



**Innovative Ideas
Keeping You Awake
At Night?**

**We Can
Help!**

**Applied Research and Innovation Services
Heart Building, Room MD115 • 284.7056**



Green Building Technologies

Applied Research and Innovation Services



Net Zero + PassiveHaus Design

MACA: Material & Advanced
Component Assemblies

Architectural Ecology

Building Integrated Renewable
Energy

Energy Management &
Monitoring

GBT Product Commercialization
& Construction Process
Efficiency

**FURTHER
YOUR
PASSION**



GBT: Net Zero Design

Discovery 3



GBT: Net Zero Design

Solar Decathlon 2009



GBT: Net Zero Design

Discovery 4



Climate Change Central



Green Building Technologies

Transportation



GBT: Net Zero Design

Discovery 5





Holmes
Approved
Homes

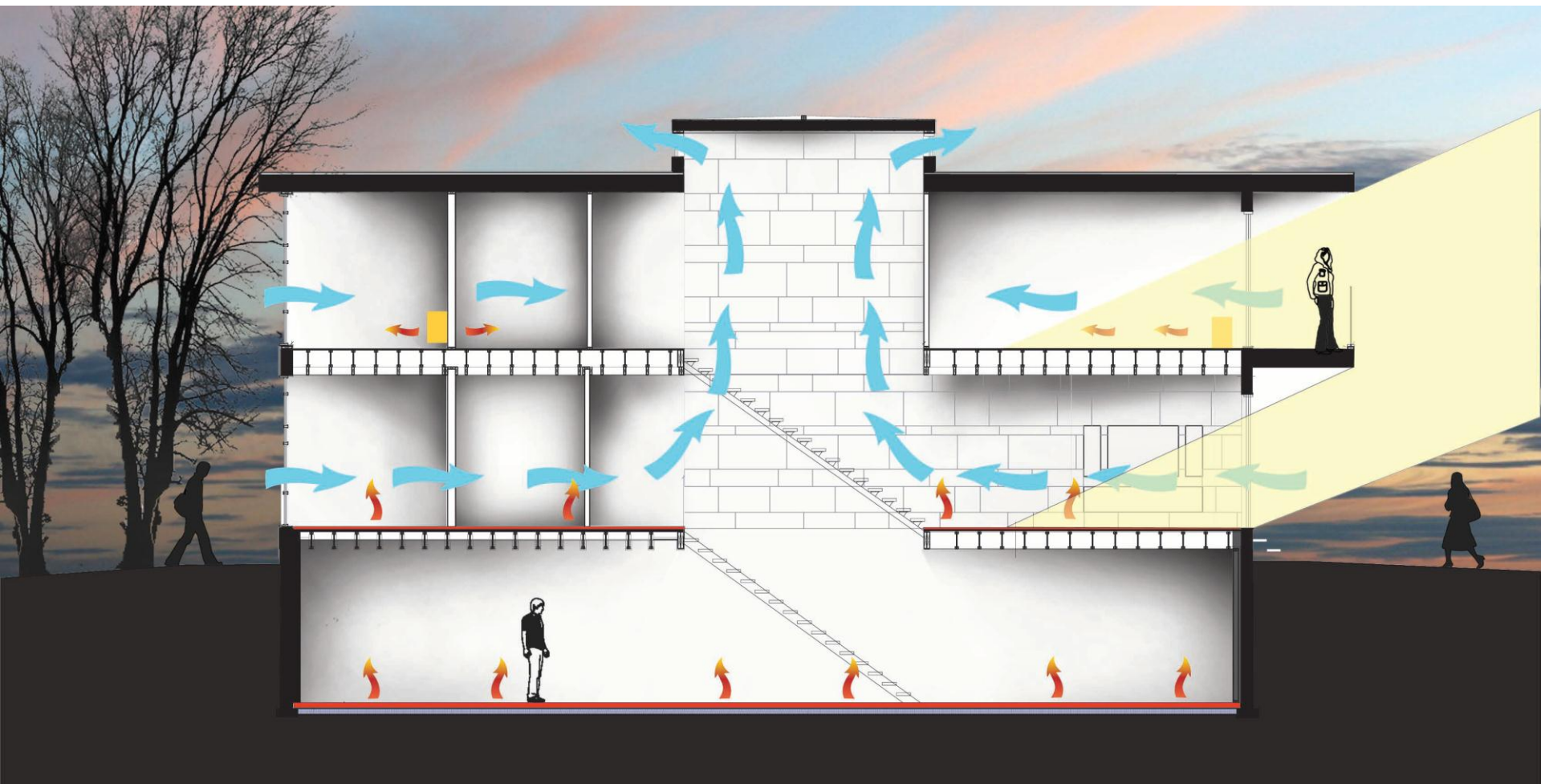


Homes



**FURTHER
YOUR
PASSION**





SUMMER

TOP OF SOLAR CHIMNEY

WINTER

SECOND FLOOR

MAIN FLOOR

TOP OF BASEMENT SLAB



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Solar Thermal Frame	Extruded Aluminium Enamel Coated Frame	1
2	Tin Backboard	.51mm aluminium back sheet	1
3	Manifold	19mm CU manifold w/ 6 12mm outlets	2
4	Fin & Tube	12mm Aluminium Sunstrip Fin	6
5	Glass Face	Low Iron 3.18mm Tempered Solar Glass	1
6	Wall Framing	38mm x 184mm SPF Backframing	1

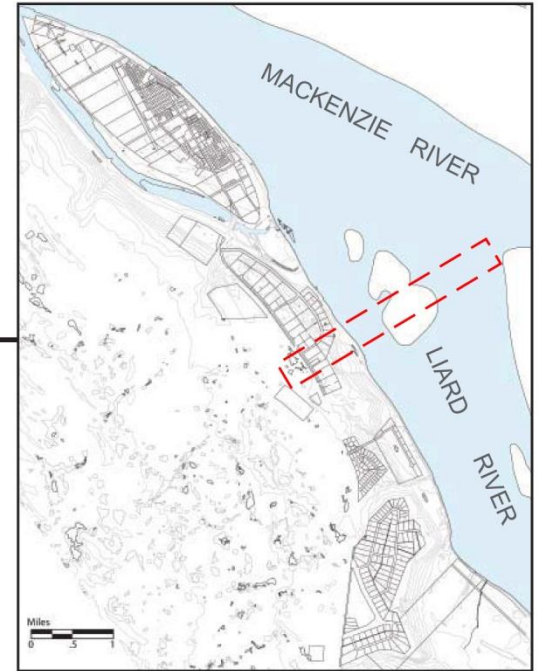
DESIGNER	CHECKED	DATE
J.A.	J.A.	2011/09/05
J.P.	J.P.	
J.S.	J.S.	
J.W.	J.W.	
J.L.	J.L.	
J.H.	J.H.	
J.C.	J.C.	
J.B.	J.B.	

