LIBRARY RESTORATION DESIGN PROJECT

Ecocultural Restoration Design on Public Landscape

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Introduction

Acknowledgments

Our restoration project design team would like to thank the following people for their help and support during various parts of the process: Peter Roberts, Jim Henshall, Paul Courville from UVic Facilities Management, Eric Higgs, Brian Starzomski, Andra Fournier, John Satchwell (Applied Aquatics), Wendy Kay (Landeca), Gordon Brock (Wes-tech), Guy Wallace (Van Isle Water Services), the staff from the Do It Centre, Dig This, and Cannor Nurseries.

Introduction

The library site requires a very unique approach to ecological restoration because it is located in the centre of a public landscape that is geared towards human activity (Schaefer et. al, 2004). Ecological restoration is defined by the Society for Ecological Restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER, 2004). Although the goal of most restoration projects is to conserve the integrity of natural ecosystems and return ecosystems to a historical trajectory, such goals would be unrealistic for the library project considering the human developments that surround the site. Although historically this site would have been part of a Garry Oak ecosystem, the urban development that has ensued over the years has altered the landscape so dramatically that it would be impossible to restore this area to a functional Garry Oak ecosystem. We will not be able to reach historic trajectory in this space: the landscape is too small, fragmented, and severely impacted by the current development and voracious rabbit problem. With this in mind, we must develop restoration principles and goals that accommodate the site's current uses and possibilities. We must consider the purpose of this site in its current age, and strive towards realizing the most integral manifestation of its purpose. The project goals are influenced by the small size of the site, the urban setting in which it is located, and the social uses of the site. This restoration project considers and integrates primary concerns of social, cultural and aesthetic intentions with secondary concerns of ecological integrity, biodiversity and wildlife habitat. While traditional ecological restoration principles are considered significantly, we also consider the improvement of socio-cultural engagement with this site as critical to the long term success of this project.

Site Analysis

Social and Aesthtics

Tucked behind the library, just on the inside of ring road lays a desolate piece of campus that is the focus of this restoration project. Though highly visible, with paths on one side and a glass wall of the library on the other, there is not much to look at besides bunnies, mulch, and a swampy-looking pond. The land is sloped at about a 45-degree angle. There are stadium like cement stairs, an encircling structure that faces the pond. There are boulders surrounding the pond reminiscent of the boulders in the fountain of the quad. The steps are also reminiscent of the quad fountain; it looks as though it was intended for people to come and sit, to gather, however, this does not happen. A well-groomed patch of grass separates the mulch areas. The few plants in the mulch are sparse and unattractive. The pond is a festering green colour. The whole site looks bleak, bland, and incomplete. The current situation has no appeal for people to visit the site, to study here, to eat here, to relax here. However, the potential is all there. By revamping the pond, creating luscious native vegetation, and adding some artistic flare to the cement stair feature, this site has the potential to flourish as a social gathering space and a cultural landmark on campus.

This site being at a central point of a university campus, there are many stakeholders who must be consulted on this project. As such, this project is also open for adapting to the considerations of these stakeholders. Students, faculty, staff and community members should be consulted, especially those who use and work in the library. UVic and Facilities Management should also be consulted.

Terrestrial Space

There are many aspects of this terrestrial landscape to review before implementing a plan. The originating bioclimatic zone is a Coastal Douglas-Fir. The elevation of this Saanich located site is 23 M (75 FT). The exposure of this site is varied as some sections receive full sun to partial to full shade. The soil is slightly acidic and is a collection of on-campus soil. It changes from dry to moist to wet depending on the season. There has recently been a sprinkler system installed. There is a slope, so the soil is water receiving and water shedding in some parts and is a combination of organic to mineral material.

Figure 1 - Plants currently at the site

This terrestrial space has native and non-native plant species present. Some of the original plants intended for this site include: Vine Mapple, Snowbrush, Oceanspray, Moch Orange, Wood Rose, Sword Fern, and Dwarf English Lavender to name a few (see Appendix A). Only a few of these plants have survived and are currently growing on the site. These plants include Snowberry, Salal, Cedar Trees and Wood Rose (see Figure 1). Other non-native plants, such as Sedum, have since been planted (see bottom right image in Figure 1). The soil has been left bare

and unfenced despite the several attempts from facilities management to plant these native species. There is currently two soiled and bark mulched patches and one grassy patch in between. This landscape is South East of the Mearn's Centre building and is therefore blocked on two sides. This blocks some of the elements such as the sun, and radiates heat from the building wall of glass. There are important differences between this area and a more naturally occurring area like a mountainous one for example. Trees would shade the system whereas the glass wall in this library landscape assists in heating it. This system, were it to be restored, would need careful planning to address these issues.

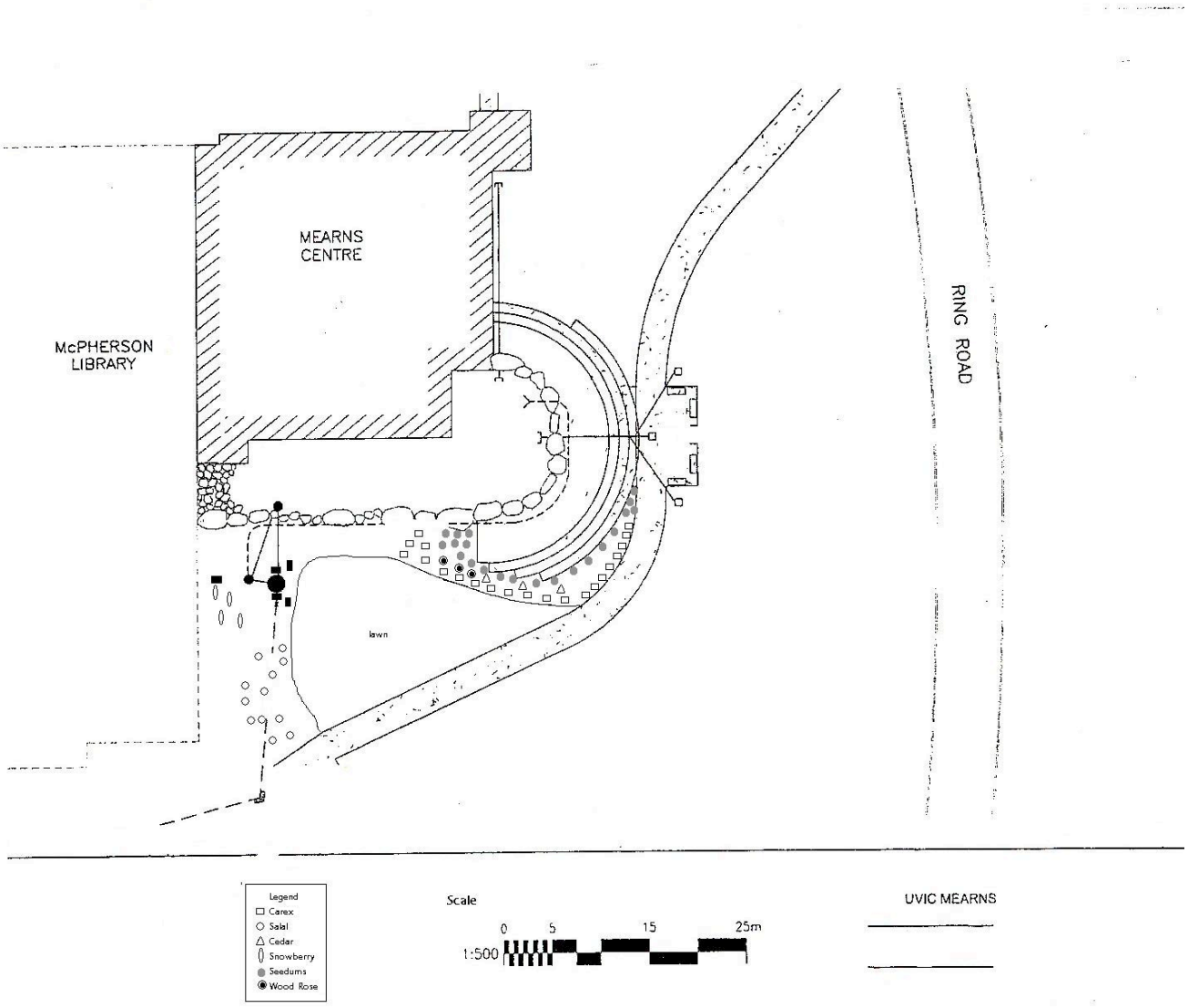


Figure 2 - Map of current site conditions.

The Pond

The pond is an artificial creation situated within a highly developed area. It is attached to the Mearn's Centre, behind the main library at the University of Victoria. The dimensions are roughly 30 feet by ten feet with one and a half feet depth of water. The original design did not include the establishment of plants; instead the pond was designed solely for its water aesthetic. In other words, the pond was meant to be seen and not touched or engaged with. The pond, as currently designed, is largely the product of a technological mindset: there is no reference made to the ecological, social, and cultural history of this area. Moreover, the production of this space is largely separated from the people who live, work, and study in and near it. The pond is representative of a larger socio-cultural pattern of commodifying nature, where the experience of nature is separated from social participation in its creation and maintenance (Higgs, 2003). The pond is ahistorical and acontextual as currently constructed, and has no connection with the area's socio-cultural and ecological past. The history of the place seems to be obliterated, and social participation in the production of the space is not valued.

The original intention for this site included a large fountain and a retention pond that would hold and cycle water (Appendix A). Unfortunately, the costs during construction became too high and the fountain was never established. It was originally thought that the sun and aeration provided by the fountain and underground pumps (Appendix A) would break up the formation of any algae (Personal communication with Facilities Management). Local experts have told us that this idea "is a joke." The sun provides energy for algae to grow, rather than to break up algae. The sun's reflection off of windows at Mearn's Centre provides even more energy to the

pond, and the presence of large amounts of algae clearly demonstrate that the original plans for this site have failed.

