

UBC Social, Ecological, Economic Development Studies (SEEDS)
Student Report



Harvest Hut Waste Redirection Site

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1.0 INTRODUCTION

1.1 Purpose and Outline

This document presents a detailed description and plan for the construction of the Harvest Hut Waste Redirection Site project. The report consists of background information on UBC Farm, scope statement for the project, three conceptual designs developed by the team, description of the decision making process, final design modifications, detailed design, construction schedule, roles and responsibilities of the team members, and risk assessment.

1.2 Plan of Action

After approval and finalization of all details, construction of the new site will be undertaken by second year UBC Civil Engineering students. The project will be completed in three days during the second semester, while keeping costs within a pre-estimated budget.

1.3 Team Members

The members of the group and their main roles are:

- Anastasia Baysheva – Team Coordinator
- Christopher Forrest – Designer and Formatter
- Daniel Bragagnini – Record Keeper and Editor
- Elliot Yii – Contact Person with the Organization
- Rommel Adrian Nocos – Designer and Final Editor
- Thomas Elliott – Designer and Construction Specialist

2.0 COMMUNITY ORGANIZATION BACKGROUND

2.1 Structure

UBC Farm is 24 hectares big and is located on the South Campus of the University of British Columbia in Vancouver. It is a student-driven model farm and is mainly used for research and learning purposes by different faculties in UBC, which include the departments of Botany, Forest Sciences, the Botanical Gardens, and the Faculty of Land and Food Systems. The farm site applies the research and innovation of the students to maintain the land and produce food with sustainable methods.

UBC Farm is managed by the UBC Farm Advisory Committee, which includes faculty, staff and students. However, countless volunteers and interns are what make UBC farm functional. UBC Farm's vision is to utilize its research and innovation on agro-ecological design to create a positive influence on the economics and ecology of urban communities.

2.2 Vision and Mission

UBC Farm Advisory Committee has a set of objectives and goals they want to accomplish. These objectives include validating UBC Farm as a significant part of the university, promoting student participation concerning the operation of the farm, and getting involved with the community by promoting sustainability. Moreover, one of the main goals of UBC Farm is to transform itself into a sustainable enterprise. This includes implementing a management system and developing farm programs that allow the people in UBC Farm to practice sustainability. This

also means establishing the farm as a viable initiative. To help them get to this goal, two Agriculture Science students came up with the idea of a market garden on the farm site in 2001. UBC Farm approved this idea and the students were allowed to put the project into operation. In its first five years, the Farm Market flourished, demonstrating an eightfold increase in cultivation capacity. However, during those years, the Farm Market struggled financially. It had to depend on grants, wage subsidies and help from volunteers to achieve a state of financial sustainability. Now the Farm Market has improved financially and cultivates countless varieties of vegetables, fruits and herbs. The UBC Farm Market operates every Saturday during the growing season, which is from June to late October. The produce on sale is always organic and fresh, meaning it is harvested the day of the market or the day before. Most of the market produce is grown by the UBC Farm staff.

2.3 Organizational Contacts

- Andrew Rushmere – Academic Coordinator
- Brenda Sawada – UBC SEEDS Manager
- Kayla McIntyre – Market Manager

3.0 SCOPE STATEMENT FOR THE PROJECT

3.1 Goals and Objectives

The goal of the project is to design and build a feasible and effective waste redirection site at UBC Farm for main use during the Farm Market. Another goal is to increase public awareness of recycling, composting, and other sustainable waste management practices at UBC Farm. The idea is to construct an aesthetically pleasing, weather and rodent-proof structure to manage the waste sorting. The structure is to house garbage and compost cans as well as recycling bins for paper and other recyclable material, that are located around the pole in the Harvest Hut area (view APPENDIX A, Figures 1 and 2). It should allow UBC Waste Management staff and UBC Farm staff to easily remove waste from the containers, at the same time preventing waste from contamination, rain leakage and odour problems. The structure is ideally portable and cheap. Thus, the main project objectives are functionality, low cost and visually appealing design. The structure should clearly indicate the type of waste thrown in each container, making the sorting process easier. It also serves to increase safety and hygiene of the Farm Market.

3.1 Constrains

The project constraints met during the design process consist of weather, rodents, material selection, size of the containers and specific Waste Management design criteria, as discussed below.

- The weather factor implies the need for having an inclined roof, so that rain and snow do not collect on top of the containers.

- Squirrels, mice and other rodents often carry infections and may cause many problems. They should be prevented from getting into containers. Therefore, a closed structure is potentially more durable and safe than an open one.
- Low price is one of the project objectives, and materials have to be selected carefully. The team was given access to the UBC Farm Tool Shed and the South Campus Warehouse. Materials available at the UBC Farm include lumber, hardware, metal scraps, livestock panels, and other assorted materials.
- Size of the containers is essential for the design and construction of the project, as the structure has to fit in the containers and remain easily portable. Careful measurements were taken before the team progressed to the design process.
- The Waste Management criteria include easy access to the containers and simplicity of the waste collection. Therefore, large containers are more preferable than the small ones.

