

GNG 1103  
**Design Project User and Product Manual**

**Neyagada Wabandangaki Guardian Program Research Facility**

**Submitted by:**

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# **1 Introduction**

Welcome to our building, a state-of-the-art facility designed to provide occupants with a seamless and comfortable experience. This user manual is a comprehensive guide to navigating and utilizing the diverse features and services within the building.

This building has been meticulously crafted to cater to the diverse needs of its officers. From cutting-edge technological amenities to thoughtfully designed communal spaces, this building aims to create a positive environment.

This manual will walk you through the various aspects of the building, providing insights into its facilities and community guidelines, including prototype making (within several photos) and several tests about the facilities in the building.

This User and Product Manual (UPM) provides the information necessary for The Neyagada Wabandangaki Guardianship Program to use the Guardian Program Research Facility effectively and for prototype documentation.

## 2 Overview

**Our problem:** There is a need for a sustainable all-weather infrastructure for the Pikwakanagan Nayagada Wabandangaki Guardian Program that enables them to serve their community by providing areas for cultural activities and harvesting plants and medicine.

The user identified a few key fundamental needs that they required in the building which are the following:

- Sustainable
- Reflective of their Identity
- 4-5 Offices, later additional spaces were requested.
- Computer Lab
- Harvesting Space
- Outdoor space
- Kitchenette
- Board Room
- Freezer Space
- Storage Space
- Washrooms
- Garage Entrance
- Wheelchair Accessibility

What differentiates our prototype from others is the unique shape of the building that comes from a traditional wigwam. A wigwam is a traditional indigenous house. Our group traded out the wooden panels for thermal glass across the ceiling to maximise the natural lighting.

Another unique aspect of our design is the large tree in the centre. This design choice makes the employees and the building users feel closer to nature as the client has a close connection to natural resources.

### **First-floor:**

Key features of the first floor include the large tree in the center as well as the plant dissection area in the back, which is connected to the computer lab to make for a seamless transition of data between the collection and uploading areas. We also have a garage door attached to the lab and the storage room with a walk-in freezer to make it easier for larger specimens to be brought in.

**Figure 1 - First Floor of Final Prototype**



## **Second-floor**

The second floor starts with a lookout at the tree on the main floor. It consists of an open-concept design for the kitchenette and breakroom area. It also has two single and four dual offices to maximise the space. There is also a second boardroom on this floor. Finally, in the image below, the outdoor area is placed below the offices as a community area.

**Figure 2 - Second Floor of Final Prototype**





## Loft floor

The team decided to add a third floor that can be used either as a storage area or an extended break/ group work area. This is not a small space; however, we wanted to utilize the high ceiling with this extended area.

**Figure 3 - Loft Floor of Final Prototype**



**Figure 4 - Front View of Final Prototype**



**Figure 5 - Top View of Final Prototype**



## **2.1 Conventions**

There are no specific conventions to be considered by the reader.

## **2.2 Cautions & Warnings**

There are no cautions or warnings to be provided by the reader. The only general caution would be to provide caution when handling tools in a construction workplace.

## **3 Getting started**

Our prototype is available on Archicad; the Archicad files have been attached to this document. To access them, you need to download the files then open them. This will bring you to the online 3D model of the prototype.

### **3.1 Configuration Considerations**

The software prototype does not have any specific input or therefore output; it is a simple 3D design of the building that can be explored or modified depending on the user's needs. The physical prototype also does not include any specific configurations.

### **3.2 User Access Considerations**

This prototype is digital and thus the only accessibility restriction would be due to impairment thus the software can be combined with additional impairment software that can enhance the images, include audio descriptions and more. Should the prototype become a true physical design then any users with physical motility issues would be able to access the elevator in

Favour of the stairs. Additionally, the exits should not be placed near any major roadway or traffic. For the physical building, as demonstrated in the figures above, the actual orientation of the building is not important however the environment it is based on is set in one away from heavy traffic and within a forest environment.

### **3.3 Accessing/setting up the System**

In order to set up the building it will follow basic procedure set by the province to construct the building This includes laying the foundation, this can be personalised to the terrain, in a heavy earthquake environment the base can be planted underground with seismic isolation plates while in high flooding areas beams can be used instead. Once it had been laid the framework would be constructed with the dome. Then the layers of floors can be added with certain modifications that can be made such as the locations of offices but taking into consideration the necessary space needed for the tree.

### **3.4 System Organization & Navigation**

For the physical aspect of the building the main components of the building that would require instruction for organisation include the side part of the building, the tree and the three floors. The placement of the side part of the building covered by the slanted roof must be placed adjacent to the dome and not at the front entrance or back garage entrance of the building. The floor plan must be followed in order to allow room for the tree to grow and expand as any deviation may lead to damaged floors due to the inevitable tree growth that will occur.

The ArchiCAD app has multiple components that help in designing a building. The main functions that were used for this building were walls, roof, slab, door, window, light and objects. The object feature is the most important of these. Archicad has libraries that store the objects available, of the many there are furniture, plumbing system, mechanical structures, structures that enhance the roof, different types of windows and door. It has different views in which the design can be displayed, the views used were north elevation, south elevation, east elevation, west elevation, 3D view and the floor plan of each floor.

### **3.5 Exiting the System**

The main exits of the building are located at the front and rear of the building.

