

UBC Botanical Gardens Conceptual Design

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CIVL 445 - Group 20

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Executive Summary

The UBC Botanical Garden is home to a world-class collection of temperate plants and trees. In recent years, the garden has been suffering from inadequate funding and underutilization, which threaten its mandate to maintain its collection for conservation, research, teaching, and public display. To address these concerns, a redevelopment of the garden was developed to increase attendance without compromising the integrity and quality of the Garden as a research institute.

Initial improvements to the visitor experience will be targeted towards ease of access and navigation within the garden. There is currently a significant lack of available parking during times of peak attendance. The existing parking lot is very inefficient in its use of space; a reconfiguration of the parking spaces will allow for a substantial increase in capacity. The proposal also includes plans for a mini-golf course located in unused green space adjacent to the parking lot. This will attract new visitors to the garden and improve the garden experience for visitors of all ages.

Accessibility and visibility of the garden is another pressing issue. The Garden is currently not clearly visible from either W 16th Ave or SW Marine Dr. In the event that the intersection of W 16th Ave and SW Marine Dr is remodeled as a roundabout, it would present an excellent opportunity to introduce new signage promoting the Botanical Garden. Additionally, a pedestrian overpass in this location connecting the Asian Garden to the North Gardens would streamline visitor circulation and increase visibility of the garden to the general public.

In combination with these improvements, a long-term marketing and development strategy will be needed to increase the appeal of the garden as a venue for weddings, conferences and other events. These events are a good source of revenue and a great way to attract returning visitors. To facilitate this, a new multi-purpose structure in the North Gardens can provide space for food preparation and guest seating in an attractive setting. The structure could also accompany a nursery greenhouse or indoor garden for public viewing.

These changes will give this world-class facility a significant overhaul to increase and retain visitors and become more environmentally sustainable. This will be accomplished while maintaining the UBC Botanical Garden's core purpose of collecting, curating, and maintaining temperate plants for research, conservation, education, community outreach, and public display.

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1.0 Introduction

1.1 Background

The UBC Botanical Garden (UBCBG) is home to a world-class collection of temperate plants and trees. Established in 1916, the UBCBG was created primarily as a teaching and research resource that encompassed most of the current UBC campus area at Point Grey. In 1966, the UBCBG was re-established as a non-academic service department and was relocated to its current location (Durante Kreuk Ltd., 2001).

The garden has been suffering from inadequate funding and underutilization which threaten its mandate to maintain its collection for conservation, research, teaching, and public display.

According to Patrick Lewis, Director of the UBCBG, the garden receives approximately \$1.0 M from UBC per year towards its \$2.0 M operating budget. Donations and modest revenue from gate admissions fill this funding gap.

The UBCBG is less known relative to other entities on campus such as the UBC Museum of Anthropology, partly due to limited visibility of the garden from both SW Marine Dr and W 16th Ave by vehicles driving past.

Accessibility is another concern of the UBCBG: the botanical garden is a 20-minute walk from the center of UBC campus, and transit service is infrequent: only the C20 community shuttle services the garden at 30-minute intervals. During large events at the UBCBG, such as the Apple Festival, the modest parking lot has insufficient capacity, requiring a shuttle to ferry visitors between parking garages on campus and the garden.

1.2 Site Location

The main entrance to the UBC Botanical Garden is located at the southwest portion of the UBC campus along SW Marine Dr at the intersection with Stadium Rd. The main portion of the garden lies west of SW Marine Drive while the North Gardens are situated at the corner of SW Marine Drive and 16th Avenue as shown in Figure 1. These portions of the botanical garden are connected via a tunnel passing underneath SW Marine Dr.



Figure 1: Location of UBC Botanical Garden (Durante Kreuk Ltd., 2001)

1.3 Objectives

To address the problems plaguing the UBCBG, a redevelopment of the garden is essential to increase attendance and revenue without compromising the integrity and quality of the UBCBG as a research institute. The focus of this conceptual redevelopment will be to implement the necessary changes to the UBCBG in a cost-effective manner. The proposed redevelopment will address issues pertaining to the visitor experience, accessibility, long-term sustainability, and marketability of the garden.



2.0 Design Considerations

2.1 Information Gathering

To provide a compelling and realistic conceptual design, more information related to the problems and direction of the UBC Botanical Garden (UBCBG) was required. During site visits to the UBCBG and plenary sessions with UBCBG management and key UBC personnel, we were able to identify the goals of key players at the UBCBG and key considerations and restrictions related to this redevelopment.

2.2 Decisions Regarding Conceptual Design Components

Through the information-gathering phase, we were able to identify areas of the garden and its operations where improvements are recommended. Through careful consideration, components were selected which reflect the values of both UBC and the UBCBG and are listed below:

- Miniature Golf Course
- Mobile Café
- Parking Redesign
- Storm Water Management
- Multipurpose Building
- Pedestrian Overpass
- Improved Marketing

2.3 Implementation Plan

The implementation of these enhancements will be conducted in a phased process. A total of three phases are proposed, based on ease of implementation. Phase One includes the projects that require the least investment, while Phase Three include the projects that have a longer-term focus. Table 1 shows the breakdown of the three different phases:

Table 1: Implementation of Conceptual Design

Stage	Component
Phase 1	Mobile Cafe Parking Redesign Improved Marketing
Phase 2	Storm Water Retention Multipurpose Building
Phase 3	Mini-Golf Course Pedestrian Overpass

3.0 Conceptual Design

3.1 Mobile Café

3.1.1 Justification

The UBC Botanical Garden (UBCBG) is a relatively large facility with paths winding through the gardens leading visitors to various attraction points throughout the gardens. During the design team's visit through the garden, the team noticed that the only point at which refreshments could be obtained in the garden was at the shop and garden centre located at the entrance/exit to the garden. Furthermore, representatives of the garden expressed interest in the addition of a refreshment centre elsewhere in the garden during plenary sessions.

