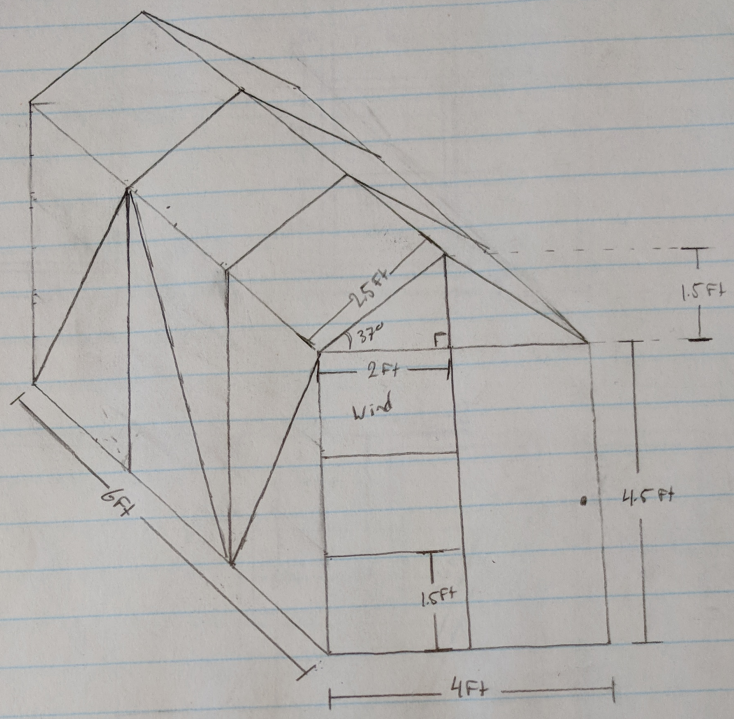
Project Deliverable D: Conceptual Design
GNG 1103 – Engineering Design
Faculty of Engineering – University of Ottawa

	Need	Design Criteria
1	Last through the winter (-30 to -40 Celsius)	Roof is made of corrugated panels to withstand heavy snow Roof also has supports every 2 feet to provide extra support and aid in mounting corrugated panels
2	Wild animals like chipmunks, squirrels and bugs	Elevated off the ground, base is made 6 inches off the ground to keep rodents out and provide stability on the soft sand.
3	Air ventilation	Rotating window with a lock is used to allow for air circulation and to lower temperatures during the summer.
4	Growing plants	Walls and roof are made of transparent material that will aid in plants growth.
5	Ground is quite sandy	Rectangular base Floor or off ground
6	Rainfall can be varied during the year.	6 mill Waterproof polyethylene is used to keep the greenhouse waterproofed through storms.
7	Transporting the greenhouse	Built in panels that can be easily disassembled for transportation using nuts and bolts.
8	Low cost	A scaled down version was created to lower cost. Also affordable materials were used such as wood, polyethylene, and corrugated roof panels.

Design



SA = 105.6 m^2 of polyethylene

SA = 30 m^2 Plastic Stuff

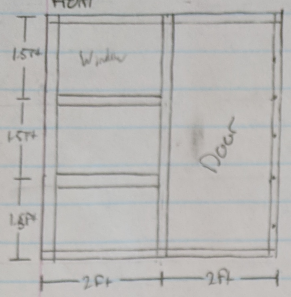
Materials

- Wood For structure
- 6mil- Polyethylene for side wraps, door and window cover
- Plastic stuff for roof cover.

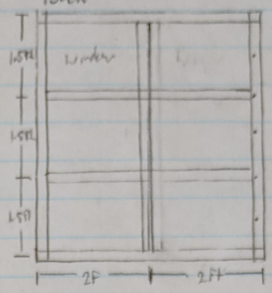
A - or • represents a nut and bolt to hold together the frames, which will be detachable.

Subsystems.