3.1 Assumptions

The project assumptions include the building schedule and the availability of materials. There is a total of 10 Civil and Mechanical Engineering design projects at UBC Farm this year. Because of the limited material, tools and space resources, the interests of student teams may intersect. In order to avoid clash of interests, every team was asked to make a list of required materials and submit it to the organization, as well as the possible dates for the building part of the projects.

4.0 THREE CONCEPTUAL DESIGNS

Following the design objectives and constraints, the team has come up with three conceptual designs. Each design had to meet a different combination of the criteria, offering the organization a variety of possible solutions to the problem.

	<i>Cost</i>	<i>Weather Resistant</i>	<i>Rodent Resistant</i>	<i>Portability</i>	<i>Accessibility</i>	<i>Large Container</i>	<i>Aesthetics</i>
Design One		√	√	√		√	
Design Two		√		√		√	√
Design Three	√				√	√	√

Table 1. Criteria met by the three conceptual designs

4.1 Design One

Design One meets four criteria out of seven. It is resistant to weather and rodents, portable and is capable to contain large containers. The four covered sides, roof and push hatch work to keep its contents protected from precipitation and rodents (view APPENDIX B, Figure 3).

Constructing the four containers as separate structures serves portability. It also allows to build each unit specifically for the required container size. The hinged doors are designed to make it easy for the waste management personal to retrieve the container from inside. However, the hinges and stoppers have to be purchased separately, which increases the structure cost.

4.2 Design Two

Design Two meets four of the seven criteria. It is similar to Design One, but it gives less protection from rodents and is visually more appealing. Design Two has four walled sides and a triangular roof to protect it from the rain and snow (view APPENDIX B, Figure 4). However, it does not contain the push hatch, thus it is possible that the rodents can get inside. As the four structures are separate they can be constructed to a specific size and easily relocated if needed. Hinged doors protect the containers from the outside and increase the cost of the structure.

4.3 Design Three

Design Three meets four criteria, which are cost, accessibility, aesthetics and the ability to contain large containers. This design is unique in that it does not have any walls, which gives it an appealing look, but leaves it wide open to the weather and small animals (view APPENDIX B, Figure 5). Having no walls and hinged doors makes it the most accessible and the cheapest of the three designs. However, because it is one solid structure it is not portable. Like the other two designs, Design Three can be constructed with materials available at the farm, but in this case there is no need to buy hinges and stoppers.

5.0 DECISION-MAKING PROCESS

In coming to a decision of which design the team will recommend to the organization, several factors were taken into account. The project constraints included cost, weather-durability, resistance to rodents, portability, the size of containers, and accessibility. The benefits and drawbacks of each design were discussed in a Multi-Criteria Decision Making form. It was decided that Design Three was the best overall candidate. The benefits and drawbacks of each design are as listed below:

	<i>Advantages</i>	<i>Disadvantages</i>
Design One	<ul style="list-style-type: none"> ○ Simple and recognizable design ○ Easy access to containers ○ Weather and rodent-proof structure ○ Requires less area (only 2 sides around the pole) 	<ul style="list-style-type: none"> ○ Necessary to purchase hinges, stoppers, and handles (increased cost) ○ Requires site preparation (concrete corner footings, metal platform) ○ Site maintenance required more frequently (roof angled towards the back, causing water-log)
Design Two	<ul style="list-style-type: none"> ○ Simple and recognizable design ○ Easy access to containers 	<ul style="list-style-type: none"> ○ Requires site preparation (perhaps concrete corner footings, metal platform)

	<ul style="list-style-type: none"> ○ Weather-proof structure ○ More open than design 1 	<ul style="list-style-type: none"> ○ Necessary to purchase hinges, stoppers, and handles (increased cost) ○ No flapping door (no protection against rodents)
Design Three	<ul style="list-style-type: none"> ○ Best aesthetics overall ○ Open structure (rain and smell do not stagnate) ○ Less material necessary ○ Easiest in terms of garbage bin loading and unloading ○ Requires less area (only 2 sides around the pole) 	<ul style="list-style-type: none"> ○ Requires site preparation (concrete corner footings, metal platform) ○ Water and rodents enter easily ○ Structure is not portable

Table 2. Decision-Making Matrix

After reviewing the above breakdown of each design, it was decided that Design Three would be the best candidate for recommendation. The table shows that this design combines the most advantages with the least amount of disadvantages. Formulating the above list has greatly helped in the process of choosing the best design. All designs are open to alteration depending on the need and preference of the UBC Farm staff and the Waste Management personnel.

6.0 DESIGN MODIFICATION

The final design chosen by UBC Farm is a combination of Designs One and Three. This design brings together the aesthetics of the initial Design Three and the closed structure of Design One. The main modification was that the structure has to use three sides of the post instead of the initial two (view APPENDIX C, Figure 6). The reason for this change was the overflow of garbage at the Farm Market.