To address the need for a refreshment centre within the garden, the design team decided to incorporate a mobile semi-permanent structure into the conceptual design for the revitalization of the UBCBG. The purpose of the mobile café is to provide a destination point within the garden that attracts visitors to other anchor points within the garden. The proposed name for the mobile café is *The Leaf*.

3.1.2 Structure

The mobile café would be composed of a recycled shipping container measuring 6 meters in length by 2.5 meters wide by 2.5 meters high. Wood siding may be applied to provide the structure with a more appealing, aesthetic air and to be a more natural addition to the garden. A door providing entry to the structure, located at one end of the café, would be used by operations staff. The structure would be constructed in such a way that while in use, the anterior wall of the structure would fold down providing a platform area for customers to view the café selections and menu. A retractable canopy would afford this customer area with shelter from sun or rain. Figure 2 illustrates the structure as it would appear in a state of operation.



Figure 2: The Leaf Mobile Café (Open)

Conversely, when the café is closed the platform would fold up and the canopy would retract to the roof. Figure 3 illustrates the mobile café in its closed state.



Figure 3: The Leaf Mobile Café (Closed)

3.1.3 Location

The design team considered different options for the placement of the mobile café. The North Gardens have much to offer in terms of existing attractions, including the Roseline Sturdy Amphitheatre, Garden Pavilion, and various specialty gardens. It was decided that the North Gardens were the best-suited area for the café as it would provide an anchor point to attract visitors to the North Gardens. Three options for the placement of the mobile café within the North Gardens were chosen and illustrated in Figure 4.



Figure 4: Potential Location Options for the Leaf Mobile Café

Location 1 is positioned on the Great Lawn, in proximity to the Roseline Sturdy Amphitheatre and is located on a major route through the garden. This location allows the café to service garden visitors attending events held at the amphitheatre and also attracts visitors to travel to the northwest corner of the North Gardens.

Location 2 is situated on the Great Lawn behind the Garden Pavilion. This location is ideal because it is centrally-located in the North Gardens and would observe greater visitor traffic. The higher-traffic area would result in higher revenue; however, as the location is more central, it would not attract people to the far corners of the garden.

Location 3 is stationed at the south end of the North Garden. Incorporated into this conceptual design location is a multi-purpose building, which will be located just adjacent to Location 3. By placing the mobile café at this point, visitors will be attracted to the building. This location does pose a problem as it is more hidden away and would not see as much traffic.

The design team recommends that Location 2 be chosen for the mobile café. The mobile café will attract more visitors to the North Gardens, and being situated in a centralized spot, will see a higher volume of visitor traffic. This results in higher revenue for potential businesses. The Garden Pavilion might allow for the storage of chairs and tables, which can be spread across the Great Lawn in proximity to the café for visitors to take a break during their tour of the garden.

3.1.4 Estimated Cost

Based on investigation into the cost of similar styled mobile cafés, the mobile café at the UBCBG is expected to cost between \$3,000 and \$6,000 (Alibaba.com, 2013).

3.2 Parking Improvements

3.2.1 Current Parking Situation

One of the main issues that the UBC Botanical Garden (UBCBG) currently faces is the lack of parking available during major events such as the annual Apple Festival, especially during days in the summer when weddings at the garden coincide with increased visitation. As such, it is vital that the existing parking lot be reconfigured to accommodate a greater number of vehicles during these high-traffic events. A tally of the existing number of parking stalls was conducted, and it was determined that a total of 83 vehicles would be able to park at the UBCBG at any given time.

3.2.2 Parking Lot Redesign

During the team's site visits conducted throughout the term, it was noted that during regular operation, the parking lots only see utilization on the order of approximately 30%. However, with the implementation of the other improvements proposed in this report, the number of visitors and parking utilization can be expected to increase significantly. As such, the team looked into various options for improving the parking experience.

Various alternatives were investigated, including the construction of a multi-storey parkade. However, this was determined to be too costly, and would not coincide with the visions of UBC and the UBCBG for a more sustainable future.

In the end, it was decided that the existing parking lot would be reconfigured to yield a greater number of parking stalls available as this is the most cost-effective solution. No additional land would be taken up for use in this project; only the space currently available within the existing footprint of the parking lot would be modified for parking purposes. As shown in Figure 5, the improved parking lot utilizes the same stall widths and lengths as the current condition (approximately 2.5 m x 5 m). Removal of the central grass island allows for additional stalls to

be added on either side. Despite the additional space created by removing this island, it was discovered that it would not be possible to add an additional row of parking stalls, as this would result in the travel lanes which are too narrow for the safe manoeuvring of vehicles. With the reconfiguration, the improved parking lot yields a total of 94 parking spaces, a 13.3% improvement.