APPROVALS	DATE
DESIGNER	
CHECKER	
ENGINEER	
MECHANICAL	
GENERAL	
INSTALL	
FIELD	

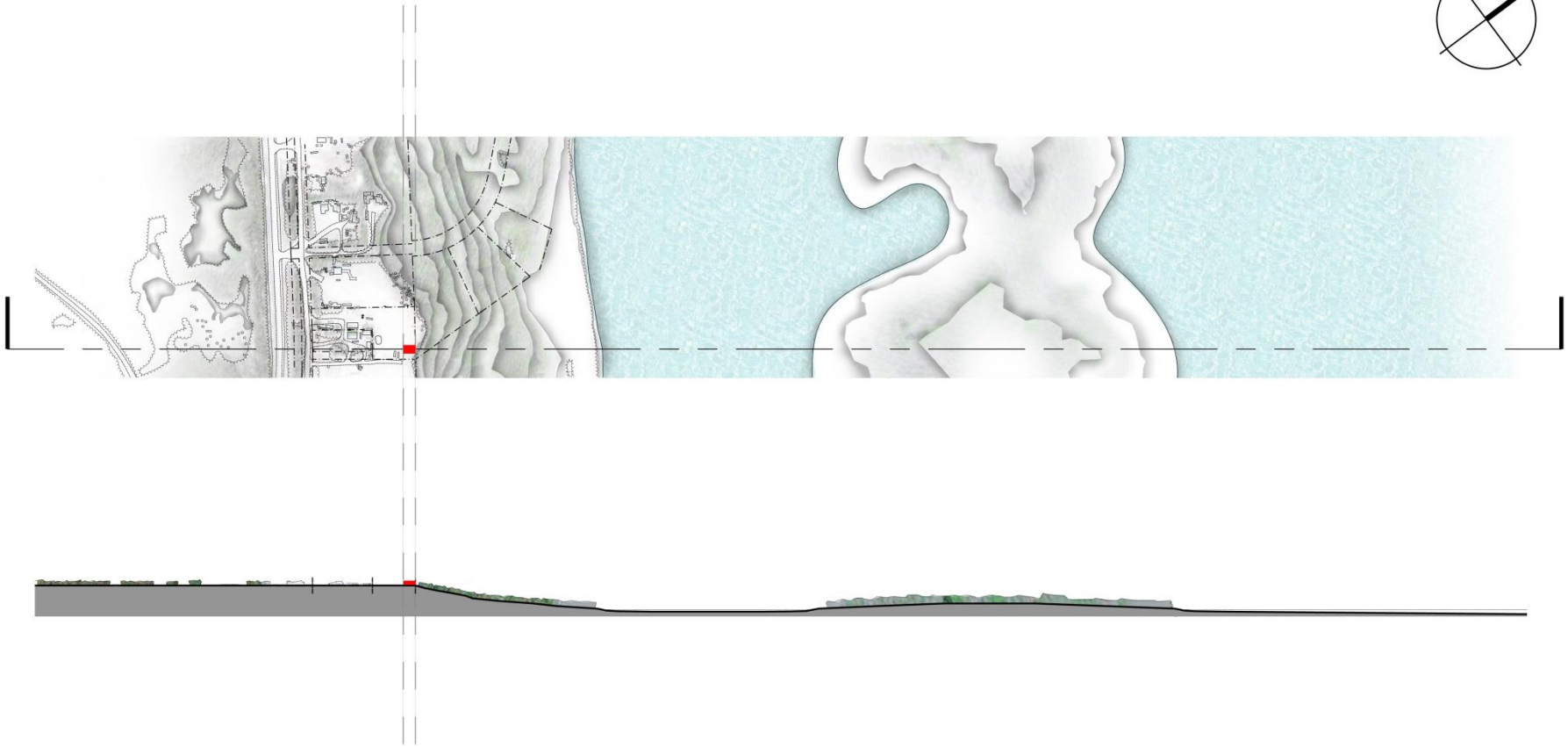
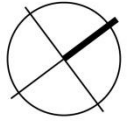
NSERC
CRSNG