Because the pond is situated at a lower elevation relative to the surrounding landscape, it is a natural space for collecting water. Water is collected in the pond from four sources: the adjacent building sheds water from the roof into the pond, water is collected from the bench area and drained into the pond, a water pump inside the pond keeps the water levels at a specified height, and an adjacent slope, which is largely bare of plants due to the overabundance of rabbits and their voracious herbivory, runs straight into the pond. Since there are few established plants on the slope, and hence few plant stems for water to follow into the clay soil, there is little opportunity for water to soak within the soil. When it rains, water and nutrients quickly run off the slope and into the pond, where there are no established plants to utilize or cycle these nutrients. The lack of functional cycling of these nutrients leads to nutrient loading in the pond. Excess nutrients are being colonized by the growing algal blooms, which are aesthetically unpleasant, and ecologically unproductive. The stagnant waters of the pond are also providing excellent breeding sites for many insects, such as mosquitoes, which blow into the building through the venting systems.

The ecological reference site for the water feature is a small marsh or bog ecosystem. These areas usually have saturated soils, and are inhabited by hydrophilic plants and microorganisms (CRD, 2008). Wetland ecosystems tend to exhibit high degrees of biodiversity. This kind of ecosystem is important because they soak up excess water during times of heavy rainfall, it purifies water, and provides an aesthetically pleasing space.

Indigenous Territory

The University of Victoria is located on unceded Coast Salish territory. We recognize the history of colonization embedded in all of the UVic landscape. We feel it is important to respect and honour the First Nations peoples when doing a restoration project on campus. To do so, we want to hold a discussion forum with the Native Students Association (NSA) to find out any particular ways that the restoration project could work towards 'decolonizing' campus. We recognize that such decolonization is a long and encompassing journey that requires the participation of all members of society. We hope that collaboration with NSA will enable a healthier more inclusive project design. Some of the ideas that we would discuss include designing an Indigenous-styled painting project on the cement stairs, and planting native species in the garden area.

Historical Ecology

Long before the University of Victoria existed, this location would have most likely been part of Garry Oak ecosystem, or, more broadly, part of a Coastal Douglas Fir ecosystem. It would not have been considered a site specifically, because it would have been part of a greater continuous forest. First Nations traditional land management practices such as controlled burning might have been used to maintain the health and functioning of the ecosystem. The details are quite difficult to come across seeing how the site is so small and has been altered so much by human interventions. The land shape, the chemical composition, the hydrology, the surroundings, every part of the landscape has been altered so dramatically, that even if it was possible to find out the exact plants and species that used to use this area as a habitat, it would not be feasible to attempt restoring the site to it's historical trajectory.

Another way to approach the question of historical ecology in this project is to look at the history of naturescaping in urban environments. Since we are dealing with a landscape that has been so severely altered by urban development, it is important to recognize how views of approaching nature in urban development have changed also. Traditionally, if there was any attempt at all to include nature in urban development, it "typically involved using non-native plants that look nice, but added little to the ecological value of the region (Schaefer et al., 2004, p.18)." We can see how this sort of 'commodification of nature' mentality was applied in the con-

struction / creation of the pond feature now present at the location. However, at the same time, there has been effort to include native plants in the vegetation, thought due to the rabbits, these plants have failed. This inclusion of native plants exemplifies a more recent approach to urban landscaping which is more of an ecological style, sometimes called naturescaping or wildscaping. In this approach "features of natural local environments are used, and the natural elements are allowed to function with very little maintenance (Schaefer et al., 2004, p.18)."

The ecological reference for the pond is a small freshwater marsh, bog, or wetland ecosystem. These areas usually have saturated soils, and are inhabited by hydrophilic plants and microorganisms (CRD, n.d.). Wetland ecosystems tend to exhibit high degrees of biodiversity, and are arguably the most biologically productive ecosystems in the world. As such wetlands are disproportionately important for the conservation of many flora and fauna species (Endangered Ecosystems Fund, n.d.). Healthy wetlands also provide many kinds of important ecosystem services including water purification; flood regulation; carbon storage; food and recreation opportunities; and the provisioning of an aesthetically pleasing space (Habitat Aquisition Trust, 2006). Unfortunately, a considerable amount of British Columbia's native wetlands have been lost in the past 100 years. According to Natural Resources Canada, 80-98% of wetlands adjacent to urban centres have been drained, filled or otherwise lost and 70% of pacific estuary marshes have been lost or degraded (NRCan, n.d.). Drainage for agricultural purposes has historically had the greatest impact on wetlands, but urban growth, industrial expansion, hydro-electric development and recreation have also had significant impacts on British Columbia’s wetlands (NRCan, n.d.).

Problem Identification

Overview

There is a lack of student, faculty, staff, and community engagement with this place. The area was originally intended as an aesthetically pleasing backdrop, rather than a place for people to interact with. As the site falls into a state of disrepair, few people seem to notice or care. The rabbits, algae, and lack of a functioning ecosystem are concerning, yet we feel the underlying problem stems from a paucity of socio-cultural engagement with this site. Ironically, the lack of engagement was inherent in the design process: the current construction of the pond comes from a technological worldview, and was designed by professionals rather than through community participation. We will try to remedy this situation through conscious attention to improving both ecology and social-cultural engagement with the site.

Figure 3 - Some examples of problems at the site: invasive species, garbage, algae, rabbits (from left to right).

The Pond

The lack of biodiversity and a functional ecosystem presents problems for the cycling of nutrients within the pond. As a result, excess nutrients continue to build up and are now being colonized by the growth of algal blooms. These algal blooms are aesthetically unpleasant and ecologically unproductive. The pond also lacks soil or any other effective substrate for plants to grow in. Thus restoration requires pushing the system over an abiotic barrier, which often requires great expense and effort (see Figure 5). The cement lining of the pond establishes a second abiotic barrier; the pond may be subject to eutrophication and any plants may suffocate over time without proper monitoring and adaptive management. The stagnant waters of the pond also provide an excellent breeding ground for many insects, such as mosquitoes, which

blow into the building through the ventilation systems. Finally, the reflection pond is ahistorical and acontextual as currently constructed, and the production of this space has been separated from the people who live, work, and study in it.

Terrestrial Space

One of the biggest problems impeding the restoration of this site is herbivory and the hyper-abundance of rabbits. In order to restore this system careful planning needs to address this issue. The rabbits on this campus are an invasive, non-native species that destroy much plant life, including trees by eating bark around the bottom of trunks. Native species of berries have been planted on the project site during previous attempts to landscape the area, and each time they were destroyed. There are also several rabbit holes present.

The slope in the landscape has many problems associated with it, including soil erosion, low water infiltration rate, difficulties in maintenance, and there can be an accumulation of not only biomass but also garbage from nearby human disturbances. These problems are compounded by the persistent rabbits, which have succeeded in eating this slope bare leaving only exposed soil.

There has been an ongoing discussion on campus to determine how to handle the overabundant rabbit population, including the formation of a Rabbit Committee. In September 2008, an initiative was put into place to advise people not to feed and handle to rabbits, but this initiative has failed to be effective. Nonetheless, a sign in the area asking people not to feed the rabbits could be helpful. While a cull or other wide scale population management tactics must be considered, these decisions are being discussed and are beyond the scope of this project. In the absence of campus-wide pest control to manage the ever-expanding rabbit population, fencing or other methods must be considered for this area.

Policy, Goals & Objectives

The University of Victoria's Community Green Map describes this water pond as a "great new study area and meeting place." The Grounds department of Facilities Management has this goal stated on their website: "Our aim is to maintain the University grounds and to showcase these grounds as a desirable place for students, staff, and the community to study, work, and play." The goals and objectives of this project reflect these intentions while keeping in mind the important interactions between the culture and ecology of this space.

Policy

Acknowledging the past historical ecosystem and its current limiting conditions (patchiness of site, fragmentation, and severe impacts from rabbits and a pond designed without ecological or socio-cultural considerations) this restoration project aims to revitalize the library in ways that will boost the social, cultural, and ecological integrity of the area. We believe this can be a place for a diverse ecosystem and a positive community space.

Goal 1 : Increasing social engagement with this space.

Goal Statement: Social engagement with a place is a good indicator of the likely success of an ecological restoration project (Parks Canada, 2008). Successful ecological restoration should help connect communities to a place, and should emphasize the importance of historical human interventions in maintaining the health and integrity of ecosystems. Those who participate in the co-creation of this space (by working *with* nature) are likely to be concerned about its state of health in the future. Participation helps to build a concerned constituency that can advocate on behalf of the ecosystem's health.

Some critics have asked pointed questions about the efficacy of ecological restoration and the ethical issues this raises (Hall, 2005). After all, nature would restore itself if only we left it alone and stopped inflicting so much damage, would it not? To this we answer yes, nature would heal itself, but over a long period of time. Moreover, many studies show that human interventions in

ecosystems can be beneficial to maintaining ecological resilience and productivity (Benayas et al., 2009). This goal is not about establishing arrogant human dominance over nature, as some have argued (Hall, 2005). Rather it is about supporting human connectedness with a place. In order to build participation and measure our success, we will strive to meet the following objectives:

- Integrate the site into relevant classes (Geography, Environmental Studies, Ecological Restoration, and Biology)
- Create materials for educational purposes
- Create signs speaking to ecosystem services of the pond and the importance of human activities in maintaining these services
- Improve aesthetics and recreational opportunities
- Create artistic design on stairs recognizing the important symbolic art of indigenous peoples in this area.