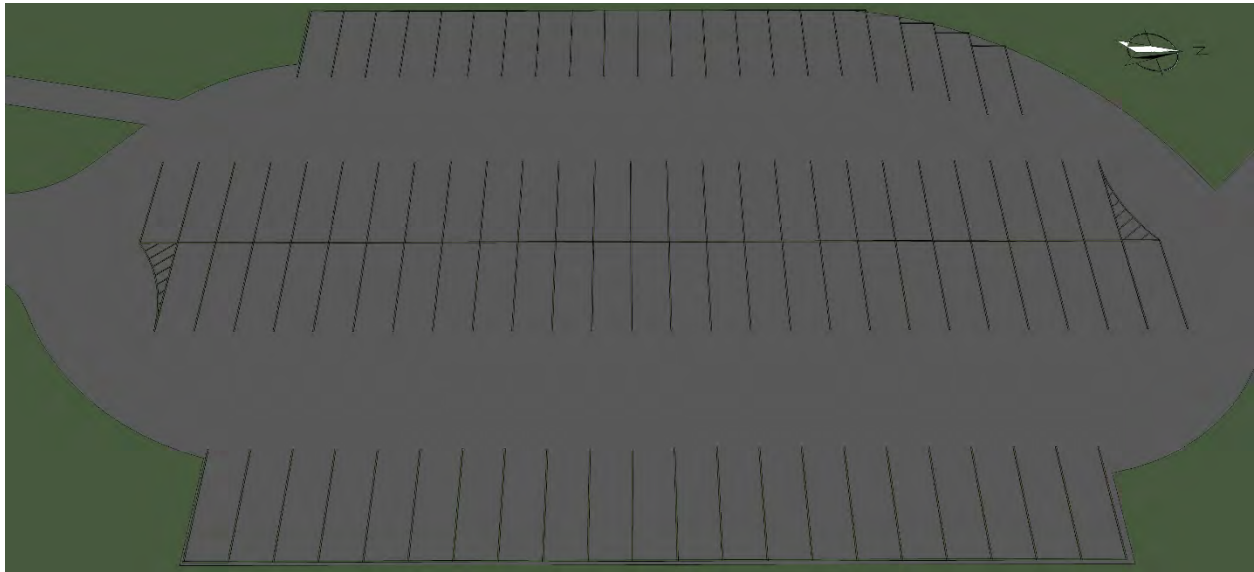


Figure 5: Improved Parking Configuration

3.2.3 Parallel Parking on SW Marine Drive

While improvements to the parking lot should provide sufficient capacity for regular operation at the improved UBCBG, they may not be able to accommodate events such as the Apple Festival. As such, the option of reconfiguring SW Marine Dr is also considered. This option proposes that the existing lane configuration of SW Marine Dr, between Old Marine Dr and Stadium Rd be altered to allow for parallel parking on the road edge. The proposed reconfiguration, shown in Figure 6, will require the following changes to the existing lane layout:

- The elimination of one travel lane in the southbound direction
- The addition of one dedicated bike lane in the southbound direction
- The addition of one parallel parking lane on the road edge

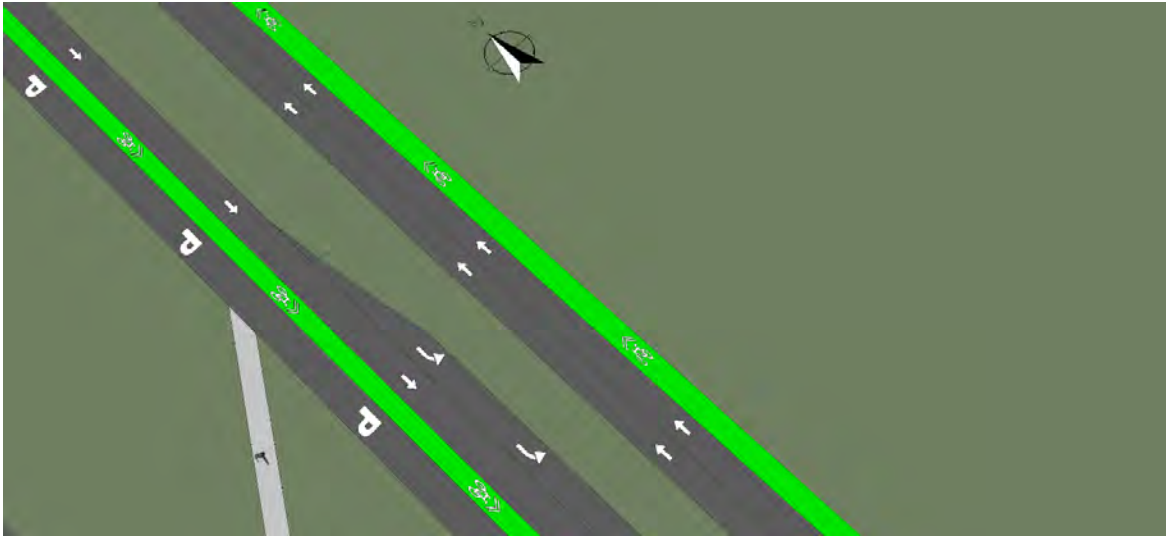


Figure 6: Additional Parking Layout along SW Marine Dr

The changes proposed would not require any major construction work as the suggested reconfiguration occurs within the existing road width and will only require lane alterations. The removal of a travel lane in the southbound direction should not pose any significant concerns as the southbound traffic volumes from NW Marine Drive are very low and are well below capacity provided by the existing two lanes prior to the intersection with W 16th Ave (British Columbia Ministry of Transportation and Infrastructure, 2002).

Overall, parallel parking along this portion of SW Marine Dr results in an additional 32 parking spaces becoming available, raising the grand total to 126 parking spaces. This improvement however is contingent on the approval from the BC Ministry of Transportation and Infrastructure due to their jurisdiction over SW Marine Dr.

3.2.4 Estimated Cost

In terms of cost, the parking improvements should have a low impact on the overall cost of the project. A breakdown of the activities required, as well as their respective unit costs (Gleason, 2006), are listed as follows:

- Paving of the existing grass island in the centre of the parking lot
 - Based on a standard price of \$2.50 per square foot for asphaltic paving, the removal and paving of the grass island will cost approximately \$15,000
- Painting of the reconfigured parking stalls
 - Based on a standard price of \$8.50 per parking stall for painting, the total cost is approximately \$1000
- Painting of the lines for the lane reconfigurations for SW Marine Dr
 - Based on a standard price of \$0.25 per foot of painting, the total cost is approximately \$1000

All together, the parking improvements can be expected to cost \$17,000. Applying a 20% contingency, this total comes up to approximately \$20,000.

3.2.5 Summary of Parking Improvements

Overall, improvements made to parking at the UBC Botanical Garden can yield a 52% increase in the number of parking spaces available. The tabulated values are provided in Table 2 below. Some additional improvements which could improve the visitor experience include the use of green pavement in the parking lot and discussions with TransLink to improve transit services to and from the UBCBG.

