

**UBC Botanical Garden & Center for Plant Research: Conceptual Design Proposal**

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# ubcbotanicalgarden & centre for plant research

## Conceptual Design Proposal



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## EXECUTIVE SUMMARY

S. H. & O. Design was asked to provide a conceptual design for the upgrade of the UBC Botanical Garden and Center for Plant Research. The purpose of this upgrade is to attract more people to the garden, generate new sources of revenue, provide recommendations to the current garden issues and make people interested in the garden.

Our mission is to enhance the functionality and visitor experience of the garden by adding in anchor attractions and addressing the concerns presented by the garden directors. We've designed two big attractions: a Showcase Glasshouse with a second garden entrance and a four story tower call the UBC Perch. Focus was put on improving the North side of the garden.

The Showcase Glasshouse will be part of a second garden entrance at Stadium Rd. and is an on-site nursery and public display greenhouse. Enclosed modules will divide varying ecosystems and a raised walkway will provide an interesting overview through the greenhouse. The Perch will include a multi-purpose space that can be used as a learning area, event space and will hold The Garden Café. There will be a patio and glass wall at the top that will offer an attractive 360 degree view of the Garden and Thunderbird Stadium. These green and recreational spaces will revitalize the garden and attract more people.

We have also provided many incremental improvements to existing garden issues. These improvements include renovations to the service lot and tunnel under Southwest Marine Drive, changes to the parking lot layout, adding a maze, additional signage, addressing stormwater management, and installing a pedestrian controlled traffic light. All of the proposed upgrades involve sub-disciplines of civil engineering. Our conceptual design will add value to the Botanical Garden, its visitors and the UBC community.

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## **1. INTRODUCTION**

This section discusses the background and history of the UBC Botanical Gardens, as well as the current issues facing the garden.

### **1.1. Client Background**

The UBC Botanical Garden (UBC BG) was established by John Davids, the first garden director, in the year 1916. From this point until the 1960s the garden's primary focus was teaching and research. The Botanical Garden then became a separate, non-academic department in 1966, opening at its current location on SW Marine Drive. The most recent developments occurred in 1990, when the administration building, reception and shop, washrooms, and parking lot were implemented. The UBC BG is the oldest continuously operating university botanical gardens in Canada, and maintains both impressive collections and research in ex-situ conservation. It is also known for community outreach, with a large base of volunteers and friends of the garden that help with items from event planning to general operations.

Due to a lack of funding and adequate revenue however, the garden is experiencing issues with operational costs, and is consequently in need of upgrades. This conceptual design plan is intended to both improve and maintain the current state of the Botanical Garden in all respects, from recreational to educational endeavours.

### **1.2. Overview of the Current Garden Issues**

When considering the areas of the garden that need the most improvement, the presentations given by Patrick Lewis, UBCBG Director, and Douglas Justice UBCBG Associate Director and Curator of Collections were carefully contemplated. Areas of improvement that were mentioned directly include visible signage on SW Marine Dr, drainage and stormwater collection, the

tunnel, parking, accessibility of gardens to both staff and the public, restaurant/food services, and anchor attractions for the north side of the garden.

In terms of accessibility, the garden is currently somewhat inconvenient to visit. On busier days, the rather small parking lot fills up quickly resulting in visitors parking in the rather expensive- and distant- UBC parking lots. For those travelling by foot from campus, the intersection of SW Marine Dr. and Stadium Rd. proves to be both difficult and dangerous to cross due to the width and flow of traffic. Signage on SW Marine Dr. is currently lacking; if it were improved, drivers would become more aware of the garden's presence. Currently, there is only one way for visitors to enter the gardens, on the south-west side. This means that when visitors have crossed through the tunnel to the north side of the garden and have finished their visit, they have to walk back to where they entered.

Some other issues the garden faces include the tunnel connecting the north and south ends of the garden, and lack of efficient stormwater collection.

The major issue the Botanical Garden is currently facing however, is the lack of visitor attractions. The north side of the garden needs 'anchors' that will draw visitors through the garden, and also improve attendance. These 'anchors' will need to not only be able to generate revenue, but will also need to increase the diversity of the garden by attracting a wider range of demographics.

The remainder of this report will address all of these concerns, providing creative, economical, and sustainable solutions.



## **2. SCOPE OF WORK**

The scope of work for this conceptual design project is as follows:

- Explore and generate ideas to redevelop the UBC Botanical Garden with respect to its mission
- Increase garden revenue
- Improve the overall visitor experience
- Enhance the role of the garden within the UBC community
- Expand the garden visitor demographic
- Address all or partial aspects of civil engineering in the conceptual design

## **3. MISSION STATEMENT**

*“To enhance the functionality and visitor experience of the garden and subsequently maintain its mission of conservation, education, community outreach, and public display, well into the future.”*

This statement combines the scope and purpose of the conceptual design outlined in this proposal with the overall mission of the garden. It clearly states what is to be accomplished for the garden in order to both improve it for the future, and maintain its current standards.