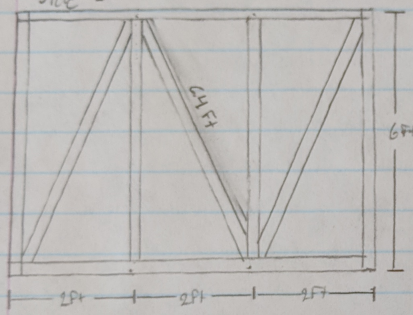
Front



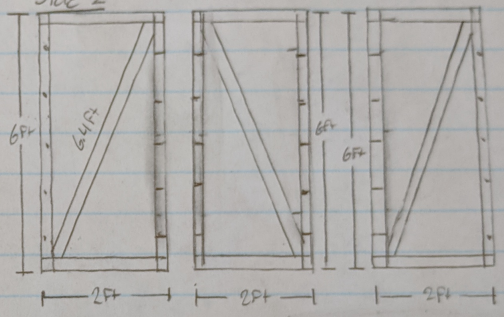
Back



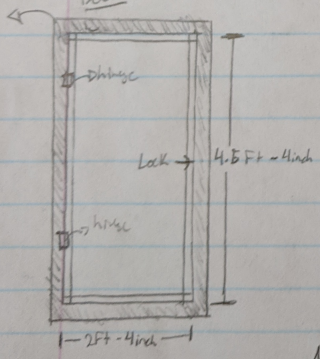
Side 1



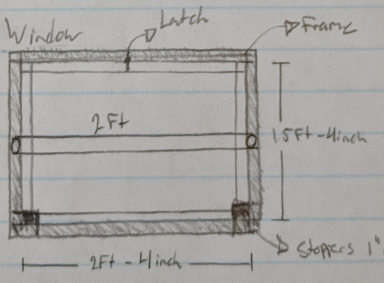
Side 2



Door

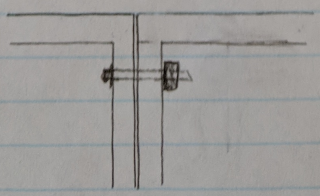


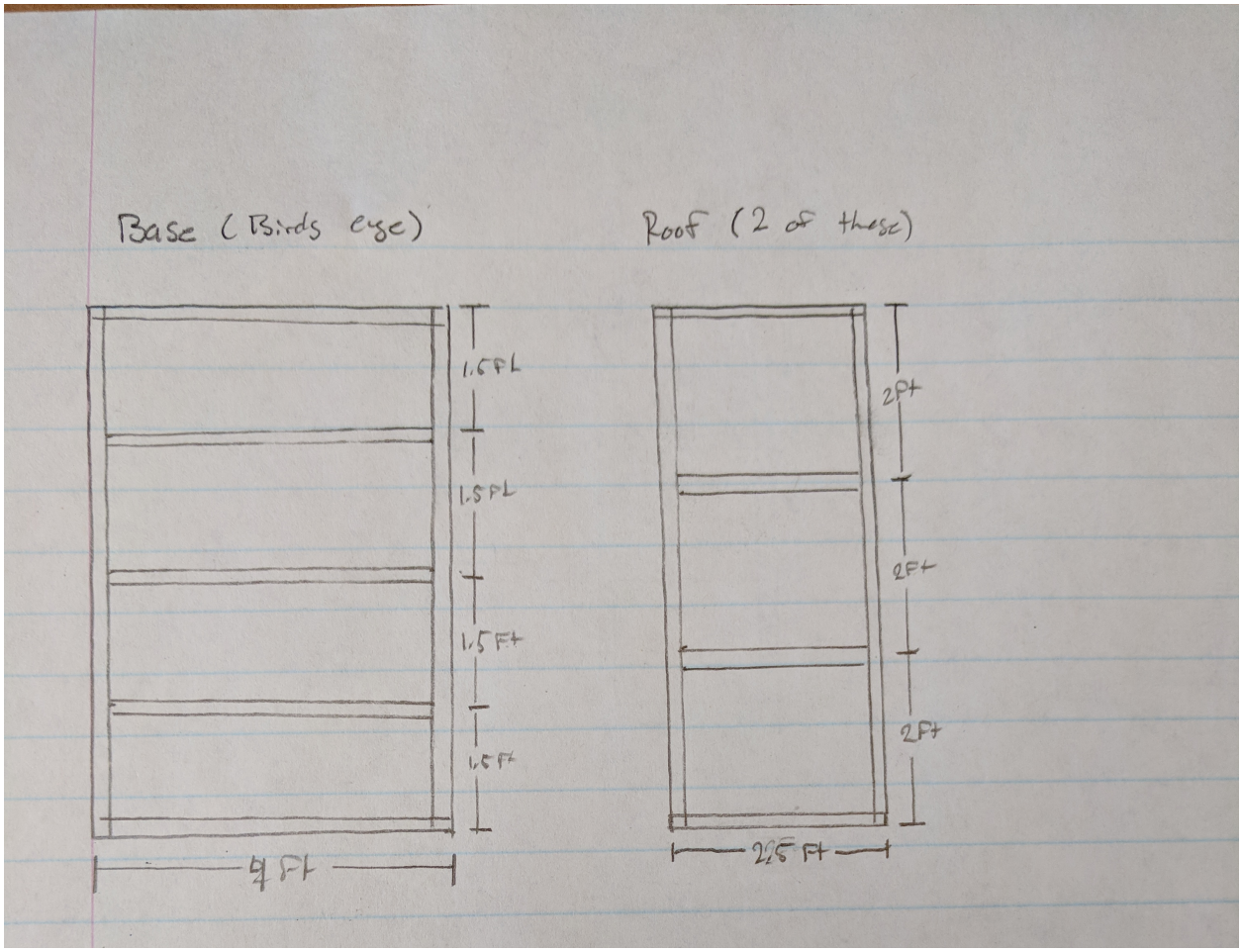
Window



* Better example on Solidworks PDF

Nut & Bolt





Joining of panels with nuts and bolts

A required aspect of the greenhouse is for it to be disassembled easily. Since our team is creating a scaled down version of the greenhouse we decided to make one wall panel disassembly to show our chosen mechanism even though it is not needed for our small scale greenhouse. The system used to join the panels panels together is drilling holes in the sides, top, and bottom of each 2ft x 4.5ft panel, and fasten the panels together with a 4 inch long bolt with a washer and nut. This can be done in multiple locations to ensure a tight seal and strong support between panels. This will reduce the panel size from 6ft x 4.5ft down to 2ft x 4.5ft which makes the disassembly much easier which in turn will satisfy the client.

Door

The door is going to be 4 ft 2 in high and 1 ft 8 in wide. This is because the total height of the front structure will be 4 ft 6 in and total width of section will be 2 in, and you have to subtract

the volume occupied by the 2 in x 4 in planks of the frame. The area of the door will be covered by polyethylene wrap, which will allow more sunlight to enter the greenhouse. The door will be attached to the frame of the greenhouse using two hinges, which will allow the door to swing outwards. There will also be a fence latch which will allow for the door to remain closed and let the user add a padlock if they wish.

Supports

Vertical supports were needed every 1.5 feet but could be extended to a maximum of 2 feet for side panels of the greenhouse. Also, a vertical support was placed two feet in, at the front and back of the greenhouse. This was done to improve vertical ridgidy and help support the weight of the roof. Moreover, 3 diagonal pieces of wood were added to to both sides of the greenhouse. 1 for each panel forming the letter “N” on a slight slant. This was done to add more stability to the structure to counteract outside forces such as wind. Furthermore, the “N” shaped reinforcement would help support the load of the roof plus the added weight of all the snow that piles up during winter. Lastly, the supports were put on a slant for the purpose of forming triangles within the side panels since, triangles are the strongest shape due to the fact that any force added is evenly spread through all three sides.