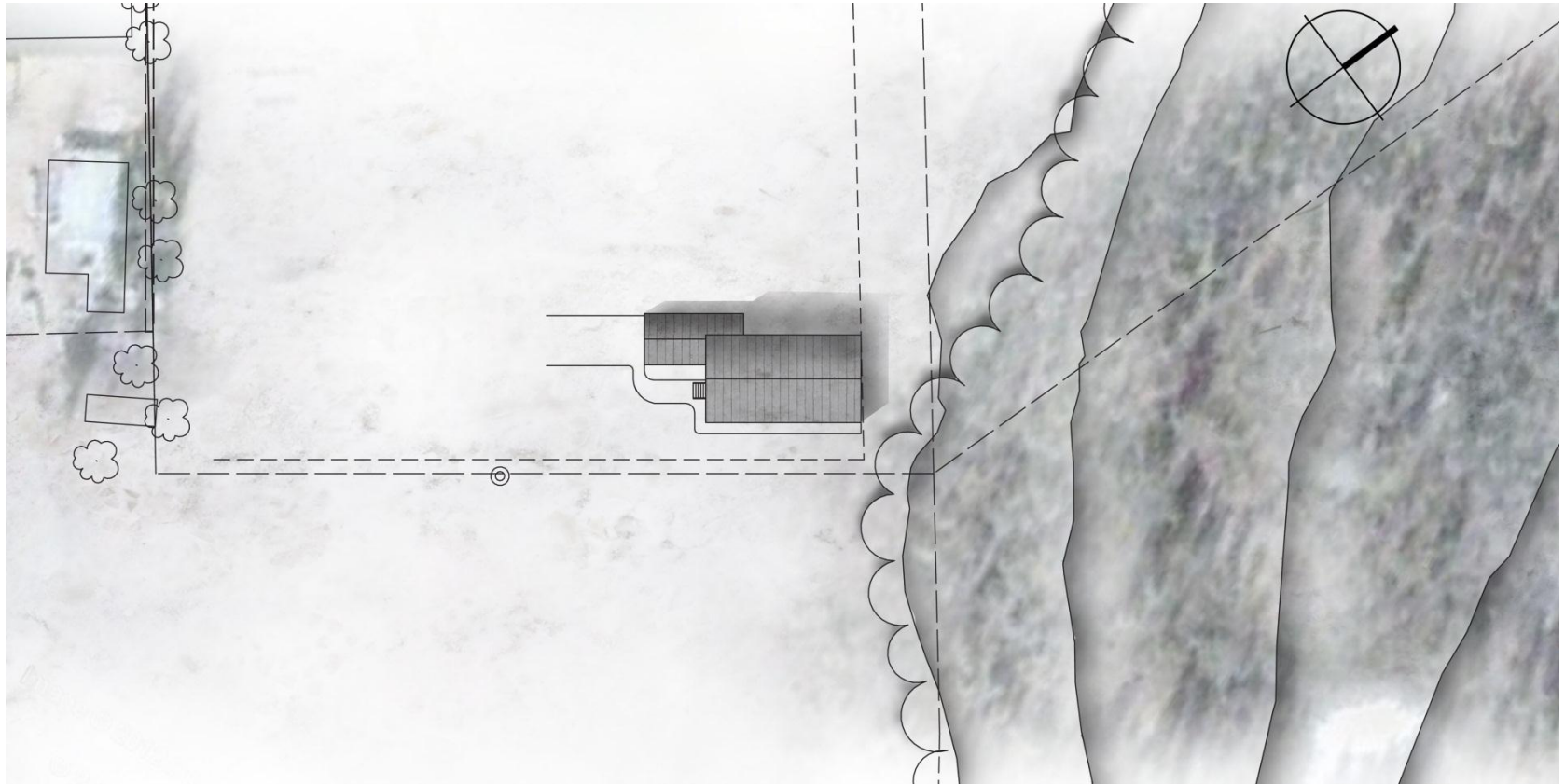
GBT: Net Zero Design Arctic House



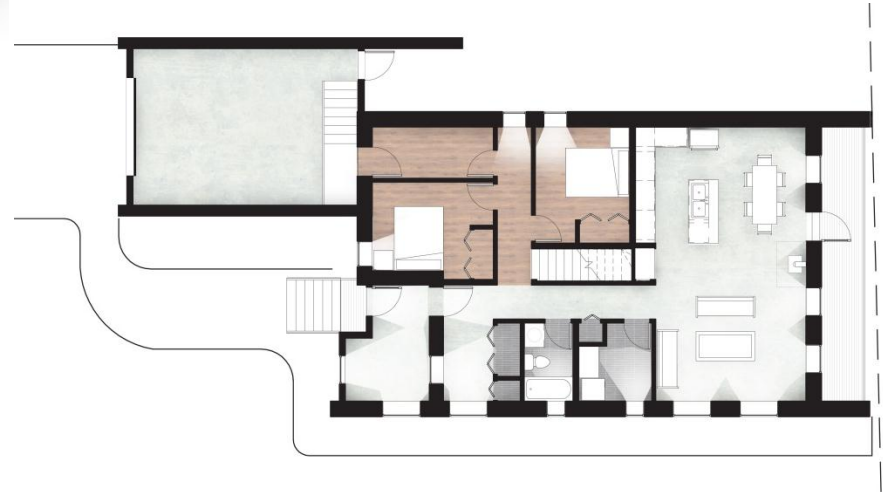
GBT: Net Zero Design Arctic House