A following meeting with UBC Waste Management has been held in order to ensure proper understanding of the project. Initially the team has concluded that design with smaller bins is more effective, because it can store more waste and the containers are easier to transport. However, after speaking to the Waste Management personnel it was learnt that one large bin is preferable over two small bins. Doubling the number of bins requires more time for the waste extraction, as well as more physical work. The bin will have to be pulled out of a tight space and will not slip out easily. Also, the vehicles used by UBC Waste Management are not designed to pick up the smaller bins. One side consideration is that more bins will mean less space in each enclosure as two small bins will occupy the space that should be taken by one large bin. Taking all of the above into consideration, it was decided to use one large container for each of the garbage, paper and metal cans sections. Two smaller bins were assigned to the compost section. Such distribution of containers would provide enough space to store one week's worth of waste and meet the requirements of the UBC Waste Management.

7.0 DETAILED DESIGN

7.1 Final Design Description

The final design consists of five separable units that come together to make one structure (view APPENDIX D). When all five of the units are connected, the structure is roughly five feet tall, eight feet long and six feet wide. Taking into consideration the materials available at UBC Farm, it was decided to use cedar for the structure. Each container requires a door attached to the unit by two latches. The roof of each container is slanted and covered in a sheet of tin. The roof contains a slot, which will be the access point for the appropriate kind of trash to be deposited into the container. The structure is built as five separate units so that the client has the option to relocate the structure. The sides of each unit that are not directly exposed to the elements do not contain a wall. Instead, in place of the wall is an extra brace to add structural support. Because of this, the units in the present state cannot be separated from the structure and placed in different locations. However, if it was required to separate the structure, all that needs to be done would be to attach a piece of plywood to the un-walled sides of each unit.

7.2 Material Estimates

This price estimate is based on available materials.

Because the availability of cedar 2X8's is questioned, the prices for two cases are provided:

- 1) 100\$ Case: 410' of 2X4 may be obtained from cedar 2X8's available at UBC Farm.
- 2) 240\$ Case: If the cedar 2X8's are assigned to another CSL project there is an estimate provided for the cost of purchasing the required lumber as SPF which would represent an economical compromise.

	Amount	Cost
Lumber		
SPF/Cedar 2X4	410'	140\$/0
Cedar 1X5	450'	Available onsite
¾ @ 4'X8' Plywood	2.5 sheets	Available onsite
4X8 Sheets light gauge tin	2.5 sheets	Available onsite
4X4	20'	Available onsite
Hardware		
Nails	Box	60\$
Deck Screws	small box	40\$
Cinderblock Supports	4	Available onsite
Hinges	10	Available onsite
	Total	100\$/240\$

Table 3. Cost of Materials.

8.0 ACTIVITY SCHEDULE

During the 3 day build of term two, each team member will be assigned a different task in regards to construction, as discussed in the following section of this report. A description of the material acquisition process during term two for the project is described below. In addition, a list of tasks for each individual day of the 3 day construction is provided. However, it is important to note that these tasks serve as guidelines only and are subject to change.

8.1 Material Acquisition

Many of the materials that will be used for the construction will be provided by UBC Farm. Some of these materials include 4x4 inch and 2x4 inch pieces of lumber, metal sheets for the base, tin for the shingles, and plywood for the outer walls and doors. However, the team will need additional materials that cannot be provided by the Farm. It is necessary to buy metal hinges for the doors of the containers. In addition, if there is a shortage in the 2x4 inch sizes of lumber, more lumber will have to be purchased.

8.2 Three Day Schedule

The following is a tentative schedule for the three day construction process at UBC Farm.

8.2.1 Day One:

- level the ground
- cut wood for the supports
- put the supports on the ground and make sure they are of proper height

- nail the supports on the existing wooden posts
- assemble the frame for the waste site

8.2.2 Day Two:

- cut wood for the 2x4 platforms
- assemble the platform, and add cedar toppings on them
- cut wood for the walls for the sides of the waste site
- assemble the walls, nailing them to the support and to the base

8.2.3 Day Three:

- cut wood for doors; two different sizes are needed
- cut plywood for the roof
- cut tin to the right sizes for the roof
- attach the tin to the plywood
- assemble the roof by nailing the tin covered plywood to the frame
- label the containers with signs that indicate kind of waste

9.0 ROLES AND RESPONSIBILITIES

This section outlines a comparison between the roles and responsibilities assigned in term one and term two. The following is a description of these roles for the organization, the team, and its members.

9.1 The Organization (UBC Farm)

Term One:

In term one, UBC Farm was responsible for providing the team with specifications and suggestions regarding the completion of the design and project. In the first weeks, Kayla McIntyre showed the project site to the team and gave a tour of the Tool Shed and the Harvest Hut. She outlined the specifications for the project, namely: an aesthetical appeal, easy to use system, organized environment, and a set of four containers for garbage, paper products, recyclable materials such as metal cans and plastic bottles, and compost. In the following weeks, Andrew Rushmere provided the team with feedback on the three conceptual designs. He suggested that the design be portable, while having outer walls to prevent squirrels and bees from entering the trash and recycling containers. In addition, he specified the need to contact and receive approval from UBC Waste Management, as they are also the stakeholders of the project.