To properly exit the software prototype, save all documents and close the application.

## 4 Using the System

Our subsystems include:

- Offices
  - used for conventional office activities for staff members such as administrative work and research
- Break room and Kitchen
  - Tables and chairs for staff to unwind and eat lunch
  - Place to socialize with coworkers
  - Double sink for easy clean up
  - Refrigerator for storing lunches
  - Extra counterspace for additional appliances (coffee machine, microwave, etc.)
- Lab space
  - Computer laboratory with 15 computers for logging data
  - Mobile plant processing station for processing plants and completing laboratory tasks
  - Nearby storage room with shelf space for storing materials used often
  - Walk-in freezer located inside the storage room for storing materials that require a colder environment
- Common work area
  - Open concept workspace for collaboration on projects
  - Comfortable seating for casual meetings
- Lean-to
  - Garage door is located next to the lean-to for easy transportation of larger shipments or materials.
  - Up to two average-sized vehicles can park under the lean-to

## 4.1 Given Features for Each Subsystem

Figure 6 - Features of Office

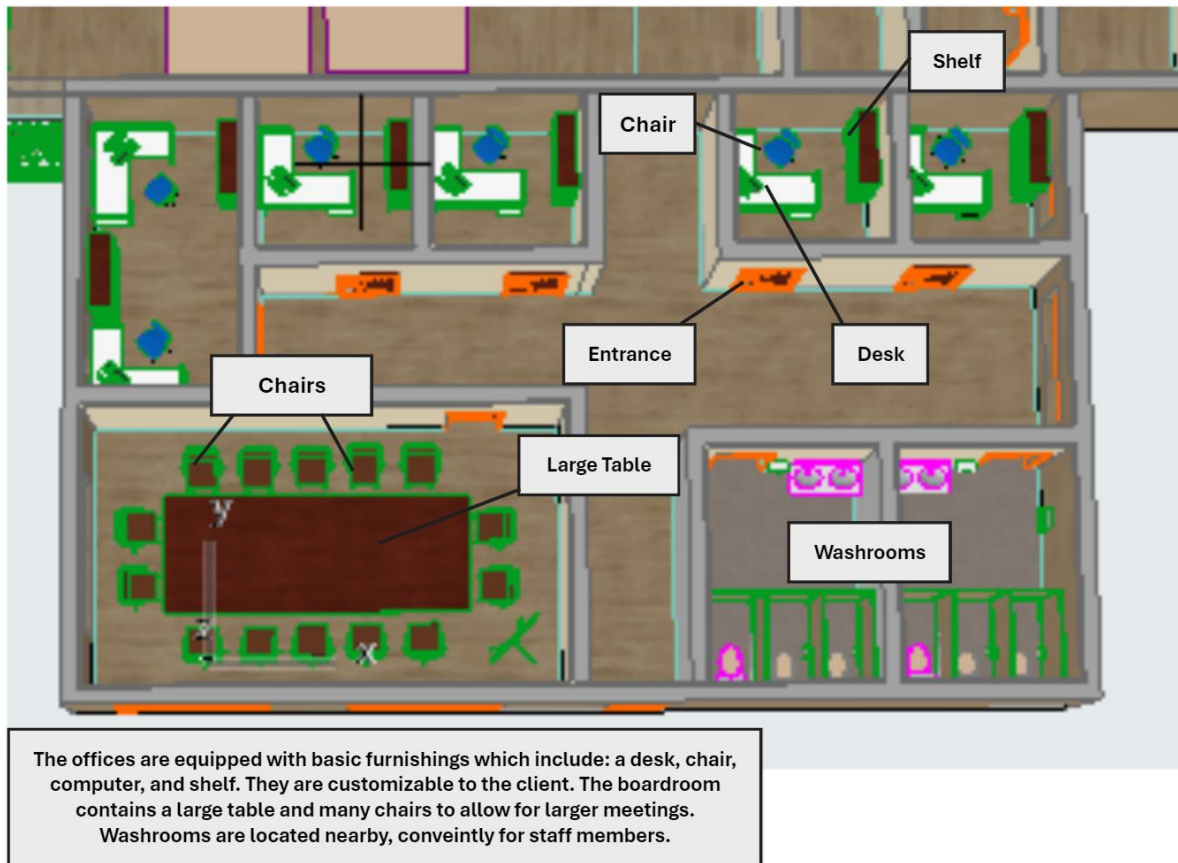
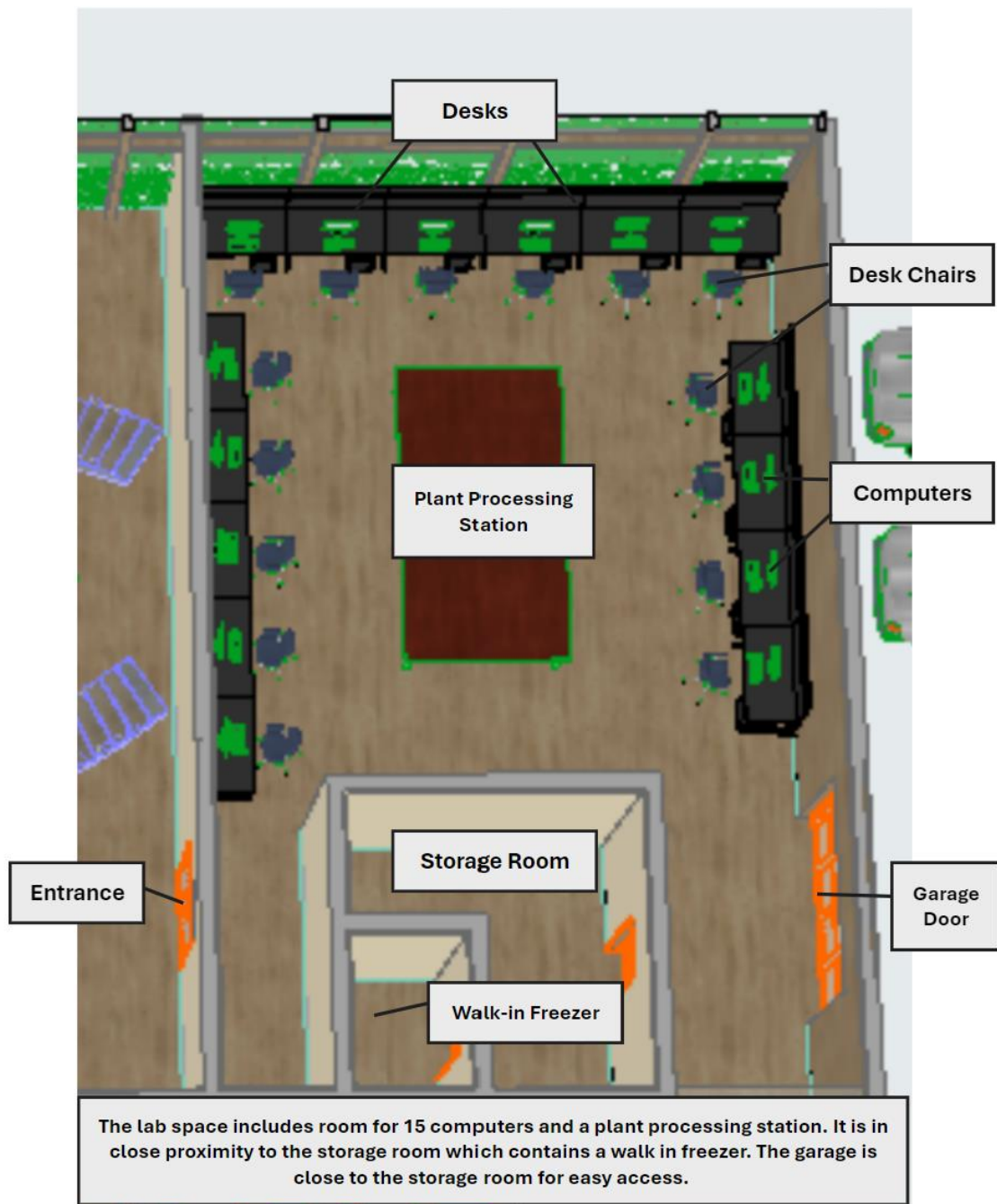