#### **4. CONCEPTUAL LAYOUT OF PROPOSED DEVELOPMENTS**

The proposed design is comprised of several solutions which together will create a more attractive destination for students, local residents and visitors to Vancouver. There are three major components to the design, each of which is detailed in the following sections. The parts are as follows:

- A tower at the east end of the central garden area, which will act as a cafe, event and learning space within the garden
- A glass showcase building at the proposed secondary entrance on the north end of the garden, which will include several ecosystems and which can be built up in modules
- Incremental changes to existing garden structures and facilities to improve the visitor experience to the gardens and improve the sustainability of the garden operations.



Figure 1 - Layout of Proposed Concepts

Legend:

1. Showcase Glasshouse and Second Entrance
2. Tower: UBC Perch
3. Pedestrian Traffic Light
4. Redesigned Parking at Existing Entrance
5. Signage along Marine Drive
6. Stormwater Management Plan
7. Hedge Maze

## **5. TOWER: UBC PERCH**

The UBC Perch is a distinctive tower that blends into the garden, while providing a useful and relaxing space for visitors, garden students and staff.

### **5.1. Description**

The tower structure will have four floors arranged in a semi-circle shape (approximate radius of 10 m), maximizing sun exposure, providing great views, and creating smooth lines that flow into the garden (Figure 2). The concave supporting columns will have growing vines, adding an organic curve that will contribute to the natural look of the structure.



**Figure 2 - UBC Perch View from Event Lawn**



### 5.1.1. Building Envelope

The tower will be made of glulam timber for the structural strength and natural appeal of wood. Double pane windows shall form the majority of the wall space, creating an indoor space that is surrounded by outdoor vegetation. The back wall facing the stadium seen in Figure 3 will be a green wall until the third floor, where a glass back wall shall be provided to view the sports field. This will combine form and function, as well as a sustainable building that will use sunlight for heating during the winter and as a light source throughout the year.



Figure 3 - Aerial View of UBC Perch from above Thunderbird Stadium

### 5.1.2. First Floor

The ground floor will be a flexible working space for garden staff and students using the garden for horticultural or biological learning. It will also incorporate the main entrance space and access to the stairs and elevator. Adjustable partition walls will be included here, similar to the ones shown in Figure 4 below, as well as horticultural equipment and tools for research, seeding and examination. The floors will be sealed concrete for durability and ease of cleaning. A mud room will be built in as a transition space from the outdoors to the indoors, creating a separate working entrance.



**Figure 4 - Example of Movable Partition Walls (Movable Partition Walls)**

### 5.1.3. Second Floor

The second floor will be another flexible open space similar to the one included below that will be generally suited to events and rentals. These events are currently focussed on weddings, but could be expanded to UBC industry events, corporate events from Vancouver companies, Garden events like Apple Fest, and graduation celebrations amongst others as illustrated by

Figure 5. These type of events will bring in large volumes of people who may not usually visit the garden, and who may return to explore the outdoors. The wall of windows looking out onto the garden makes the visitors feel like they are part of nature.

When not in use by events, the space could be used as an expansion space for the Garden staff's work, or as additional room and table space for the Cafe, discussed later.



**Figure 5 - Formal Dining Room for Events (Grand Overlook, 2013)**

#### **5.1.4. Third Floor**

The third floor will host the cafe and bar space for various events. The back wall will be made of glass, for viewing of the stadium during sports events (see Figure 7). The room should have multiple tables to accommodate student studying space as well as garden visitors taking a break from the outdoor sights. There will be a food service nook for the cafe food and beverage preparation, as well as for use during events if desired by the client. This floor level will have a complete view of the gardens (see Figure 6) below from the forest to the south, over the food and physic garden, to the great lawn and finally north to the glasshouse described in section 6.



**Figure 6 - UBC Perch Cafe**



**Figure 7 - Thunderbird Stadium (Thunderbird Stadium, 2009)**

### **5.1.5. Fourth Floor**

The top floor is a combined indoor and outdoor space, with a large patio offering panoramic views of the garden, the ocean and Thunderbird stadium. Seasonal vines will grow on trellis over the patio to provide shade during the summer months while maintaining maximum sun exposure during the winter months. The enclosed viewing room will provide optimum views during foul weather.

### **5.2. Justification and Potential Benefits**

As a green building with a unique shape, the UBC Perch will be a destination to students on campus looking for a calming study space, visitors to the garden who are looking to take a break in their exploration, and an iconic structure that can be used as a learning tool for integration of structures within natural environments, using plants as a building component.

