Quadra Hill Wetland Planting Plan

Zoe Peterson, V01005214; Natalie Waite, V00976390; Erin Miller, V00836089; Aryan Sethi,V01042026.

University of Victoria in Partnership with the Galiano Conservancy Association

ES 471: Galiano Field School

Eric Higgs, Adam Huggins

August 18th 2025

Table of Contents

Summary

This report is a planting plan that was created as a group project as part of the UVic ES 471/ER 412 Galiano Field School. Our team researched the history of Quadra Hill Wetland, including ecological, biological, social, and cultural factors. We used resources provided by the Galiano Island Conservancy (GCA) to outline the framework for this project, and were able to compare our ideas to past work on wetlands completed by previous students and conservancy staff. We interviewed community members on their opinions and noticings of a successful wetland ecosystem, keeping humans presence in mind. Time was spent in the field with our teachers Eric Higgs and Adam Huggins where we observed the physical composition of the landscape, with the helpful context of an ArcGIS map database of the area. We compiled information, created a spreadsheet to visualize and organize our planting plan, and revised an ArcGIS map to reflect the comprehensive planting plan with the changes made to the site. The plants chosen were based on availability in the Galiano Conservancy Association's nursery, and ones that were best suited for this restoration project to meet the goals and objectives. Planting areas were broken down into smaller zones in order to better characterize the conditions observed and the predicted success of different plant communities in specific areas. As a group, we discuss our findings, such as the intense presence of agronomic grasses, and the necessity for berries and shrubs. We determined further steps we can take in the aid of regeneration and re-establishment such as the structure of the wetlands and fencing according to known browsing pressures. Finally, we introduce our suggestions for monitoring, further restoration, possible plan adaptations, and signs of success.

1.0 Introduction

1.2 Situating Ourselves and Our Work

This Wetland Planting project will take place on the shared, asserted, unceded traditional territories of the Spune'luxutth (Penelakut), Hwlitsum/Lamalcha Nations, other Hul'q'umi'num'speaking peoples, SENĆOŦEN and W̱SÁNEĆ speaking peoples, and any others with rights and responsibilities to the island, as well as the Ceded Territory of the sc̓əwaθən məsteyəxʷ (Tsawwassen Nation) (*Our Shared Territory*, n.d.). The relationships to this island are complex. Post contact, complexity comes from current and past tools of colonization not limited to; biowarfare, residential schools, the 60s scoop, the millennium scoop, physical violence, land theft, forced relocation, ethnic cleansing, the reservation system, and the Indian status system, all acting to dispossess and disconnect land and identity (Suzanne Fourniers and Loren Sylvie, Personal communication, July 10, 2025). Post Contact complexity also comes from the ways people survived; Nations taking in displaced peoples, people from different Nations forming community, love between people of different Nations, and with Settlers, all leading to complex family ties and relations to the coast (Suzanne Fourniers and Loren Sylvie, Personal communication, July 10, 2025). Pre-contact complexity comes from Indigenous conceptualization of 'Galiano' not as one island - discrete and isolated - but as a mosaic of places; all with place names, all with different rights and responsibilities from different Nations according to seasonal rounds, some overlapping (Part I: One Island?, 2022; *Our Shared Territory*, n.d.). This conceptualization sees Galiano as connected, not separated, by waterways to what are now the neighboring gulf islands, Vancouver Island, and to the Mainland (Part I:

One Island?, 2022). It was traditionally a meeting place for Nations along the Southern BC coastline, and as a southern passageway between the Mainland and Vancouver Island (Eric Higgs, Personal Communication, July 2025). Just as we as scientists celebrate biodiversity, we can too celebrate and lean into the intricate and multifaceted relationships to these lands. All of us working on the project have been brief guests and visitors during our time on Galiano, none of our ancestors have stepped foot on these lands before us. We have much to learn. We would like to humbly pay our respects to the ancestors of these lands, and to the people whose ancestors have been in relationship to these lands and waterways since time immemorial.

1.2 Geography

Quadra Hill is located near the middle of Galiano Island, which in turn is one of the islands between Vancouver Island and Vancouver. This property creates connectivity between Great Beaver Swamp and the Millard Learning Center, which is part of the Mid-Island Protected Areas Network. It has a surface area of 46.77 hectares, elevations ranging from 57.88 to 185.77 meters, and is located in the Coastal Douglas Fir moist maritime biogeoclimatic zone. It consists of two semi-parallel northwest-to-southeast-oriented ridgelines. The sedimentary rocks of the Trincomali anticline, which date back to the Cretaceous, are what make up Galiano Island (Huggins & Thompson, 2023). It has a Mediterranean-type climate with

Figure 1. Map showcasing Galiano Islands location in relation to Vancouver Island broadly to the west, mainland canada to the east, and the USA to the south, as well as surrounding Gulf Islands. (*Gallery: Archaeology on Galiano Island | Washington State Magazine | Washington State University*, n.d.)

mild, rainy winters and very dry summers, with average annual precipitation on Galiano of 404.8 mm per year (Canada, 2025).

1.3 Social and Recent History

Historical record of Quadra Hill precontact is sparse, the extent of the recorded and observed uses of the area indicates that the area was likely used for the hunting and harvesting of essential wildlife and flora (Huggins & Thompson, 2023).

Figure 2. Photo of current pond extent. Located between sites 1, 2, and 4. Picture taken by Natalie Waite.

Following European colonial contact, the majority of Quadra Hill was subject to forest harvesting, clear cut operations, and agricultural use (Huggins & Thompson, 2023). Major logging events from 1932 and into the late 1990s are evident throughout the site's history by observation of the forest stand composition, logging road, and skid trails present (Huggins & Thompson, 2023). The area of focus for this report is situated in the Northwest corner of the Quadra Hill Property, and shares a drainage area with the Great Beaver Swamp. Following the various clear-cut and disturbance events starting in the 1950s, it was then converted into a small homestead with agricultural fields, orchards, and pastures in the 1990s (Huggins & Thompson, 2023). The site holds historical evidence of this management in the form of the species present, drainage ditches, excavated ponds, logging roads, fencing, various human structures and remaining personal belongings of the former resident (evident during our field visit)(See Figure 2).