Figure 7 - Lab Space and Storage Room Features



**Figure 8 - Features of Kitchenette and Breakrooms**

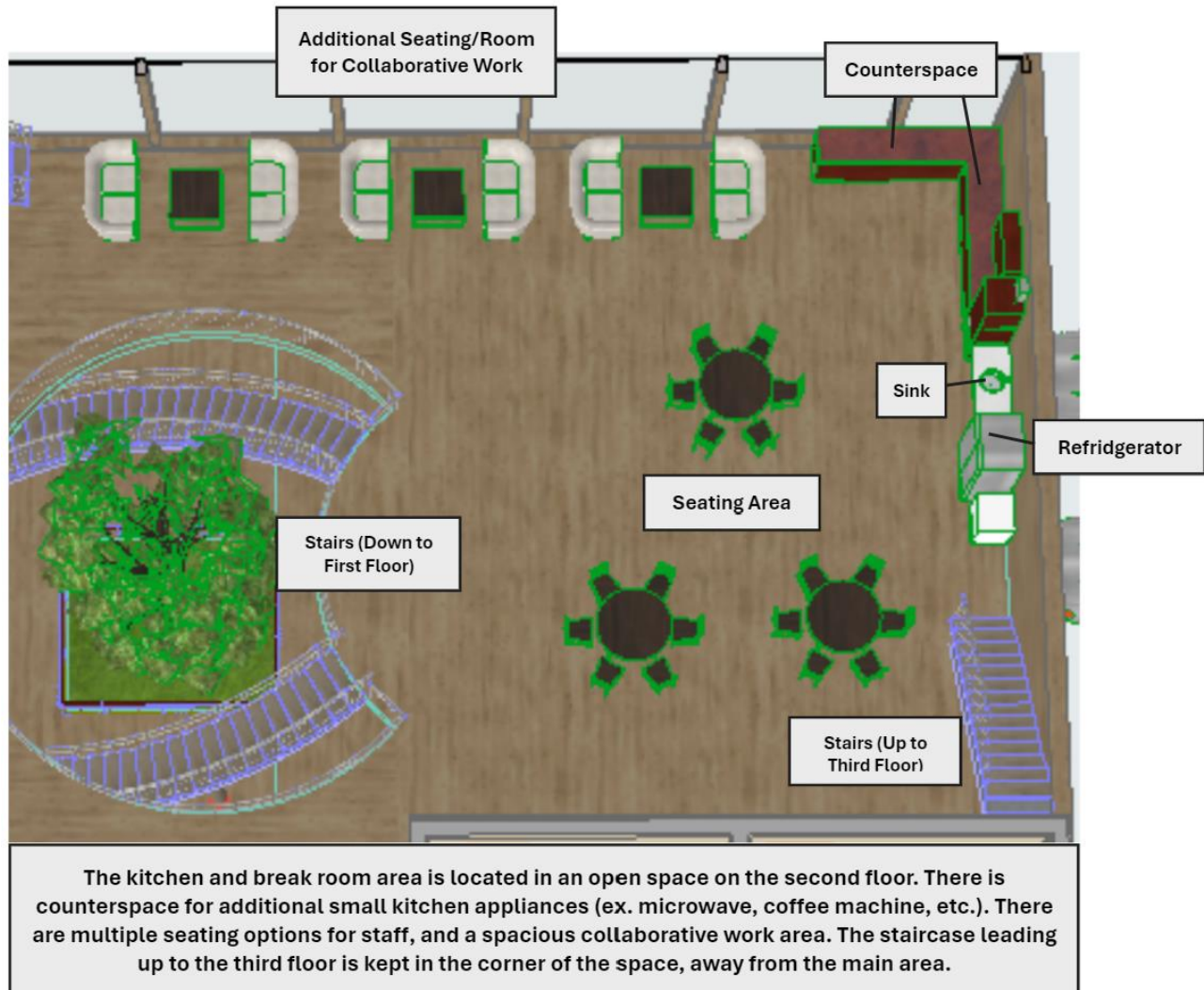
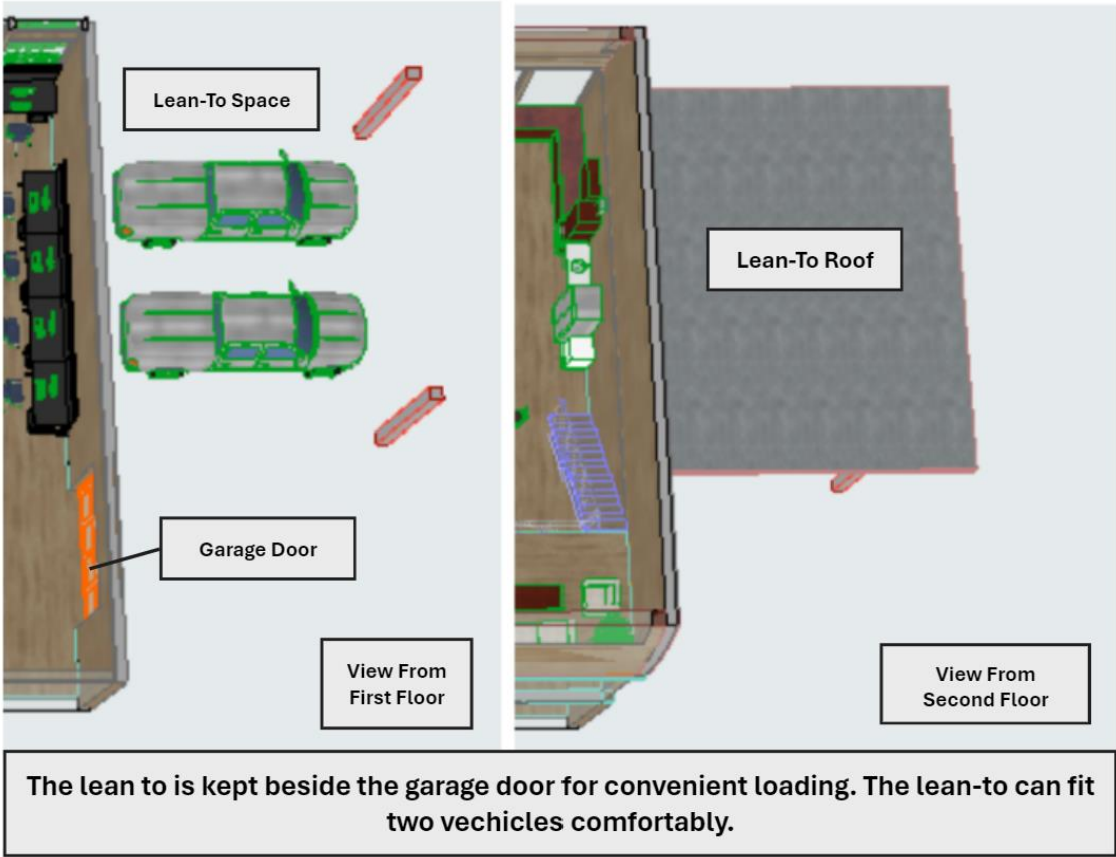


Figure 9 - Feature of Garage and Lean-to





## **5 Troubleshooting & Support**

### **5.1 Error Messages or Behaviors**

The only significant error that may occur is any error with opening the Archicad program which can be resolved through their individual support/help systems and contact.

### **5.2 Maintenance**

Key maintenance the physical building may need includes annual evaluations for structural support, cleaning of the window and thus a custodian present. It will require a gardener for the upkeep of the tree. Their way requires technical support for any devices such as the computer refrigerator and plumbing for washrooms.