GBT: Net Zero Design Arctic House

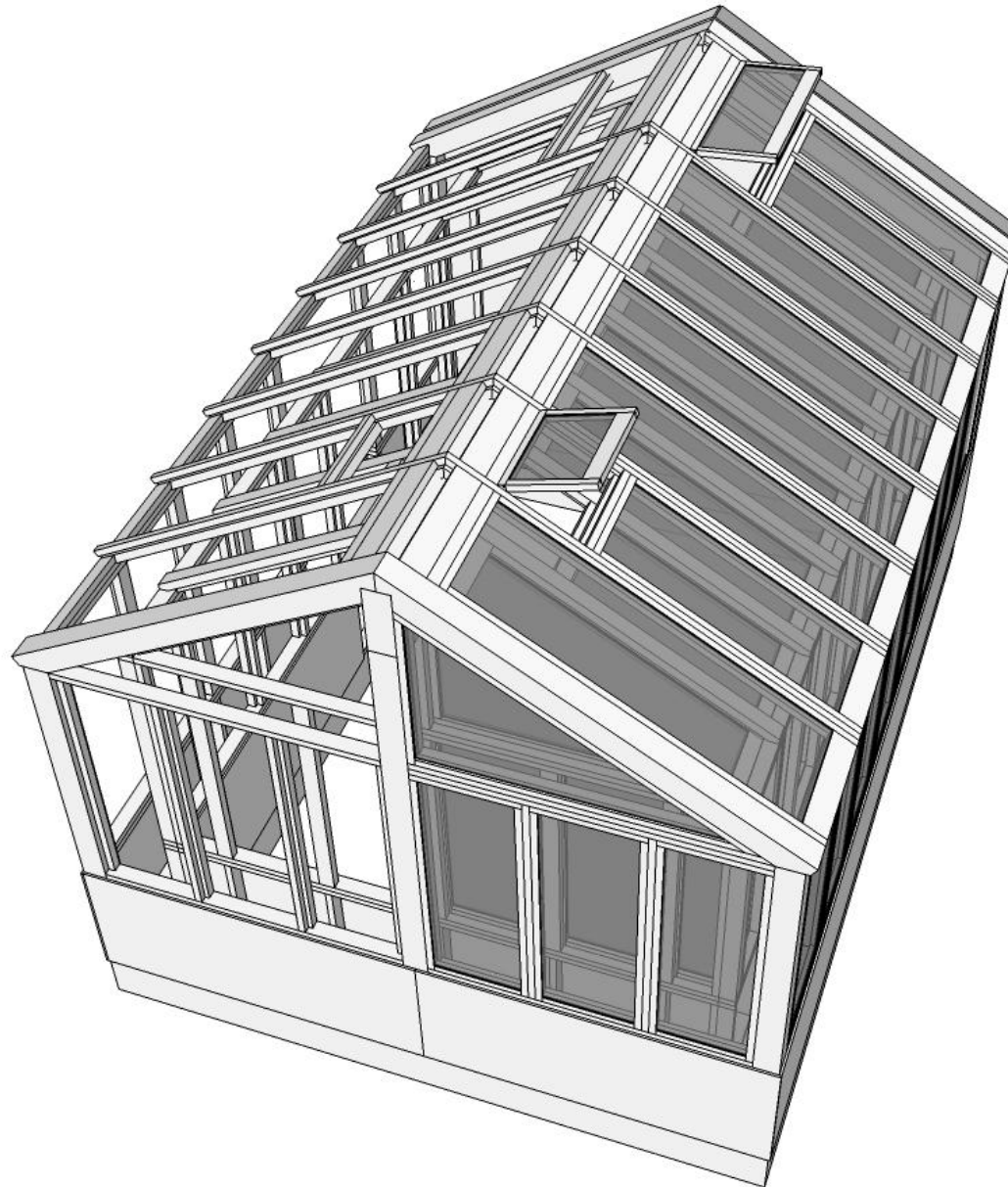


GBT: Net Zero Design Arctic House



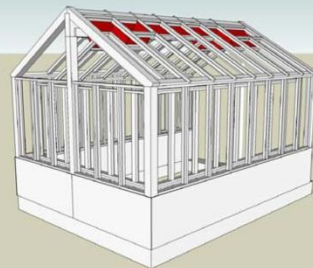
