologically and structurally diverse vegetation (FR 2-1, 3-1). ~~Five (5)~~ salvaged *R. nutkana* will be planted in Polygon 2 to provide food for native insects (FR 2-2) (Leigh 1999). ~~Three (3)~~

L. involucrata in 1-gallon pots will be planted throughout Polygon 2 (Table 3) to attract hummingbirds and deer, which browse on the leaves and twigs (FR 2-2) (Leigh 1999). ~~Five (5) salvaged *C. cornuta* will be planted in Polygon 2 (Table 3) to provide nesting, resting, hiding, and hibernation habitat (FR 2-1) as well as provide food resource for birds, deer and small mammals (FR 2-2) (Leigh 1999). Ten (10) *C. sericea* in the form of bare-root will be installed in the of Polygon 2 (Table 3) to provide wildlife cover and food resources for birds, small mammals (FR 2-1, 2-2) (Leigh 1999). Five (5)~~ *A. circinatum* will be salvaged (Table 3) and planted ~~in 10 m centers~~ in order to provide soil binding qualities, cover for deer, birds or small mammals and provide food resources for mentioned native fauna (FR 2-1, 2-2) (Leigh 1999). One (1) salvaged *Symphoricarpos albus* (snowberry) will be installed in Polygon 2 (Table 3) to provide native fauna with nesting, resting, hiding and hibernation habitat (FR 2-1) (Leigh 1999).

For the tree layer, ~~six (6)~~ *T. plicata* in 1-gallon pots or in bare-root form will be planted on 3 m centers throughout Polygon 2 (Table 3) to promote establishment and dominance of native canopy (FR 1-2). *T. plicata* can live more than 1,000 years and is resistant to rot (FR 3) (Leigh 1999), which can help ensure its survival against insect attack (Freitag and Morrell 2001) and fungi associated with damp grounds (Scheffer 1957). ~~Five (5)~~ *A. rubra* in 1-gallon pots will be planted in Polygon 2 (Table 3) for its tolerance to drought and stabilization of disturbed soils (FR 2, 3) (Leigh 1999). Three (3) *P. sitchensis* in 1-gallon pots will be installed into Polygon 2 (Table 3) to increase presence of a structurally and biologically diverse native plant community (FR 1-2) and provide cover or food resources for wildlife (FR 2-1, 2-2) (Leigh 1999).

AD25: In total,13 *Rubus spectabilis* (salmonberry) were planted rather than the proposed five (5) due to receiving additional live stakes.

AD26: In total, 30 *Oemleria cerasiformis* (Indian plum) were planted rather than the proposed 14, due to receiving additional live stakes.

AD27: *Sambucus caerulea* (blue elderberry) was replaced with *Sambucus racemosa* (red elderberry) due to a lack of availability.

AD28: Three (3) *Philadelphus lewisii* (mock orange) were planted along the southern border of this polygon as per the guidance of our team instructor. The planting location of the other individuals was changed to Polygon 5 due to the greater abundance of insolation received when compared to Polygon 2.

AD29: The number of *Ribes sanguineum* (red-flowering currant) plantings was reduced from ten (10) to seven (7) because three (3) individuals were planted in Polygon 3.

AD30: The number of *Rosa nutkana* (nootka rose) plantings was reduced from five (5) to one (1) because we needed more shrubs in Polygon 3.

AD31: The number of *Lonicera involucrata* (black twinberry) planted was increased from three (3) to seven (7) due to more individuals being donated.

AD32: *Corylus cornuta* (beaked hazelnut) was not planted due to a lack of availability.

AD33: *Cornus sericea* (red osier dogwood) was not planted due to need for more shrubs in Polygon 3.

AD34: The number of *Acer circinatum* (vine maple) was reduced from five (5) to one (1) due to a lack of salvage availability.

AD35: The number of *Thuja plicata* (western redcedar) was reduced from six (6) to two (2) due to cost.

AD36: The number of *Alnus rubra* (red alder) was increased from five (5) to twelve as a result of the team receiving extra plants.

AD37: *Rubus parviflorus* (thimbleberry) was increased from zero (0) to four (4) because it is a shade and moisture loving shrub that provides forage for wildlife.

AD38: Seven (7) *Physocarpus capitatus* (pacific ninebark) were installed due to availability and receiving extra funds for plants.

AD39: Six (6) *Fragaria chiloensis* and six (6) *Fragaria vesca* individuals were installed in raised beds near the eastern border of Polygon 2, as suggested by FNCF.

Polygon 3

Polygon 3 will remain covered in *R. armeniacus* until the rest of the site is well established. This will inhibit the appearance of trails, as per the request of the City of Bothell, and discourage public access to the site, aiding in the prevention of compaction of soil and trampling of the plant installations. Our Stewardship Plan (see **Design for the Future)** will detail the next steps for *R. armeniacus* removal and native plant installation.

AD40: Work on Polygon 3 was authorized by the City of Bothell on April 13, 2018. This polygon was mulched and planted with early-successional native shrub and small tree species after the removal of Himalayan blackberry (*Rubus armeniacus*).

AD41: Groundcover species were not installed in this polygon due to the harsher conditions and need for larger shrubs to compete with encroaching *R. armeniacus*.

AD42: The installment of species that could form a canopy layer was constrained by the power cables running over the eastern side of the polygon. No large trees were planted in this area, so the main canopy cover will be from large shrubs.

AD43: To form a robust shrub layer throughout the polygon to compete with encroaching *R. armeniacus (F.R. 3-3),* seven (7) *Rosa nutkana*, two (2) *Rosa gymnocarpa*, three (3) *Ribes sanguineum*, two (2) *Rubus spectabilis*, two (2) *Holodiscus discolor*, four (4) *Cornus sericea*, one (1) *Acer circinatum*, two (2) *Lonicera involucrata*, three (3) *Oemleria cerasiformis*, three (3) *Symphoricarpus albus*, and four (4) *Rubus leucodermis* were installed. This species were selected because they can tolerate mid- to full sun and dry summer conditions. Many can spread easily, which will help them outcompete the *R. armeniacus*. They all provide forage and habitat structure for wildlife (F.R. 2-1, 2-2), and many are indigenous food sources.

AD44: On the western side of Polygon 3 where canopy height is not constrained by power cables, one (1) *Alnus rubra*, one (1) *Pseudotsuga menziesii*, two (2) *Quercus garryana*, and one (1) *Salix lucida* were installed. These early successional species are sun-loving and fast growing, which will result in quick canopy establishment to help shade out *R. armeniacus* (F.R. 1-1) and provide wildlife habitat (F.R. 2-2). There is a wide range of mature heights between the species, ensuring diverse habitat structure (F.R. 2-2).

Polygon 4

Although the *A. rubra* at this polygon is excellent for fixing nitrogen in the soil and establishing a canopy, it is a short-lived species. Therefore, *T. plicata* will be installed to ensure canopy cover remains and is enhanced by a shift toward year-round cover in the future for the purpose of shading out *R. armeniacus* (FR 3-3). ~~Two (2) individuals~~ will be installed at a 3.5 m spacing, acquired from salvage if available or purchased in a 1-gallon pot from local nurseries.

Once the *R. armeniacus* at the site is removed, a new understory will be installed (FR 1-2). ~~15 *P. munitum* individuals~~ will be added to the site (Figure 8), some acquired from salvage events and some purchased as bare-root and in 1-gal pots. Three (3) *Dryopteris expansa* (spiny wood fern), acquired from local nurseries in 0.5-gallon pots,

will be placed in microsites where they will receive adequate shade near the *A. rubra* and *T. plicata*. One (1) *R. spectabilis* will be installed in the form of a live stake.

AD45: Three (3) *T. plicata* individuals were installed due to availability.

AD46: The number of *P. munitum* individuals was decreased from fifteen to seven (7) due to price and the need for individuals in other areas of the site.

AD47: The number of *R. spectabilis* livestakes went up from one (1) to four (4) to account for livestake mortality.

AD48: Four (4) *Tellima grandiflora* individuals were installed to increase groundcover biodiversity.

AD49: To create a robust and biodiverse shrub layer, nine (9) *Oemleria cerasiformis* livestakes, one (1) *Holodiscus discolor*, three (3) *Gaultheria shallon*, and one (1) *Cornus sericea* were installed.

AD50: One (1) *Pseudotsuga menziesii* individual and three (3) *Salix lucida* livestakes were installed to increase canopy diversity.