### **5.3 Support**

To contact the Archicad support the following methods of contact can be utilised:

Email: [support@graphisoft.ca](mailto:support@graphisoft.ca)

Phone: 1-800-238-3992

These are available Monday - Friday from 9am-8pm alongside specific webinars for the program.

Support for the physical model may include support from a construction team or engineering team in order to for this design into the user's preferred lot of space in order to consider the most optimal orientation.

## **6 Product Documentation**

The main area of the building is constructed out of wood for aesthetic purposes. For example, the hardwood flooring. However, these are easily replaceable with ceramic flooring or others for expense or design purposes.

The large tree in the lobby was a design choice made to make the building users closely related to nature. This is something that the people in the guardianship program felt strongly about. The tree also reduces the building's general carbon footprint, making it more sustainable and maintainable in the long run. The tree acts as a natural cooling factor for the building. Similar to the social science building at the University of Ottawa.

As for the general appliances, countertops and furniture of the building, the guardianship program has complete control, as these were not factors that influenced the design process. The prototype allows for an average-sized fridge, microwave and dishwasher. If larger appliances are needed, we would recommend reviewing the design layout to account for their larger sizes.

The storage room on the main floor has a large walk-in freezer; this design choice was made to maximize the floor space and proximity to the garage door to make for a seamless transition of larger samples being brought to the facility. This walk-in freezer/ fridge cannot be exchanged for an average size or household fridge as it will not be sufficient space for the program.

### **Exterior:**

The shape of the exterior of the building came from a traditional wigwam shape. However, the group traded out the wood panelling for thermal windows. This design choice was made to maximize the window space without losing heat. We do not recommend changing out the thermal windows for regular ones since this would raise the electricity bill in the winter, making the design less sustainable in the long term.

## 6.1 General

### 6.1.1 BOM (Bill of Materials)

Figure 10 - BOM of All Subsystems and Additional Units

		Quantity	% of Total	Cost per S.F.	Cost
<b>A</b>	<b>Substructure</b>		<b>6.16%</b>	<b>\$11.55</b>	<b>\$115,546.11</b>
A1010	Standard Foundations			\$3.93	\$39,325.91
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide	360		\$1.70	\$17,043.98
	Spread footings, 3000 PSI concrete, load 200K, soil bearing capacity 6 KSF, 6' - 0" square x 20" deep	19		\$1.88	\$18,753.57
	Spread footings, 3000 PSI concrete, load 300K, soil bearing capacity 6 KSF, 7' - 6" square x 25" deep	2		\$0.35	\$3,528.36
A1030	Slab on Grade			\$3.26	\$32,562.00
	Slab on grade, 4" thick, non industrial, reinforced, recycled plastic vapor barrier	5000		\$3.26	\$32,562.00
A2010	Basement Excavation			\$0.17	\$1,659.90
	Excavate and fill, 10,000 SF, 4' deep, sand, gravel, or common earth, on site storage	5000		\$0.17	\$1,659.90
A2020	Basement Walls			\$4.20	\$41,998.30
	Foundation wall, CIP, 4' wall height, direct chute, .099 CY/LF, 4.8 PLF, 8" thick, 3" XPS	35		\$0.33	\$3,337.18
	Foundation wall, CIP, 4' wall height, direct chute, .148 CY/LF, 7.2 PLF, 12" thick, 3" XPS R15	360		\$3.87	\$38,661.12
<b>B</b>	<b>Shell</b>		<b>30.72%</b>	<b>\$57.63</b>	<b>\$576,281.17</b>
B1010	Floor Construction			\$9.13	\$91,315.50
	Wood column, 8" x 8", 20' x 20' bay, 10' unsupported height, 133 BF/MSF, 160 PSF total allowable load	5000		\$0.27	\$2,674.50
	Wood beam and joist floor, 12"x16" girder, 8"x16" beam, 2x10 joists @ 16", 20'x20' bay, 75 PSF LL, 102 PSF total load	5000		\$8.86	\$88,641.00
B1020	Roof Construction			\$2.75	\$27,544.65
	Wood roof, flat rafter, 2" x 12", 16" O.C.	5000		\$2.75	\$27,544.65
B2010	Exterior Walls			\$31.36	\$313,589.15
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill, 3" XPS	6912		\$31.36	\$313,589.15
B2020	Exterior Windows			\$6.85	\$68,487.78
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"	75.13		\$6.85	\$68,487.78
B2030	Exterior Doors			\$1.66	\$16,603.88
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening	1		\$0.87	\$8,666.45
	Door, aluminum & glass, with transom, bronze finish, hardware, 3'-0" x 10'-0" opening	1		\$0.45	\$4,473.55
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening, low VOC paint	1		\$0.35	\$3,463.88
B3010	Roof Coverings			\$5.87	\$58,740.21
	Roofing, single ply membrane, TPO, 60 mil membrane, heat welded seams, fully adhered	5000		\$1.23	\$12,313.00
	Insulation, rigid, roof deck, extruded polystyrene, 40 PSI compressive strength, 4" thick, R20	5000		\$2.66	\$26,560.60
	Roof edges, aluminum, duranodic, .050" thick, 6" face	360		\$1.20	\$12,003.84
	Flashing, aluminum, no backing sides, .019"	360		\$0.22	\$2,199.83
	Gravel stop, aluminum, extruded, 4", duranodic, .050" thick	360		\$0.57	\$5,662.94
<b>C</b>	<b>Interiors</b>		<b>15.03%</b>	<b>\$28.20</b>	<b>\$281,961.57</b>
C1010	Partitions			\$5.32	\$53,217.15
	Wood partition, 5/8" fire rated gypsum board face, no base layer, 2x4, @ 16", 5/8" reg gypsum board opposite face, 0 insul	4000		\$1.90	\$19,000.40
	1/2" fire rated gypsum board, taped & finished, painted on metal furring, low VOC paint	6912		\$3.42	\$34,216.75
C1020	Interior Doors			\$6.08	\$60,796.20
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8", low VOC paint	50		\$6.08	\$60,796.20
C1030	Fittings			\$1.86	\$18,625.44
	Toilet partitions, cubicles, ceiling hung, stainless steel	12		\$1.86	\$18,625.44
C2010	Stair Construction			\$1.45	\$14,538.65