Table 2: Parking Improvements Summary

	Existing	Improved
Parking Stalls	83	94
Parallel Parking	0	32
Total	83	126
Percent Increase	51.8%	

3.3 Improved Marketing

Marketing will begin when the project is publicly announced, as the UBC Botanical Garden (UBCBG) must experience a boost in promotion to generate interest. More attention will need to be drawn to the UBCBG, which will be accomplished using the marketing initiatives suggested in this report. Once funding is in place for the project, the new ideas will be publicized in campus-local publications such as “*The Ubyyssey*”, “*The Thunderbird*”, and advertisement space in local newspapers. By increasing people’s awareness of the UBCBG, it will be beneficial when an exciting feature such as the mini-golf course, described in this conceptual design, is completed.

3.3.1 Campus Awareness

The UBCBG is unfamiliar to the majority of students on the UBC campus. As social media plays an important and undeniable role in modern marketing, Facebook, Twitter, and Instagram accounts for the UBCBG should be better utilized to increase awareness. Popular university-operated social media groups, such as the ones on Facebook, focus on prospective undergrads and current students (/youbc, /universityofbc). These could be used to advertise the gardens in conjunction with event flyers placed on popular approved billboards, which would provide URL links, QR codes or other means to access the aforementioned social media outlets.

3.3.2 Event Hosting and Social Calendar

Plans for a new multipurpose building increase the potential of the UBCBG to host events. Many groups on campus such as alumni societies, clubs and fraternities are often in need of event space. The UBCBG could fill this demand as a potential place to stage their events. Other campus organizations such as UBC Recreation already campaign to convince these groups to attend their events. Offering incentives, a technique which tends to increase event attendance, could prove useful to the UBCBG. A mark of a successful venue is continuity. By hosting regularly-scheduled events, the Botanical Garden can increase its recognition and develop a stronger return rate of customers. Photography contests, scavenger hunts and fundraisers are just some of many options.

3.3.3 Signage

The UBCBG is located in an area of UBC which is much less travelled by foot. Consequently, there are no major foot travel routes in the area. Although it is situated along a major road, the garden is not advertised as a major attraction. Given the high traffic volume on SW Marine Dr and W 16th Ave, the conceptual design emphasizes placing directional and tourism attraction signs along these roadways to promote awareness of the UBCBG.

3.3.4 Evaluation of Initiative Effectiveness

After the implementation of these marketing initiatives, surveys are recommended to be taken on campus in order to gauge their respective effectiveness. Online polling options can also be utilized on the UBCBG Facebook pages and combined to increase the sample size. For this to be effective, a detailed, meaningful set of polls will be needed to analyze each initiative or effect on public perception.

3.3.5 Budget

Marketing is an area the UBCBG needs to be improved upon. Whereas the recommendations made in this section are extremely flexible, the principal of using high-exposure means to promote the garden remains. A full-time, marketing consultant capable of managing a long-term campaign is needed for the task. The Botanical Garden is selling an experience, and the purpose for marketing is to attract more viewers to this experience. As fees for these services vary significantly, adapting an objective-based billing system, such that payments are made when visitor numbers increase and goals are met, can ensure that the benefits of the campaign are reasonable compared to the cost.

3.4 Storm Water Management

3.4.1 Water Management Issues in the UBCBG

There are several ponds and streams in the garden which are used to enhance the appearance of the garden. The bedding of these water features are made of loose sands which are permeable to liquid and susceptible to significant drainage. Currently, these garden features are filled with potable water to maintain sufficient water levels. Although water in Vancouver is relatively

inexpensive, it is more sustainable to collect and use stormwater rather than continue with current practices.

3.4.2 Utilizing stormwater from the University of British Columbia

In order to manage stormwater, UBC divides the entire campus into four catchment areas. These are the North, West, 16th Avenue, and South catchments as shown in Figure 7 (UBC: Campus + Community Planning). The West Catchment is close to the UBCBG, with its stormwater led into a main pipe which runs along the south side of Stadium Rd. This water then crosses SW Marine Dr and the botanical garden before being drained off the cliffs into the ocean. The reuse of stormwater in the garden can be achieved by incorporating a water detention structure that is primarily fed by the stormwater main along Stadium Rd.



Figure 7: UBC Catchment Areas

3.4.3 New Stormwater Collection Facility

This conceptual design recommends the collection and reuse of stormwater from UBC by constructing a reservoir near the garden. The reservoir serves dual purposes, as it is also designed to serve as a leisure area for garden visitors and local community to enjoy.

3.4.3.1 Location of the Stormwater Collection Facility

The proposed location of the stormwater collection facility is at the southeast corner of the intersection of SW Marine Dr and Stadium Rd. Selection of this location is due to its proximity to the UBCBG and stormwater main for the West Catchment, and available space to the east the intersection which is currently unused. By constructing the facility at this optimal location, materials required and construction costs are minimized.

3.4.3.2 Properties of the Stormwater Collection Facility

The reservoir is designed mainly of concrete with an impermeable layer to prevent water leakage. The dimension of the reservoir is 8 m long, 5 m wide, and 3 m deep, yielding a storage volume of 120 m³. Spanning above the reservoir lays a 1.5m-wide wooden bridge, designed for access to visitors and the general public. Wooden fences are to be used around the reservoir for public safety.

3.4.3.3 Functions of the Stormwater Collection Facility

The main function of the facility is to store stormwater for the garden's use. It also functions as a leisure area for visitors of the garden and the general public. As shown in the Figure 8, the proposed reservoir collects stormwater from the UBC West Catchment pipe and stores it for future use. This retained stormwater can be used for irrigation and as a source of water to feed the ponds and streams. As Figure 8 shows, delivery pipes are used to deliver stormwater from the reservoir to the Asian Garden. The wooden bridge is designed over the reservoir to allow people to cross over the facility. The area surrounding the reservoir will be stocked with plants to integrate the facility with the local environment.