Term Two:

In term two, UBC Farm will provide the team with access to the Tool Shed and the Harvest Hut, where most of the building will take place. Andrew Rushmere will continue to provide feedback for the team, and he will be available to answer any questions that may arise during the construction. UBC Farm will also provide the team with scrap materials, including metal sheets for the base of the containers and plywood for the outer walls. Although some of the sheets are larger than the base of the containers, the tools provided by UBC Farm can be used to make them to the appropriate size. Finally, UBC Farm will notify team members of any inconveniences and hazards related to the construction process.

9.2 The Team

During term one, the team was responsible for drafting the deliverables of the report and creating the three designs (with approval of UBC Farm and UBC Waste Management). During term two, the team will be responsible for constructing the structure that will house four containers (garbage, paper products, cans, and compost) around the wooden post in front of the Harvest Hut in a three day period.

9.3 The Members

Term One:

In term one, the members of the team assigned roles for the successful completion of the project. All members attended regular meetings one to two times per week, contributed in the design process, and wrote at least one section of this report. The following is a list of the roles delegated to each member:

- Mentor Contact and Team Leader (Anastasia)

- Client Contact (Elliot)
- Record Keeper (Daniel)
- Google Sketch-up 3D Models (Chris, Adrian, Thomas)
- Technical Report Editors (Anastasia, Daniel, Adrian)
- Technical Report Formatter (Chris)

Term Two:

Throughout term two, Anastasia and Elliot will continue to contact the mentor and the client, respectively. It is the responsibility of each team member to arrive on time and wear the appropriate wardrobe for construction. All team members will be following all safety regulations given provided by UBC Farm with regards to the tools in both the Tool Shed and the Harvest Hut. The following is a list showing the tasks of each member during the 3 day construction period, as seen in Table 3.

Team Members	Task
Daniel, Adrian, and Chris	Levelling the foundation
Daniel, Thomas, and Elliot	Cutting the metal sheets for base
Adrian, Elliot, and Chris	Cutting the plywood for the outer walls
Chris, Thomas, Adrian, and Elliot	Assembling the outer walls / roof and connecting to the base
Anastasia and Thomas	Assembling the trash dispenser on the roof of containers
Daniel and Elliot	Assembling the doors with connecting hinges

Anastasia and Adrian	Labelling the containers with signs
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Table 4. Delegation of roles and responsibilities for term two construction.

10.0 RISK ASSESSMENT

10.1 Safety Risks

Because construction is a major part of the Harvest Hut Waste Redirection Site Project, there is some concern about safety during its assembly. The design consists of metal, so metal cutting is a possibility when constructing the waste site. Metal cutting can pose safety hazards when performed improperly. Therefore, team members who are responsible for cutting metal sheets will be required to learn the safety and basics of sheet metal cutting beforehand. In addition, woodwork is going to be important in the building of the waste redirection site as well, since the design will mostly be composed of wood. Similar to metal cutting, team members in charge of the woodwork will be also be required to learn how to properly and safely use the desired woodworking machine before he or she uses it. All team members involved in the construction of the project will be expected to wear protective gear at all times. This includes wearing protective coveralls, safety glasses or goggles, gloves, and dusts masks when required (will most likely be used when working with wood). Team members will be advised not to wear loose clothing and any jewellery or clothing accessories that can get tangled with the machines, such as necklaces, bracelets, or neckties. Furthermore, group members will be made aware to handle sharp tools carefully and to ensure that each equipment is turned off after use.

10.2 Odour Risks

One of the projects goals that the group had to consider when designing the models for the organization was to make sure that the waste site is rodent proof. However, UBC Farm also wanted the site to be breathable so that odours do not accumulate inside the structure.

Because the organization felt that it would be best to enclose the waste site with plywood to keep rodents out, the final design focuses more on the structure's ability to prevent rodents from coming into it than its capability to let odour escape. This poses a possibility of odour problems, especially with garbage and compost. Since the garbage can and compost bin are going to be encased on all sides, it will be difficult for foul smells to escape.