Goal 2: Honoring Indigenous territory and historical practices in maintaining ecological resilience.

Goal Statement: Historical practices, grounded in Traditional Ecological Knowledge and Wisdom (TEKW), have played important functional roles in maintaining the integrity of ecosystems (Turner et al., 2000). Human interventions in many (if not all) ecosystems have supported ecological resilience, as well as the reduction of undesirable plants and other species (SER, 2004). We acknowledge the importance of these historical practices, and will measure the success of this project by striving to meeting the following objectives:

- Recognizing and drawing attention to the ecological function of historical practices through signage and educational materials.
- Plant native vegetation that have played an important role in First Nations diet, ceremony, and culture.
- Create artistic designs on the stairs recognizing the important symbolic art of indigenous peoples in this area.

- Produce educational materials and signs which speak to the importance of native plants in First Nations culture, such as traditional harvesting methods.

The presence of edible plants in this library landscape will emphasize the importance of First Nations people and their past and present role in harvesting these resources. The edible plants establish Traditional Ecological Knowledge on campus and will support the growth of wild foods in a sustainable manner.

Goal 3: To increase ecological integrity of the space.

Goal Statement: We recognize that the ecological system needs to self-organizing, resilient, and needs as many species representative of a native wetland as is possible within the confines of the space. To be resilient, the ecosystem requires many functional ecosystem. We recognize that turning the pond back into a 'natural' wetland, with all species characteristic of the reference, is impossible given the limitations of the space, the fragmentation of the system, and the severe impacts through the creation of the original pond. Nevertheless, we will try to create a system that will be able to cycle nutrients, build and stabilize soil, oxygenate water so that it stays clear, and maintain ecological resilience during varying climatic periods. We will measure the success of our project by meeting the following objectives:

- Increasing the number of functional species in both the pond and terrestrial areas.
- Increasing biodiversity
- Increasing habitat for local native fauna
- Reducing nutrien runoff from the slope

Goal 4: To remove rabbits from area.

Goal Statement: We recognize the overabundance of rabbits as detrimental to the system. As long as rabbits continue to feast on plants and dig holes at their roots, successful restoration of this site will not be possible. Therefore, methods of controlling rabbits on this site will be necessary. The methods of control must be evaluated for successes and failures, and appropriate

amendments must be made to ensure effective control. Successful rabbit control will be measured by meeting the following objectives:

- Increased plant health (eg. bigger plants, longer life spans, and more foliage)
- Increased plant abundance
- Decrease in number of rabbit holes and feces, indicating decrease in rabbit presence
- Ensuring rabbits are not entering fenced-off areas

Goal 5: Revitalizing aesthetics by improving green spaces, including the pond

Goal Statement: Despite the artificial nature of the pond, an aquatic habitat has been created and now gives several opportunities for biodiversity and aesthetic enhancement. We recognize the important impacts that green spaces have on the quality of our lives as measured by criteria such as levels of stress, ability to focus, happiness and life satisfaction, and opportunities for encountering and engaging with nature (Louv, 2006). Improvements to the aesthetics of the space will be measured by the following objectives:

- Protect property from flooding and erosion
- Reduce algae
- Improve aesthetics and recreational opportunities
- Create habitat for ducks and other water-inclined species

Project Design

Terrestrial Restoration

According to Parks Canada's *Principles and Guidelines For Ecological Restoration* (2006), a detailed restoration plan includes definition of the scope of the project. There are longer-term goals for this site, including increasing biodiversity and creating habitat, and this plan is intended to remain adaptable and dynamic with respect to meeting those goals. Currently, for the terrestrial area of this site, it seems imperative that 1) the slope is stabilized and 2) the rabbits are controlled. Rabbits need to be controlled so that plants can become established, which will stabilize the slope. Once these two things are achieved, there will be more room for achieving further goals.

Native Plants and Slope Stabilization

Planting on the slope and stabilizing the soil benefits both the land and water features of this site. As the soil is mainly bare, water runoff from the slope deposits nutrients from the soil into the pond. Erosion could easily occur, washing away the soil. To prevent these potential problems, a wide variety of native plants that are suitable for the conditions can be planted to stabilize the soil. We have chosen plants that bare fruit, in effort to recognize traditional food sources in Coastal Douglas Fir ecosystems. These plants should be inter-planted which confuses and deters pests, among other ecological benefits.

Before planting, which will occur around May according to our time-line, mulch will be added to the soil. This sheet mulching technique involves layering different nutrient-rich substances to improve soil structure, and to add more organic matter which is rich in nitrogen and carbon. The first layer is nitrogen-rich used coffee grounds, available to be collected for free from coffee shops on campus. Second is a generous layer of leaf litter, followed by a couple inches of compost, and both of these things are available for free from Facilities Management and the Campus Community Garden.

Native Plants

The following list describes the plant species we have decided to plant in this area and offers a description of some characteristics. We have chosen plants that bare fruit, in effort to recognize traditional food sources in Coastal Douglas Fir ecosystems.

- Coastal Strawberry (*Fragaria chiloensis*): This is a perrenial herb that can grow up to 25 cm in height. The white flowers bloom in the summer and develop into small red edible berries which can be food for birds and mammals. It thrives in dry to moist soil which would be appropriate closer to the top of the slope on our landscape.

- Saskatoon Berry (*Amelanchier alnifolia*): This is a deciduous shrub that grows up to 8m in height. The fruit is a small purple pome that ripens in the early summer. It grows in full sun and deep, well-drained soil. It should be planted in an area with deeper soil.

- Salal (*Gaultheria shallon*): This evergreen plant is a dense and aggressive spreading plant that can grow up to 4 m in height. It produces a black, reddish-blue or dark purple berry that is 6-10 mm. long and somewhat hairy. It needs a well-drained, acid soil to flourish. It is food for birds, attracts hummingbirds, butterfly larval plant, food for mammals, and is known to be deer resistant.

- Thimbleberry (*Rubus parviflorus*): This shrub blooms in the spring and can provide an edible tart fruit food for birds and food for mammals in the late summer. It reaches 3m in height. It thrives in moist soil and with sun to partial shade. Thimbleberry also makes great jam!

- Oregon Grape (*Mahonia aquifolium*): This is an evergreen plant that can grow up to 1-1.5 m in height. It blooms in late spring. It grows in sun to semi-shade and likes well-drained soil. It produces a purple edible berry.

Planting Design

When deciding how to arrange the planting of different species, we decided to combine methods of traditional gardening where each species is planted in it's own specific area, with a more wildscaping approach where the plants are dispersed randomly. As shown in Figure 4, although each plant species is located primarily in one area, these areas overlap, creating a more dynamic landscape design. We decided to take this approach because it would be conducive to monitoring and signage, yet still remain true to natural design.

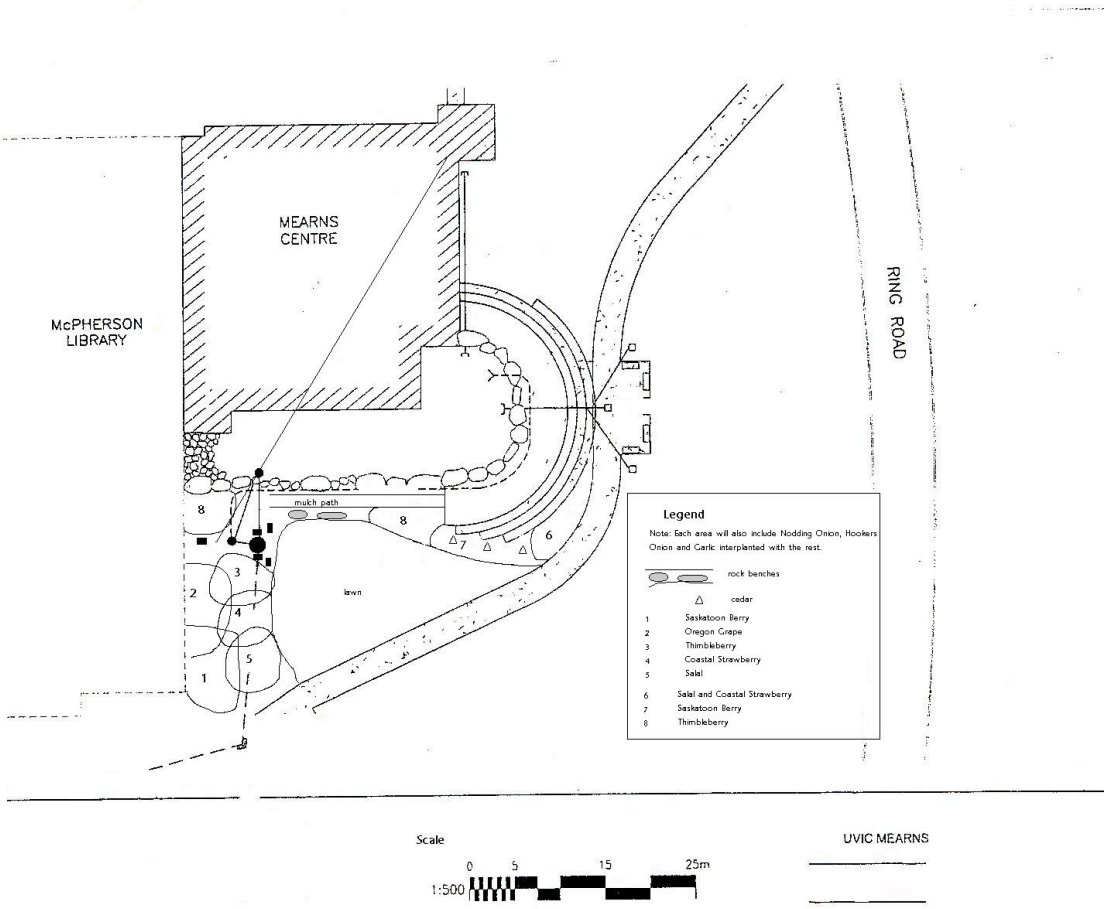


Figure 4 - Site design for terrestrial spaces.