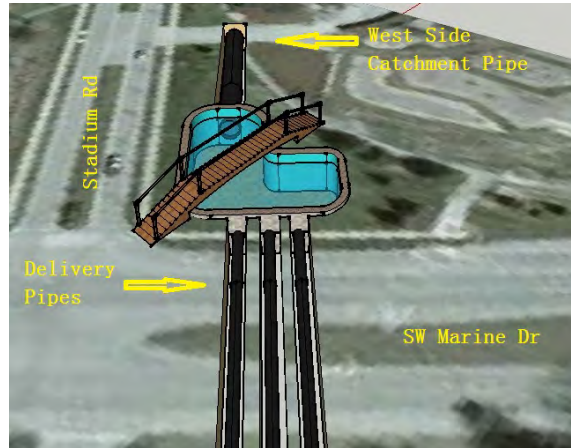


Figure 8: Stormwater Collection Facility and Connections

3.4.4 Estimated Cost

The proposed stormwater storage is 8 m long, 5 m wide and 3 m deep. This occupies an area of 50 m² or 60 square yards including the thickness of the concrete wall. Excavation will cost about \$150 per square yard (Smith, 2013). The cost of concrete is approximately \$4 per square foot, and surface area inside the reservoir is 120 m² or 1300 square feet (ConcreteNetwork.com, 2013). The cost of the pipes will cost \$80 per meter. (M Con Products Inc., 2013). Now assuming that the length of each of the three pipes used to deliver water is about 400 m and that a crew of eight works on this project for 10 days, Table 3 is generated showing the costs of this Stormwater Collection Facility, totalling \$90,000.

Table 3: Cost Estimate of the Stormwater Collection Facility

	Unit price (\$)	Quantity	Component Cost (\$)
Excavation	150.00	60	9,000.00
Concrete	4.00	1300	5,200.00
Pipes	80.00	400	32,000.00
Labour	45.00	640	28,800.00
Total (includes 20% contingency)			90,000.00

3.5 Multipurpose Building and Greenhouse

One of the highest priority goals of this proposal is to provide the UBC Botanical Garden (UBCBG) with the means to increase visitorship, functionality, and improve public awareness. It was made apparent over the last several weeks that many of the visitors attending events, like weddings and the Apple Festival, were seeing the gardens for the first time and wanted to return. We believe that a new multipurpose building located in the North Gardens will provide the means to introduce new visitors to the garden and to host more and larger events. With easy access to the nearby Great Lawn and Roseline Sturdy Amphitheatre, a new building would be extremely well suited for hosting weddings, conferences, and educational workshops. The building will also feature a kitchen, classroom, work space, and equipment storage. Additionally, we are proposing the construction of a greenhouse near the multipurpose building and adjacent to the Food Garden. Together, the two buildings will be wood structures built according to LEED Gold or higher specifications.

3.5.1 Building and Greenhouse Location

Several competing factors were considered when selecting a location for the proposed multipurpose building and greenhouse. Ultimately, we have chosen to locate the multipurpose building on the northeast side of the Food Garden and incorporate its design into the existing Arbour Garden and walkway. Proximity to key garden features, distance from the main garden entrance, and the possible interruption of existing land use were all factored into the decision. Another possible location for a building would be in the northern portion of the Great Lawn, however, accessibility to the garden entrance would be impacted, and we would recommend an alternative building design for that location. The Food Garden location will provide ample space for a building with a 16 by 16 meter footprint while leaving enough open grass space for events to move outdoors. Figure 9 shows the proposed locations of the multipurpose building and greenhouse in the garden. Furthermore, the setting is very attractive and the building functionality will complement any future additions nearby, such as an outdoor oven. The greenhouse will be located north of the Food Garden and adjacent to the multipurpose building. The close proximity of both features will enable convenient equipment storage in the multipurpose building and potential heat exchange with future modifications.



Figure 9: Proposed Location of Multipurpose Building and Greenhouse

3.5.2 Building Design and Features

Our design of the multipurpose building is intended to be incorporated into the existing Arbour Garden and walkway and, together with the greenhouse and Food Garden, provide an impressive entrance into the North Gardens. Figure 10 is a conceptual rendering of the proposed building and greenhouse viewed from the entrance to the North Gardens.



Figure 10: Conceptual Rendering of the Multipurpose Building and Greenhouse

The main floor of the building is 13 by 20 meters (2800 square feet) and will feature a small kitchen, a large dining and sitting area, and public restrooms. There are French doors facing onto the Arbour Garden and walkway, as well as the opposite side of the building for additional event space. The basement is 16 by 20 meters (3400 square feet) and features a large classroom,

storage for equipment, offices, and space for utilities. In keeping with the building's LEED aspirations, wood construction and a green roof have been included in this proposal. Additionally, traditional light-frame wood construction should help to limit the building's overall cost. Using an RS Means derived cost of \$228 per square foot (RS Means, 2013), the expected cost of the multipurpose building will be approximately \$1.5 - \$2 million.

Figure 11 shows the conceptual design of the multipurpose building and illustrates its incorporation with the existing walkway.



Figure 11: Conceptual Design of Proposed Multipurpose Building and Walkway

3.5.3 Greenhouse Design and Features

The proposed wood-frame greenhouse has a footprint of 8 by 11 meters and is located directly beside the Food Garden. The excellent insulative properties of wood, combined with efficient glass windows will be highly effective at retaining heat, will extend the viable growth period for plants grown in the greenhouse. The greenhouse, in combination with the multipurpose building, will also be a showcase for the North Gardens and provide educational opportunities for students and visitors of the Botanical Garden. The building's temperature will be regulated by automated ventilation and motorized windows on the roof. Heating during cooler months can be a significant expense for greenhouses, therefore, if usability during the winter is a priority for the

UCCBG, an independent heating system or shared heating system with the multipurpose building may be required.