APPENDIX A: LIST OF FIGURES



Figure 1. Wooden post and project site at UBC Farm



Figure 2. Current recycling and compost containers with labelling at UBC Farm

APENDIX B: HAND SKETCHES OF CONCEPTUAL DESIGNS

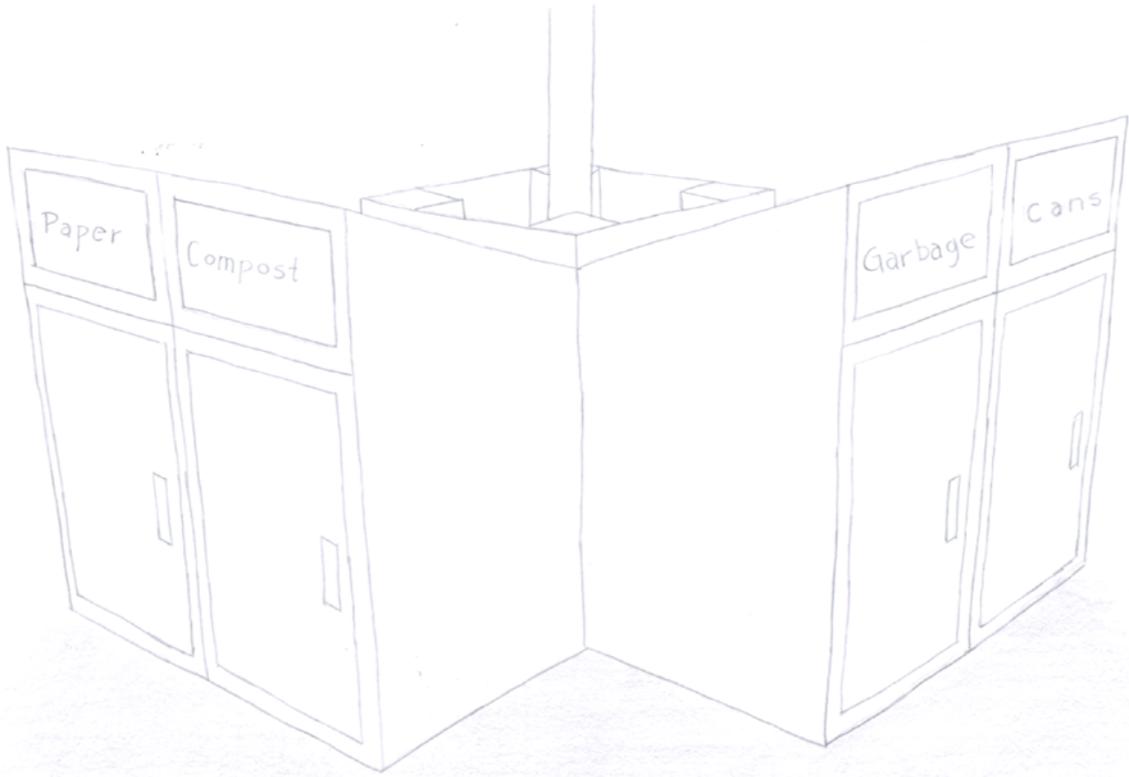


Figure 3: Hand Sketch of Design 1

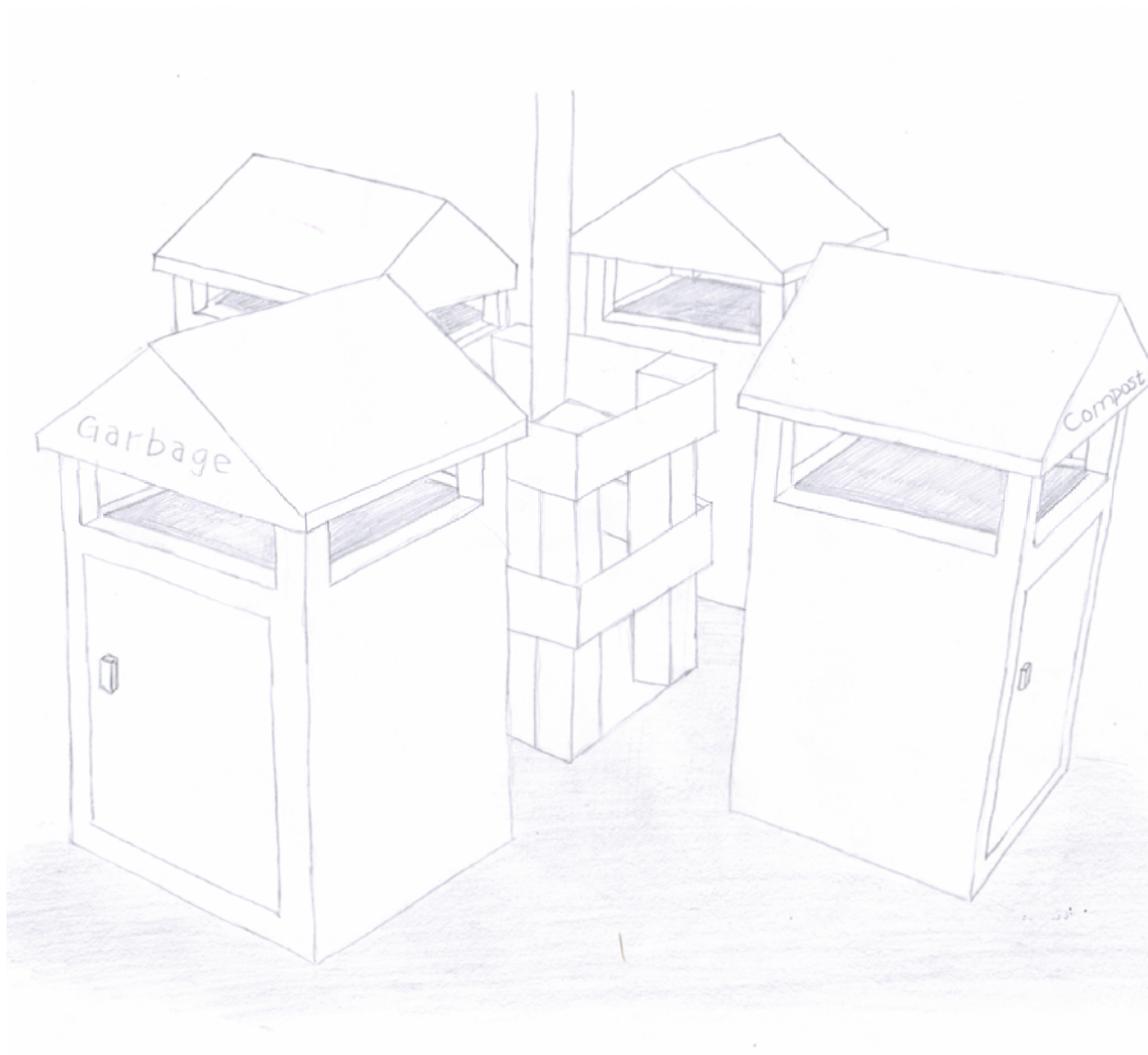


Figure 4. Hand Sketch of Design 2