Slope

The slope is a point of connection between the interrelated terrestrial and aquatic systems (see Appendix A). Water runoff from the slope deposits nutrients from the soil into the pond, as there is currently a lack of plants on this slope. Erosion could easily occur, washing away the soil. To prevent these potential problems, a wide variety of native plants that are suitable for the conditions can be planted to stabilize the soil. These plants should be inter-planted which confuses and deters pests. Organic materials can be added to improve the soils by adding structure and nutrition as well as balancing the soil pH. Implementing rocks and paths can direct the water flow so water logging does not occur.

Rabbit Control Methods

For controlling rabbits, fencing is expensive and not necessarily effective. Most fences are not aesthetically pleasing for the social atmosphere we are trying to create. Rather than fencing in the whole area, which excludes people as well, chicken wire fencing will be installed around various plots with a path created between them. The fencing is primarily to keep rabbits away from young plants, and may potentially be removed in the future when the system is better established as seen fit by monitoring and evaluation.

Other methods of controlling rabbits include unpleasant scents, either by spraying something on the plants or by planting rabbit-repelling plants. There are several chemical sprays available including coyote urine, as well as other methods such as sprinkling cayenne or limestone on the wet leaves of plants. While the sprays may or may not work, many of them need to be reapplied after rainfall which makes this option expensive and impractical. Also, because of the extent of the rabbit problem at UVic, many effective tactics recommended by gardeners with a small-scale rabbit problem may be less effective here. A second smell-based tactic is inter-planting onions and garlic within the garden. Rabbits are repelled by the Allium family. Two native wild onions include “Hooker’s onion” or “tapertip onion” (Allium acuminatum) and “Nodding onion” (Allium cernuum), and these will be planted within plots as well as outside the fencing.

Other deterrents for rabbits include decoys of predators. There has been consideration for creating habitat for predators, but for an area of such small size and so close to human activity this did not seem a viable option so a decoy hawk was chosen instead. Potentially the increase of human social activities at this site may discourage rabbit activity, but it may also attract rabbits who expect to be fed. For this reason, the signs on site should include a brief explanation of restoration efforts and the correlation to feeding the rabbits.

In the future, an extension of this project should be considered to remove the lawn area of the site to replace non-native grass species. Lawn removal, along with increased social activity in the area and the other rabbit control methods mentioned above, may help discourage rabbits from ravaging the area.

For now, this proposal includes areas to be fenced off. To install the chicken wire fencing, first a trench about 6 inches deep and 8 inches wide will be dug around the areas to be planted. The chicken wire is 36 inches wide and will be cut to necessary length. 3-foot long rebar stakes will be put in the trenches, and the bottom 6 inches of the chicken wire should be folded out into an L shape and buried to discourage burrowing by rabbits. The chicken wire will be tied to each stake.

Pond Restoration

Reducing algae

Approaches to addressing algae growth generally fall into two categories: chemical and biological. Chemical approaches include the use of a copper ion exchange unit, which would poison the water and make it uninhabitable to plant and bacteria growth (Personal communication with Gordon Brock). While this would effectively improve the aesthetic quality of the pond, it would not increase biodiversity or social engagement with the area, which are both integral to

our policy and goals. Another tactic is to use a UV filter, which would help break down any biological growth in the pond including algae (Personal communication with Gordon Brock). Again, while this approach would improve the aesthetics of the water, it would not increase biodiversity or social engagement. A third option is to use an organic product called 'microbe-lift', which is a bacterium that would quickly eat up excess nutrients and out-compete the algae. The use of 'microbe-lift' does not in any way conflict with the goals of increasing biodiversity and social engagement. In fact, the bacterium in microbe-lift helps plants to grow and could be used as a site preparation for ecological restoration of the pond. This product is currently being used by Dockside Green, a LEED platinum certified building complex which is experiencing a very similar problem in their ponds. 'Microbe-lift' would need to be used every spring when the algae has a chance to take up the nutrients faster than the plants, which are just coming out of winter hibernation. It would be used every week, for one month, until the plants were able to start cycling nutrients at a faster rate.

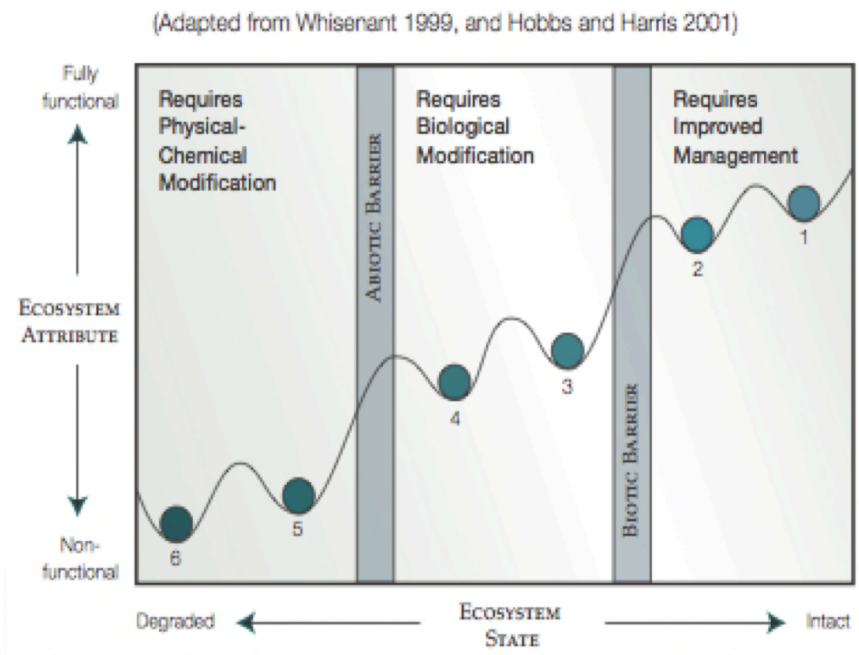


Figure 5 - Conceptual model for ecosystem degradation and restoration.

Establishing a growth medium for plants

Because there is no soil in the pond, we need to establish some sort of substrate for the plants to grow in. This means we need to push the system beyond its abiotic barrier to restoration (see Figure 5). Through consultation with local experts (John Satchwell from Applied Aquatics), we discovered that no special soil would be necessary for this pond. Leaf litter, along with gravel to weigh it down, would likely work very well. The plants should be able to pull nutrients out of the water, and the rocks and leaf litter should provide a space for plants to set down their roots. Soil should increasingly build up over time through processes of ecological succession - birth,

death, decomposition and release of nutrients back into the water. This may eventually present a problem in terms of soil build up, and the pond may need to be dredged every few years.

Increasing biodiversity

Many of the plants we would use in designing the pond restoration are bog and marsh plants which like water and are able to oxygenate the water to keep it clean, such as common cattails, hard-stemmed bulrushes, swamp lanterns, bur-reeds, parrot feather. While the different species have different qualities and ecological functions, we are unsure how these species will assemble into a sustainable and resilient community, and how this community will function ecologically. According to Thompson & Starzomski's (2007) 'Biodiversity & Ecological Function model,' it is very difficult to discern which plant species would be most useful in establishing ecological function and increasing ecological resilience. The Drivers and Passengers Hypothesis states that some species are more responsible for ecological function than others. The trouble is we do not know which species will likely provide more ecological function in the pond. The Portfolio Hypothesis states that some species become more important than others in different times and stages of ecological succession, and under varying climatic and environmental conditions. Further research needs to be taken into the ecological function of species, especially in terms of oxygenatation of the pond. We are concerned about eutrophication and the suffocation of plants, that is, the sustainability of the system over time. It should be noted that because the glass wall of the Mearn's centre reflects sunlight into the pond, the pond gets very warm and this speeds up anaerobic processes. Without an oxygen pump, bacteria and plants will likely suffocate over time. This points to another major abiotic barrier which will take careful planning to successfully address (see Figure 5). We could use an oxygen pump in conjunction with plants that oxygenate the soil and water.