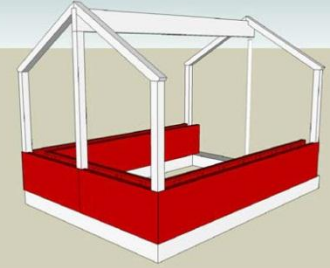
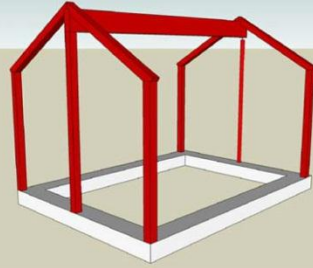
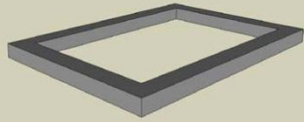
GBT: Net Zero Design

Solar Soap Bubble Greenhouse

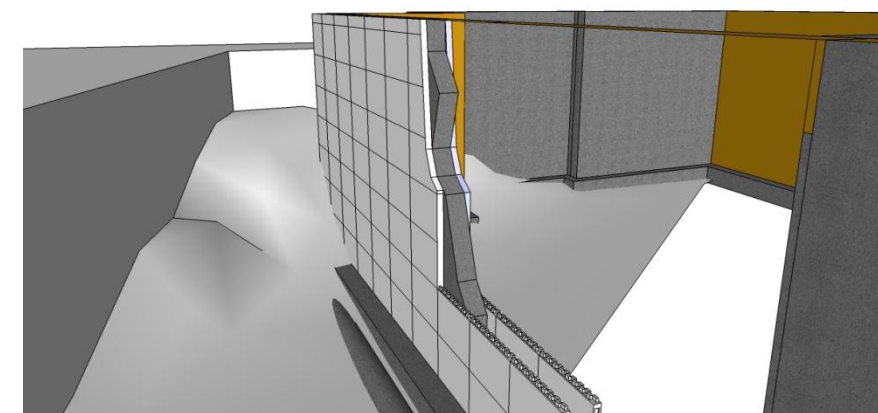
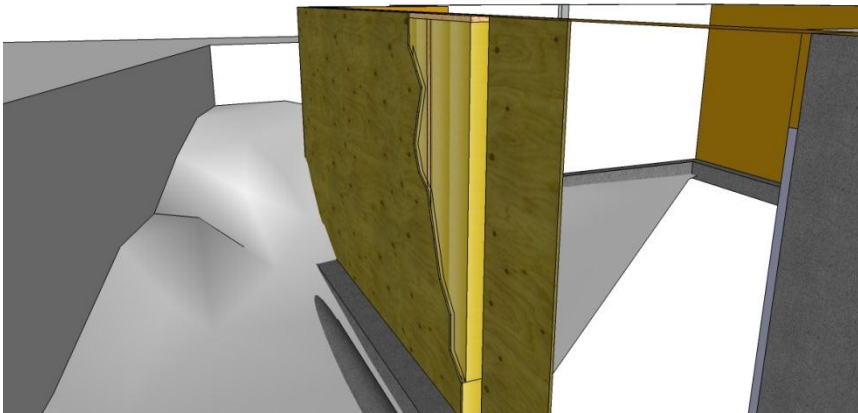
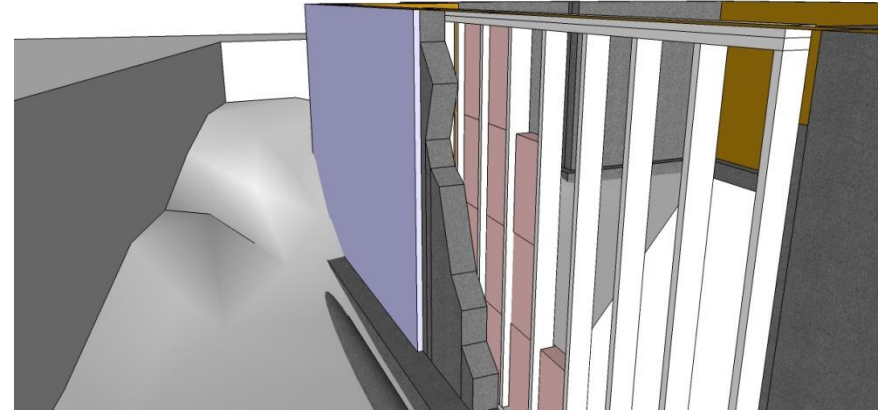
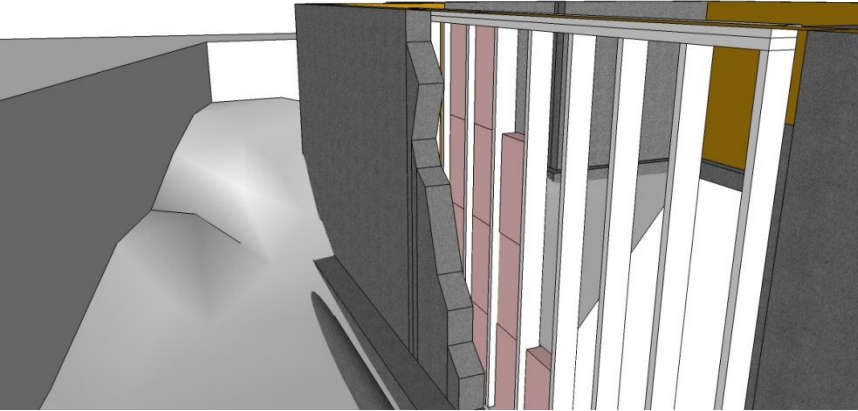