Polygon 5

Plant selections for Polygon 5 (Table 3) will need to address several biotic and abiotic conditions. Species planted in this polygon will need to handle soil erosion due to the 9% slope, seasonal upslope runoff during precipitation events, well-drained soils, possible summer droughts, and an insolation average ranging from 0 - 25%.

The selected tree species (Table 3) are intended to establish an upper and middle canopy layer that will shade out the encroaching *R. armeniacus.* Five (5) *A. rubra* in 1-gal pots will be planted 3 m apart along the western boundary (Figure 9). This species was selected for its fast growth in order to create an upper canopy (Leigh 1999) (FR 1-1, 3-3). In addition, it will also provide soil stabilization, habitat, and a native food source for various wildlife and invertebrate species (Leigh 1999) (FR 2-1, 2-2). Ten (10) *Abies grandis* (grand fir) in 1-gal pots will be spaced 3 m apart and planted throughout the central portion of this polygon in an east-west pattern (Figure 9). Five (5) *T. plicata* in 1-gal pots and bare-root form will be planted along the southern border just and north of polygon 4 (Figure 9) with 3.5 m spacing. Both *A. grandis* and *T. plicata* were selected for abilities to tolerate shade, provide year-round shade, and endure seasonal fluctuations in soil moisture (Leigh 1999) (FR 1-1, 3-3). *A. grandis* is more drought tolerant, and both species can be purchased in bare root bundles at low prices (provided this form is available). *T. plicata* serves as a food source for deer and numerous avian species while also providing habitat for butterfly larvae (Leigh 1999) (FR 2-1, 2-2). Seven (7) *P. menziesii* in 3-gal pots and bare-root form will be planted with 3 m spacing among the *A. grandis* throughout the center portion of this polygon

with an east-west pattern (Figure 9). *P. menziesii* be used to provide shade, habitat, food resources, and nesting opportunities (Leigh 1999) (FR 1-1, 2-1, 2-2, 3-3). We chose to incorporate *Acer macrophyllum* (big leaf maple) because it can handle erosion well and will increase soil cohesion (Leigh 1999). This species will contribute woody debris to the forest floor while also providing nesting sites, various food resources, and nectar in early spring (Leigh 1999) (FR 1-1, 2-1, 2-2, 3-3). The two (2) 1-gal pot forms of *A. macrophyllum* will be planted with 3 m spacing in the southern and western portion of this polygon (Figure 9) in order provide more shade for the coniferous species throughout development.

The function of the shrub canopy species (Table 3) will also be to provide shade for deterring *R. armeniacus* encroachment as well as some native food resources for both humans and wildlife. Five (5) salvaged *A. circinatum* with 1 m spacing will be planted (Figure 9) to help create a tall shrub canopy layer and enhance soil cohesion (Leigh 1999) (FR 1-1, 3-3). This species will also provide food resources, cover and concealment for wildlife, and its flowers will serve to attract pollinator species to the site (Leigh 1999) (FR 2-1, 2-2, 3-3). Four (4) *Rubus parviflorus* (thimbleberry) with 5 m spacing will be planted in the northeastern portion of this polygon (Figure 9). It was selected for its ability to increase soil cohesion and create shade thickets (Leigh 1999) (FR 1-1, 3-3). Not only do the thickets provide cover, their flowers will attract pollinator species while their berries and foliage serve as food resources (Leigh 1999) (FR 2-2). Introducing *R. spectabilis* will provide cover for wildlife, nectar for pollinator species, and food resources (Leigh 1999) (FR 1-1, 2-1, 2-2, 3-3). We will plant six (6) live stake or 1-gal pot sized plants in the southwestern portion of this polygon (Figure 9). Once *R. spectabilis* becomes established, it will also contribute to soil stability (Leigh 1999) and help offset damage from the multiple rodent burrows (C 5).

When choosing ground cover species, we wanted to incorporate plants with the potential ~~to provide sufficient cover~~ in order to deter reemergence of *R. armeniacus*. We chose *A. uva-ursi* because it is a flowering evergreen species that produces flowers and fruit (Leigh 1999) (FR 1-1, 2-1, 2-2, 3-3). Ten (10) bare-root plants with 1 m spacing will be located along the northern and southern boundaries of this polygon (Figure 9). *A. uva-ursi* can also tolerate dry soils, assist in soil stabilization, provides habitat for butterfly larvae, and provides food resources for many wildlife species (Leigh 1999) (FR 1-1, 2-2, 3-3). Four (4) *Tellima grandiflora* (fringecup) in 1/2 -gal pots will be planted around the boundary of of polygon 4 (Figure 9).

AD51: The proposed placement of *Arctostaphylos uva-ursi* (kinnikinnick) was changed according to the guidance of our team instructor. Changes reflect the efficacy of the species as a groundcover during its first few growing season.

BUDGET PLAN

Labor Budget

These numbers are based on ~~three~~ work parties with ~~15 volunteers on November 11, 2017, 10 volunteers on January 20, 2018, and 15 volunteers on February 3rd as well as~~ estimated labor throughout the project to complete the tasks necessary to meet project functional requirements.

AD54: A section for moving and spreading mulch was added per suggestion of Dr. Gold. Much time is committed to this task and the addition of this section in the labor budget reflects significant volunteers and team hours spreading/moving mulch. The layout of the labor budget was adjusted based on feedback from our instructors to make the information easy to read.

Financial Budget

OUTREACH EFFORTS

To meet the tasks for building stewardships capacity (FR 4) at our site and for the North Creek Forest at large, we plan to engage various constituencies in field work and on-site education. Our volunteer work parties will provide opportunities to reach out and engage the surrounding community (FR 4-1). During our field events, education on *why* we are restoring the forest will be considered just as imperative as to *how* it is being restored (FR 4-1).

A total of ~~ten (10)~~ work parties are planned, with a few calling upon specific volunteer groups. These opportunities allow the community to build a relationship with fellow volunteers and make a connection with North Creek Forest (FR 4-2). These specific volunteer groups include University of Washington Bothell (UWB) students involved with the Outdoor Wellness program, UWB students enrolled in the Introduction to Restoration Ecology course, middle school and high school students in the Northshore School District, and employees of local businesses.

AD55: Ten (10) work parties were planned; however, one was canceled due to severe weather. Nine (9) community work parties took place, with two (2) FNCF educational outreach events involving elementary school classes and a few members of the UW-REN team present to assist FNCF.

At each work party, the team will emphasize the importance of ecological restoration. Work parties will begin with an introduction of the team and a description of the UW REN program. A brief history of the site and forest will be recounted, progress on the current site, as well as a vision for the future. A safety briefing and demonstration will occur before any tools are distributed.

WORK TIMELINE

The following Gantt chart provides a detailed work timeline to complete tasks that satisfy functional requirements. This timeline spans Winter and Spring Quarter 2018 and adherence is critical to keep the project moving forward smoothly. By accomplishing small tasks and tracking progress, the overall goals for Project Site 7 will be attained within the project time frame.

AD56: Several tasks were changed to reflect the work the team and the volunteers contributed to meet the goals of the project. In addition, the layout of the project timeline was adjusted to a user friendly format per request of our instructors and a color key was added per request of the City of Bothell.

DESIGN FOR THE FUTURE

Stewardship expectations and development plan

The team will be designing a Stewardship Plan during April and May that will provide detail on further monitoring and maintenance of the project site upon the team's graduation (June of 2018). As discussed with our Community Partners, FNCF will monitor the project site up to three (3) years after the "completion" of the team's restoration. Frequent replenishment of mulch will be needed to suppress the growth of invasive species (Chalker-Scott 2009) as well as monitoring and possible watering of the plants during the summer dry seasons. We expect continued work on the project site through more volunteer work parties involving the surrounding community organized and led by FNCF. After three years, the plant material should be well established and the need for maintenance activities greatly diminished. The Stewardship Plan will provide specific guidance as to responses to plant mortality and

other adverse events. Periodic monitoring for invasive species encroachment and adaptive management will be necessary as in any urban park setting and this will hopefully be coordinated between FNCF and the City of Bothell.

AD57: FNCF will be handling the immediate maintenance, watering, and issues regarding plant mortality of the site. The City of Bothell will be in charge of filling the water totes located on the southwestern corner of the project site.