Pond Plants

In order to meet the goals and objectives of the project, we created a planting program selecting species that provide the most overall benefit to the site. 8 species were chosen on their individual merits. Wapato or the broadleaf arrowhead (*Sagittaria latifolia*) is a semi-aquatic tuberous perennial with a height of 20-90 cm tall. It requires a wet environment with an exposure of sun

to partial shade, and spreads easily in saturated soils. This plant produces beautiful white flowers and arrowhead shaped leaves. It also produces edible tubers that were widely used by the Indigenous peoples of North America (Garden Guides, n.d.). Hard-stemmed bulrush (*Scirpus acutus*) is a deciduous and grass-like plant. It can reach a height of 9 ft., requires a wet environment with sun exposure, and spreads through its rhizomes. This tall bulrush has tough, round stems and works well along lakes and marshes. Aboriginal peoples have used the roots, pollen, and flowering spikes as food, and the plant's stems were used to construct

baskets, mats, temporary shelters, and other household items. This plant also provides food, cover, and nesting habitat for waterfowl and other birds. Moreover, this plant is currently used to treat contaminated water (Washington State, n.d.). Common cattail (*Typha latifolia*) is a semi-aquatic perennial that grows to a height of 1-3m, and requires sun to partial shade. They can outcompete other natives so careful management and regular monitoring is essential. This plant can perform important functions that keep an ecosystem healthy including water purification, which reduces nutrients as well as any mud entering from the surrounding area. Indigenous peoples have used this plant for centuries, and many parts are edible. The roots are quite nutritious, containing more starch than potatoes and more protein than rice. The young shoots are reported to be tasty as cooked vegetables, and the pollen can be used in baked goods. In addition to food, cattails have also provided people with building materials and have been used for their medicinal properties (Washington State,n.d.). Slough sedge (*Carex obnupta*) is an evergreen and grass-like plant. It can reach a height of 3 ft. in moist wet environments and requires sun to partial shade. It spreads readily and thus requires diligent monitoring and management. This plant provides food and shelter for a large variety of waterfowl, and is still used by Aboriginal peoples for basket weaving (Garden Guides, n.d.). Western skunk cabbage (*Lysichiton americanus*) is a hardy plant with a skunk-like odour, which attracts pollinators. It requires full sun to partial shade with moist and boggy soil type, and can grow to more than a metre in height with a bright yellow flower and oval green leaves that reach about 75 cm wide. The leaves and roots are edible and have been used as a food source by the Northwest Coast peoples; particular processing methods like steaming and roasting eliminate the slightly bitter, acrid taste (E-Flora BC, n.d.). Henderson's checker-mallow (*Sidalcea hendersonii*) is a perennial groundcover with a height of 5 ft. It grows well in moist to wet soils and requires sun. It has a beautiful bloom of

purple or pink flowers all summer (E-flora BC, n.d.). Parrots feather (*Myriophyllum aquaticum*) is a bright perennial freshwater herb and has stems that can grow from 20 to 60 inches long. It adapts to high nutrient environments, thrives in good light, and prefers a slightly alkaline environment. Its textured foliage helps provide shade for the pond, smaller plants, and insects. It exhibits two different leaf forms depending on whether it is growing as a submerged plant or as an emergent.

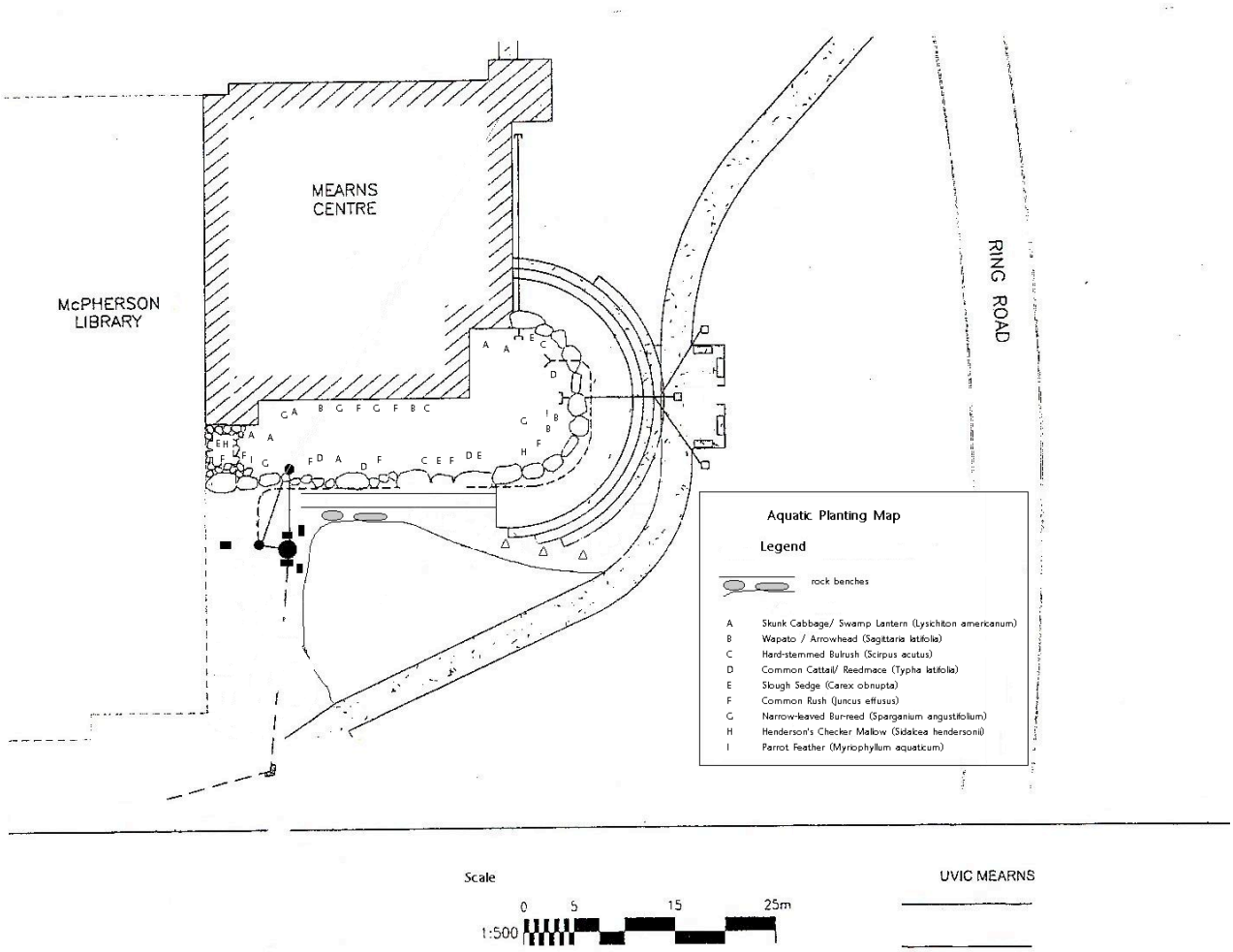


Figure 6 - Planting design for pond plants.

Cultural / Social Restoration

Creating a Community Space

In an effort to invite people to connect with each other, there is a path leading along the bottom of the slope and a bench at the water's edge (see Figure 4). The bench is a big rock, in the style of those at the Social Science and Math building, and the path is laid out with mulch, which is available on campus from Facilities Management. The concrete stairs will be painted by local artists in a native-inspired design, and there are already four benches at the top.

There will be educational signs posted at the library restoration site. A sign will identify each plant on both land and water, and there will another sign which includes brief description of the restoration project, including both land and water aspects. The signs will also ask people not to feed the rabbits.

All aspects of this project will be openly available in the Environmental Studies Common Room, and this will also be made known on the signs.

Engaging Students

In effort to engage students with the site we would have as much opportunity for involvement as possible. We want people to connect with this place through restoration, education and community. This site is situated at a central location on campus, and an excellent opportunity to engage students, staff, faculty and community members in the focal practice of restoration (Higgs, 2003). In this way, rather than a more technological restoration activity, we introduce the possibility of students making a real connection with their campus space, and taking responsibility for it's future direction.

The initial planting taking place at this site will be done entirely by volunteers over the course of four days spread out over one month. While planting, students will be taking time to do something they feel good about, and to connect with the land in a way that is unavailable to many students caught up in a world of projects and computers. Students then have an opportunity to become actively engaged and grounded in the physical place of their surrounding campus.

Reviving Indigenous Location

The plants that have been chosen have played significant roles in the area's traditional cultures. The terrestrial fruit-bearing plants are all edible, and so are the wild onions but they were less commonly eaten. The aquatic plants served a variety of purposes, for example Slough Sedge is a popular basket material and Cattails provide stuffing for pillows, bedding, insulation, and a variety of other uses. Tubers from Wapato were very important food source for the Chinook of lower Columbia, and leaves from Skunk Cabbage were dubbed "Indian wax paper" because of their common use as lining for berry baskets and steaming pits (Pojar and Mackinnon, 1994).

(Image from Alcheringa Gallery)

Traditional wisdom and knowledge of these plants is disappearing, and every effort to revive them is significant.The informational signs will focus on indigenous culture and the significance of these plants and their associate practices in this area.

The stairs will also be painted with native-inspired artwork. Students and other local artists will work towards an appropriate design.

Ecocultural restoration

We need to work towards a model of restoration that includes human beings and the ecological function of historical practices. We need to move beyond a strict dualism between culture and nature, which tends to rank culture as more important than nature and thus makes it terribly

difficult to create conditions of reciprocity and respect (Higgs, 2003). "The divide between nature and culture in contemporary Western cultures is deep and wide" (Higgs, 2003, p. 240). Restoration pushes against this division "by implicating human practice and participation inside ecological processes. A restored ecosystem is usually hard to separate from the human participation that went into its making. If ecological restoration exists only to perpetuate the separate estates of nature and culture, it will not break the pattern. What is inspiring about restoration is that it *does* change the pattern under the right conditions" (Higgs, 2003, p. 240).

Implementation and Management

Timeline - Short Term

Fall semester:

Communicate with all stakeholders and obtain all necessary permissions to move ahead with the restoration project. Build interest by communicating with faculty, staff, students, and interested community members. Keep them informed and get them involved during the actual restoration.

Within the semester, a budget must be secured either by applying for University funding or by fundraising.

This will include outreach to increase public interest and connecting with other groups on campus to get more involvement and volunteers. Outreach includes creating posters, building connections with clubs and course unions, setting up an information board in library, using social media to connect with students, staff, faculty, and the local community, and giving presentations in classes.

Beginning of Second Semester:

Acquire all necessary materials (see Budget). At this point, a team will be working towards creating effective signage for the site which will include information about restoration, about this project specifically, about the various plant species, and about the rabbit problem. These signs will be displayed around the site for educational purposes and to gain further community support.

March to April:

Prepare the site for restoration. In the pond, preparation includes reducing algae growth through weekly application of 'microbe lift' for one month in late winter. On the ground, it will include mulching the soil to increase organic matter in the soil and improve soil structure.