GBT: Net Zero Design

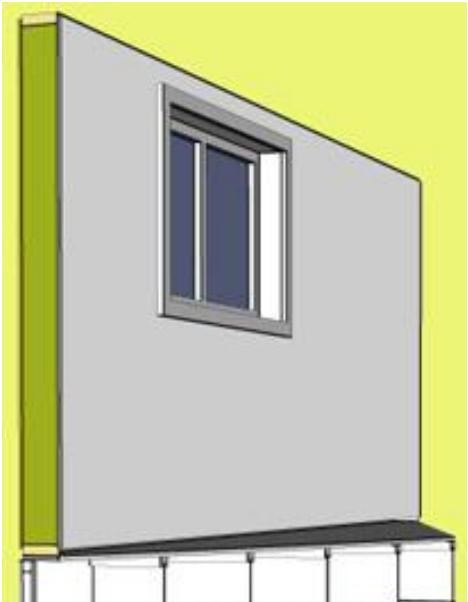
Solar Soap Bubble Greenhouse



MACA: Material & Advanced Component Assemblies



Best Practice Installation Procedures



Competitive Analysis Report: Wall Sheets
**ALBERTA ADVANCED WALL ROUNDTABLE
 PERFORMANCE CRITERIA & WALL SHEETS**

CONSTRUCTABILITY

LABOUR & MATERIAL

- Ease of Construction/ Framing & Insulation
- Workforce Skill Level
 - Workforce Safety
- Required Additional Labour

TIME MANAGEMENT

- Transportation to Site
 - Time to Lock Up
- Increase Build Cycles
 - On Site Assembly
 - Custom Alterations

PROFESSIONAL SERVICES

- Required Engineering Approvals
 - Inspection Services
- Education Builder, Trade, Inspector
 - CSA/ CCMC Approval
 - Innovation Product Workaround

DURABILITY

PRODUCT LIFESPAN

- Quality Construction
 - Moisture Resistant
 - Structural Integrity
 - Warranty

BUILDING SCIENCE INTEGRITY

- Susceptible to Weather
 - Aged R-Value/ Insulation
 - Settling, Compression
 - Air Barrier Performance
 - Long Term Resistivity

MATERIAL LOSSES

- On Site Waste
 - Transportation Damage
 - On Site Damage
 - Theft & Vandalism

PERFORMANCE*

ENERGY EFFICIENCY

- EnerGuide ERS Rating
 - % Improvement to Base Specification
 - Energy Saved kWh/GJ Annual

THERMAL PERFORMANCE

- R Value
 - Thermal Transfer
 - Air Leakage Control

MOISTURE PERFORMANCE

- Vapour Barrier Control
 - Breathable/ Ability to Wick or Self-Dry
 - Damage Associated with Moisture