		Quantity	% of Total	Cost per S.F.	Cost
C2010	Stair Construction			\$1.45	\$14,538.65
	Stairs, wood, prefab box type, oak treads, wood rails 3'-6" wide, 14 risers	5		\$1.45	\$14,538.65
C3010	Wall Finishes			\$1.27	\$12,690.85
	Vinyl wall covering, fabric back, medium weight	4800		\$0.95	\$9,519.07
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats, low VOC	3200		\$0.32	\$3,171.78
C3020	Floor Finishes			\$5.01	\$50,119.28
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 24 oz	6000		\$2.72	\$27,194.40
	Tile, ceramic natural clay	1000		\$1.16	\$11,583.80
	Vinyl, composition tile, 12" x 12" x 1/8" thick, recycled content	3000		\$1.13	\$11,341.08
C3030	Ceiling Finishes			\$7.20	\$71,974.00
	Acoustic ceilings, 3/4" mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support	10000		\$7.20	\$71,974.00
<b>D</b>	<b>Services</b>		<b>43.35%</b>	<b>\$81.34</b>	<b>\$813,381.88</b>
D1010	Elevators and Lifts			\$14.91	\$149,134.80
	Hydraulic passenger elevator, 3000 lb, 3 floors, 12' story height, 2 car group, 125 FPM	1		\$14.91	\$149,134.80
D2010	Plumbing Fixtures			\$4.50	\$44,992.67
	Water closet, vitreous china, bowl only w/ auto flush sensor flush valve, wall hung, 1.28 gpf	4.8		\$1.77	\$17,713.20

		Quantity	% of Total	Cost per S.F.	Cost
	Urinal, vitreous china, wall hung, waterless, ADA	2.4		\$0.19	\$1,914.04
	Lavatory w/trim, vanity top, PE on CI, 20" x 18", faucet w/ hydroelectric powered motion sensor	4.8		\$1.04	\$10,389.77
	Service sink w/trim, PE on CI, wall hung w/rim guard, 24" x 20"	2.4		\$0.94	\$9,368.40
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH, GreenSpec certified, ADA	2.55		\$0.56	\$5,607.26
D2020	Domestic Water Distribution			\$0.22	\$2,157.75
	Gas fired water heater, commercial, 100< F rise, tankless, on-demand, natural gas/propane, 8.4 GPM	0.5		\$0.22	\$2,157.75
D2040	Rain Water Drainage			\$0.94	\$9,374.15
	Roof drain, CI, soil, single hub, 4" diam, 10' high	2		\$0.48	\$4,776.94
	Roof drain, CI, soil, single hub, 4" diam, for each additional foot add	73		\$0.46	\$4,597.21
D3040	Distribution Systems			\$2.88	\$28,769.59
	Heat recovery pkgs, air to air, enthalpy recovery wheel, 10000 max CFM	1.5		\$2.88	\$28,769.59
D3050	Terminal & Package Units			\$16.75	\$167,486.50
	Rooftop, multizone, air conditioner, green offices, 25,000 SF, 50 ton SEER 14	10000		\$16.75	\$167,486.50
D4010	Sprinklers			\$3.90	\$38,972.00
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 5000 SF	3400		\$1.72	\$17,176.39
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 5000 SF	6600		\$1.90	\$18,978.37
	Standard High Rise Accessory Package 3 story	0.5		\$0.28	\$2,817.24

		Quantity	% of Total	Cost per S.F.	Cost
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 5000 SF	3400		\$1.72	\$17,176.39
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 5000 SF	6600		\$1.90	\$18,978.37
	Standard High Rise Accessory Package 3 story	0.5		\$0.28	\$2,817.24
D4020	Standpipes			\$1.06	\$10,591.50
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor	0.6		\$0.57	\$5,713.14
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, additional floors	2.25		\$0.49	\$4,878.36
D5010	Electrical Service/Distribution			\$6.03	\$60,273.28
	Overhead service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 800 A	1.25		\$1.62	\$16,155.94
	Feeder installation 600 V, including RGS conduit and XHHW wire, 800 A	100		\$2.00	\$19,986.30
	Switchgear installation, incl switchboard, panels & circuit breaker, 120/208 V, 3 phase, 800 A	1.2		\$2.41	\$24,131.04
D5020	Lighting and Branch Wiring			\$17.52	\$175,233.96
	Receptacles incl plate, box, conduit, wire, 16.5 per 1000 SF, 2.0 W per SF, with transformer	10000		\$5.15	\$51,531.30
	Miscellaneous power, 1.2 watts	10000		\$0.36	\$3,584.70
	Central air conditioning power, 3 watts	10000		\$0.64	\$6,369.80
	Motor installation, three phase, 460 V, 15 HP motor size	2		\$0.54	\$5,438.40
	LED fixtures recess mounted in ceiling, 0.69 watt per SF	11500		\$7.90	\$79,041.46
	Daylight dimming control system, 5 fixtures per 1000 SF	5000		\$0.85	\$8,507.30