During this time, the pump in the pond will be replaced to a solid handling pump and a skimmer box should be added to filter leafy debris. When the microbe lift treatment is complete,

soil will be built in the pond by adding mulch and leaf litter into the pond until it is six inches thick all around. Two inches of loose gravel should be added to weigh down the mulch and leaf litter.

May:

The initial planting should take place around May. A series of weekly volunteer days will be organized to engage students, staff, faculty and community members.

In the pond, plants should be added carefully into the water keeping in mind the sun and shade patterns. On the ground, each area of planting must be accompanied by the immediate installation of a chicken wire fence (as described above in Project Design section).

According to Facilities Management (personal correspondence), an area of land this size would take approximately two days with three people planting all day. At 10 hours a day, this would equal approximately 60 working hours. Including the fencing, path-building and aquatic aspects to this estimate, the volunteer days may need to cover 100 hours of work. With four weekly volunteer days spread out over one month and ten volunteers at each one, this would be 2.5 hours per person per day, which is completely achievable, especially if the goals for community engagement are realized.

Timeline - Long Term

Continued maintenance and evaluation must be undertaken in the months and years following the initial implementation of this project.

One way in which this plan continually engages staff and students is by incorporating the site into courses from various departments, including Biology, Geography, Environmental Studies and Ecological Restoration. These classes can all use this site as an example of innovative cultural and ecological reclamation of a technologically driven disaster.

Community involvement can be maintained through future volunteer days and social gatherings planned around this space. The walking path will encourage more visitors to the site, who will hopefully read the signage and learn about the plants and the restoration of a system.

Evaluation should take place by way of the student survey (Appendix C) as well as completing the checklist provided in the "Monitoring and Evaluation" section of this paper. Volunteers and classes should complete these at least twice a year.

Budget

Short Term Budget:

Terrestrial Plants	Cost	Size	Qty.	Total Costs
Hooker's Onion	$2.75	1 gallon pot	7	$19.25
Nodding Onion	$5.00	1 gallon pot	9	$45.00
Garlic	$2.00	large bulb	10	$20.00
Coastal Strawberry	$1.50	4 inch pot	6	$9.00
Salal	$4.00	10 cm pot	8	$32.00
Oregon Grape	$17.00	1 gallon pot	6	$102.00
Saskatoon Berry	$10.00	1 gallon pot	8	$80.00
Thimbleberry	$4.00	1 gallon pot	6	$24
Rabbit Proof Materials				
Chicken Wire	$15.49	36'x25' roll	4	$61.96
Rebar	$1.49	3 feet	12	$17.88
Decoy Hawk			1	$17.00
Pond Plants				
Skunk Cabbage	$6.00	1 gallon pot	6	$36.00
Wapato, Arrowhead	$2.15	10 cm pot	7	$15.05
Hard-stemmed Bulrush	$2.15	10 cm pot	8	$17.20
Common Cattail	$2.15	10 cm pot	8	$17.20
Slough Sedge	$4.50	10 cm pot	6	$27.00
Common Rush	$2.15	10 cm pot	5	$10.75
Narrow-leaved Bur-reed	$4.50	1 gallon pot	7	$31.50
Henderson's Checker-mallow	$2.75	10 cm pot	5	$13.75
Parrots Feather	$17.96	5 bunches	7	$125.72
Pond Materials				
Microbe Lift	$79.98	6 lbs.	2	$159.96
Solid Handling Pump	$300.00		1	$300.00
Miscellaneous				
Promotional Materials				$20.00
Sign Materials				$40.00
			GRAND TOTAL:	$910.97

Long Term Budget:

This includes the help of facilities management with seasonal maintenance with their assigned salary. We would also like to incorporate volunteer work from the students and community who will combine their efforts with facilities management with the manual labour in the initial planting and for the future.

Monitoring and Evaluation

Frequent monitoring of the restoration site is an important part of the restoration process. Monitoring evaluates whether or not the goals and objectives were accomplished (SER, 2004). Frequent monitoring also supports the identification of problems as they arise, and quick adjustments can be made to help solve these. Ecological restoration is largely an iterative process: frequent monitoring and making adjustments should be expected.

Survey

Monitoring the success of the library site restoration will be done through a combination of qualitative and quantitative methods. The site will be monitored by future ES 240 and 341 classes as a method of learning how to measure success of public landscape restoration projects that integrate social, cultural, and ecological values. One of the major ways of measuring the social and cultural success of the project will be from surveying people's thoughts on the uses of the site before and at seasonal intervals after the completion of the project (see Appendix C). The results of the surveys will be stored in a public file cabinet in the Environmental Studies commons room, so everyone can have access to the results over the years. This cabinet will contain blank copies of the survey so that students can easily make copies and perform the survey at their convenience. This cabinet will also contain a few copies of the full restoration plan, so that future students can know the intention and thought process of the project, and can be free to adapt the monitoring and evaluation processes if they feel it is necessary. We believe that a successful restoration project is an adaptive and flexible one, especially when we are so focused on the public landscape setting in which the site is located.

Repeat Photography Inventory

One of the most effective ways in ecological restoration to monitor the changes and developments at a project site is by taking photographs from specific angles over spaced out time intervals. This allows for the people to see a visual representation of the changes, and is often the most resonating representation of success. We suggest that photographs be taken from the locations marked on Figure 6, every month for the first year, and then once or twice a term (de-

pending on student interest) in the following years. The reason for the high frequency of photographic recording for the first year is because the changes can occur very rapidly, and we want to be sure to monitor these changes with as much precision as possible. These photos should be printed and stored in the file cabinet along with the other monitoring data in the Environmental Studies commons room.

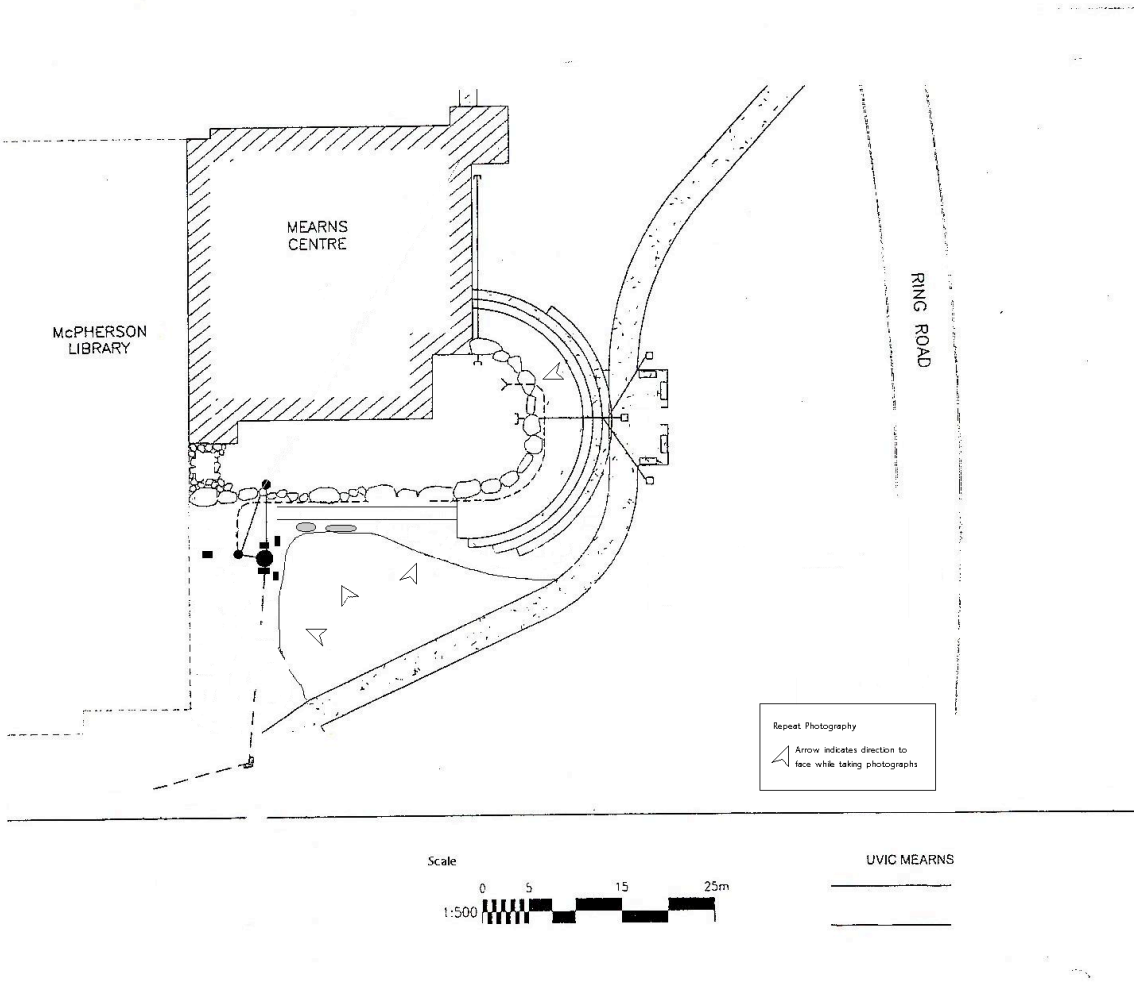


Figure 6 - Arrows mark the positions of where photos are to be taken from.

Invasive Species Removal

Monitoring regularly for invasive species would be most effective if done by facilities management. Since the area is so small, and is already monitored by facilities management for aesthetic purposes, it would not require very much additional effort to keep an eye out for invasives. If facilities management did happen to find an invasive problem on the site, it would be recommended that they contact students studying ecological restoration to help address the problem. In this way, the students could learn hands on experience in dealing with the monitoring and repairing of a restoration project, and it would also be less work for the folk at facilities management.