As a flexible space with installed amenities, the following income opportunities will be available from the tower:

- Food and beverage sales from the cafe for garden visitors on a break and students using the studying space
- Alcohol sales from the bar for specific liquored evenings



- Event rentals
- Thunderbird Stadium sporting events income, in association with UBC Athletics, from spectators and their food and beverage purchases
- Horticulture training programs using the first floor teaching and learning spaces

### **5.3. Proposed Implementation Plan**

Key information regarding the construction and use of the tower are presented in this section.

#### **5.3.1. Construction and Delivery Access**

Access to the tower would be via the 16th Ave entrance, and up an expanded paved path to the tower location (marked by an X) as shown in Figure 8 below. This will allow full sized vehicles access to the site without significantly affecting the garden. Further access during construction may be possible from the east side in the Thunderbird Stadium. Any plants that may be removed for the placement of the tower will be relocated to another area of the garden or within the new plant spaces included with the modular Glasshouse. Additionally, construction is proposed during the months of current closure of the gardens (November 15-March 15) to limit impact to the visitor experience.



**Figure 8 - Service Road with Access to UBC Perch**

### **5.3.2. Integration of the Tower to the Environment**

The addition of growing vines up the columns will integrate the structure into the natural greenery of the garden. The rapid development of this look can be facilitated by using many vines growing from several heights along the columns. In addition, the clarity of windows will provide transparency of the building within the environment while the curved wood members will blend in with the natural setting and the similar curves in the Glasshouse.

### **5.4. Environmental Considerations**

The tower will use natural sources where possible in its operations. Solar heat will be captured during the winter months through the glass walls, reducing the energy heating needs of the building. During the summer months this effect will be reduced through natural shade provided by trellis and plants which will minimize the penetration of sun rays into the building, avoiding over heating of the interior. Lighting will mostly available from the sun during daylight hours while low energy installations will provide evening and night time illumination. Water collected on the roof and patio surface will be collected and pooled into a plant watering basin, while excess flow will be sent into the stream crossing the garden and into the lower gardens below SW Marine Dr. The green wall forming the back of the tower will act as a thermal insulator and regulator as well as a noise barrier from the stadium. In addition to being an attractive and calming source of nature within a building, the inclusion of this green wall within the garden, will allow the Garden to undertake research involving these system, which will fit well within the scope of current industry demands and the mission of the UBC Botanical Gardens.

## 6. SHOWCASE GLASSHOUSE AT NEW GARDEN ENTRANCE

The showcase glasshouse is an on-site nursery and public display greenhouse. It will act as a second entrance at Stadium Road (at the north-east corner of the garden) and function as a year round attraction. This building also has the option to be built in stages due to its simple architecture. The north east corner of the garden, near Stadium Rd., will be redeveloped. This corner will have privacy shrubs around the service yard with a relocated driveway, a small garden and lawn to welcome visitors, and the Showcase Glasshouse containing a second entrance (see Figure 9).



Figure 9 - Redevelopment of North-East Garden Corner

A unique feature of the Showcase Glasshouse is that it will contain three distinct climate zones. Transparent, interior walls that are able to slide will separate the zones. Depending on funding, these domes can be built at separate times. Elevated walkways and platforms will provide an interesting and easy viewing of the plants below. This green and recreational space will attract more people to the garden in the winter months of November, December, January and February; in turn increasing the revenue that the garden generates.

This building will be built in conjunction with a second entrance to the garden and landscaping renovations to the area surrounding the service yard. The new landscape architecture and entrance are described in detail in section 7, below. As shown in Figure 9 above, the Showcase Glasshouse will be visible from Stadium Rd., making the garden easily recognizable and showcasing its beauty.