1.4 Quadra Hill Wetland Plan

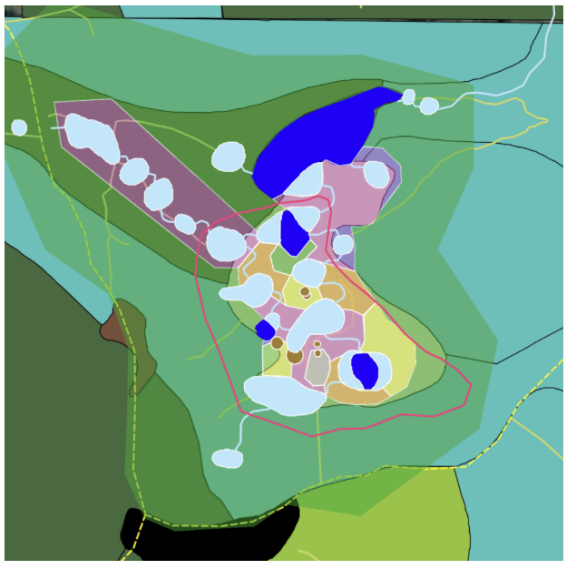

Figure 3. Uvic fieldcourse planting plan overlaid on top of the Galiano Conservancy Associations proposed ecological restoration plan

In 2023, the Galiano Conservancy Association purchased the land from the Aqueduct Foundation as a missing piece to strengthen the continuity between the Mid-Island Protected Areas Network (Huggins & Thompson, 2023). Quadra Hill Wetland is destined to be another ambitious project with the GCA, following the design and successful implementation of the Crystal Creek Wetland project, which we used as a reference for much of the planning (Borg *et.al.,* 2021).

The goal of the project is to mimic beaver-made wetland pools that are natural in the surrounding area and plant communities associated with old-growth Western redcedar (*Thuja plicata)* swamps (Silverman, S., 2024). The overarching goal of this project follows the values of the "Cedars for the Next Century" project outlined with the 'Chrystal Creek Watershed restoration (Galiano Conservancy Association, 2025).

Before our planting plan is implemented, Quadra Hill wetland will have undergone a few changes, which have been outlined in the *HCTF: Fish & Wildlife Proposal Budget 2025-26* grant led by Adam Huggins to the Fish and Wildlife grant with the Habitat Conservation Trust Foundation (2024). The aim of the project is to recreate and maintain wetlands that encourage associated wildlife such as the blue-listed Northern Red-Legged Frog (*Rana aurora*), the American beaver (*Castor canadensis*), and other amphibian and wetland bird species. The creation of many ponds and waterways of varying size and structure by rough and loose techniques will not only encourage the establishment of these species but will also "increase

water storage on land and increase carbon storage by at least 341 tons over the next 30 years."(Silverman, S., 2024). A major change is proposed to decommission the former logging road that captures the outflow of water going into the Great Beaver Swamp, effectively decreasing soil and nutrient retention in the wetland. Rough and loose techniques will disrupt this process, allowing for a more natural flow of water, and habitat for native flora and fauna (Silverman, S., 2024)

Additional action to the site includes the removal and disposal of structures, personal remnants, and garbage, removal and plugging of ditches, distribution of coarse woody debris (CWD), and monitoring/management following the initial planting and establishment. The CWD will be sourced from an adjacent Quadra Hill site undergoing forest thinning processes (Hammond. H., *et.al.,* 2024) CWD is being stored currently in a derelict gravel pit onsite and which is a major concern for invasive vegetation (Desormeaux. C., *et. al., 2023*).

2.0 Goals and Objectives

Upon familiarizing ourselves with the site and background documentation, we determined four main goals for the planting and structure of the wetland communities at Quadra Hill.

2.1 Goal #1: Enlist plants to promote native regrowth and outcompete invasive species.

Objective 2.1a

Plant roughly 560 plants, majority in the shrub and tree variety to shade out invasive grasses before their re-establishment according to the allotted budget.

Objective 2.2b

Focus on regeneration in areas of well-established native species such as western red cedar and red alder (*Alnus rubra*) which can outcompete invasives and agronomic grasses.

2.2 Goal #2: Structure ecotones and microecosystems to encourage target species

Objective 2.2a

Design various sites according to the perceived moisture, sun exposure, present species, and nutrient levels in order to create micro-communities and ecotones that encourage gradual establishment in the newly formed ponds.

Objective 2.2b

Choose plant communities which can encourage target species such as American beaver and the northern red-legged frog

2.3 Goal #3: Utilize plants that reflect social and ecological needs.

Objective 2.3a

Meet with the project manager (Adam Huggins) to determine the overall community goals of the project and the audience/structure for the visitors and community

Objective 2.3b

Interview community members on the species they visualize presently in a wetland ecosystem and those with which they can interact with.

Objective 2.3c

Meet with the project manager (Adam Huggins) to determine ecological needs of a wetland.

2.4 Goal #4: Counteract ungulate browsing effects

Objective 2.4a

Determine the plant species that deter herbivory of black-tailed Deer (*Odocoileus hemionus*) and structure plant communities accordingly in unfenced areas.

Objective 2.4b

Using pre-determined fencing plans and knowledge of ungulate deterring plants, design a budget friendly caging plan for plants that require protection.