Project design and stewardship expectations

The design of this project has been modeled with the intent for the project site to mature and become established using limited resources and minimal maintenance. With these parameters in mind, the team focused on planting drought-tolerant species that can flourish in drier seasons with extended periods between watering. High-density planting can help combat plant mortality, and incorporating species of later succession will jump start the shift of the surrounding plant communities through successional development. Since the site is still bordered by *R. armeniacus*, ~~deep mulch~~ will be applied to reduce reinvasion and the need for weeding. The insertion of evergreen species will create shade, which will also inhibit the re-establishment of invasive species. The team wants a successful project and therefore designed the project site to survive despite limited resources, using the above incorporated ideas to reduce the maintenance burden.

AD58: An approximate 6-8 in layer of mulch was applied onsite.

The aforementioned Stewardship Plan will address the needs of the project site for its long-term success. This Work Plan was created with a vision of a mixed deciduous-conifer forest that provides wildlife habitat through its diverse understory. We hope that runoff from uphill, whether natural or through impervious surfaces, will be filtered by the increase of diverse plant life before entering North Creek. As the plants in our site become more established and mature, we hope to be a successful reference for future UW-REN teams at North Creek Forest; eventually restoring the impaired sections of North Creek Forest into a self-sustaining ecosystem utilized by the local public for educational and recreational purposes.

MAP REVISIONS AND ADDITIONS

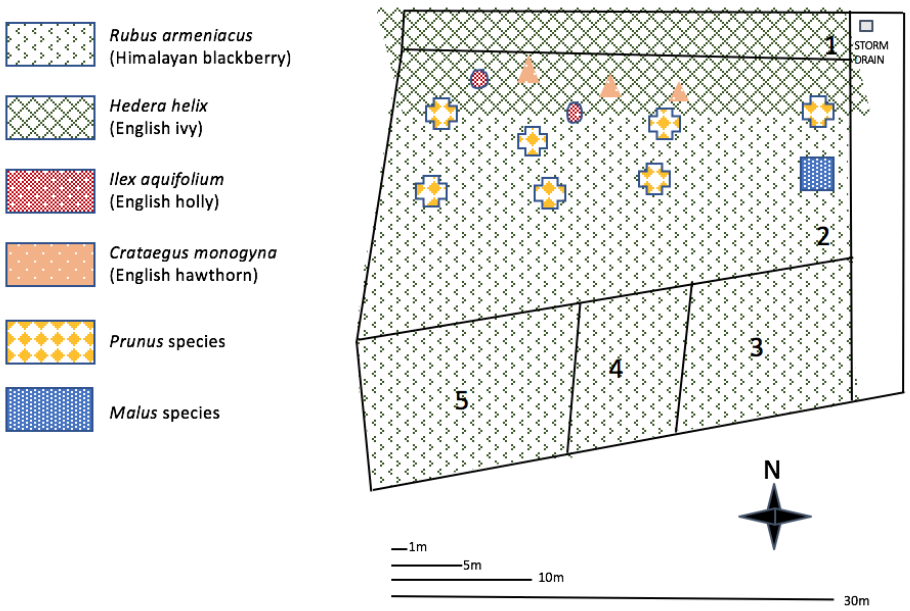

Figure 3: Existing non-native vegetation of project site by polygon.

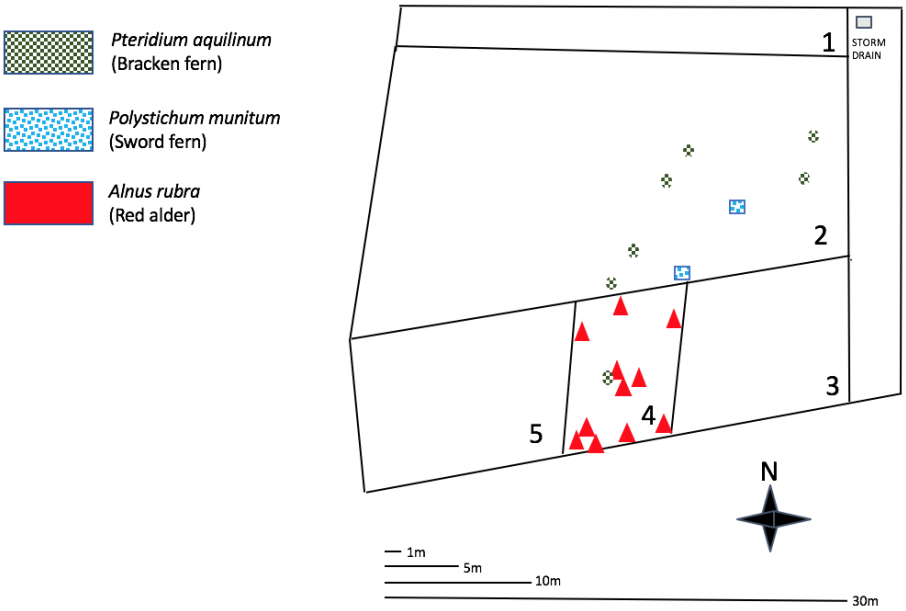

Figure 4: Existing native vegetation of project site by polygon.