		Quantity	% of Total	Cost per S.F.	Cost
	Daylight dimming control system, 5 fixtures per 1000 SF	5000		\$0.85	\$8,507.30
	Lighting on/off control system, 5 fixtures per 1000 SF	10000		\$0.96	\$9,647.60
	Lighting on/off control system, 10 fixtures per 1000 SF	10000		\$1.11	\$11,113.40
D5030	Communications and Security			\$9.88	\$98,788.32
	Telephone wiring for offices & laboratories, 8 jacks/MSF (cost per MSF)	7.5		\$1.76	\$17,578.31
	Communication and alarm systems, fire detection, non-addressable, 100 detectors, includes outlets, boxes, conduit and wire	0.5		\$3.42	\$34,172.05
	Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and wire	0.5		\$2.16	\$21,640.80
	Fire alarm command center, addressable with voice, excl. wire & conduit	0.5		\$0.67	\$6,667.41
	Internet wiring, 8 data/voice outlets per 1000 S.F.	7.5		\$1.87	\$18,729.75
D5090	Other Electrical Systems			\$2.76	\$27,607.36
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 7.5 kW	0.43		\$0.07	\$715.52
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW	1			\$1.36
	Energy monitoring systems, electrical, three phase, 5 meters	0.5		\$0.74	\$7,372.50
	Energy monitoring systems, mechanical, BTU, 3 meters w/3 duct & 3 space sensors	1		\$1.43	\$14,252.10
	Energy monitoring systems, Front end display	3		\$0.21	\$2,120.55
	Energy monitoring systems, Computer workstation	1		\$0.31	\$3,145.33

This BOM features the specific cost for all of the subsystems and will be utilized for ease of use.

## 6.1.2 List

General machinery for constructing commercial buildings would be needed. Some key equipment are:

- Excavator
- Tractor
- Saw
- Grader
- Trencher

- Bulldozer
- Crane
- Compactor
- Loader

For the interior of the building, you will need:

- Fridge
- Microwave
- Dish washer
- Any additional laboratory equipment that the guardian program requires
- Walk in freezer installation unit

### **6.1.3 Instructions**

The general instructions for building an industrial size building similar to ours include:

#### **Gaining proper permits.**

- Make sure the building will fit all the provincial and federal regulations.
- Apply for a construction permit for the building

#### **Excavate**

- Prepare the land for the foundation according to the design dimensions. In our case this is 1: 300 scale.
- Pour the concrete foundation ensuring it meets the structural specifications.

#### **Structure general construction:**

- Based on the design plans provided assemble the general structural framework.
- Including the interior walls, roof, other structural elements(countertops)

### **Utility and infrastructure installation**

- Necessary plumbing and electrical components are installed.
- Set up the industrial infrastructure required such as the walk-in freezer.

### **Interior construction**

- Countertops and other interior elements are installed.

### **Interior desing**

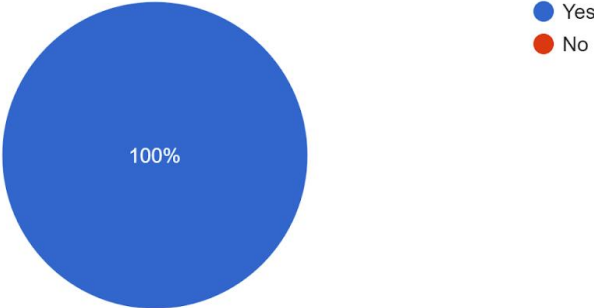
- Lasty the interior design of the building is complete. This includes painting the walls and furnishing the interior.

## **6.2 Testing & Validation**

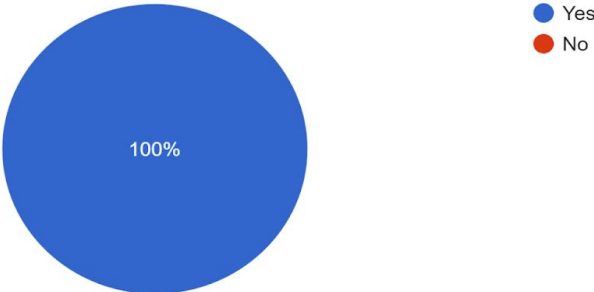
Using Google Forms reviewers were able to input whether or not the design could be considered as acceptable according to the identified design criteria based on the client's needs. Using the Google Forms software allows users to evaluate the efficiency of the design based on the percentage outlined by the responses, as above 90% is considered effective. There are no specific requirements or considerations to be considered. The results of this process for each design are outlined below:

**Figure 11 - Results from Prototype III Testing Each Design Criteria**

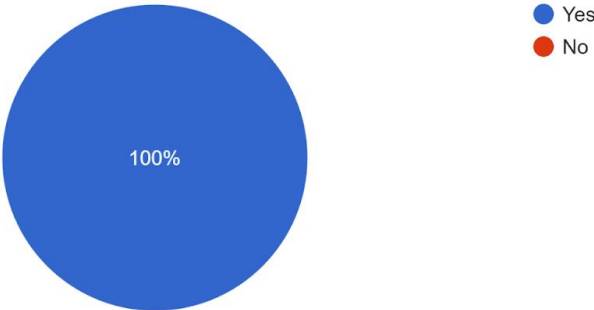
Building is Sustainable  
27 responses



Building Has Comfortable Rooms  
27 responses

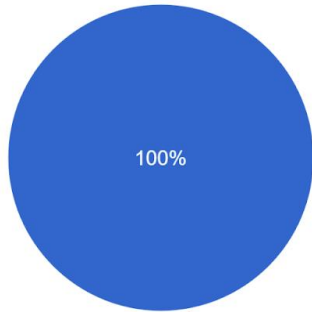


Building Contains Equipment Storage Space  
27 responses



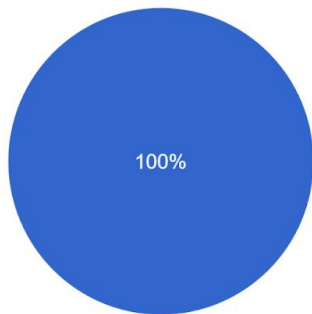


A Computer Lab  
27 responses



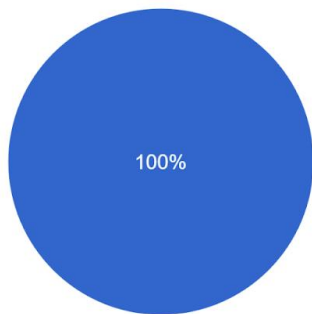
● Yes  
● No

Has an Outside Lean-to and Parking Space  
27 responses



● Yes  
● No

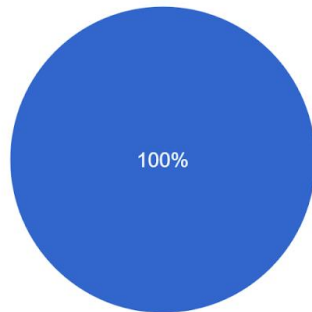
Has a Harvesting Station  
27 responses



● Yes  
● No

### Has at least 5 offices

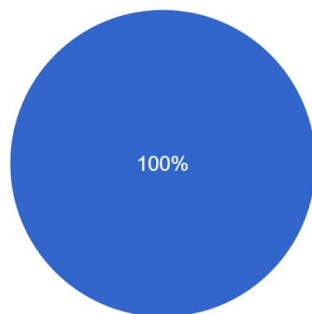
27 responses



- Yes
- No

### Briefing Room

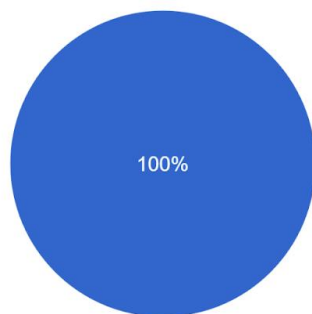
27 responses



- Yes
- No

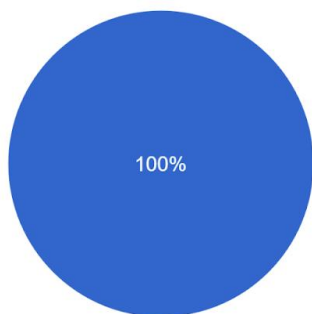
### Washrooms

27 responses



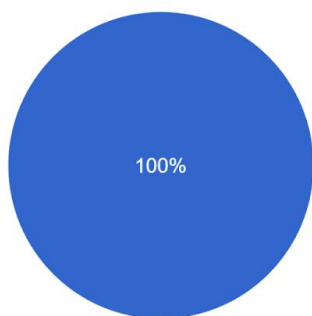
- Yes
- No

Kitchenette  
27 responses



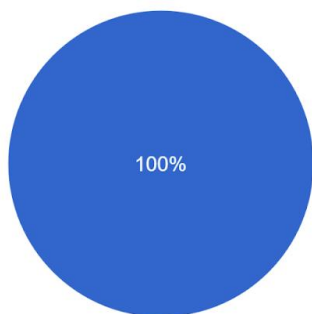
● Yes  
● No

Pleasing Aesthetics  
27 responses



● Yes  
● No

Accessible Building  
27 responses



● Yes  
● No

## **7 Conclusions and Recommendations for Future Work**

From the three different prototypes, we learned new strategies to make the building more functional. We learned how to maximize storage space by adding overhead storage, and how to make the building more thermally efficient by reducing the amount of windows on the side, but still maintaining the extra sunlight from the glass roof. Since the facility resides in Ontario, it had to be all weatherproof, having the ability to run throughout the entire year. We decided to add a slant to the roof of the right side of the building, so snow can easily fall onto the ground. For sustainability purposes, we also learned that keeping more greenery within the building eliminates the need for air conditioning throughout the summer. More improvements can be made with further research on effective strategies to reduce carbon footprint and electricity usage. With more time, the team would conduct research on sustainable infrastructures and brainstorm more ways to incorporate these methods into our design. We would also refine our 3D model, perfecting the structural components (panelling, slanted roof).