Monitoring Review List

This review list is designed to be an easy tool for monitoring the site.

	Poor	Good	Excellent
Native Plant Count On Land	[_____]		
Native Plant Count In Pond	[_____]		
Amount of Berries Produced	[_____]		
Pruning Completion	[_____]		
Maturation of Species	[_____]		
Soil Drainage	[_____]		
Soil Texture	[_____]		
Algea	[_____]		
Invasive Species Removal	[_____]		
Rabbit Remvoval	[_____]		
Human Disturbance	[_____]		

Monitoring Checklist

This checklist is designed to be an easy tool for monitoring the site.

1. Social Engagement	YES	NO
UVIC Student Involvement		
Public Volunteers		
Artistic Designs		
Sign Creation		
Public Gardening Programs		
2. Honouring Practices	YES	NO
Educational Materials		
Education Signs		
Native Vegetation		
3. Ecological Integrity	YES	NO
Species Present in Pond?		
Species Present on Land?		
Presence of Habitats		
4. Rabbit Removal	YES	NO
Rabbit Holes		
Grazing		
General Disturbance		
Fence Holes		
Rabbit Feces		

5. Water Feature	YES	NO
Drainage Problems		
Flooding		
Erosion		
Aesthetically Pleasing		
Evidence of Recreation		

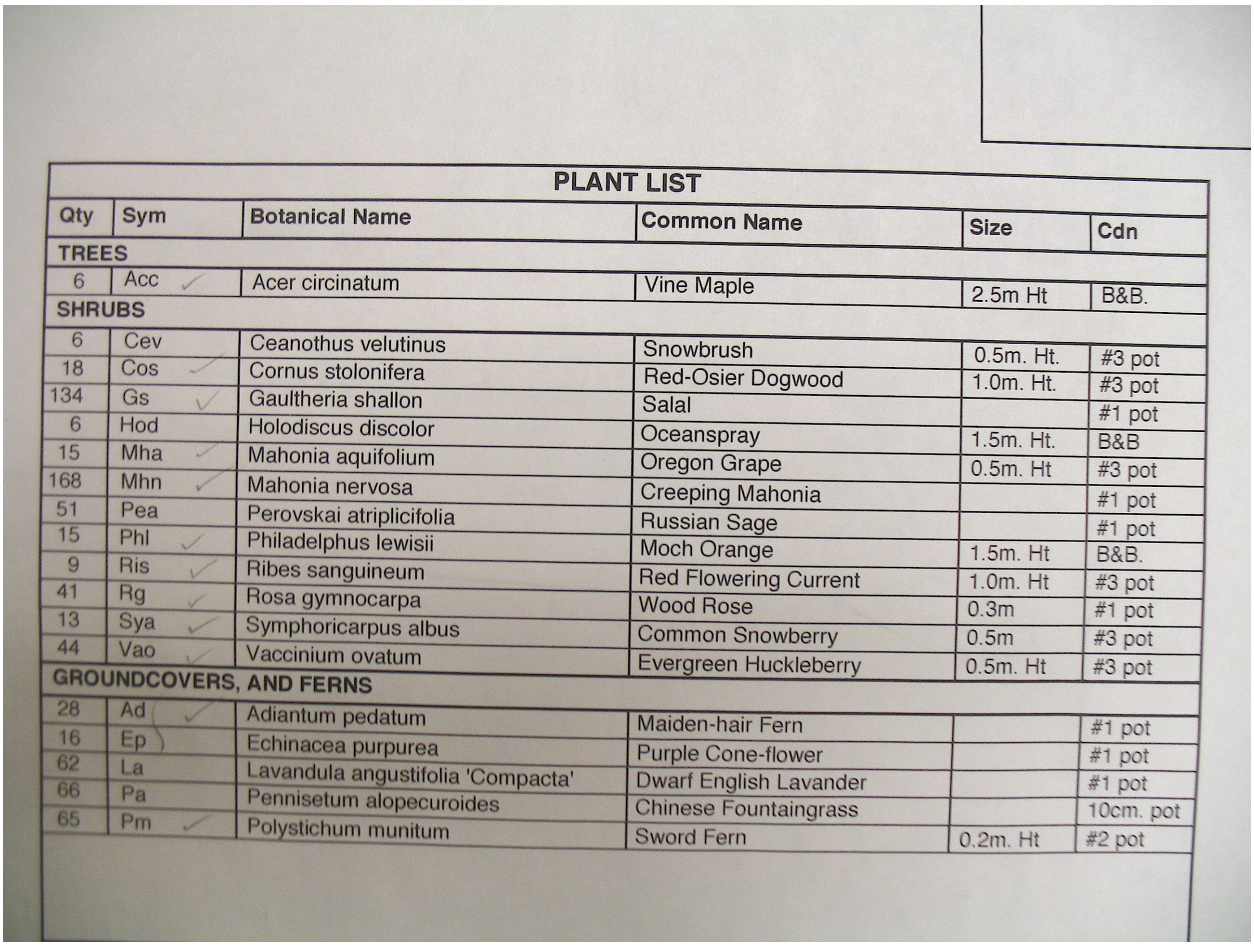
Conclusion

For the initial implementation of this project, sufficient monitoring and evaluation will be necessary to determine how successful this project has been at achieving the stated goals. When it is noticed that aspects of the plan are not effective, these should be amended appropriately. For example, it is unknown what combination of species and how many species are needed to rebuild an ecosystem and functions. More research should be done into interactions between species in similar systems, and what keystone species may be missing so a more resilient system can be achieved.

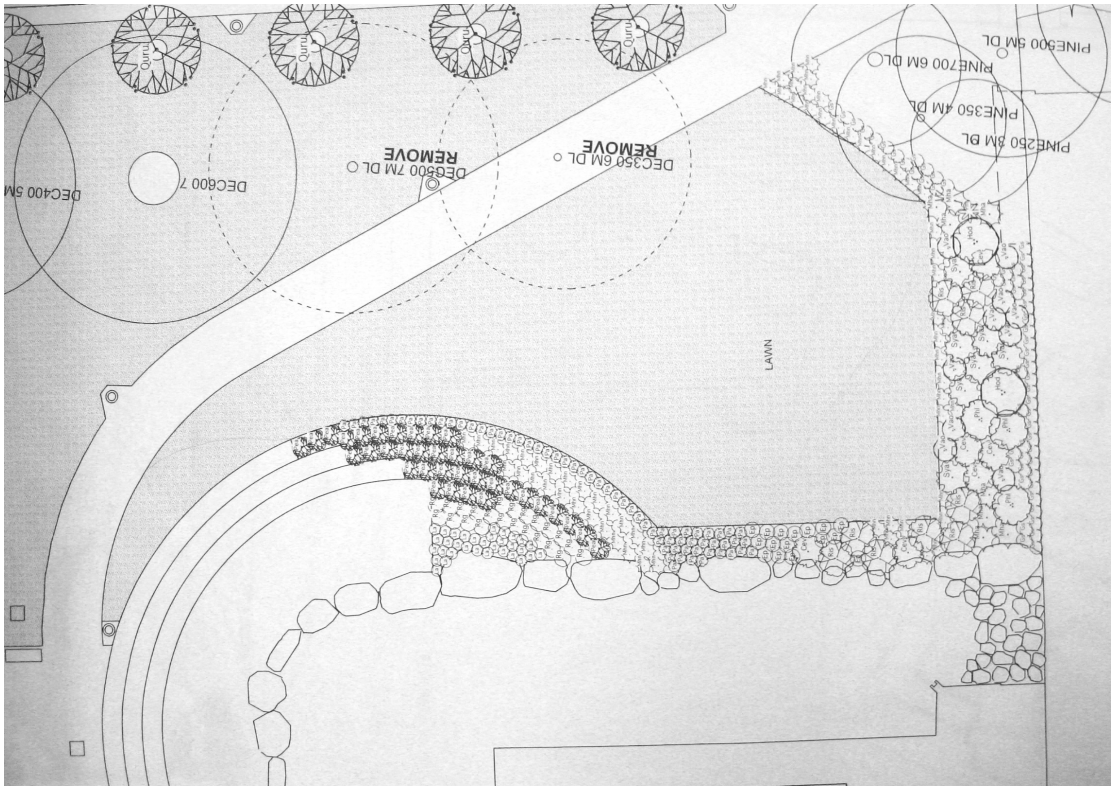
While all the stated goals are complementary and interrelated, building the community connections and support is absolutely necessary for the success of this project. A successful restoration project must be efficient, engaging and effective (Parks Canada, 2008). Building the connections between community and place will insure the place will be looked after.