### **6.1. Description**

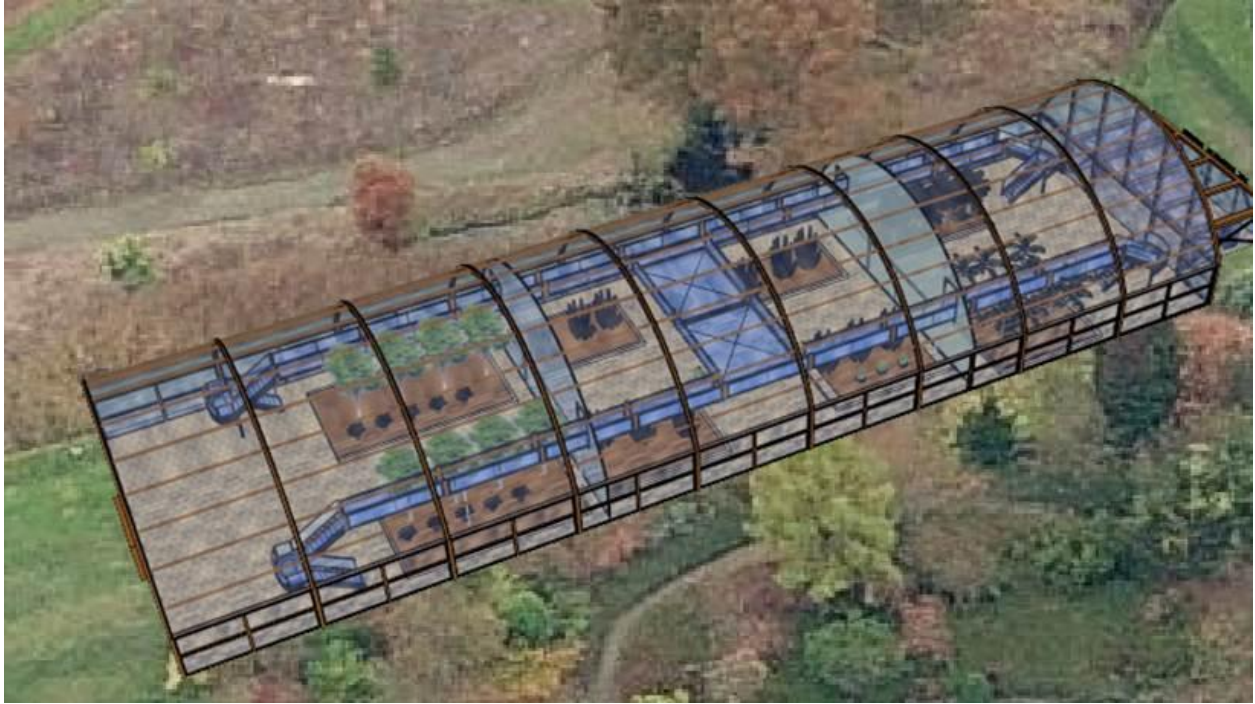
The showcase building will be built of glulam (glued and laminated wood) arches with glass panels connecting the arches. The double pane glass panels will provide natural light. Approximate dimensions of 15 m wide x 50 m long x 15m high will allow the structure to fit into the existing space as shown in Figure 10. This space will house a nursery to grow developing plants, as well as a greenhouse for more exotic and non-native species.



**Figure 10 - End View of the Showcase Glasshouse, Looking East**

The interior wall separating the zones will isolate weather conditions from one section to the other. Distinct climates will be developed in each dome, or section. Providing there is enough funding, this building is proposed to contain three different climate zones as shown in Figure 11, below, although as these modules are independent systems, further domes can be included as needed. Following the entrance area, there will be a hot and dry desert climate, welcoming to winter visitors. The plants from the existing desert garden will be moved to this zone (as the existing desert garden area will be used for the UBC Perch tower). A transparent wall will separate the desert zone from the second, moderate climate, representative of Vancouver's climate. A nursery can be present in this zone; a place to grow and develop plants for sale and use outside of the garden. The third, and final zone will be a tropical zone with foreign flora from different parts of the world.





**Figure 11 - Overhead View of the Greenhouse Interior**

Figure 11 also shows the elevated walkways that will extend from one end of the greenhouse to the other. There will be a main viewing platform in the middle zone, allowing for a bird's eye view of the plants and activity going on in the showcase glasshouse. The endwall panels and some of the roof panels will be able to open, allowing for breezes circulation during the summer (Figure 12).



**Figure 12: View of Glasshouse from Great Lawn**

## **6.2. Justification and Potential Benefits**

The Showcase Glasshouse will add value to the garden, its visitors and the UBC Community. It will create additional revenue to the garden, be a place to relax, a place to learn and will generate new interest in the garden. There are also potential research opportunities that could arise from having a new greenhouse and nursery at UBC. Adding different climates will be interesting to children and teenagers in grade school. The variety and development stages of plants would be an educational opportunity for grade school tours.

Currently, the garden is closed during the winter, due to low visitor demands during these months. Providing an interesting, indoor attraction, that fits with the theme and ambience of the garden, will greatly increase the demand of visitors in these months. Because of the unique showcase structure more people are also likely to come during summer months. The revenue the garden generates will increase due to the inflow of new visitors attracted to this appealing new space.

The showcase building is a single story and is relatively low to the ground, therefore minimal shadows will be cast on the garden. The simple, natural lines of this building will be identifiable of a greenhouse from the street, but will not overpower or remove from the atmosphere of the garden once inside. This building is subtle from inside the garden, but eye catching from Stadium Rd. to draw in interest and people to the gardens.

The entrance and showcase building are combined to minimize construction and operations cost. One staff member or volunteer will be able to run the building at the same time. This structure is near Stadium Rd. so there would be easy access to construction crews and deliveries could easily be made.