3.0 Methods

3.1 Preliminary Research

Our group began by doing preliminary research on the site. This included reading over the 2024 Quadra Hill Baseline Report to understand the site's history, current ecology, and previous findings. We also completed research on the GCA's role in the site. This included reviewing the *HCTF: Fish & Wildlife Proposal Budget 2025-26* to understand the GCA's plans, goals, and budgetary restraints for the site (Adam Huggins, Personal Communications, July 2025). We utilized the GCA's ArcGIS account to view the ecological baseline and current plans for the site (See Figure 1.). We were also able to speak directly to Adam Huggins to learn more in depth about the goals for the site, as well as to Adam Huggins and Eric Higgs about the acquisition of the site. Furthermore, we were able to use internal documents such as *GCA Planting Notes & Observations,* and *Visual Guide to Indicator Plants for the CDFmm (Draft)* to better understand plant niches, necessary conditions, and relationship specific to Galiano Island *(*Adam Huggins, Personal Communications, July 2025). We also did preliminary research on

analogous GCA wetland sites/planting plans such as the Chrystal Creek Watershed (*Chrystal Creek Watershed | Galiano Conservancy Ecological Restoration Chrystal Creek*, n.d.).

3.2 Field Work

Our group visited the site multiple times, both with and without the guidance of Adam Huggins and Eric Higgs. During this field work we walked around the entire site, documenting the characteristics of the landscape, including geography, species composition, bird presence, and species success. We correlated our observations on site with the mapped area in ArcGIS, dividing it into subsites shown in Figure 6. This helped us better understand the unique characteristics of each subsite and to aid in our creating procedures (See Appendix 1).

Figure 4. Zoe Peterson, Natalie Waite, Aryan Sethi, Erin Miller, and Adam Huggins directly south of Site 1 during field visit.

3.3 Planning

Utilizing our preliminary research, our group began with determining key problems including the site's history of disturbance such as logging, agriculture and more broadly settler colonialism. We then moved to goal setting, creating goals based on our discussions with Adam Huggins and those presented in the *Enhancing Connectivity and Restoring Degraded Habitats on Galiano Island* grant (Adam Huggins, Personal Communications, July 2025).

3.4 Community Engagement

During our limited time on the island we were able to briefly speak to some community members and ask about their wants for the site. We asked if there was anything they felt we should take into consideration including any specific plants or species they would like to see. We specifically asked Loren Sylvie (Coast Salish and Portuguese with family relations to Galiano Island) and Suzanne Fourniers when they came to speak, and we also opened up these same questions after our community presentation. Loren Sylvie and Suzanne Fourniers both expressed consideration for food plants for people and animals alike, with examples of such as thimbleberry (*Rubus occidentalis*) and salmonberry (*Rubus spectabilis*), as well as stinging nettle (*Urtica dioica*) as many on Galiano have relationship to nettles and attend a yearly Stinging Nettle Festival, which is a favourite celebration of the Galiano island community (Personal communication, July 10, 2025). There was also a request by Loren Sylvie for us to aim to get as close as possible to a return to the Native/precolonial conditions of the site. Additionally, Fournier mentioned that the local beavers quite enjoyed bogbean, a hint in the right direction to the overall goals mimicking the natural changes brought on by beaver presence in a wetland (Personal communication, July 10, 2025).

Figure 5. Painting of Stinging Nettle (*Urtica dioic*) by Natalie Waite.

4.0 Findings

In order to understand the present plant communities, seedbank, and the odds the wetland will face once established, we spent a large portion of our site visits recording plant presence and success. This helped us better understand what to focus on for our goals of native regrowth, outcompeting invasive plants, and establishing a biodiverse ecosystem. Our group completed a survey around the entire wetland, following the GIS map to aid with determining the location of the future pools after the ground is altered by a machine operator. We named these sites according to the communities we determined would establish successfully, followed the future conditions of the wetland, and/or already established landmarks. Regeneration Station, which constitutes a largely intact area, is included in order to show what sort of species we can expect to re-establish without intervention, it is not a formal planting site and is more so an inventory of plants that may encroach later.

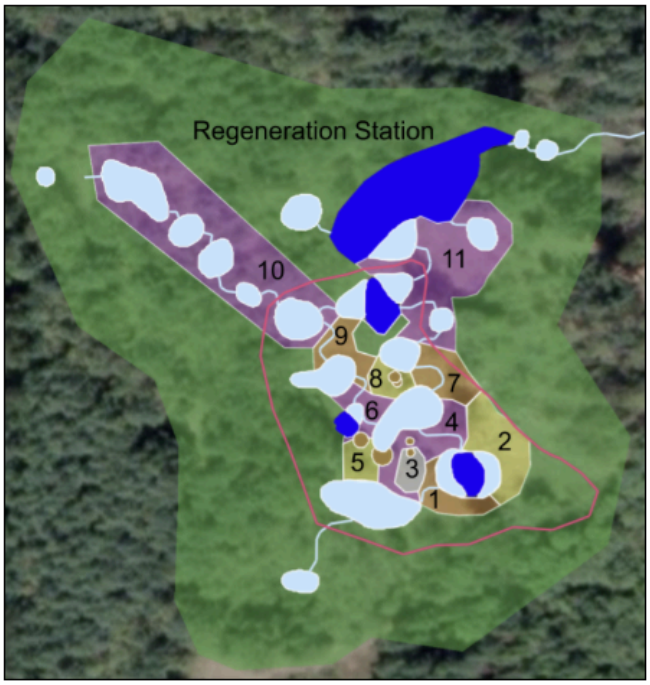

Figure 6. Map of Planting Plan Sites overlaid upon the Galiano Conservancy Associations proposed ecological restoration plan. Dark blue represents current water, light blue represents proposed ponds, red line represents proposed fencing, brown circles represent current cedar trees on site, green represents Regeneration Station. Site 1 = Alder Lane, Site 2 = Maple Ridge, Site 3 = Snaggy Shack, Site 4 = Cedar Central, Site 5 = Cherry Pit, Site 6 = Berry Farm, Site 7 = Crab Apple Castle, Site 8 = Cottonwood Crescent, site 9 = Hazelnut Hollow, Site 10 = Willow Way, Site 11 = Prickly Palace.