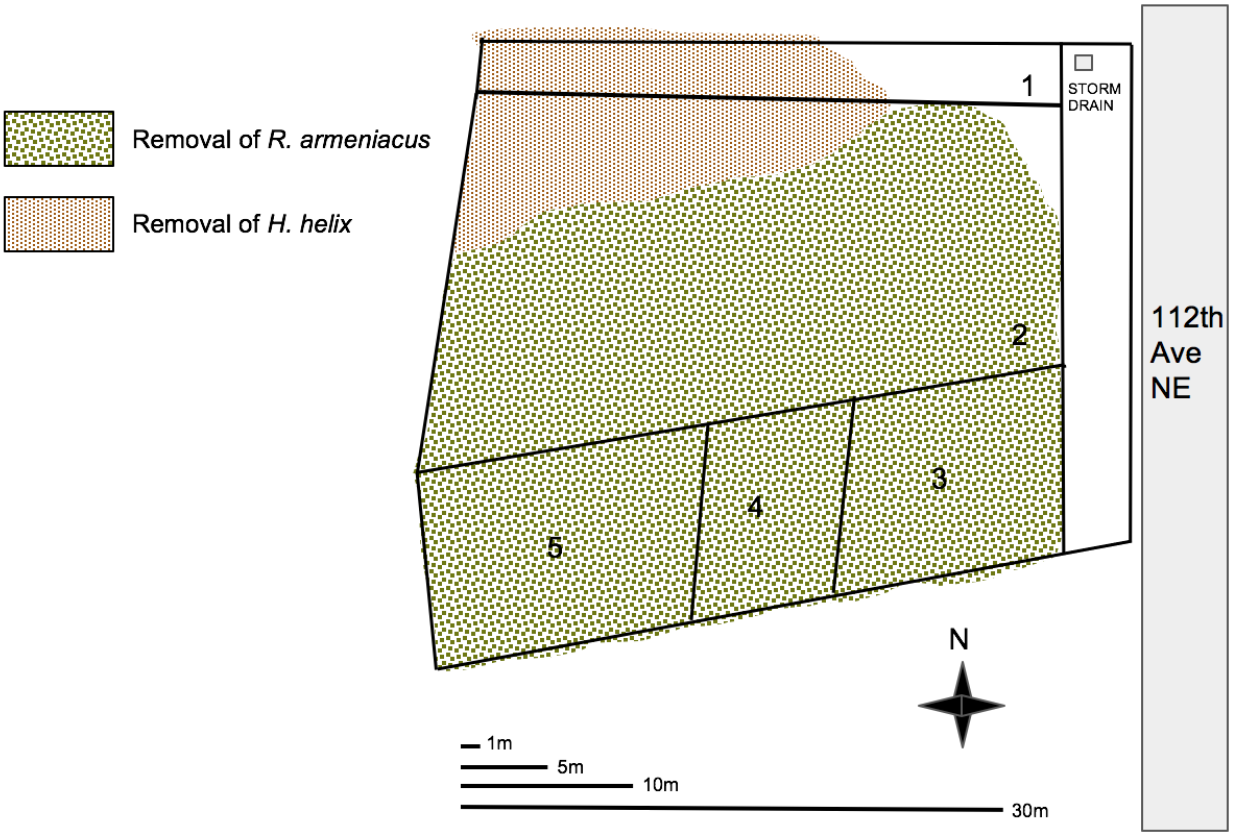

Figure 5: Site preparation map indicating invasive species removal

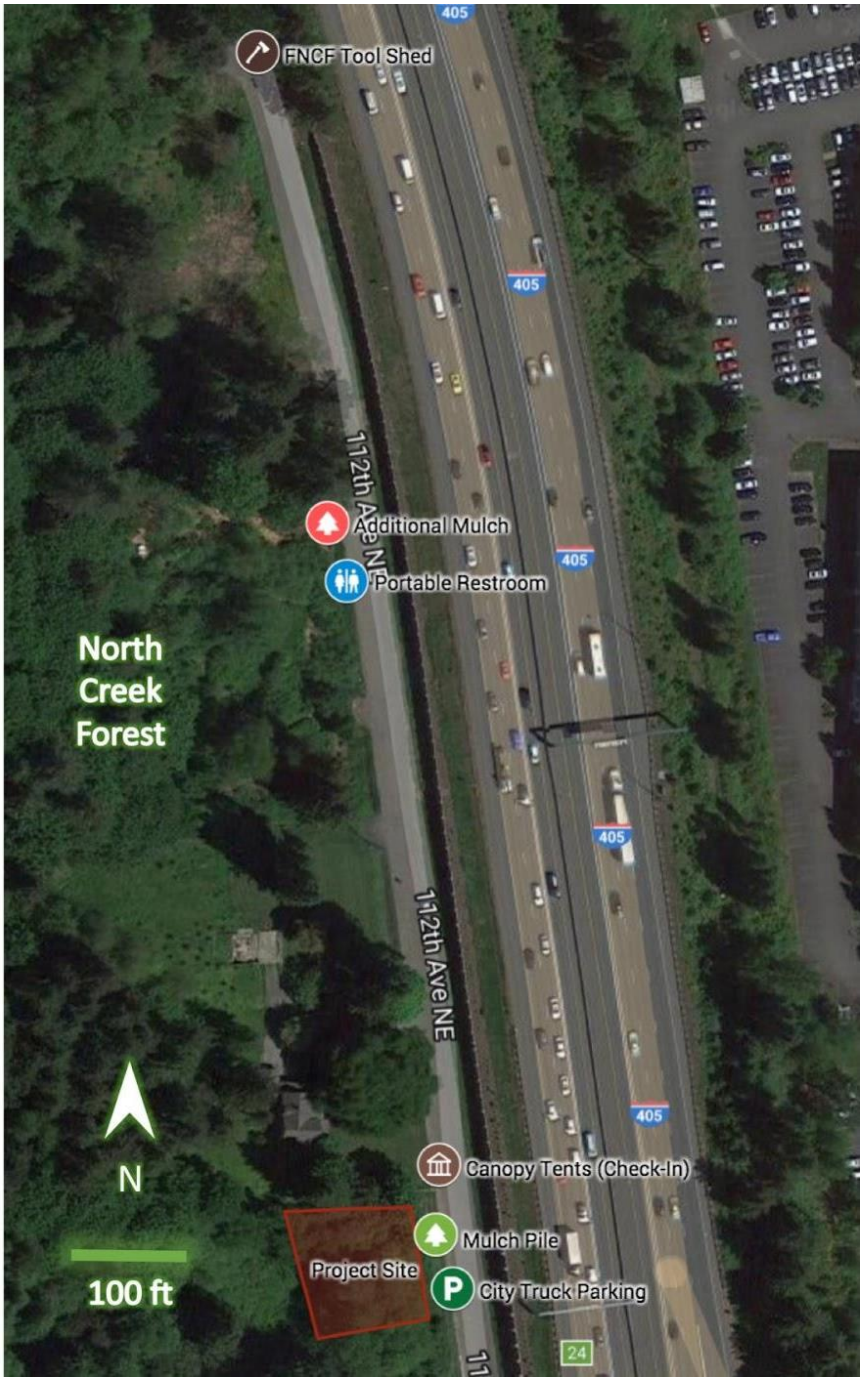

Figure 6: Original map of project site logistical considerations. Images: Google Maps.

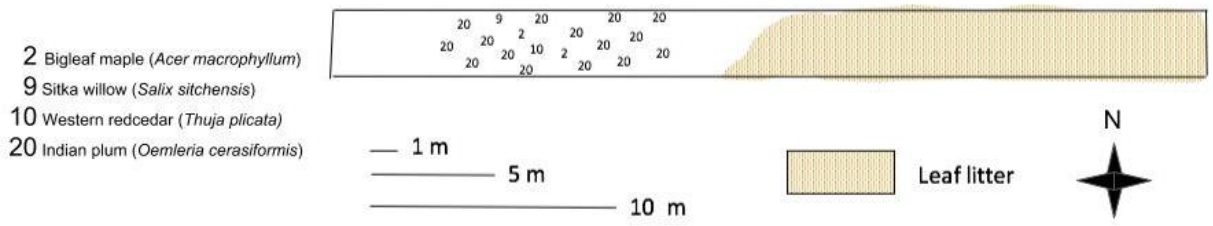

Figure 7: As-built map for Polygon 1.

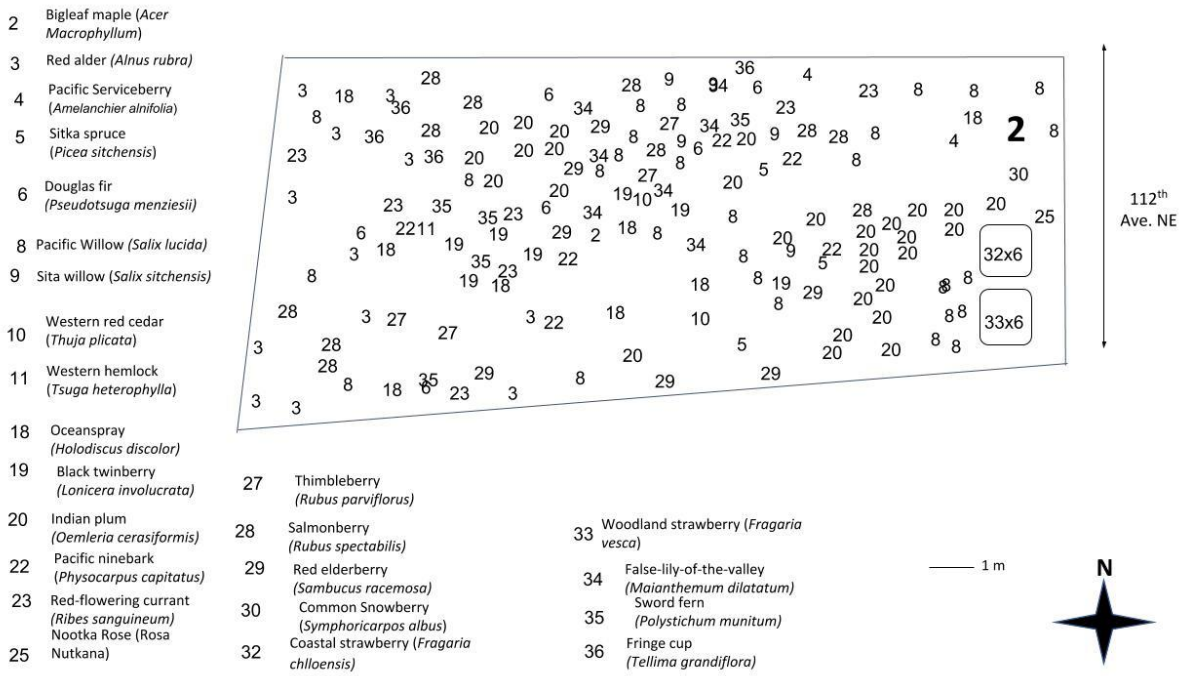

Figure 8: As-built map for Polygon 2.