Figure 12 is a rendering of the proposed greenhouse showing the wood-frame structure and interior arrangement of plant beds. The cost of the greenhouse will be largely dependent on the selected fixtures and utilities; however a reasonable estimate of cost is approximately \$500,000 (RS Means, 2013).

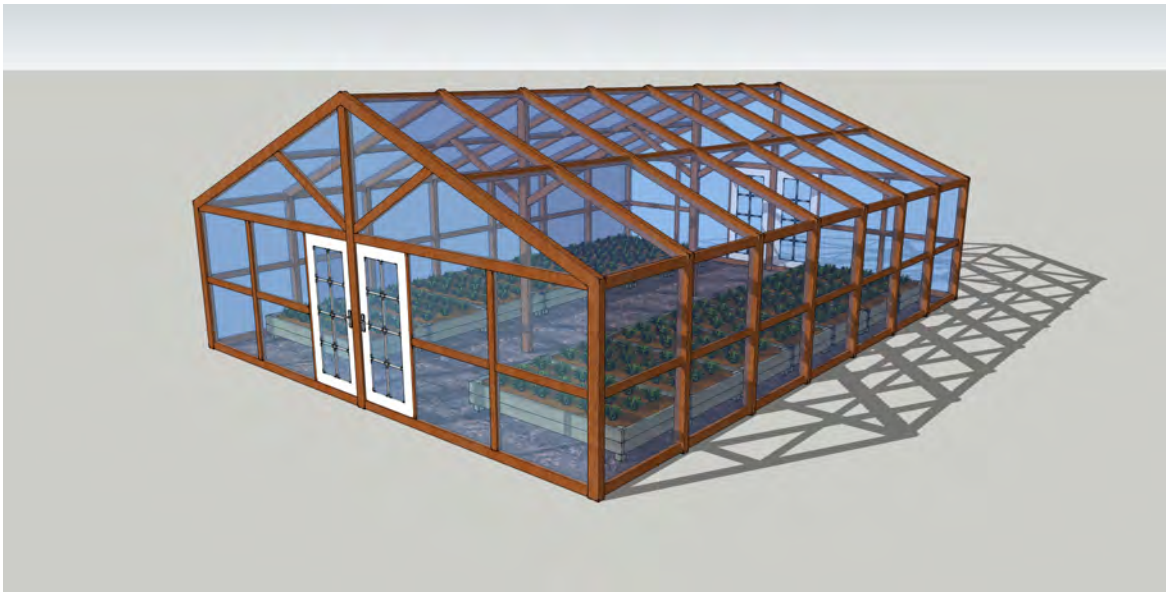


Figure 12: Conceptual Design of Proposed Greenhouse

3.6 Miniature Golf Course

3.6.1 Goal

The goal of the mini-golf course is to increase the number of visitors to the UBC Botanical Garden (UBCBG) site to increase the visibility of the UBCBG and to generate revenue from a demographic of people that are unlikely to visit a botanical garden. A large portion of traffic to the mini-golf course is expected to enter the UBCBG through free admission (UBC students) or discounted admission bundles to both the mini-golf and UBCBG (general public).

3.6.2 Rationale

Mini-golf is an entertaining game that is easy to play, but difficult to master. It is a fun and social activity that requires little physical exertion, making it an attractive outdoor activity for all ages and skill levels. The only mini-golf course in Vancouver is located at Pacific National Exhibition, and only a few courses are less than an hour's drive from the city center. Table 4 below illustrates that there exists a market for mini-golf in Vancouver through comparison with Victoria, BC.

Table 4: Comparison of Population and Mini-Golf Courses


	Greater Victoria Area	City of Vancouver
Population ^{[1][2]}	330,000	603,502
Mini-Golf Courses	5	1
Residents/Course	66,000	603,502

Sources:

[1] (Greater Victoria Chamber of Commerce, 2013)

[2] (City of Vancouver, 2013)

The Greater Victoria area has five successful mini-golf courses all located less than a 30-minute drive from its city center. These mini-golf courses are successful in lieu of the fact that they have limited transit service, making them similar to the proposed course at the UBCBG. Based on these factors and comparing the number of residents per mini-golf course, a mini-golf course at the UBCBG should be successful, however, it should be noted that this is just one potential indicator of success and more extensive analysis should be performed.



A mini-golf course at the UBC Botanical Garden is expected to draw a large number of people who are looking for a fun and inexpensive activity on a pleasant day. Students from UBC who come to play mini-golf during a break in their day or after classes are likely to explore post-game since garden admission is free for them. In the evenings and on weekends, more of the general public is expected to play. It is expected that a portion of these mini-golfers will take advantage of the proposed discounted garden rates and will explore the UBC Botanical Garden.

The visibility of the mini-golf course and, by association, the UBCBG, is expected to increase by word of mouth. Anyone who has seen the concept of the mini-golf course has been excited by it and has stated that they would most definitely play a round of mini-golf there. Inclusion of the mini-golf course in UBC activity guides and temporary signs around campus during the first few weeks of September and April would bring the mini-golf course to the attention of UBC students. Students will mention the course and the UBCBG to their friends and family, which will encourage them to visit.

3.6.3 Content

To justify the construction of the mini-golf course according to the UBC Botanical Garden's mission statement, we propose that the foliage be an assortment of plants from the garden's collection to display. Ideally, the majority of these plants should be perennials, as this will reduce the amount of required planting each year. These plants should be robust, as players will pursue their balls off-course resulting in potential damage to the plants.