4.1 “Regeneration Station”

This is the area that surrounds the site which we believe has a high likelihood of regenerating without much intervention, it is in the transition zone between the pasture and the Douglas-fir (*Pseudotsuga menziesii*) forest. Lots of western redcedar, red alder, big-leaf maple (*Acer macrophyllum*), western sword fern (*Polystichum munitum*), salal (*Gaultheria shallon*), Douglas fir, invasive grasses, stinging nettle, foxglove (*Digitalis*), trailing blackberry (*Rubus ursinus*), docks (*Rumex spp.*) sedges (*Carex spp.)*.

4.2 Site 1: “Alder Lane”

This site is made up of many species of agronomic grasses such as orchard grass (*Dactylis glomerata*), bentgrass (*Agrostis spp.*), and reed canarygrass (*Phalaris arundinacea*), as well as Canada thistle (*Cirsium arvense*), western redcedar, stinging nettle

4.3 Site 2: “Maple Ridge”

An elevated area that we believe would be suitable for big-leaf maples. Presently there are red alder, foxglove, stinging nettle, western redcedars and bracken fern (*Pteridium aquilinum* There is also a well-established population of Scotch broom (*Cytisus scoparius*) that was in seed during our visit.

4.4 Site 3: “Snaggy Shack”

This site is in the middle of a field with existing western redcedar snags; it will soon be surrounded by ponds. There are also many invasive grasses, sedges, stinging nettle, canadian thistle, catchweed bedstraw (*Galium aparine*), bracken fern and foxglove. Mostly shaded.

4.5 Site 4: “Cedar Central”

Western redcedars are dominant in this area and are currently creating shade; after this project is started it will sit between two wetland ponds. Currently there are western redcedars, many species of pasture grasses, buttercups (*Ranunculaceae*), self heal (*Prunella vulgaris*), apple trees (*Malus)*, forget-me-nots (*Myosotis*), foxgloves, bracken ferns, Canadian thistles, and trailing blackberry.

4.6 Site 5: “Cherry Pit”

Currently this site is an open grassy field with snowberry (*Symphoricarpus albus*), self heal, Canadian thistle and buttercup. After the restoration project it will likely be a mound since the machine operator will be moving soil from the earth to create the ponds and will need to place it somewhere nearby.

4.7 Site 6: “Berry Farm”

Trailing blackberry, canada mint (*Mentha canadensis*), Oregon grape (*Berberis nervosa*), agronomic grasses, sword fern, snowberry and western redcedars are in this area, located close to a human-made pond.

4.8 Site 7: “Crab Apple Castle”

This site is composed of a drier slope with grasses all throughout and alders at the top of the slope. Slope goes upwards opposite the wetland.

4.9 Site 8: “Cottonwood Crescent”

This site is open and full of agronomic grasses but does include two old cedar trees as well as thistle and ferns. It will become a sort of land spit between two pool areas.

4.10 Site 9: “Hazelnut Hollow”

This zone has an existing introduced walnut tree (*Juglans*), western redcedar, agronomic grasses and trailing blackberry. It is adjacent to some more apple trees, which will be removed upon rough and loose.

4.11 Site 10: “Willow Way”

This area has been regenerating well on its own, creating a lot of shade. There is alder, western redcedar, trailing blackberry, bracken ferns, red huckleberry (*Vaccinium parvifolium*) , Canada mint, slough sedge (*Carex obnupta*), European holly (*Ilex aquifolium*), salmonberry and agronomic grasses lining the former road site. This site is at a later successional stage than other sites.

4.12 Site 11: “Prickly Palace”

This area is an expansive open area that contains hundreds of foxgloves, many invasive grasses, red huckleberry and Nootka rose (*Rosa nutkana*). It also has old growth Douglas firs and other native tree species like western redcedars, red alders as well as Hooker’s willow (*Salix hookeriana*), Scouler’s willow (*Salix scouleriana*) , and Pacific willow (*Salix lasiandra*). This site is next to an area that seasonally has an influx of water next to it, where sword ferns and sedges are thriving.

5.0 Considerations and Recommendations

5.1 Site Considerations

This section includes reasoning which was all encompassing of our plan, whereas Table 1 will showcase individualized reasoning behind planting decisions. For this site we recommend planting a diversity of species that would work well in a wetland habitat. Choosing to plant different groupings of native species gives a better chance of survival; if one species isn't suitable then there still be others that can thrive, increasing resilience (Standish, R.J. and Hulvey, K.B., 2014). This contrasts planting monocultures, which can be highly susceptible to disease and pests. (Standish, R.J. and Hulvey, K.B., 2014). Planting nursery stock in 1 gallon pots should have the best chance of survival after installation compared to 4 inch pots, and while suiting our budget better than 2 gallon pots (Adam Huggins, Personal Communication, July 2025).

Additionally, by using cuttings from trees and shrubs that root easily, such as willows and poplars, costs can be reduced. These cutting adapted plants can also regenerate quicker on the land especially when there is browsing pressure (Breton V., Forestier O., Guindon O., and Evette A. (2014). This initial installation of 560 plants (as determined by budget and site needs) should create enough shade to outcompete invasive plant species, but it will be important to revisit the site and potentially plant more species in the future (Adam Huggins, Personal Communications, 2025). It is the hope that the native shrubs and trees selected will be able to outcompete the invasive species, and create a shadier habitat for the targeted species.

There is an exclusion plan in place to create a fenced area to keep deer out of a large chunk of the land, this is to minimize herbivory and help with survivorship of young plants

(Breton V., Forestier O., Guindon O., and Evette A., 2014). For the plantings outside of the large fence there will be a budget for individual cages around the plants that are known to be browsed on by deer. There is potential to remove these cages in future years if the trees and shrubs grow large enough that the deer are unable to reach their branches, or when populations are well established. Some cages may need to be enlarged if plants require more space due to growth but still require protection.