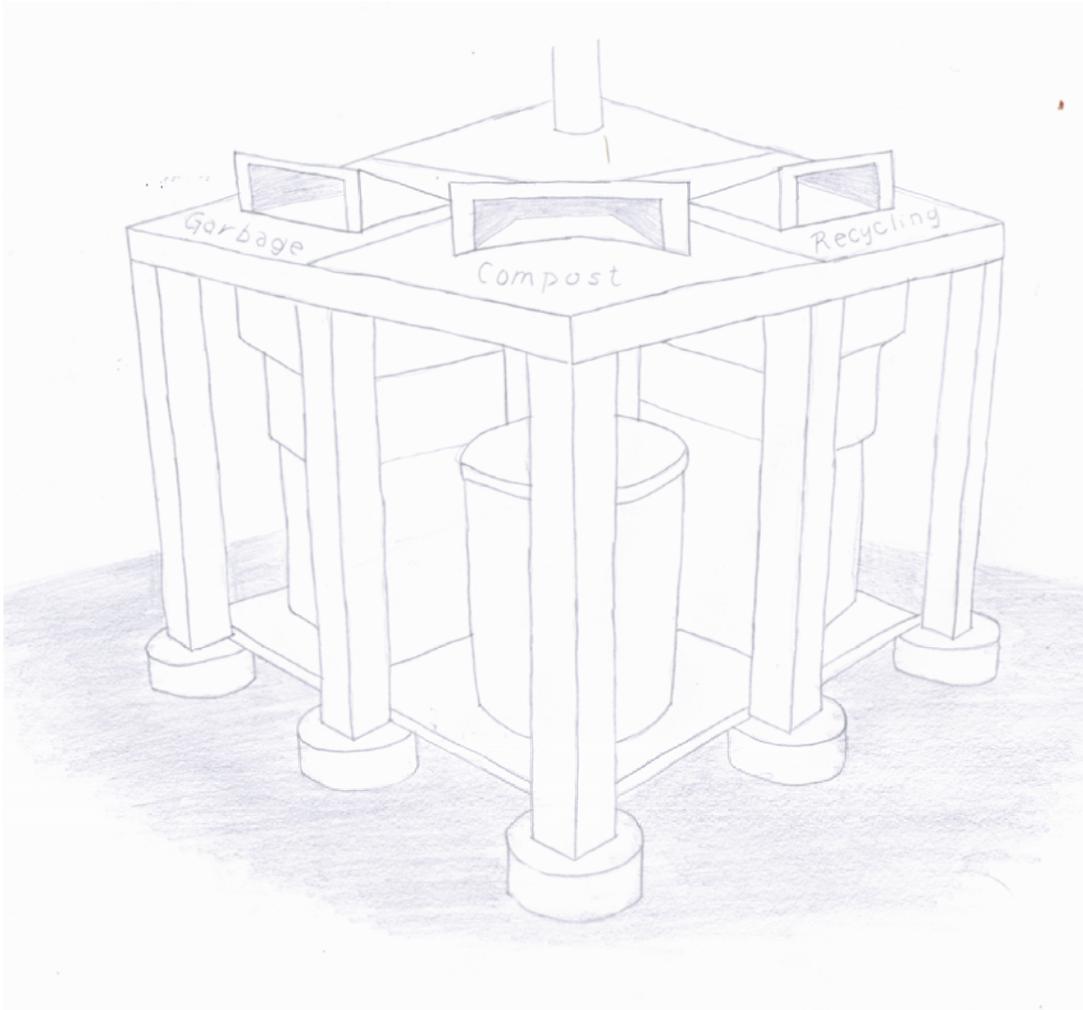


Figure 5. Hand Sketch of Design 3

APPENDIX C: FINAL DESIGN PLAN

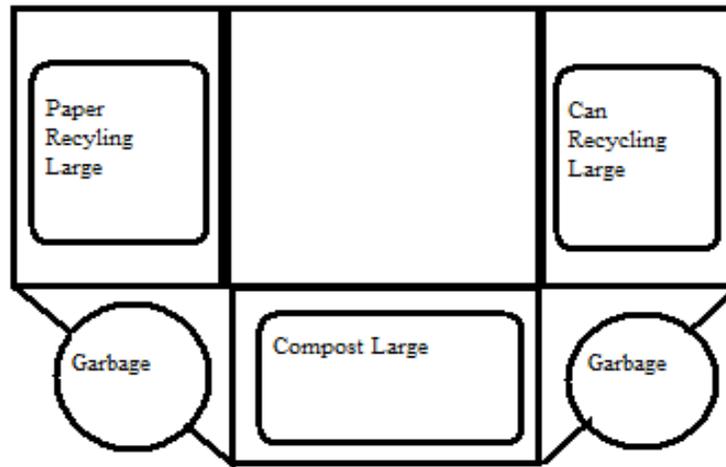
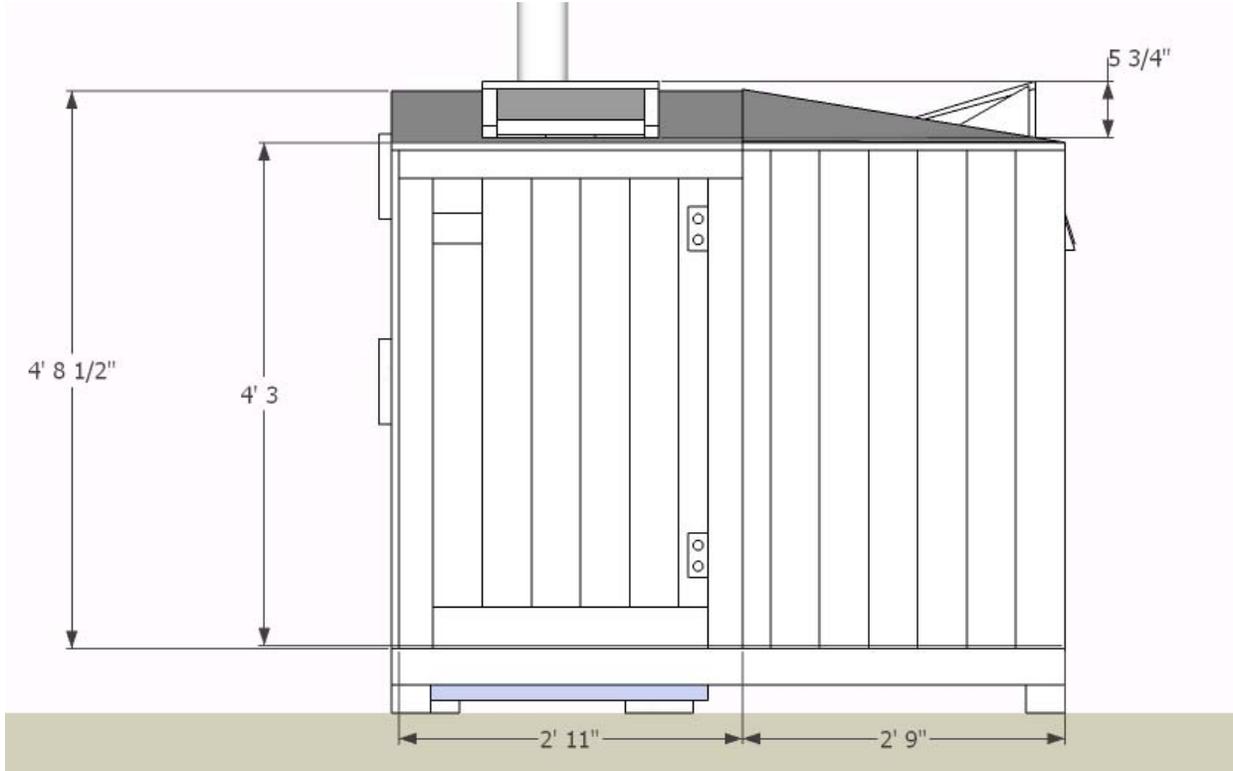