Informational signs will be posted at each hole to identify key and interesting information about each of the plants growing along the course. Some of this information would include plant name, place of origin, uses, and any interesting trivia related to the plant. This approach will display the garden to mini-golfers and educate them about some of the garden's species.

3.6.4 Location

The preferred location of the mini-golf course is in an empty plot of land at the northwest end of the UBCBG between the parking lot and Old Marine Drive as shown in Figure 13. The mini-golf course is expected to use between 1000 to 1500 m² of the 3000 m² shown in Figure 13.

The location of the mini-golf course is near the main entrance to separate access to the mini-golf course from the rest of the garden to help preserve the tranquility of the garden for patrons. The proximity of the mini-golf course to the main gate allows the garden admissions cashier to handle both the mini-golf and garden visitors while also controlling access to both.

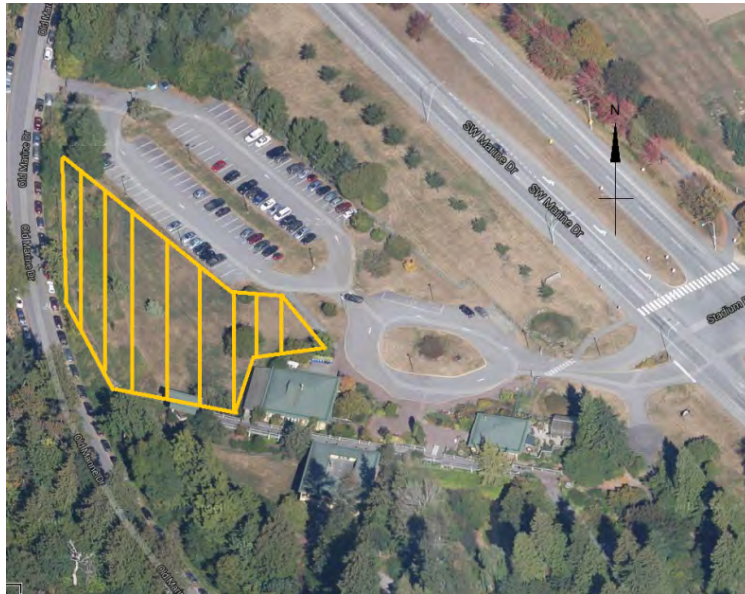


Figure 13: Proposed Location of Mini-Golf Course

During site visits to the UBCBG, it was mentioned that the UBCBG was planning on using the space identified in Figure 13 for a cherry orchard or some other purpose. Due to the flexibility in course design, the mini-golf course could be designed to accommodate any plans the UBCBG may have for the space. Figure 14 below shows a concept of the mini-golf design that allows for the creation of a cherry orchard.



Figure 14: Conceptual Mini-Golf Course and Adjacent Orchard

3.6.5 Construction

3.6.5.1 Earthwork

Minor earthwork is expected to be undertaken in the construction of a mini-golf course to achieve the topography required to create an interesting game, direct any surface water to appropriate detention and drainage areas, and to accommodate decorative structures on the course. A moderate amount of earthwork is expected for excavating decorative ponds and other features should they be required in the course design.

3.6.5.2 Course Construction

The footprint of each hole will be underlain with a layer of compacted gravel covered by an artificial grass surface. This surface assembly is expected to facilitate sufficient drainage during storm events. Some pooling of water is expected during heavy storms, but it is expected to drain before mini-golfers show up to play when the weather clears. Course borders will be constructed of brick or cast-in place concrete curbs that will integrate with the gravel and grass layers to create the playing area. Figure 15 shows the potential structure of the playing surface.



Figure 15: Mini-Golf Course Cross-Section

Staging areas at each hole will be made of placed brick to allow for surface drainage. Each staging area will consist of a bench, garbage can, and informational sign. Paths between holes will be constructed of brick or concrete pavers to facilitate surface drainage.

3.6.5.3 Garden Beds

Planted areas beside the mini-golf course will be either in-situ or in planter beds as determined by the final design. The use of planter beds should be avoided to reduce construction cost and to minimize impact on subsurface water flow. Subsurface irrigation pipes will feed sprinklers located in each bed as necessary and will connect to the UBCBG water supply.

3.6.5.4 Decorative Structures

Decorative structures should be included on the mini-golf course to increase its aesthetic appeal to mini-golfers and should be of high quality to properly reflect the prestige of the UBCBG and UBC as a whole. Figure 16 shows several examples of suitable decorative structures for a mini-golf course.



Figure 16: Concept of Mini-Golf Course with Decorative Structures

Decorative structures could be designed and constructed by UBC Arts Students or artists in the community. The UBCBG could also host a design competition to create these structures which would also increase the garden's visibility.

3.6.5.5 *Sustainable Materials*

Course components should be constructed with sustainable or recycled materials to adhere to UBC's sustainability policies. Some potential uses of sustainable materials are summarized in Table 5:

Table 5: Sustainable Materials for Use in Mini-Golf Course Construction

Component	Sustainable Material
Course Borders/Planter Beds	Green concrete containing recycled aggregates and waste products such as fly ash and ground blast furnace slag.
Pathways	Pavers made from waste concrete from the UBC Materials Lab.
Decorative Structures	Wood and metal retrieved from building demolition.
Course Bedding	Recycled concrete aggregates.

3.6.6 Maintenance

With the proper selection of plants and quality construction, maintenance of the mini-golf course should be minimal. Depending on the season, daily or weekly maintenance would be restricted to cleaning debris off the course, pruning plants, and emptying garbage bins. Annually, maintenance would be limited to replanting annuals, and fixing and repainting course structures and benches.

3.6.7 Funding

The UBCBG may be able to convince UBC to fund this mini-golf course as it adheres to the garden's mission and will increase visitor traffic to the garden. Some of the mini-golf course's artistic elements could be designed and constructed by UBC Fine Arts students as an element of a special course or by winners of a design competition. A portion of the art costs could be covered by grants from the federal government. Donations from wealthy benefactors who see the merit of this mini-golf course could fund help to fund construction.