All sites are wetland adjacent and include wetland adapted species to be planted in close proximity to wetlands. Topography has been considered particularly when considering access and proximity to lower elevation wetlands and water. Consideration for current species composition is also included. While different sites have differing conditions, and reasoning behind planting plans, there will also be some plants seen across sites to aid in continuity of the landscape. We wanted a diversity in density as well hence some sites being more densely planted than others.

5.2 One Year Planting Plan

Table 1. Distribution of Plants.

Site Name	Total plants	Composition Recommendation	Site Specific Considerations.
Alder Lane (Site 1)	55	2 red alder, 2 red-osier dogwood (*Cornus sericea*), 2 salal, 1 Pacific ninebark (*Physocarpus capitatus*) , 2 Nootka Rose, 2 blackcap raspberry (*Rubus leucodermis*), 4 salmonberry, 10 Hooker's willow, 10 Pacific willow, 10 Scouler's willow, 4 hardhack (*Spirea tormentosa*), 3 western redcedar, 3 evergreen huckleberry (*Vaccinium ovatum*)	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has an open and complex structure, so shade creation is a large focus - All sites are wetland adjacent and include wetland adapted species to be planted in close proximity to wetlands.

Maple Ridge (Site 2)	34	4 big-leaf maple, 2 red-osier dogwood, 3 black hawthorn (*Crataegus douglasii*), 1 black cottonwood (*Populus balsamifera trichocarpa*) 4 Douglas fir, 7 Nootka rose, 1 Hooker's willow, 1 Pacific willow, 1 Scouler's willow, 2 hardhack, 6 snowberry, 2 western redcedar	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has an open and complex structure, so shade creation is a large focus - This site features topography sloping upwards opposite to their adjacent wetland, there is focus both on wetland adapted plants downslope, and more mesic plants upslope.
Snaggy Shack (Site 3)	48	1 Pacific crabapple (*Malus fusca*), 3 osoberry (*Oemlaria cerasiformes*) , 2 blackcap raspberry, 3 thimbleberry (*Rubus parviflorus*) , 3 salmonberry, 10 Hooker's willow, 10 Pacific willow, 10 Scouler's willow, 3 red elderberry (*Sambucus nigra*), 2 snowberry, 1 highbush cranberry (*Viburnum edule*)	- This site is the adjacent areas to cedar stands, there is the possibility of planting more shade adapted species, and less focus on shade creation. - There is focus on planting plants commonly associated with cedars. -
Cedar Central (Site 4)	68	3 Oregon grape, 4 Pacific crabapple, 1 osoberry, 2 Douglas fir, 5 Nootka rose, 3 thimbleberry, 4 salmonberry, 13 Hooker's willow, 11 Pacific willow, 11 Scouler's willow, 1 Sitka willow (*Salix sitchensis*), 2 hardhack, 6 western redcedar, 2 evergreen huckleberry	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has cedar trees, there is the possibility of planting shade adapted species adjacent to these cedars. - Connecting to the cedars for the next centuries project, we hope to create a cedar centred site.
Cherry Pit (Site 5)	13	1 big-leaf maple, 2 Pacific crabapple, 2 red elderberry, 3 hardhack, 3 western redcedar, 2 bitter cherry (*Prunus emarginata*)	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has cedar trees, there is the possibility of planting more shade adapted species, and less focus on shade creation. - This site will most likely be used to dump dirt excavated during the wetland creation process (Adam Huggings, Personal communications, July 2025), there is a focus on mesic plants.
Berry	33	2 Oregon grape, 2 osoberry, 2	- This site is adjacent to regeneration station

Farm (Site 6)		Douglas fir, 2 stink currant (*Ribes bracteosum*), 2 flowering currant (*Ribes sanguineum*), 2 gooseberry (*Ribes spp.*), 2 blackcap raspberry, 2 thimbleberry, 2 salmonberry, 2 Hooker's willow, 2 red elderberry, 4 hardhack, 3 western redcedar, 2 evergreen huckleberry, 2 highbush cranberry	which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has cedar trees in a half moon shape around the wetland, more cedars can be planted to extend this, and more shade adapted species can be planted adjacent to these cedars. - Due to the request of Loren Sylvie (Personal communications, July 10 2025), we decided to emphasize food plants such as berries here.
Crab Apple Castle (Site 7)	19	10 Pacific crabapple, 2 red elderberry, 2 hardhack, 5 western redcedar	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site features topography sloping upwards opposite to their adjacent wetland, there is focus both on wetland adapted plants to be planted downslope, and more mesic plants to be planted upslope. - Due to the request of Loren Sylvie (Personal communications, July 10 2025), food plants such as Crab Apple are emphasized. - This site can be an homage to the wetlands past as an orchard.
Cottonwood Crescent (Site 8)	67	5 red-osier dogwood, 4 Pacific crabapple, 2 Pacific ninebark, 10 black cottonwood, 2 stink currant, 2 flowering currant, 2 baldhip rose (*Rosa gymnocarpa*), 2 Nootka rose, 10 Hooker's willow, 10 Pacific willow, 10 Scouler's willow, 4 hardhack, 4 western redcedar	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has an open and complex structure, so shade creation is a large focus - This site has cedar trees, there is the possibility of planting shade adapted species adjacent to these cedars.
Hazelnut Hollow (Site 9)	16	4 big-leaf maple, 2 beaked hazelnut (*Corylus cornata*), 3 Douglas fir, 1 Hooker's willow, 1 Pacific willow, 1 Scouler's willow, 1 Sitka willow, 3 western redcedar	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - Due to the request of Loren Sylvie (Personal communications, July 10 2025), we decided to emphasize food plants such as