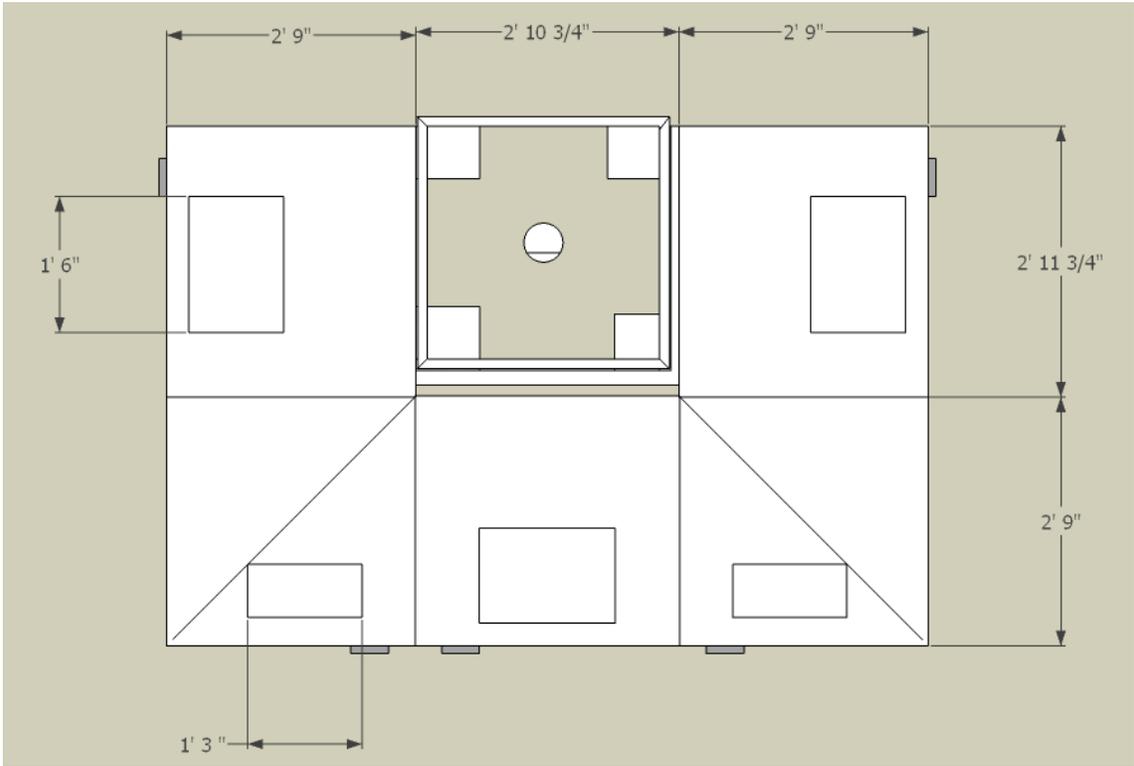
Figure 6. Planned layout of the waste redirection site

APPENDIX D: FINAL DESIGN VIEWS

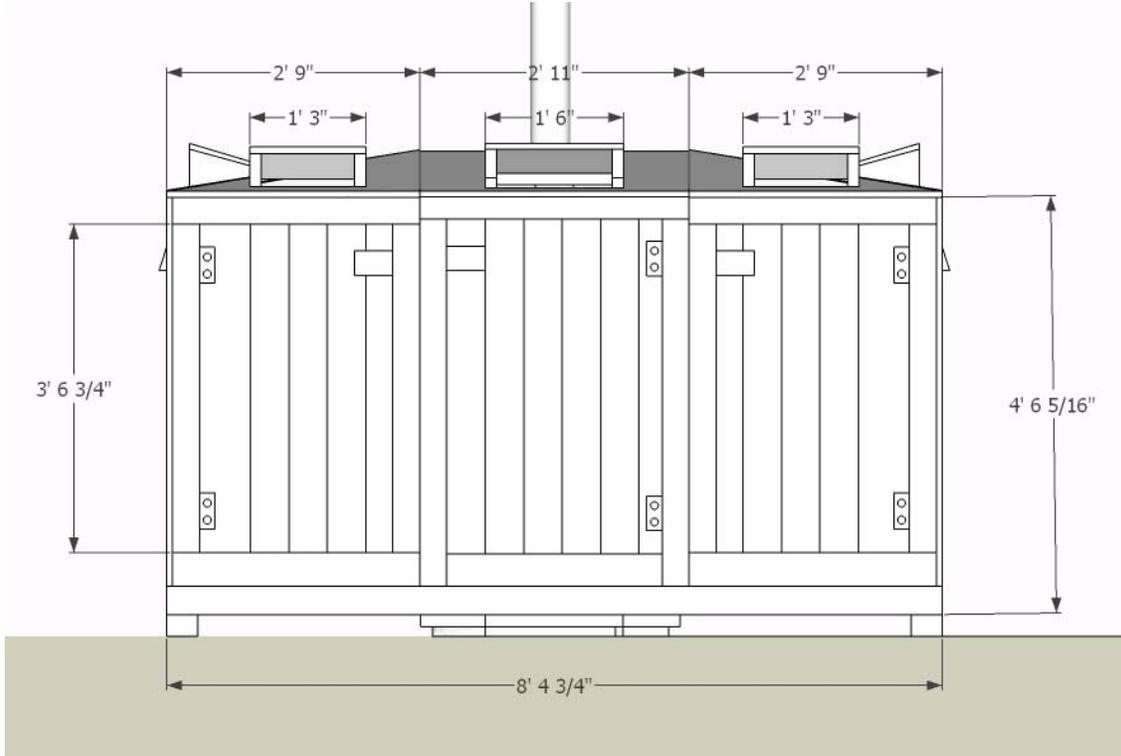
North-West Elevation (side)



Top View



North East Elevation (Front)



Plan View