3.6.8 Estimated Cost

The estimated cost of the mini-golf course is expected to be between \$200,000 and \$300,000 based on a reasonably sized course with water features, decorative structures, and a maximum elevation change of approximately 2 m. This preliminary cost estimate was generated by comparing to features in quoted prices from the Miniature Golf Construction Company in Missouri with an added 30% contingency to cover for differences in labour costs, material costs, and taxes.

3.7 Pedestrian Overpass

As part of the overall plan to increase the number of visitors to the UBC Botanical Garden (UBCBG), we propose the construction of a pedestrian overpass, called the Garden Bridge as part of Phase 3 of the implementation. Spanning over a planned, future roundabout located at W 16th Ave and SW Marine Dr, this bridge serves to promote both the UBCBG and the university while improving routing through the Garden. As the Garden Bridge has the largest physical impact on the surrounding landscape, it has a large value as a reminder that the UBCBG is a world-renowned botanical garden with valuable temperate plants in its vast collection.

3.7.1 Location

The bridge spans over the intersection at W 16th Ave and SW Marine Dr, connecting the North Gardens with the southern portion of the Asian Garden. This alignment serves to connect the area surrounding the Garden Pavilion and Food Garden with the southern part of the Asian Garden, and can be seen in Figure 17.



Figure 17: Proposed Garden Bridge Alignment

There are significantly higher pedestrian volumes in the North Gardens, with large events such as the annual UBC Apple Festival taking place on the Great Lawn. Weddings are also events which generate significant pedestrian volumes in the North Gardens. With the southern part of the Asian Garden experiencing lower numbers of visitors, this bridge alignment serves to increase the popularity of this area which also contains the Greenheart Canopy Walkway. These relative pedestrian volumes were observed during site visits to the UBC Botanical Garden in October 2013.

In addition to the higher pedestrian traffic at this location, the bridge's location on the UBC campus offers an excellent opportunity to the Botanical Gardens for promotion. SW Marine Drive is one of the four arterial routes into UBC. With almost 9000 vehicles entering the intersection from just the southeast approach daily as of 2002, there is sufficient traffic volume

for the pedestrian overpass to increase awareness of the UBC Botanical Gardens (British Columbia Ministry of Transportation and Infrastructure, 2002).


3.7.2 Bridge Design

In order to further promote the UBCBG's world-class collection of temperate plants, the bridge is designed to accommodate plants on both sides of a winding path, as shown in Figure 18. The curves serve to minimize the artificial feeling of concrete the bridge is constructed of. The path is made of brick to further integrate the bridge into the garden and increase the visitor experience. Fencing the bridge is necessary from a safety point of view; by utilizing glass as the main fencing material, further enhancement is made to the aesthetics of the garden while still promoting safety. The glass creates a clear view of the collections on the bridge to passing vehicles and cyclists travelling through the roundabout below, further promoting the botanical garden.



Figure 18: Proposed Garden Bridge at W 16th Ave and SW Marine Dr

The bridge is one of the choke points in the garden, alongside the Moon Tunnel, which connect the North Gardens and Asian Garden. This unique feature of the botanical garden can be better utilized, as a high percentage of visitors pass through these two passages. Select plant collections are displayed on the Garden Bridge for promotional and educational purposes, as well as for enhancing the overall aesthetics of the structure.



The height clearance above the roundabout is designed with double-decker tour busses in mind. This is due to the expectation for the number of visitors to the UBCBG to rise as a result of these improvements. The bridge is also wheelchair accessible as part of the overall approach of making the garden more accessible. A ramp design was chosen for both approaches onto the bridge as opposed to using stairs for this reason.

3.7.3 Water Collection Capability

The pedestrian bridge has been conceptualized with UBC's Sustainability Initiative in mind. Traditional bridges require gutters and associated drainage systems to manage runoff. Rather than tying this into the existing drainage system, as it would be done traditionally, the Garden Bridge's soil acts as the drainage system. Water seeps slowly through the soil and drains in a controlled manner into pipes embedded at the base of the soil. These pipes collect water the water, which can then be used potentially as an educational tool for water management or drainage. The water can also be used for supplying a portion of the botanical garden's creeks in conjunction with the stormwater collection facility to lessen the UBCBG's dependence on potable water.

3.7.4 Estimated Cost

This pedestrian overpass is most expensive item in this conceptual design. Due to the bridge being at a conceptual stage of inception, a cost estimate has been realized using a benchmark of landmark footbridges. Using a mean value of € 54,366 per meter for benchmarked bridges, and a Euro to Canadian Dollar conversion rate of 1.3, the cost of this overpass comes to \$7 - \$8 million (Duguid, 2011).

4.0 Estimated Cost

In the interest of having an estimated overall cost for the conceptual design created by our design team, the following section summarizes the associated estimated costs for each design phase and component. The individual estimated costs for each component have been discussed in more detail in Section 3.0 and have been summarized in Table 6 below.

Table 6: Estimated Project Cost Breakdown

Conceptual Design Component		Estimated Cost
Phase 1	Mobile Cafe	\$3,000 - \$6,000
	Parking Lot Reconfiguration	\$20,000
Phase 2	Water Management Facility	\$90,000
	Multi-Purpose Building and Greenhouse	\$2.0 - \$2.5 million
Phase 3	Miniature Golf Course	\$200,000 - \$300,000
	Pedestrian Overpass	\$7 - \$8 million
Total		\$9.3 - 10.9 million

The total cost of the project is estimated to be \$9.3 - 10.9 million. Further cost analysis should be completed in order to define a better estimate of projected costs for the detailed design of these components. Every effort was made during the conceptual design process to consider the economic feasibility of each design component, and our design team believes that we have found an effective compromise between cost and functionality.

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