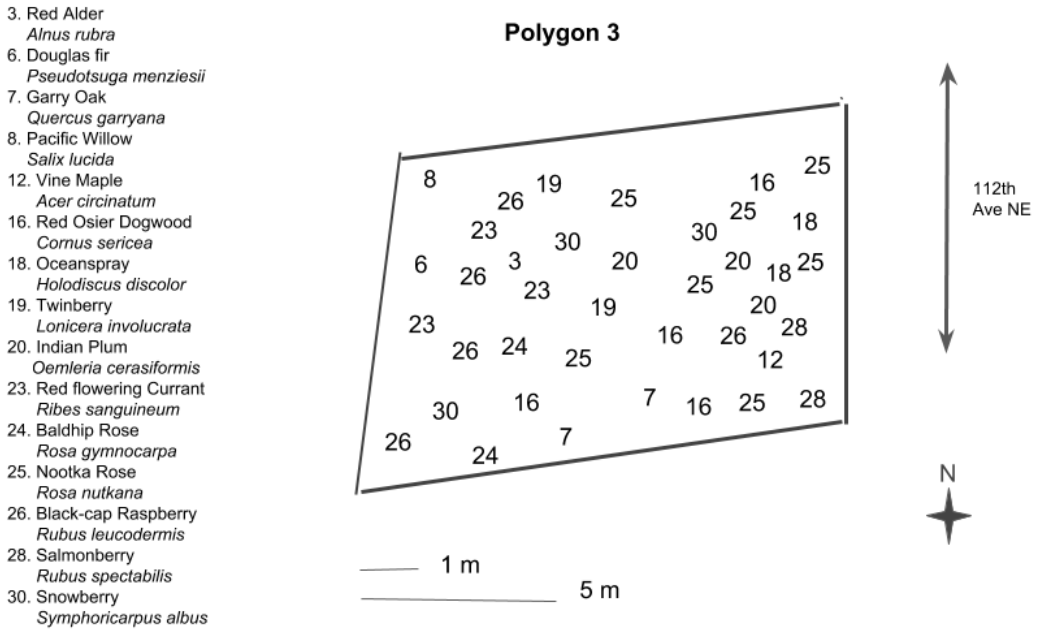

Figure 9: As-built map for Polygon 3.

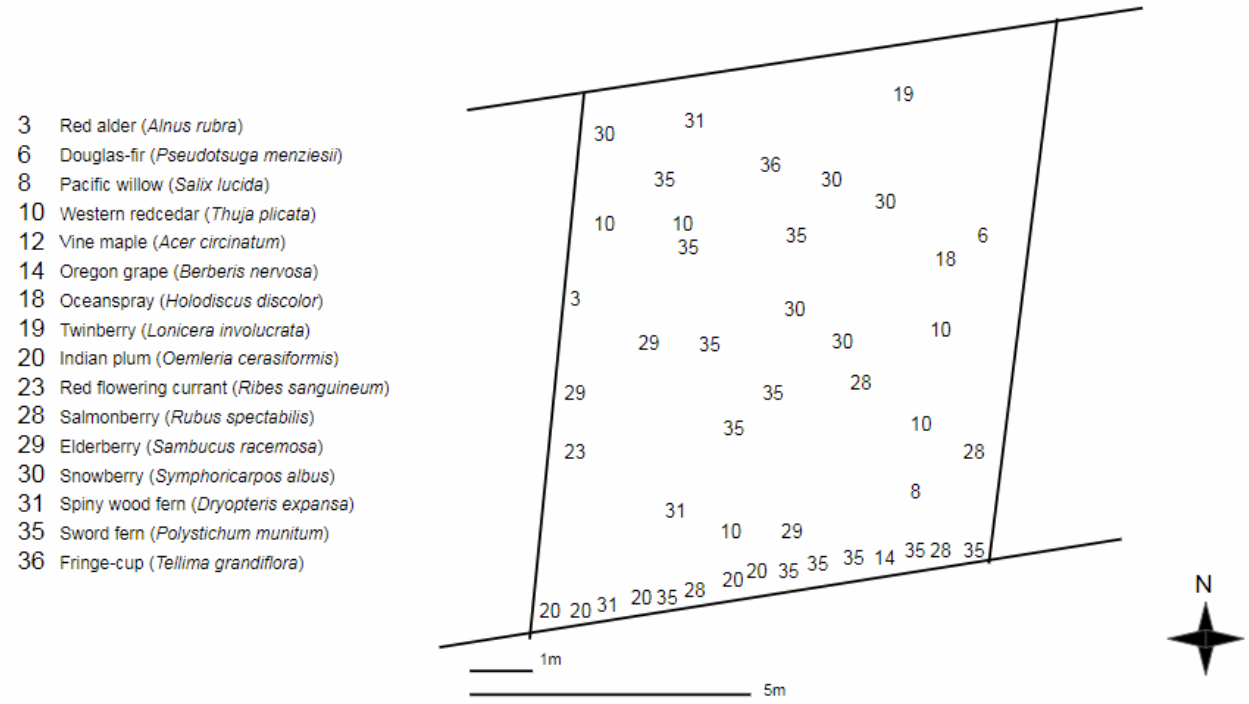

Figure 10: As-built map for Polygon 4.

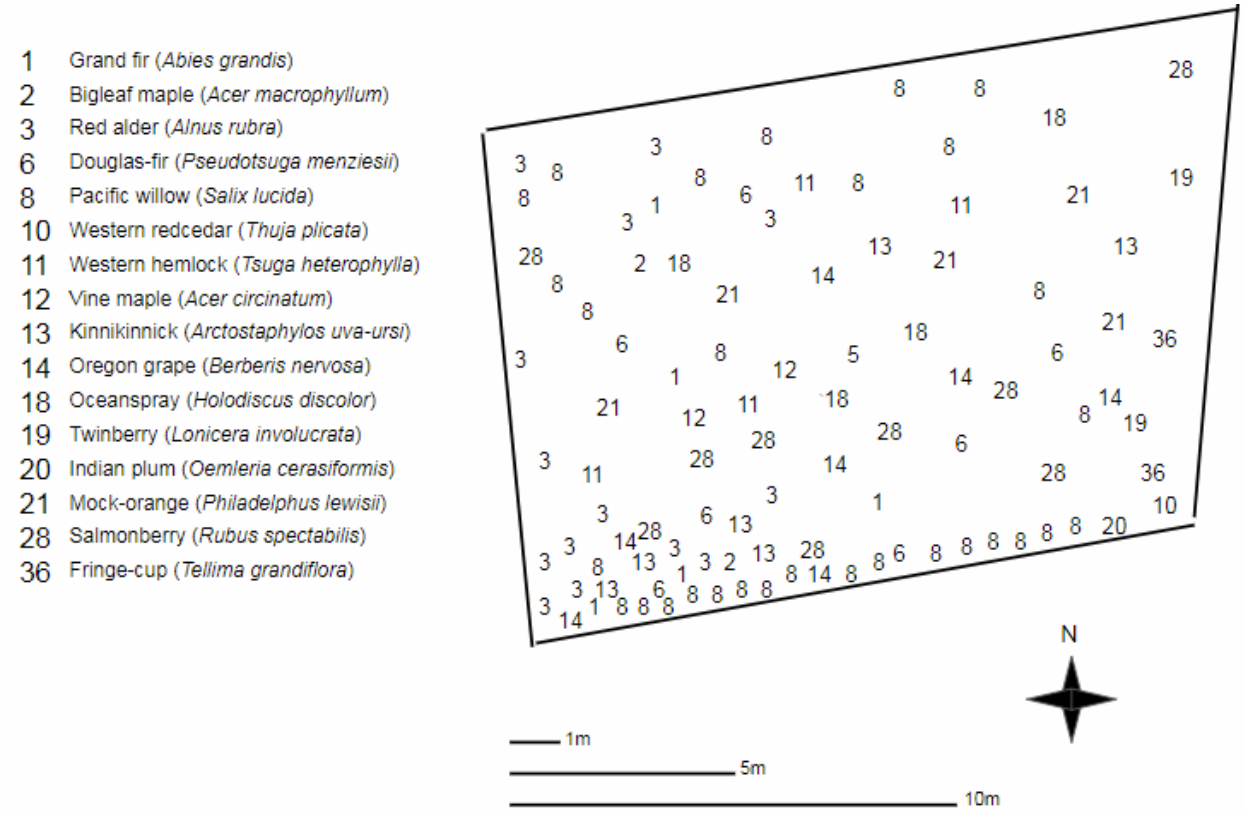

Figure 11: As-built map for Polygon 5.

TABLE REVISIONS

Table 2. Environmental conditions in Polygons 1 through 5.