			- Beaked hazelnut can pay homage to current nut trees which will be removed in the rough and loose process.
Willow Way (Site 10)	101	10 red-osier dogwood, 2 oceanspray (*Holodiscus discolor*), 7 skunk cabbage (*Lysichiton americanus*), 10 bog bean (*Menyanthes trifoliata*), 2 gooseberry, 3 thimbleberry, 3 salmonberry, 20 Hooker's willow, 20 Pacific willow, 20 Scouler's willow, 4 hardhack	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - Site 10 is at a much later successional stage as other sites, allowing for the planting of shade and wetland adapted species right away, rather than waiting until shade is created; this allows for more targeted planting such as bog bean which can attract local beavers (Suzanne Fornier, Personal communication, July 2025). - Due to the request of Loren Sylvie (Personal communications, July 10 2025), we decided to emphasize food plants such as skunk cabbage here.
Prickly Palace (Site 11)	106	4 big-leaf maple, 4 Oregon grape, 5 black hawthorn, 5 black cottonwood, 5 Douglas fir, 2 baldhip rose, 20 Hooker's willow, 20 Pacific willow, 20 Scouler's willow, 4 hardhack, 2 snowberry, 10 western redcedar, 5 evergreen huckleberry	- This site is adjacent to regeneration station which should allow for the recolonization and reduction of fragmentation in more disturbed sites once shade is established. - This site has many thistles which can be shaded out well (Adam Huggins, Personal Communications, July 2025), there should be extra focus on shade creation in thistle populated areas when planting. - This site includes portions outside of the fenced areas, there is focus on plants which have shown to be resistant to deer herbivory to limit the amount of plant cages needed.

5.3 Five Year Plan

The long-term success of this project will need ongoing engagement and monitoring, as many restoration projects do. In addition to monitoring plant success, regeneration, and other wildlife presence, we suggest using bird surveys in the future to help determine the success of

this project. Within the next 5 years, we can begin to plan to build bird boxes for three rare species in the area, including in the Quadra Hill 2024 baseline report, that are blue-listed, yellow-listed, and of special concern to SARA and COSEWIC. These include the great blue heron (*Ardea herodias fannini*), band-tailed pigeon (*Patagioenas fasciata*), and olive-sided flycatcher (*Contopus cooperi*)(Martini et al., 2024). The Cornell Lab of Ornithology can serve as a guide for designing and placing bird boxes in the wetland after five years (Martini et al., 2024).

Additionally, evidence of Townsend's voles (*Microtus townsendii*) presence has been seen in the Chrystal Creek Watershed and may pose an issue in the future for this site. It will be interesting to make note of the effects they have after planting and if there are any methods that can deter the vole from targeting desired trees. It would be helpful if future cohorts of the Galiano Field School continue to study this area to help better the understanding on how to create wetland habitats.

We also suggest reevaluating each site's successional stage and building a new planting plan based on current conditions, particularly since most sites have a current focus on shade creation, more shade tolerant species can be planted such as those being planted in site 10.

We suggest that once shade is established, native sedges and rushes can be planted if they are not self establishing, in order to attract the blue-listed northern red-legged frog (Hall, 2017).

Finally, this site could be a wonderful place to provide some informative signage close to the hiking path to give visitors to the trail a greater understanding of how the ecosystem is being restored and the methods used, as well as the history and cultural uses of wetlands. This would allow community members to become more engaged with the site and interested in the work being done there or the importance of wetlands.

6.0 Budget

This budget has been created within the parameters of the proposal created by the GCA to receive funding from the Habitat Conservation Trust Foundation and other funding partners. We have allocated 560 native plants with a budget of $3,967 out of our total budget of $5500, which has been spread across 11 sites as shown in Appendix 2.

Roughly 64 plants require cages in site 10 and site 11, which cost around $640. With the leftover budget, more plants can be planted later on. With room in the budget, there is available money to spend on the site currently filled with woody debris which plans are currently uncertain (Adam Huggins, Personal Communications July 2025).

All plants are sourced from Galiano's nursery stock except for beaked hazelnut and bitter cherry which can be sourced from Frasers Thimble Farms with a quote of $19.95 per 1 gallon plant - these are referred to in the budget within the 2 gallon column for mathematical simplicity. A more comprehensive budget is available in Appendix 2.

7.0 Discussion

It will be important to monitor the site in the future after creation of the ponds and planting the shrubs and trees. Due to environmental factors like climate change and the introduction of invasive species it can be difficult to encourage a landscape to transition to a more natural state after agricultural use. As well selecting plants that have cultural significance and can be a food source for people and other species. This initiative is important due to the discrimination that Indigenous peoples can experience while trying to use the land, and the disappearing public land. The complicated past of this being a logged area and a temporary home for a goatherder gives opportunity for the space to be managed in a creative way that supports

biodiversity. In upcoming years it is key that the Galiano Conservancy Association keeps taking care of the space, taking notes on what plant species thrive, monitoring for target species, and observing how the cages protecting the fresh plantings are working. Possibly a focus could be on an additional planting plan a few years down the line to fill any gaps that had come up in the landscape, and provide an even more biodiverse ecosystem, as well as help the sites move forward through successional stages.

The Quadra Hill wetland faces challenges from climate change. Changes in weather patterns and higher temperatures could have an impact on the ecosystem. Variation in precipitation amounts have the potential to affect wetland hydrodynamics. This could increase the water required to keep the saturated soils that store carbon. If the wetlands dry up, the carbon held in that soil will break down more and release greenhouse gases (Ontario Nature, 2024)

8.0 Acknowledgements

Thank you to the Galiano Conservancy Association for hosting us, Adam Huggins and his team were helpful mentors and teachers. Eric Higgs, our professor for this course, brought enthusiasm and joy to the learning journey, facilitating engaging and important conversations and friendships. Sylvie Hawkes and Alia Johnson, our two amazing TAs helped immensely in our preparedness for this course, our paper, and our future careers, maintaining the importance of holding a diversity of backgrounds to aid in our learning and experiences. We are grateful to the many different mentors that visited over the course of the 9 days, whom we shared valuable lectures and conversations with and who empowered us to ask questions and be curious. A very special thanks to Lúthien Teel for nourishing our minds and bodies as the incredible chef for this

course and with her delightful humor. Finally, a big thanks to our classmates for their willingness to discuss, engage, and fuel connection. We appreciate having the honour to work with every student, professor, and community member and the opportunity to learn on the beautiful land of Galiano Island.