### **6.3. Proposed Implementation Plan**

This proposed concept can be implemented in stages. The stages are as follows:

1. Remove berm and complete the landscaping around the service yard and new entrance
2. Build the entrance
3. Construct the showcase building
4. Future additions to the south end of the structure

It would be more cost efficient to build the entrance at the same time as the showcase building because construction crews would be on site, there would be one mobilization cost and there would be some economies of scale involved with building more things at once. Additions could be easily added to the south endwall, making the building longer. The simple, symmetrical shape of the building allows for identical panels to be added, at any width, to the end of the structure.

The concrete work for the foundation will be done on site, but the glulam arches will be fabricated off-site. Because this building is on the edge of the garden, near Stadium Rd. (Figure 9), disruption to the regular function of the garden will be minimal during construction and there will be minimal damage to the garden. The prefabricated arches, glass roof and sidewall panels will be erected quickly, with cranes set up near Stadium Rd. Since the cranes will be set up outside the garden, the garden grounds will not be damaged or crushed from the crane footprint. Construction crews will enter the site from Stadium Rd., and will not disrupt garden visitors.

### **6.4. Environmental Considerations**

There will be many environmental features built into the greenhouse-nursery, with an aim for LEED Platinum achievement. Water collection troughs will be added to the edges of the roof. The water collected in these troughs will flow into a collection basin, and then will run through a



series of filters to be used for irrigation within the greenhouse. The double paned glass panels will allow for natural sunlight to provide a significant of the heating for the building. Materials that meet LEED and UBC standards will be used and construction practices will also be carefully considered in order to build a green and efficient structure.

## **7. INCREMENTAL IMPROVEMENTS TO EXISTING GARDEN ISSUES**

The implementation of the Showcase Glasshouse and UBC Perch is intended to increase the visitor attendance to the UBC Botanical Gardens, meaning that the garden needs to remain functional. Addressing the smaller issues that exist within the garden allows for a more complete conceptual upgrade. As a larger group of people will be attracted to the garden as a result of these new attractions, upgrades to the accessibility and sustainability of the garden need to be made. The succeeding sections include recommendations for the issues brought forth by Patrick Lewis, UBCBG Director, and Douglas Justice, UBCBG, Associate Director and Curator of Collections, as well as problems that were noted during site visits. Introducing these incremental changes in the following order will allow the garden to improve its overall functionality, while keeping up with the climbing visitor attendance.

### **7.1. Additional Garden Entrance**

There is currently only one entrance to the garden, located near the parking lot. This is a significant issue because visitors do not have easy access to the east side of the garden. Visitors must walk through the tunnel (under SW Marine Drive), enjoy the attractions on the east side of the garden, and then retrace their steps. This results in an unnecessary distance of 0.5 km covering previously viewed garden spaces.

A secondary entrance will provide a direct path to the north garden. This side of the garden is used for weddings and special events, therefore having an entrance and exit there will make the attractions more accessible since visitors will not have to retrace their steps back to the main entrance. As a result, the garden experience will be better, increasing likelihood of return customers.

The entrance will be incorporated with the new showcase building (Section 6). Figure 1 shows the proposed location for the new entrance. There are two options for this entrance: an attendant could grant entrance or an automated machine could allow access. An automated machine, similar to the ones Translink uses for the Skytrain and Canada Line could be used. A ticket would be bought at a booth and then scanned at the entrance gate. This would eliminate the need for an attendant and their additional extra salary cost. For UBC students, their student cards could be used to allow access.

## **7.2. Service Lot Renovation**

There is also a large berm, hiding the service yard from view. This berm is taking up a lot of valuable real estate. S. H. & O Design therefore proposes to optimize that space by removing the berm, and rearranging the service lot, thus making way for a new and attractive entrance to the Garden at that location, and for a separate and more convenient entrance to the service lot, as shown in Figure 9. This implementation would require a substantial amount of earthworks and landscaping, valued at around \$200,000, as well as the transposition of the trees in the berm to another location in the garden, with implementation time estimated to be around two weeks.

## **7.3. Parking Lot Layout**

Parking considerations were highlighted as a problematic concern for visitors to the garden. Particularly for events, parking is severely limited and has previously cost the gardens significant amounts to provide shuttling services to their facilities. Three solutions are tentatively possible and could be combined to further increase the parking availability for the garden.

### 7.3.1. Option 1: Improve Current Parking Lot Design

There is currently an inefficient use of space in the garden parking lot. While this parking area cannot be extended beyond its current footprint due to limitations by UBC regulations, a rearrangement of stalls, as shown in Figure 13, along with the removal of the existing central green median could increase the number of stall available to 114 spots.