Polygon Area (m^2)	~~**69.7**~~ **88.5**	~~**517.**~~ **562**	~~**58.0**~~ **144.5**	~~**87.0**~~ **101.8**	~~**210.4**~~ **196.3**
Environmental Factors	**Polygon 1**	**Polygon 2**	**Polygon 3**	**Polygon 4**	**Polygon 5**
Soil texture	Sandy clay loam	Loamy sand	Loamy sand	Clay loam	Sandy clay loam
Soil moisture	Well-drained	Well-drained	Well-drained, moist due to slope	Well-drained	Well-drained, retains some water
Slope	2-12%	2-12%	0%	2-3%	9%
Light availability (including seasonal variation)	0-25%, some increase in winter due to loss of deciduous tree leaves	0-25%, increasing in winter with loss of unknown deciduous tree leaves	75-100% due to lack of canopy layer and eastern aspect.	50-75%, increasing in winter with loss of *A. rubra* leaves	0-25%. Increasing in winter with the loss of surrounding deciduous tree leaves
Human impacts	Narrowest of polygons- serves as a natural pathway to access the upslope, western portion of the forest	Remnants of planted orchard (*Malus* sp), invasive *H. helix, R. armeniacus* and *I. aquifolium*	Dominated by Invasive *R. armeniacus*	Invasive *R. armeniacus*	Dominated by invasive *R. armeniacus*
Other considerations	Leaf litter can reach up to 2 ft in depth from fallen leaves on the adjacent lawn being leaf-blown onto the site	Rodent channels present	Water collected by the above forest flows to polygon 3, as it is located at the bottom of the slope.	Rodent channels present	Rodent channels present

AD58: Polygon boundaries were changed following the complete removal of invasive species. Polygon areas have been updated to reflect boundary changes.

Table 3. List of common plant species in Polygons 1 through 5.

Growth Form	Polygon 1	Polygon 2	Polygon 3	Polygon 4	Polygon 5
Herbaceous	_____	*Pteridium aquilinum*	_____	*Pteridium aquilinum*	*Polystichum munitum*, *Pteridium aquilinum*
Shrubs	*Hedera helix* *Rubus armeniacus* *Rubus ursinus*	*Crataegus douglasii*, *Hedera helix*, *Rubus armeniacus*	*Rubus armeniacus*	*Rubus armeniacus*	*Rubus armeniacus*
Trees	_____	*Ilex aquifolium* ~~*Malus fusca* unknown non-native deciduous sp.~~ **Unknown non-native *Malus sp*.** **Unknown non-native *Prunus sp*.**	_____	*Alnus rubra*	_____

AD59: The *Malus* species was determined to be non-native by FNCF. The unknown non-native deciduous species was determined to be non-native and in the *Prunus* genus by FNCF.

Table 4. Plant materials for installation in Polygons 1-5.

	Polygon 1			Polygon 2			Polygon 3			Polygon 4			Polygon 5		
Species	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**
Herbaceous															
Dryopteris expansa										3	3	1-gal pot			
Fragaria vesca				**6**	**0.25**	**4-in container**									
Fragaria chiloensis				**6**	**0.25**	**4-in container**									
Maianthemum dilatatum				6	1	4-in. container									
Polystichum munitum				10**8**	1	bare-root, ½-gal pot, salvage				15**7**	2**3**	bare-root, ½-gal pot, salvage **1-gal pot**	4	1	½-gal pot

Tellima grandiflora				4	1	½ gal pot				**4**	**3**	**½-gal pot**	4	1	1/2 – gal pot
Shrubs															
Acer circinatum				5	1	salvage	**1**	**1**	**Salvage**				5 **1**	1	salvage
Arctostaphylos uva-ursi													10	1	Bare-root
~~*Corylus cornuta*~~				~~5~~	~~2~~	~~salvage~~									
Cornus sericea				5	2	salvage	**4**	**3**	**1-gal pot**	**1**	**1**	**1-gal pot**			
Gaultheria shallon				**3**	**5**	**1-gal pot**				**3**	**3**	**1-gal pot**			
Holodiscus discolor				**8**	**3**	**1-gal pot**	**2**	**3**	**1-gal pot**	**1**	**1**	**1-gal pot**	**6**	**5**	**1-gal pot**
Lonicera involucrata				3 **6**	3	1-gal pot	**2**	**5**	**1-gal pot**				**2**	**5**	**Bare-root**
Mahonia nervosa													**6**	**5**	**1-gal pot**

Oemleria cerasiformis	**15**	**3**	**livestake**	14 **30**	1	live stake & 1-gal pot	**3**	**5**	**Livestake**	**9**	**3**	**Livestake**	**5**	**3**	**Livestake**
Philadelphus lewisii				10 **3**	1 **5**	bare-root							**7**	**5**	**Bare-root**
Physocarpus capitatus				**7**	**7**	**Bare-root**							**3**	**5**	**Bare-root**
Ribes sanguineum				10 **7**	7	bare-root	**3**	**5**	**Bare-root**						
	Polygon 1			**Polygon 2**			**Polygon 3**			**Polygon 4**			**Polygon 5**		
Species	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**	**#**	**Spacing (m)**	**Form**
							Shrubs								
Rosa gymnocarpa							**2**	**5**	**Salvage**						

Rosa nutkana				5 **1**	2	salvage	**7**	**5**	**1-gal pots & salvage**						
Rubus leucodermis							**4**	**3**	**1-gal pot**						
Rubus parviflorus				**4**	**5**	**1-gal pot**							4	5	1-gal pot
Rubus spectabilis				5 **13**	1	live stake & 1-gal pot	**2**	**5**	**livestake**	**4**	**5**	**1-gal pot and livestake**	6 **9**	1	live stake & 1-gal pot
Sambucus ~~caerulea~~ racemosa				10 **3**	1 **5**	bare-root **1-gal pot**									
Symphoricarpos albus				1	1	salvage	**3**	**5**	**1-gal pots**						
Trees															
Abies grandis													10 **4**	3	1-gal pot

Acer macrophyllum	**2**	**5**	**Salvage**	**1**	**1**	**1-gal pot**							2	3	1-gal pot
Alnus rubra				10 **12**	3	1-gal pot	**1**	**1**	**1-gal pot**	**4**	**5**	**1-gal pot**	5 **14**	3	1-gal pot
Amelanchier alnifolia				**2**	**3**	**1-gal pot**									
Picea sitchensis				3	3	1-gal pot							**1**	**1**	**1-gal pot**
Pseudotsuga menziesii				9 **6**	3	bare-root & 3-gal pot	**1**	**1**	**Bare-root**	**1**	**1**	**1-gal pot**	7	3	bare-root & 3-gal pot
Quercus garryana							**2**	**2**	**1-gal pot**						
Salix lucida				10 **27**	3	Live-stake	**1**	**1**	**Livstake**	**3**	**5**	**Livestake**	**28**	**3**	**Livestake**
Salix sitchensis	**2**	**1**	**Livestake**	**10**	**3**	**Livestake**									

Thuja plicata	**1**	**1**	**1-gal pot**	6 **2**	3	bare-root or 1-gal pot				2 **3**	3.5	salvage or 1-gal pot	5 **1**	3.5 **1**	bare-root or 1-gal pot
Tsuga heterophylla				**1**	**1**	**1-gal pot**							**4**		**1-gal pot**

Table 5. Total plant materials table

Species	Forms	Total Number
Herbaceous		
Dryopteris expansa	1-gal pot	3
Fragaria chiloensis	**4-in container**	**6**
Fragaria vesca	**4-in container**	**6**
Maianthemum dilatatum	4-in. container	6
Polystichum munitum	~~Salvage~~, bare-root, and 1-gal pot	~~25~~ **15**
Tellima grandiflora	½-gal pot	8
Herbaceous subtotal		~~**42**~~ **44**
Shrubs		
Acer circinatum	salvage	~~10~~ **2**
Arctostaphylos uva-ursi	bare-root	10
~~*Corylus cornuta*~~	~~salvage~~	~~5~~
Cornus sericea	salvage	5
Gaultheria shallon	**1-gal pot**	**6**
Holodiscus discolor	**1-gal pot and bare-root**	**18**
Lonicera involucrata	1-gal pot	~~3~~ **10**
Mahonia nervosa	**1-gal pot**	**6**
Oemleria cerasiformis	live stake ~~and 1-gal pot~~	~~14~~ **62**