Base

The base is required in order to keep the entire structure as stable as possible because it is said that the location where the greenhouse would be located is windy. The size of the base is 4 ft by 6 ft, which is the size of the greenhouse. It has to be mentioned that there are some supports what have to be put in order to increase the stability of the structure. The supports are going to be put in every 1.5 ft. Consequently, there will be 3 supports in overall. Additionally, the top of the base is going to be covered with plywood and it will be like floor.

Roof

It was decided by the group that the roof will be a triangular roof for the greenhouse. At the front section, the roof is designed to have a roughly 37° angle between the span and the ridge in order to let the snow slide down from the roof during the winter. The height of the ridge is 1.5 ft, which will bring the total height of the greenhouse to 6 ft. A support beam will be placed in the middle of the front section at a 2 ft interval, which means that the hypotenuse of the triangle will be 2.5 ft.

On the horizontal section of the roof, there are two connections spaced every 2 ft built between the length of each roof in order to increase its stability while the greenhouse is experiencing a heavy snow.

Inside the greenhouse there will also be added support beams. There will be one 6 ft beam that goes from the front to the back, and at 2 ft horizontals two 2 ft beams will connect each side of the support beam to the side, as well as a 2 ft beam connecting it to the top.

Window:

We decided to put windows on the front side and back side of the greenhouse to allow the user to control air flow of the greenhouse. Each window has two parts, the frame and rotating section. The frame will be 2 ft x 1.5 ft, which will be built in as part of the support of the back frame. Also, we have a 2ft axis that connects opposite sides of the frame, which the window section will rotate around. The rotating section will be 1 ft 8 in x 1 ft 2 in to accomodate for the size of the frame. The frame has two stoppers on each corner at the bottom side. The stoppers will help the bottom of window cannot through the frame when we need close it. At the top of the frame, we have a lock for windows. The area window will be covered by polyethylene, which allow more sunlight to enter.