Deliverable H: Prototype III- Test plan

The objective of the test plan is to examine the stability and endurance of the greenhouse structure constructed. The overall functionality of the greenhouse will not be tested since the hydroponic system has not yet been installed within the greenhouse. Therefore, this will be a focused physical prototype that will examine the endurance of the wood members against a variety of forces with different magnitudes and points of application. This test plan will not examine the greenhouse's ability to maintain constant temperature, or whether it is able to keep pests from entering the structure. The following test plan will help identify design flaws and uncover any ease-of-use issues.

As mentioned above, the test plan's objective is to measure the structure's resilience against forces with different magnitudes and point of applications. The attribute that we will be focusing on is whether the wood member will deviate from its original position, and if the deviation is severe enough that it will cause the structure any permanent damage. The testing method will be a physical prototype test as no software simulations will be created to model the different stresses on the structure.

The test will involve exerting applied forces through a rope and pulling on the wood members. A 1.5 meter rope will be tied around the middle of wood member (2.5-3.0 meters from the bottom) and one person will pull on the rope. If this causes a 5-10% change in the position of the wooden piece, then a support structure must be put in place. If the force applied causes a change in position less than 5-10%, then we will have 2 people pull on the rope. If the wooden piece is stationary, then no further support is needed. We will repeat this cycle for every wood member composing the walls and roof. A force-measuring device must be used to be able to measure the magnitude of the applied force exerted on the structure.

The test plan has not been performed yet since prototype III is not fully constructed. It is expected that we will finish the wooden frame by next Thursday, and the test will be conducted then. The main data entries that we will be taking note of are the amount of force that is exerted onto the frame and the deviation of the wooden member from its original position to its new position (in the x, y, and z- axes).

While constructing the third prototype, it was observed that the sides were not stable standing on their own. Therefore, a solution suggested was to add Oriented Standard Boards (OSB) to make the sides be more stable. Instead of having a tall piece of OSB around the bottom of the greenhouse as we had originally planned (for insulation), we will be using a smaller amount of OSB around the bottom but adding more around the perimeter of the top of the walls as well. The OSB at the bottom of the greenhouse will be 1 foot tall while the OSB at the top will be 8 inches in height. The reason for having shorter pieces of OSB around the bottom of the greenhouse is because we realized after building the first prototype that it would limit the amount of light at the bottom of the greenhouse where the hydroponic system and the plants would be installed.

One change that has been made from the second prototype is the shape of the roof. Although we decided to keep the triangle roof for prototype two, after further consideration, we changed the roof to be in a gambrel shape. This is to allow for easier snow removal. In addition,

this allows for more headspace near the edges of the greenhouse while keeping the same height in the middle.

In order to complete the greenhouse, next steps include attaching the OSB boards and the roof. The polytarp will be need to be fixed to the walls. Polycarbonate panels will need to be attached to the roof.

Pictures are attached below of what prototype III looks like so far:

Figure 1: The side walls and the base.

Figure 2: The base.

Figure 3: The frame of the base in construction.