9.0 References

Breton V., Forestier O., Guindon O., and Evette A. (2014), ECOLOGICAL RESTORATION UNDER PRESSURE FROM INVASIVE ANIMAL SPECIES: USE OF SALICACEAE CUTTINGS IN A RIVER BANK OVERRUN BY COYPU, River Res. Applic., 30, pages 1002–1012, https://doi-org.ezproxy.library.uvic.ca/10.1002/rra.2688.

Canada, E. (2013, April 16). *Canadian weather—Environment canada*. https://weather.gc.ca/canada_e.html?redirectCityCode=bc-93

Chrystal creek watershed | galiano conservancy ecological restoration chrystal creek. (n.d.). Galiano Conservancy. Retrieved 4 August 2025, from https://galianoconservancy.ca/ecological-restoration/wetlands/chrystal-creek-watershed/

Desormeaux, C., Irwin, M., Jacobsen, H., & Lessard-Northrup, A. (n.d.). *Introduced Species Management Plan: Quadra Hill on Galiano Island (British Columbia, Canada)*. https://galianoconservancy.ca/wp-content/uploads/2023/08/Quadra-Hill-Introduced-Species-Management-Plan.pdf

Ecol Manag Restor, 15: 26-29. https://doi-org.ezproxy.library.uvic.ca/10.1111/emr.12084

WETLANDS AND CARBON CAPTURE (Convention on Wetlands | 50th Anniversary). (n.d.). Ramsari.

Environment Canada (2022). Southern Gulf Islands Historic Data. Retrieved on Aug 4 2025 https://weather.gc.ca/city/pages/bc-93_metric_e.html

Gallery: Archaeology on galiano island | washington state magazine | washington state university. (n.d.). Retrieved 17 August 2025, from https://magazine.wsu.edu/web-extra/gallery-archaeology-on-galiano-island/

Hall, T. (2017, April 20). Northern red-legged frog. *A Rocha*. https://arocha.ca/northern-red-legged-frog-2016/

Hammond, H., Huggins, A., & Erickson, K. (2022). *Quadra Hill Forests: Ecological Restoration Prescription*. https://galianoconservancy.ca/wp-content/uploads/2025/02/Quadra-Hill-Forests-Ecological-Restoration-Prescription.pdf

Huggins, A., & Thompson, M. (2023). *Quadra Hill Baseline Report*. Galiano Concervancy Association. https://galianoconservancy.ca/wp-content/uploads/2023/11/Quadra-Hill-Baseline-Report-2023-small-file.pdf

Martini, M., Rasmussen, K., Stewart, N., Vaughan, A., & Waddell, R. (2024). *Quadra Hill Baseline Report*. https://galianoconservancy.ca/wp-content/uploads/2024/08/Quadra-Hill-2024-Baseline-Report.pdf

Our Shared Territory. (n.d.). Galiano Conservancy; Galiano Conservancy. Retrieved 31 July 2025, from https://galianoconservancy.ca/about/

Part I: One Island? (2022). Galiano Conservancy Association.

Standish, R.J. and Hulvey, K.B. (2014), Co-benefits of planting species mixes in carbon projects.

Wetlands are carbon storage superstars. (n.d.). *Ontario Nature*. Retrieved 4 August 2025, from https://ontarionature.org/campaigns/wetlands/wetlands-are-carbon-storage-superstars/

10.0 Appendices

Appendix 1. Site Noticings from Initial Site Visit

Site Name	Existing plants	New Trees	New Shrubs	New Perennials	Description of Area	Planting?	Fenced?
Regeneration Station	Western Red Cedar,Red Alder, Big-Leaf Maple, Giant Sequoia,Sword Fern, Salal, Doug fir, black capped raspberry, bracken fern, agronomic grasses, stinging nettle, foxglove, thistle, trailing blackberry,mullein, dock, sedges				Single story transitional zone between pasture and doug fir forest, wet-ish, lots of plants to establish inside pasture	N	Y/N
Cedar Central	Western Redcedar,agronomic grasses, buttercups, self heal, apple tree, forget me not, foxglove,bracken fern, trailing blackberry, Canada thistle	cedar, hookers willow near wetland	Salmonberry,thimbleberry,evergreen huckleberry, saskatoon, dull and shiny Oregon grape, black cap raspberry,		Just outside regeneration station, many older cedars creating good shade, drier site now but future between two wetlands	yes, some cedars, but mostly under layer 27 plants 6 cedars 3 thimble 4salmon 2 huckle 2 Saskatoon 3 and 3 of both grapes 1 black cap raspberry	Y

						3 hookers willow	
Snaggy Shack	Agronomic Grasses, invasive sedges, Western Red Cedar snags, stinging nettle, Braken fern, Canadian thistle, catchweed bedstraw, foxglove	osoberry	Salmonberry, highbush cranberry			7 plants 3 salmon berry, 1 high bush cranberry, 3 osoberry	Y
Maple Ridge	red alder, foxglove, stinging nettle, western red cedar, braken fern	big leaf maple, black hawthorn, some of each willow in lower wetland site, red osier dogwood, cotton wood	Nootka rose, snowberry,			25 Plants 4 big leaf maple, 1 douglas maple, 7 Nootka rose, 4 snowberry outside fence, 3 black hawthorn, one of each willow, 2 red osier dogwood, (at bottom) 1 cottonwood	Y/N
Alder Lane	very agronomic grasses, Canada thistle, cedar, stinging nettle	red alder, cedar	salmonberry, salal			2 alder, 4 salmon berry, 3 salal, 1 cedar	
Berry Farm	trailing blackberry, Canada mint, Oregon grape, agronomic grasses, sword fern, cedar, strawberry	cedar, osier dogwood, osoberry, hardhack	gooseberry, Saskatoon, salmon, snow, evergreen buck, high bush, elder, black cap,			2 of each berry, 3 cedar, 4 hardback, 3 dogwood, 2 Oregon grapes	