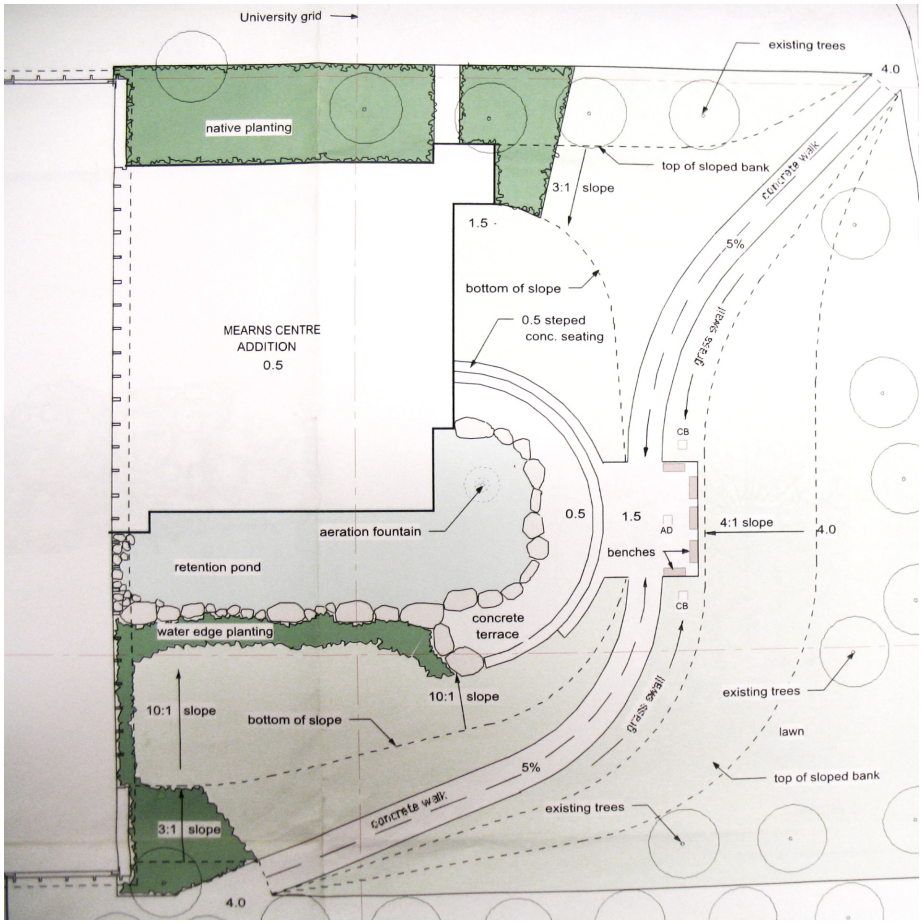
Appendix A - Original Plans for Site

The first image shows the list of plants intended for planting. The second image shows where these plants were intended to be planted. The third images shows the slopes, which affect hydrological drainage. Original site plans designed by Don Vaughn Architecture.

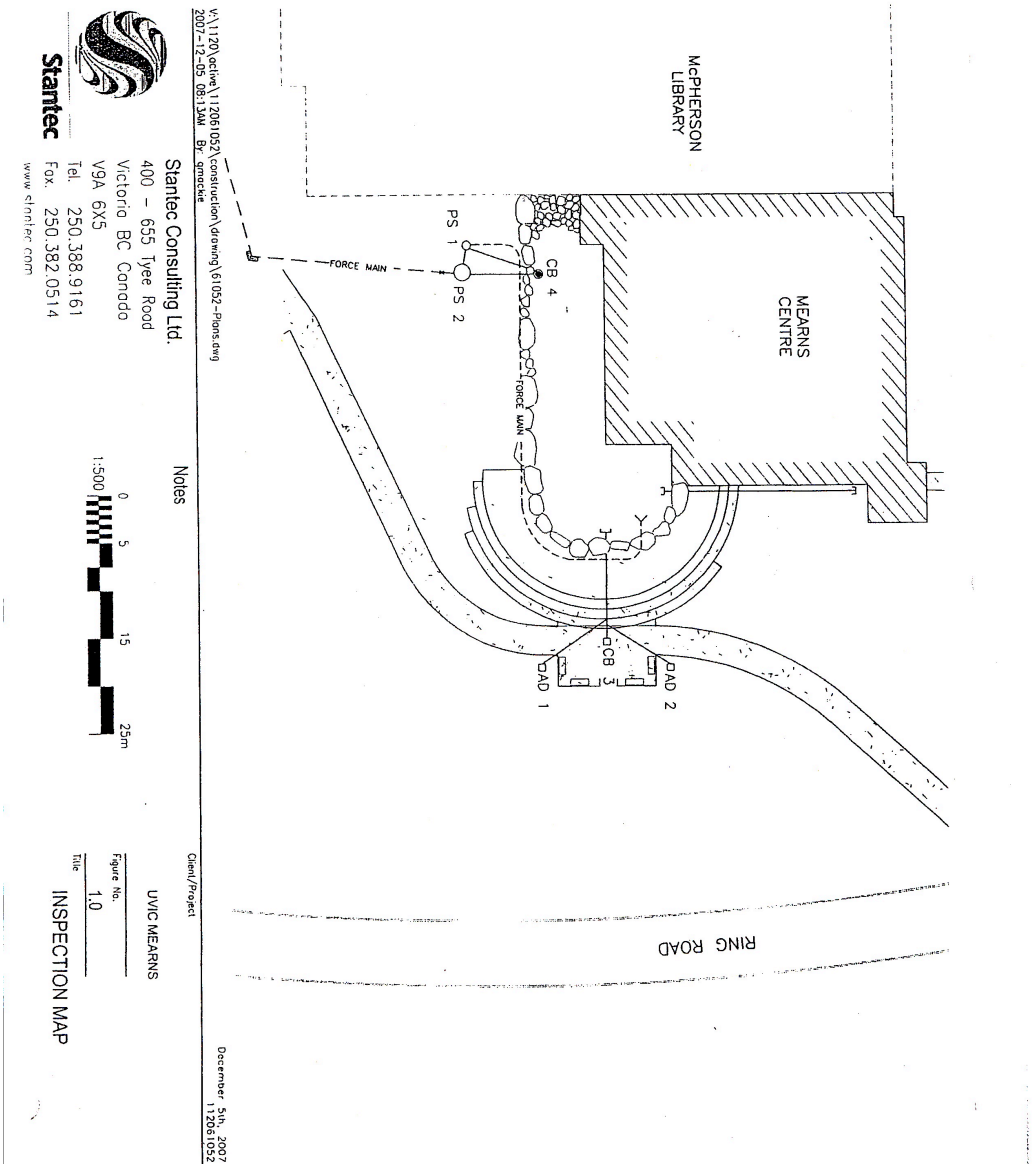


PLANT LIST					
Qty	Sym	Botanical Name	Common Name	Size	Cdn
TREES					
6	Acc	Acer circinatum	Vine Maple	2.5m Ht	B&B.
SHRUBS					
6	Cev	Ceanothus velutinus	Snowbrush	0.5m. Ht.	#3 pot
18	Cos	Cornus stolonifera	Red-Osier Dogwood	1.0m. Ht.	#3 pot
134	Gs	Gaultheria shallon	Salal		#1 pot
6	Hod	Holodiscus discolor	Oceanspray	1.5m. Ht.	B&B
15	Mha	Mahonia aquifolium	Oregon Grape	0.5m. Ht	#3 pot
168	Mhn	Mahonia nervosa	Creeping Mahonia		#1 pot
51	Pea	Perovskai atriplicifolia	Russian Sage		#1 pot
15	Phl	Philadelphus lewisii	Moch Orange	1.5m. Ht	B&B.
9	Ris	Ribes sanguineum	Red Flowering Current	1.0m. Ht	#3 pot
41	Rg	Rosa gymnocarpa	Wood Rose	0.3m	#1 pot
13	Sya	Symphoricarpus albus	Common Snowberry	0.5m	#3 pot
44	Vao	Vaccinium ovatum	Evergreen Huckleberry	0.5m. Ht	#3 pot
GROUNDCOVERS, AND FERNS					
28	Ad	Adiantum pedatum	Maiden-hair Fern		#1 pot
16	Ep	Echinacea purpurea	Purple Cone-flower		#1 pot
62	La	Lavandula angustifolia 'Compacta'	Dwarf English Lavander		#1 pot
66	Pa	Pennisetum alopecuroides	Chinese Fountaingrass		10cm. pot
65	Pm	Polystichum munitum	Sword Fern	0.2m. Ht	#2 pot


LAWN
REMOVE
REMOVE
DEC350 6M DL
DEC600 7M DL
DEC600 7
DEC400 5M
PINE250 5M DL
PINE350 4M DL
PINE700 6M DL
PINE500 5M DL
Quercus
Quercus
Quercus
Quercus


University grid
existing trees
4.0
native planting
top of sloped bank
concrete walk
3:1 slope
1.5
5%
bottom of slope
0.5 steped
conc. seating
grass swall
MEARNS CENTRE
ADDITION
0.5
CB
0.5
1.5
AD
4:1 slope
4.0
aeration fountain
benches
retention pond
CB
concrete
terrace
water edge planting
existing trees
10:1 slope
10:1 slope
bottom of slope
grass swall
lawn
5%
top of sloped bank
concrete walk
existing trees
3:1 slope
4.0

Appendix B - Map of Pond Hydrology



CB4 is a pump that regulates the water level. When water is too high, it is pumped to PS2 and the force main takes it to the sewage drain. When water is too low, water from PS2 is pumped back into the pond.

Rainwater caught between AD2 and AD1 is drained into the pond via CB3. Here there is another pump that re-circulates the water. It is carried to PS1 through the force main and re-circulated back into the pond. (Plumbing Shop at Facilities Management)

Appendix C - Survey for Library Site

1.Have you ever visited the site behind the library?
Yes No

2. If yes, please circle the reasons why you have visited?
To learn To hang out To study To relax To engage with nature To explore To eat Other

3. Do you often see people engaging in social activities in this area?
Yes No Sort of

4. Do you feel the site represents the Indigenous territory on which it is located?
Yes No Sort of

5. On a scale of 1 to 5, with 1 being not at all pleasing and 5 being extremely pleasing, how do you rate the aesthetic appeal of the site?
1 2 3 4 5

6. Do you view the library site as being an important social place on campus?
Yes No Sort of

7. Do you view the library site as being an important cultural place on campus?
Yes No Sort of

8. Do you view the library site as being an important ecological place on campus?
Yes No Sort of

9. Please explain what changes would make the site more appealing to visit?

10. Please explain what changes would make the site more representational of Indigenous land?

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Wendy Kay (Landeca)

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