Philadelphus lewisii	bare-root	10
Physocarpus capitatus	**bare-root**	**10**
Ribes sanguineum	bare-root	10
Rosa gymnocarpa	**salvage**	**2**
Rosa nutkana	salvage **and 1-gal pot**	~~10~~ **8**
Rubus leucodermis	**1-gal pot**	**4**
Rubus parviflorus	1-gal pot	4
Rubus spectabilis	live stake and 1-gal pot	~~11~~ **28**
Sambucus ~~caerulea~~ ***racemosa***	bare-root	~~10~~ **3**
Symphoricarpos albus	salvage	~~5~~ **4**
Shrubs subtotal		~~**107**~~ **202**
Trees		
Abies grandis	~~bare-root~~ **1-gal pot**	~~10~~ **4**
Acer macrophyllum	1-gal pot **and salvage**	~~2~~ **5**
Alnus rubra	1-gal pot	~~15~~ **31**
Amelanchier alnifolia	**1-gal pot**	**2**
Picea sitchensis	1-gal pot **and salvage**	~~3~~ **4**
Pseudotsuga menziesii	Bare-root, **1-gal** and 3-gal pot	~~16~~ **15**
Quercus garryana	**1-gal**	**2**
Salix lucida	Live stake	~~10~~ **59**

Salix sitchensis	Live stake	12
Thuja plicata	1-gal or bare-root	~~13~~ 7
Tsuga heterophylla	1-gal pot	5
Trees subtotal		~~69~~ 146
Total plant material		~~218~~ 392

Table 6: General (non-plant) materials and tools

Task	Materials	Qty	Source		Tools	Qty	Source
1-1a	flagging tape	2 rolls	FNCF		loppers	11	FNCF
					shovels	12	FNCF
					trench shovels	4	FNCF
					wheelbarrows	4	FNCF
					gloves	30	FNCF
					rakes	4	FNCF
					tarp	5	FNCF
1-1b	flagging tape	2 rolls	FNCF		shovels	12	FNCF
					gloves	30	FNCF
1-1d	mulch	251 yd^3	Coordinated by FNCF		wheelbarrows	4	FNCF
	flagging tape	2 rolls	FNCF		pitchforks	~~2~~ 5	FNCF
					shovels	12	FNCF
					rakes	4	FNCF

Table 7: General materials requirements for project

Materials	Qty	Source
Loppers	11	FNCF
Shovels	12	FNCF
Trench shovels	4	FNCF
Hand pruners	4	FNCF
Wheelbarrows	4	FNCF
Rakes	4	FNCF
Pitchforks	~~2~~ **5**	FNCF
Gloves	30	FNCF
Buckets	4	FNCF
Flagging tape rolls	2	FNCF
Mulch	**270 yd^3**	**Local tree service companies via ChipDrop.com**

Table 8. Labor budget by source

Labor by source (revenue)	Total hours
Team	~~**410**~~ **477.5**
Volunteers	
11/11/17 Veteran's Day	~~*45*~~ **65**
1/20/18 Work Party	~~*45*~~ **65**
2/03/18 Work Party	~~*60*~~ **80**
2/17/18 Work Party (cancelled due to unsafe weather conditions)	*0*
3/03/18 Work Party	~~*85*~~ ~~*80*~~
3/09/18 Soundview School	***60***
3/31/18 Work Party	~~*80*~~ **120**
4/07/18 Work Party	~~*80*~~ **200**
4/21/18 Work Party in Celebration of Earth Day	~~*130*~~ **200**
5/05/18 Work Party	~~*85*~~ **150**
5/19/18 Work Party	~~*90*~~ **150**
Total Volunteer	~~**700**~~ **1170**
TOTAL	~~**1110**~~ **1647.5**

Table 9. Expenditures by major category

Expenditures by major category	Cost
Plants	
conifer trees	~~139.39~~ 147.00
broadleaf trees	~~74.46~~ 87.70
shrubs	~~212.10~~ 277.60
groundcover	~~136.88~~ 105.40
Subtotal plants	**~~562.83~~** 617.7
Mulch	
Mulch Provided by FNCF	0.00
Subtotal mulch	**0.00**
Tool rental	
Tools Provided by FNCF	0.00
Subtotal tool rental	**0.00**
Food for volunteer events	
Event on 2/3/2018	~~30.00~~ 67.00
Event on 2/17/2018	~~30.00~~ 67.00
Event on 3/3/2018	~~30.00~~ 67.00
Event on 3/31/2018	~~30.00~~ 67.00
Event on 4/7/2018	~~30.00~~ 67.00
Event on 4/21/2018	~~30.00~~ 67.00
Event on 5/5/2018	~~30.00~~ 67.00
Event on 5/19/2018	~~30.00~~ 67.00
Subtotal for food	**~~240.00~~** 536.00
Transportation	
Potential U-Car Rental (Pick-up; 10 Hours)	~~50.00~~ 0.00
Subtotal for transportation	**~~50.00~~** 0.00
Printing	
Final Poster Printing	20.00
Subtotal for printing	**20.00**
PROJECT TOTAL	**~~872.83~~** 1173.7

Table 10. Revenue by fund source

Revenue by fund source	
Course fee allotment	**600.00**
Fundraising	
Total fundraising	**0.00**
Cash donations	
cash donations by team members	~~0.00~~ **70.00**
cash donations by sponsor	0.00
cash donations by neighborhood group	0.00
Total cash donations	~~**0.00**~~ **70.00**
In-kind donations	
tool rental waiver ($ value)	~~3770.91~~ **3,209.7**
Food for Volunteer Events ($ value)	~~240.00~~ **536.00**
Total in-kind donations	~~**4,010.91**~~ **3,745.7**
PROJECT TOTAL	~~**4,610.91**~~ **4,415.7**

LESSONS LEARNED

Overall Approach

Now that we have almost reached the end of the project's duration, we are able to look back on the project and see what worked well and what did not, as well as ways we would have changed the approach.

Having planned work parties on the 1st and 3rd Saturdays of the month during winter and spring quarters was essential in order to complete the project. FNCF, the team, and the volunteers could rely on having regular work parties and did not need to make plans as each one came up, making it easier on everyone. Due to the large amount of *R. armeniacus* and *H. helix* to remove and the plants that needed to be installed, we needed a lot of work parties, and having them regularly scheduled accomplished that.

The team had 16 virtual team meetings over the course of the year via Google Hangouts. We also kept in communication through email and a Google Hangouts chat. Since we live far apart and attend two different UW campuses, we were unable to have in-person meetings very often, and Google Hangouts became an essential tool for us.

Part of our communication was helping each other keep a positive outlook. At times, the project was overwhelming and we weren't sure of our ability to complete our plan. We stayed motivated and positive by reminding each other that the work we were doing was valuable and sending photos of what the site initially looked like to see how far we'd come.

A more in-depth site assessment would have made the project easier. The overwhelming presence of *R. armeniacus* made it difficult to delineate polygons based on site conditions, and we had to modify the polygon delineation once all of the *R. armeniacus* was removed.

The team struggled with keeping track of the hours we spent working on the project. We should have kept a better record. Our method was to input the hours we spent in the field and doing administrative work (e.g. writing reports, community outreach, keeping up the blog) into a Google Sheets spreadsheet. Perhaps a mobile app would have been more easily accessible and would have helped us keep a better record.

One of the key lessons learned was the importance of "before" and "after" photos. We were able to find a photo of our site from August 2017 thanks to Google Maps; however,

it would have been better to take the picture ourselves in order to ensure an accurate comparison between site conditions before the project and site conditions after.

Site Preparation

At one of our last few work parties, we discovered a bird's nest in one of the few remaining *R. armeniacus* thickets. It was no longer in use, but it made us realize that there are birds that utilize the *R. armeniacus* in North Creek Forest as a place to build nests. Had we known that at the beginning of the project, we would have put more of an emphasis on completely clearing out the *R. armeniacus* in the fall and winter before beginning plant installation, so as to avoid the chance of disturbing an actively-used nest in the spring.

Plant Selection & Installation

Our actual planting matched with the original planting plan well in terms of species. However, we added twelve species to our initial list (Table #) and installed *Sambucus racemosa* (red elderberry) instead of *Sambucus caerulea* (blue elderberry) due to availability. The numbers of individuals were significantly different, with 218 planned and 392 actually installed.

It would have been preferred to keep an accurate count of the livestakes of *S. lucida/sitchensis?, O. cerasiformis,* and *R. spectabilis* as they were being installed. Since they were acquired from salvage and immediately distributed to volunteers to plant, we did not count them at the beginning and instead had to go back and count once they had been installed.

The past project sites at North Creek Forest were a valuable resource for choosing the species for our planting plan. We were able to visit the previous years' sites to see what plants were thriving, such as *H. discolor, M. nervosa, G. shallon,* and *A. grandis*.