Figure 13 - Rearrangement of Parking Stalling in Existing Parking Lot

### 7.3.2. Option 2: Enter into Agreement to Use the Existing Thunderbird Stadium Parking Lot

The parking lot at Thunderbird Stadium can park approximately 84 vehicles and would be close to the proposed secondary entrance discussed in this report and marked in Figure 14 as box A. This would increase the benefit of the second entrance and exit along Stadium Rd while offering twice the current parking spaces. Arrangements with UBC Parking and UBC Athletics could be discussed in order to increase the advertised parking available to the botanical garden visitors and develop a potential partnership between the two UBC entities.

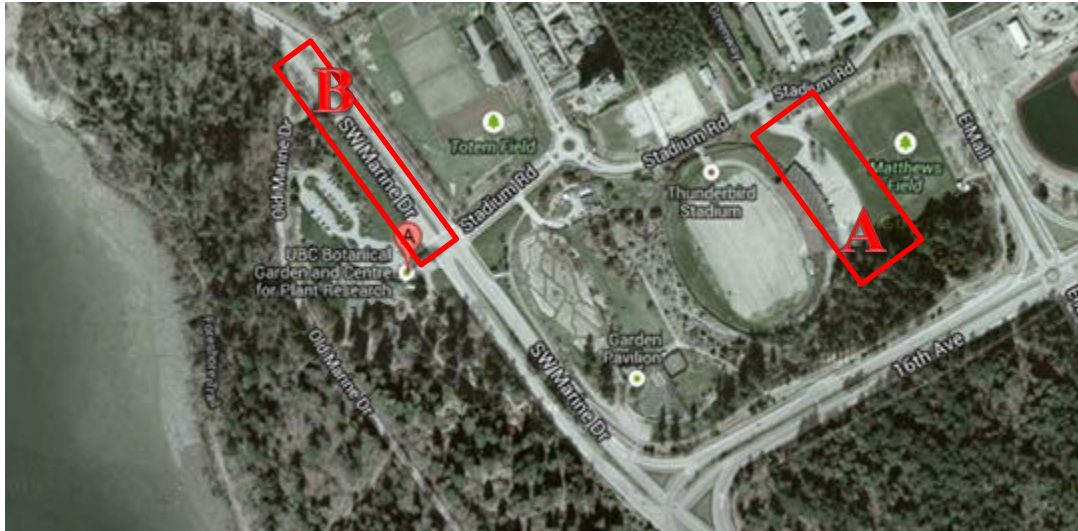


Figure 14 – Alternative Parking Areas

### 7.3.3. Option 3: Use the Right Lane of Southbound Marine Drive for Parking Stalls

Pending the decision of BC Ministry of Transportation regarding the closing of the right lane of southbound Marine Drive in the vicinity of the gardens (see Figure 14) and the box labelled B. this paved space could be used to increase the parking spaces near the garden.

## 7.4. Tunnel Renovation

The tunnel which links the west and east halves of the garden under Marine Drive is neither attractive nor welcoming due to its dark and claustrophobic corrugated steel construction. In order to improve the tunnel’s appearance as well as contribute to the garden’s goal of educating and inspiring visitors, our team proposes that the tunnel be retrofitted to serve as a functioning exhibit of hydroponic growing techniques.

This exhibit will capture the interest of visitors by demonstrating that ongoing horticultural research is vital to the future of food sustainability under increasing population pressure. To show the progression in technology the tunnel is organised in a chronological fashion. At one

end, the comparatively primitive method of growing in clay pots used by the ancient Egyptians nearly 4000 years ago (Raviv and Leith, 2007); at the opposite end a system showing the capture of heavy metals from effluent by lettuce as demonstrated by Rababah and Al-Shuha (2009).

To take advantage of the tunnel's circular cross-section the plants will be supported on shelves attached to the wall at the point of greatest width and hanging from cables at their interior edge. Grow lamps and drip lines will be installed along the length of the tunnel as required. Plaques and interactive displays will explain the benefits and drawbacks of hydroponic growing and work to increase the public's awareness of these methods. A variety of useful food or fibre plants will be grown to offset the uninteresting steel backdrop of the tunnel and emphasise the practicality of hydroponic growing.

#### **7.5. Maze / Labyrinth**

The current visitor demographic at the garden consists largely of seniors, benefactors, alumni, and events participants. In order for the garden to generate steadier revenue, attractions that will broaden the target demographics are needed. S. H. & O Design therefore proposes that a configurable hedge maze be constructed on the lawn east of the food garden and south of the physic garden.

Toft (2004) discusses the rich history of mazes and their increasing popularity as a leisure attraction. He points out that the 42 mazes in the United Kingdom in 1980 exploded to more than 200 by 2004. The natural mystery of mazes will draw visitors across the garden and encourage them to explore. Markers are placed at dead ends and special locations within the maze, providing historical facts about mazes and their important to gardens worldwide.