			Oregon grapes				
Cherry Pit	snowberry, agro, trailing, self heal, Canadian thistle, buttercup,	bittercherry,	mound lover			2 bitters, huck?	
Willow Way	alder! Cedar, salal, sword, trailing, agro grasses, braken, red huckleberry, Canada mint, slough sedge, European holly, strawberry , other native sedge , salmon berry, mullien	Sitka Willow, Scoulers Willow, Hooker's Willow, Pacific Willow, dogwood, ocean spray, hardback	salmonberry, red current	skunk cabbage,	2 ocean spray, stake a bunch of willows (ADD TO SPREADSHEET #), errands needs more stakes, 4 ocean spray towards front and back , 5 skunk cabbage (Plant not available) , 2 current		
Crabapple Castle		Pacific Crabapple, hookers and scoulars willow	Nootka rose ,				
Cottonwood Crescent		Black Cottonwood, doug maple, scoulers willow					
Prickly Palace	huckleberry, foxglove, agro, trailing, sword fern, Doug fir, cedar, alder and willows	Black Hawthorn , Willow near bottom, cedar, fir, pacific ninebark,	Nootka Rose, snow, bald hip,	fireweed, pearly everyl asting	5 cedar, 3 Doug fir, 2 grand (grand fir not available), 2 hawthorns, 2 baldhip, away from willow		

		maple			lots of sun,		
Hazelnut hollow	walnut, cedar, agro, trailing	crab apple, willows				2 crab apple, one of each willow	

Appendix 2. Total Budget of Each Species to be Planted

Total Budget									
Common Name	**Scientific Name**	**Hul'qumi'num Name**	**live stakes (0)**	**4 inch (5$)**	**1 gal (15$)**	**1 gal (12$)**	**2 gal (20$)**	**Total Plants**	**Total Cost**
Big Leaf Maple	*Acer macrophyllum*	Ts'alhulhp, Q'um'-unulhp	0	0	0	13	0	13	156
Yarrow	*Achillea millefolium*	T'uliqw-ulhp	0	0	0	0	0	0	0
Red Alder	*Alnus rubra*	Kwulala'ulhp	0	0	0	1	1	2	32
Oregon Grape	*Berberis aquifolium*	Lulutth'sulhp	0	0	0	9	0	9	108
Red Osier Dogwood	*Cornus stolonifera sericea*	Kwum-kwin-mutth'	0	0	0	19	0	19	228
Beaked Hazelnut	*Corylus cornuta*	P'qw'axw	0	0	0	0	2	2	40
Black Hawthorn	*Crataegus douglasii*	Metth'unulhp	0	0	0	8	0	8	96
Salal	*Gaultheria shallon*	T'eqe'	0	0	0	2	0	2	24
Oceanspray	*Holodiscus discolor*	Qethulhp	0	0	0	2	0	2	24
Skunk Cabbage	*Lysichiton americanus*	Ts'a'kw'a'	0	0	7	0	0	7	105
Pacific Crab Apple	*Malus fusca*	Qwa'up-ulhp	0	0	0	21	0	21	252
Bog Bean	*Menyanthes trifoliata*		0	0	0	10	0	10	120
Osoberry	*Oemleria cerasiformis*	Tth'uxwum'	0	0	5	0	0	5	75
Pacific Ninebark	*Physocarpus capitatus*	Kwunulhp	0	0	0	4	0	4	48
Black Cottonwood	*Populus balsalmifera trichocarpa*	Tsuw'nulhp	0	0	0	16	0	16	192
Bitter Cherry	*Prunus emarginata*	T'ulum'	0	0	0	0	2	2	40
Douglas Fir	*Pseudotsuga menziesii*	Ts'sey'	0	0	0	16	0	16	192
Stink Currant	*Ribes bracteosum*	Sp'eetth'	0	0	0	4	0	4	48
Flowering Currant	*Ribes sanguineum*	Sqwuliius	0	0	4	0	0	4	60
Gooseberry	*Ribes spp.*	T'em'hw	0	0	4	0	0	4	60
Baldhip Rose	*Rosa gymnocarpa*	Xwiinlhp	0	0	0	4	0	4	48
Nootka Rose	*Rosa nutkana*	Qel'qulhp	0	0	0	16	0	16	192

Blackcap Raspberry	*Rubus leucodermis*	Tsulqama’	0	0	0	6	0	6	72
Thimbleberry	*Rubus parviflorus*	T’uqwum’	0	0	0	11	0	11	132
Salmonberry	*Rubus spectabilis*	Lila’	0	0	0	16	0	16	192
Hooker's Willow	*Salix hookeriana*	Sxwelu'elhp	80	0	0	7	0	87	84
Pacific Willow	*Salix lucida*	Sxwelu'elhp	80	0	0	3	0	83	36
Scouler's Willow	*Salix scouleriana*	Sxwelu'elhp	80	0	0	3	0	83	36
Sitka Willow	*Salix sitchensis*	Sxwelu'elhp	0	0	0	2	0	2	24
Red Elderberry	*Sambucus nigra*	Tth’iwuq’	0	0	4	2	0	6	84
Hardhack	*Spiraea douglasii*	T’eets’ulhp	0	0	0	32	0	32	384
Snowberry	*Symphoricarpos albus*	P’up’q’iyasulhp, P’up’q’iyas, T’ets’ulhp	0	0	0	8	0	8	96
Western Red Cedar	*Thuja plicata*	Xpey’	0	0	0	41	0	41	492
Evergreen Huckleberry	*Vaccinium ovatum*	Ye’xum	0	0	2	10	0	12	150
Highbush Cranberry	*Viburnum edule*	Qwemtsuls	0	0	3	0	0	3	45
Total			240	0	29	286	5	**560**	**3967**