Our acquisition of watering resources did not coincide with our planting work parties. On several occasions we had to bring in water in buckets, because the large water totes that were placed in the southwest corner of the site had not been delivered and filled. We should have secured watering resources before we began planting.

Client, Community, & Internal Relations

Open and constant communication is absolutely essential to the success of such a project. Having two (2) community partners and our team members enrolled in different campuses made it that much more important to keep an open line. It is this flow of

conversation that aided in the timely completion of assignments and smooth operating of volunteer work events.

Although it is more personable to speak face-to-face or over the phone, it is also important to have communication in writing. There are different forms of communication; and team members, community partners, and the local community will all respond differently. Having that written form of communication provides evidence of correspondence and a way to follow up on other conversations and tasks.

Working with the team in-person has proven to be more productive than over Google Hangouts. The team participated in one to two virtual meetings per week to check-in on upcoming assignments or tasks. It would have been better to attempt weekly in-person meetings, especially during the times a major assignment was due.

Budget

Labor Budget

The original projection for labor hours of volunteers and the team was an underestimated figure. Originally, the team estimated that 1100 total hours would be needed to complete the project within the allotted time, including 700 volunteer hours and 400 team hours. After coordinating nine volunteer work parties, the team committed over 470 hours while volunteers contributed over 1100 hours towards the success of the project. The team hours do not reflect the time committed to completing documents for the project.

Table 11. Labor budget

Task	Project Budget (Planned)		Project-to-Date (Actual as of 05/19/2018)	
	Team (Hours)	Volunteer (Hours)	Team (Hours)	Volunteer (Hours)
Site Preparation				
Border demarcation	26.0	--	26.0	--
Mulch rodent channels	3.0	--	3.0	--
Plant staging	15.0	--	2.0	--
SUBTOTAL	**44.0**	**0.0**	**31.0**	**0.0**
Invasive plant removal				
H. helix (English ivy)	50.0	80.0	23.0	181.0
R. armeniacus (Himalayan blackberry)	250.0	440.0	124.5	386.5
	300.0	**520.0**	**147.5**	**567.5**
Moving & spreading mulch				
Moving mulch	15.0	70.0	2.5	124.5
Spreading mulch	8.0	40.0	24.0	176.5
SUBTOTAL	**23.0**	**110.0**	**26.5**	**301.0**
Planting native species				
Polygon 1	--	--	--	12.0
Polygon 2	15.0	80.0	5.0	24.3
Polygon 3	--	--	1.5	12.5
Polygon 4	4.0	10.0	2.5	25.5
Polygon 5	5.0	25.0	17.5	48.3
SUBTOTAL	**24.0**	**115.0**	**26.5**	**122.6**
Salvage plants				
	10.0	50.0	5.0	5.0
SUBTOTAL	**10.0**	**50.0**	**5.0**	**5.0**
Remove invasive compost				
	25.0	50.0	32.0	113.0
SUBTOTAL	**25.0**	**50.0**	**32.0**	**113.0**
Donation Acquisition				
November 9, 2017	2.0	--	2.0	--
January 18, 2018	2.0	--	2.0	--
January 27, 2018	2.0	--	1.0	--
January 30, 2018	2.0	--	1.0	--

February 12, 2018		2.0	--		1.0	--
February 28, 2018		2.0	--		1.0	--
March 28, 2018		2.0	--		3.0	--
April 4, 2018		2.0	--		1.5	--
April 18, 2018		2.0	--		1.0	--
May 2, 2018		2.0	--		1.0	--
May 5, 2018		--	--		0.5	--
May 16, 2018		2.0	--		1.0	--
SUBTOTAL		**22.0**	**0.0**		**48.0**	**0.0**
Monitor site/water plants						
		50.0	--		11.5	61.0
SUBTOTAL		**50.0**	**0.0**		**11.5**	**61.0**
Community Outreach						
Maintain blog/instagram		50.0	--		11.5	--
Engage community in stewardship		75.0	--		17.0	0.0
Coordinate bi-monthly V.W.P.		225.0	--		121.0	--
SUBTOTAL		**350.0**	**0.0**		**149.5**	**0.0**
TOTAL LABOR		**848.0**	**845.0**		**477.5**	**1,170.1**

Financial Budget

Although the team still has some administrative work to do and these numbers are not final, our actual expenditures were significantly lower than our original financial budget (Table #). Our closest estimate was volunteer labor, where we underestimated the cost by under $300.

We overestimated the team's labor cost by over $10,000, mostly due to community engagement. A lot of the community engagement portion of the project, such as promoting work parties on social media and contacting potential volunteer groups, was done by the Friends of North Creek Forest, so a lot less work fell to the team in that area.

An unexpected donation of $70 came from UW when some of the capstone teams had surplus money in their planting budget; we used the money to purchase extra plants (Table 12).

Table 12: Project total (planned) budget vs. actual budget

Revenue	Project Total (Planned) Budget						Project-to-Date (actual as of 05/25/2018)					
	UW (Labor)	UW (Cash)	Client (Cash)	In-Kind (Non-labor)	In-Kind (Labor)	Total	UW (Labor)	UW (Cash)	Client (Cash)	In-Kind (Non-labor)	In-Kind (Labor)	Total
University of Washington		$619.02				$619.02		$538				$538.00
Team	$36,200					$36,200	$25,612.50					$25,612.50
Client						$0.00						$0.00
Volunteers				$4,010.91	$12,375	$16,385.91				$3,238.48	$12,097.50	$15,335.98
Donations						$0.00		$70.00				$0.00
TOTAL REVENUE	$36,200	$619.02	$0.00	$4,010.91	$12,375	$53,204.93	$25,612.50	$608	$0.00	$3,238.48	$12,097.50	$41,486.48

Gantt Chart

Though it was our intention to adhere to the schedule we drafted, various circumstances led to changes in the completion of tasks throughout the project timeline. In addition, the original tasks written in the project timeline did not adequately reflect the work the team or volunteers accomplished and were updated as a result. The team planned to have finished planting by the last work party in April, but due to an excess in revenue and additional plants donated, we installed our last few plants during the last work party in May. Despite this, we coordinated all work parties planned except for one which was cancelled due to inclement weather. The development of the Gantt chart aided in conceptualizing the project within the scope of time given even if we did not always stay on schedule.

Table 13. As-built project timeline

As these charts include a significant amount of information, they would have to be insterted into this document with text too small to be readable. In the interest of providing a cohesive Gantt chart that can be viewed in one piece, please see the following links:

January-March: https://docs.google.com/spreadsheets/d/1tPpkvVZ7d0g1WsEOi922sIi7_wuqh60ajzxEfu3382A/edit?usp=sharing

March-June: https://docs.google.com/spreadsheets/d/1R6PxQE3ZPj-OlCC4hmJflufhhuJORRtWa-SpS2P8iZM/edit?usp=sharing

We understand that this is not feasible for a printed binder and are working toward a solution.

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APPENDIX

Things to Consider

Non-native vegetation - weeds of concern

English holly (*Ilex aquifolium*) is non-native to the Pacific Northwest. Although it is not on the Washington State Noxious Weed List, it is still classified as a Weed of Concern in King County (King County 2018) and is on the prohibited plants list in some cities. English holly is also on the monitor list under Washington State Noxious Weed Control Board (NWCB, n.d.). English holly berries are known to be toxic to humans and the continued spread of the species can prevent the growth of native forests in the region. Holly can also prevent surrounding plant species from retaining sufficient moisture (King County 2008).

English hawthorn (*Cratageus monogyna*) is considered a Non-Regulated Noxious Weed in King County, Washington (King County 2017). Its berries are dispersed by birds and animals which can lead to the formation of thick growth, thus outcompeting native species. English hawthorn is also known to be used as blockades for containing livestock (King County 2017, NWCB n.d.); however, these blockades occurring in natural areas can cause issues for wildlife movement.

Both English holly and English hawthorn are present at the site in low abundance. There are several solutions regarding removal, including physical removal by digging up the plant or through repeated herbicide control. The team recommends addressing these non-native trees at the site as soon as time and resources allow.

Rodent burrows

During the initial site assessment, rodent channels were present throughout the site. As the site continued to be “disturbed” through volunteer work parties every other week along with weekly site visits by the team, the number of burrows and channels have subsided. Since the arrival of spring and wrap up of the final UW-REN work party, the channels have now increased in amount and area.

The team recommends close monitoring of the site by Friends of North Creek Forest to prevent a high percentage plant mortality.