The proposed maze will not, however, be composed of thousands of yew or cedar shrubs and take a considerable time to establish. S. H. & O Design suggests that the walls of the maze be constructed of panels which support living wall media. By using a modular design, the layout of the maze can be changed to draw repeat visitors and add a challenge. Living walls are becoming more popular for their usefulness in reducing building energy costs, scrubbing city air, and decreasing stormwater runoff (Perini et al. 2011). Plaques placed along the walls will describe how living walls are grown and what benefits they have. By combining an old maze concept with new modular and sustainable design criteria, S. H. & O Design believes that this feature can boost visitors to the garden while upholding its vision.

#### **7.6. Signage for Garden Entrance**

One issue that was noted during the site visit was the lack of “eye-catching” signage advertising the entrance to the Botanical Garden. Currently, there is only one sign located close to the entrance that fails to grab motorists’ attention because of its size and location. S. H. & O Design feels this is an easy and inexpensive issue to resolve and should be addressed as soon as possible by implementing the following:

- Replace the existing sign with a larger, more appealing one, and place it further up the street as shown in Figure 15. This will give motorists heading southbound on SW Marine Drive more time to notice the entrance to the Garden
- Add similar signs at two other locations as designated in Figure 16 that will alert motorists heading northbound on SW Marine Drive and eastbound on Stadium Road



**Figure 15 - New Sign on SW Marine Dr., Looking South**



**Figure 16 - Locations of New Signs**

The cost and implementation time would obviously depend on the final design of the signs, which would preferably resemble or follow the same architectural style used for the new structures. However, the addition of these new signs will undoubtedly promote the Garden more effectively and might attract passers-by that otherwise would be unaware of its existence.

## **7.7. Stormwater Management**

Currently, the pond that is located on the North side of the UBC Botanical Garden is experiencing leakage of potable water. This is resulting in the garden having to periodically refill the pond in order to maintain its current water level. The main reason that the pond is leaking is due to the coarse-grained permeable soil that makes up the pond boundary. This seepage and leakage is leading to erosion of the plants and soil on the area surrounding the pond, and also an excess use of potable water. The implementation of relatively simple stormwater management technologies will help to improve the overall sustainability and efficiency of the garden pond.

### **7.7.1. Solutions**

In order to solve the negative effects of leaking and seepage two options have been explored, each providing a different benefit to the garden. The first solution is one that will solely solve the



issue of seepage-related erosion, without actually stopping the leaking. This option, while having a relatively smaller capital cost, will require more labour and upkeep, and is also less sustainable as it will require filling to maintain water levels. By planting vegetation around the pond's boundary, the erosion of the pond's edges is reduced. The second, more recommended option is one that involves the implementation of an impermeable membrane, transforming the pond into a rainfall collection basin. This detention pond will benefit from Vancouver's high levels of precipitation, and will also have the ability to function as a source of grey water. The rainwater, or 'grey' water will be able to function as a source of irrigation for the garden, as well as in washroom facilities, and other applications where potable water isn't required.

#### **7.8. Pedestrian Controlled Traffic Light**

While addressing the problems of the gardens in terms of accessibility, the intersection of SW Marine Dr and Stadium Rd is considered to be a problem area. Currently, this rather busy and wide intersection is difficult and dangerous to cross as it only contains pedestrian crossing signs. This leads to the recommendation of placing a pedestrian controlled traffic light on SW Marine Dr. This traffic light would be push-button controlled on both sides of the intersection, paired with overhead flashing amber lights. The safety of pedestrians is of high priority, and the implementation of this pedestrian light would be invaluable in improving the accessibility and safety of the garden's staff and visitors.

Prior to a pedestrian light such as this one being approved, certain study and data requirements laid out by the Ministry of Transportation and Infrastructure must be met. According to the Pedestrian Crossing Control Manual for British Columbia, the following studies must be completed:

- Gap study or vehicular count
- Pedestrian count, including age distribution
- Speed study, to determine the 85<sup>th</sup> percentile speed

Other information needed includes stopping sight distance, proximity of adjacent traffic signals, traffic signal timing, road geometry, and review of accident history. After the appropriate data is collected, the type of pedestrian crossing control can be selected. If this intersection meets the requirements laid out by part 2, section 3 of the Pedestrian Crossing Control Manual for British Columbia, a pedestrian traffic light can be approved.

## 8. IMPLEMENTATION PLAN

The improvements and infrastructure development proposed in this report may be implemented throughout the Gardens in stages, depending on the existing financial ability, community and UBC support and the increase in visitor numbers. However, in order to improve the visitor experience, augment revenue income to the Gardens while maintaining continued development of the Gardens, the following priority and cost schedule is proposed. The costs in table 1 below are rough estimates based on past engineering experiences.

**Table 1 - Priority Schedule and Costs**

<b>Priority</b>	<b>Development</b>	<b>Estimated Cost</b>	<b>Construction Time</b>	<b>Expected Benefits</b>
<b>1</b>	Garden entrance, including earthworks and the first module of the glasshouse	\$200,000 entrance works \$1,000,000 module	2 weeks (entrance works) 3 weeks (module)	Improved flow of people through the Gardens. Attractive, practical and noticeable new entrance
<b>2</b>	Incremental Improvements: <ul style="list-style-type: none"> <li>• Signage</li> <li>• Parking</li> <li>• Stormwater</li> <li>• Tunnel</li> <li>• Maze</li> <li>• Pedestrian Crosswalk</li> </ul>	\$15, 000 \$100, 000 \$50, 000 \$20, 000 \$60, 000 \$20, 000	1 week to 1 month each	Enhanced image of the garden on campus, improved visitor experience, better sustainable practices supported by the garden and better services for event rentals
<b>3</b>	The Perch Tower	\$5,000,000	3 months	Increased revenue due to cafe and large event rental space Opportunity for garden to research plant and building interactions and uses
<b>4</b>	Further glasshouse modules	\$1,000,000/ module	5 weeks	Advancement in garden's horticultural capabilities and interesting architectural feature in Garden

The priority schedule in table 1 provides the garden with enough flexibility to customize the overall development. For example, not all eight items included in our list of incremental developments need to be completed right away. It is recommended to first focus on the additional entrance and the service lot renovation. These two items need to be done in accordance with one another as they increase the accessibility of the gardens to the public, and also provide incentive for the showcase glasshouse. As shown in the proposed implementation plan in section 8, the next step would be the construction of the Perch Tower. The reason this item is given its priority is that this diverse building will act as an anchor and a source of revenue for the gardens. As this example demonstrates, the components of the plan are flexible in their implementation, allowing the UBC Botanical Gardens to really customize the development to their needs.

## **9. CIVIL ENGINEERING SUB-DISCIPLINES UTILIZED IN THE CONCEPTUAL DESIGN**

There are several civil engineering sub-disciplines that are involved in building a tower and a greenhouse. Construction management and delivery services will be used throughout all phases of the project to ensure the building meets the criteria set out by UBC and the Botanical Garden. Geotechnical and structural (including seismic) design is relevant for safe construction, serviceability and reliability of the building throughout its lifetime. Building envelope performance, an important new specialty, will be included in the planning and materials purchasing. Design of wastewater and stormwater systems will also be needed. Environmental engineers will be consulted to ensure the project is completed according to UBC's sustainability goals and its Campus Plan.

The incremental improvements to existing garden issues will require a sub-set of the engineering disciplines described above. Transportation engineers will be consulted in the design and approval of the pedestrian controlled traffic light, new signage, parking lot layout, and service yard driveway relocation. Hydrological engineers will be required for the stormwater management. Construction management will also be involved in the planning, development and construction of each project.

## **10. CONCLUSION AND RECOMMENDATIONS**

This plan for the redevelopment of the UBC Botanical Gardens will revitalize its overall presence, drawing in more visitors and increasing revenue. This conceptual proposal has described each component of the plan in great detail, and provides conceptual drawings of the two major developments: the UBC Perch tower, and the showcase glasshouse building. In order to enhance the overall visitor experience, these two ‘anchor’ buildings will act as recreational, educational, and event spaces. In addition to the implementation of these two multi-purpose spaces is a range of suggested incremental improvements. The incremental developments are important in order to improve the accessibility and functionality of the gardens, in turn boosting visitor numbers and hence making the UBC Perch and the showcase building more feasible and appealing attractions.

S. H. & O Design recommends that the implementation plans mentioned in sections 5.3, and 6.3 for the UBC Perch and showcase building respectively, be followed closely. Since these two plans have been developed to consider ease and efficiency of construction, economics, and sustainability, we believe they adequately suit the garden’s needs. Section 8 provides an overall implementation plan considering the incremental improvements, the garden entrance and showcase glasshouse, and the UBC Perch in terms of construction priority, time, and estimated cost. As we are currently in the preliminary stages of development, the cost estimates are basic estimates, and a more detailed cost estimate will be provided in the next phase of this project.

S.H.&O. recognizes and understands the limitations of the UBC Botanical Gardens in terms of funding, staff, and space. In the event that the implementation of each aspect of this conceptual plan isn’t financially feasible, staging of items may be carried out through discussions with the Botanical Garden administration, suiting their current needs and budget. This may involve a shift

in the proposed schedule and priorities. The construction sequence will be flexible dependent on resulting visitor and income projections. However, the currently proposed schedule anticipates visitor and revenue growth in order to financially support and provide incentive for further growth in infrastructure development in the gardens by development of 'anchor' structures in the gardens.

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