COST**

COST PER LINEAR FOOT

- Cost per Linear Foot
 - Material Takeoff
 - Labour Estimate
 - Product Value

VALUE PER \$ SPENT

- Increased Cost = Reward
 - Low Cost
 - High Performance
 - Cost Recovery

COST TO CUSTOMER

- Partnership Premium
 - Minimum Performance
 - Package Upgrade
 - Utility Savings/ Mortgage Increase

MARKETABILITY

ENVIRONMENTAL PROGRAMS

- Rebate Eligible
 - LEED, Built Green Checklist
 - Air Leakage Control
 - EnerGuide ERS Minimum

CUSTOMER DEMAND

- Sound/ Noise Suppression
 - Quality Control
 - Call Back Reductions
 - Comfort/ Drafts
- Customer Requests for System

SALES & INNOVATION

- Promotional Product Partners
 - Government/ Supplier Incentives
 - Innovative Use/ High Performance
 - Champion of Change

* Energy Efficiency has been derived from a Base / Sample plan modeled in Hot2000 with a conventional specification.

**Roundtable Consensus: Despite considering the categories attached the group preferred a less expensive is better approach. -4 pts. for least expensive, -1 pt. for most expensive

Competitive Analysis Report: Wall Sheets

SIPS: STRESS SKIN INSULATED PANELS



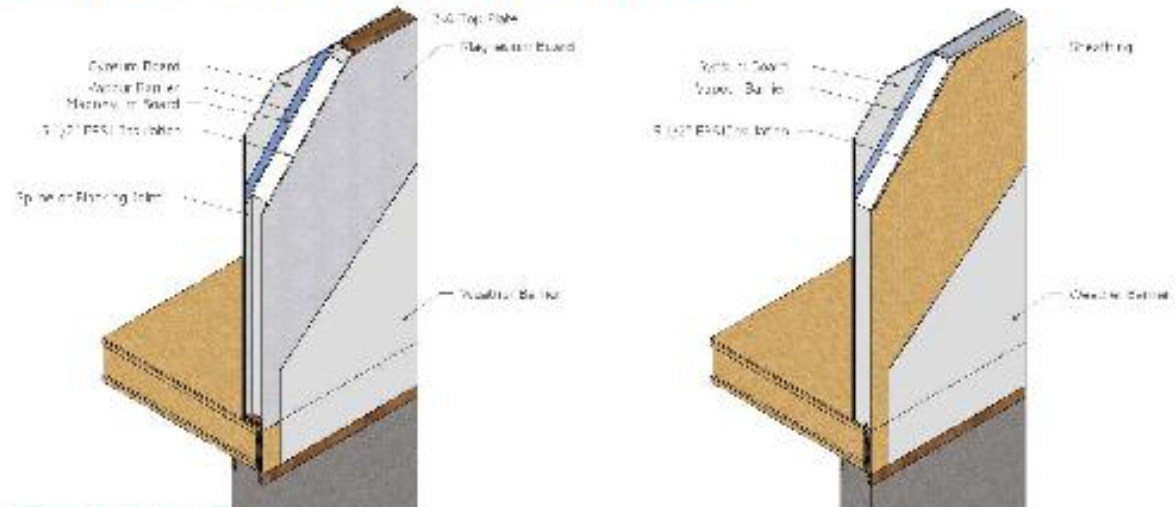
INTRODUCTION

Stress skin panels use metal, OSB, plywood and other sheathing adhesively fastened to thick foam insulation comprise all SIP panels. Panels erect quickly with an experienced crew and often provide the highest R Value in the thinnest depth wall on the market. See multiple high performance walls:

Straube, J., & Smegal, J. (2009). Building America Special Research Project - High-R Walls Case Study Analysis. Retrieved from buildingscience.com.

SCORING WALL SYSTEM:

BUILDABILITY	3
DURABILITY	3
PERFORMANCE	4
COST	2
MARKETABILITY	2



BUILDABILITY

Labour and Material

General comments from participants were that Stress Skin Panel's with both structural connections on 4' centres, or spline connections were harder to assemble in comparison to other walls, but once learned would erect faster. They are heavily engineered and require plans and engineering letters to meet inspection requirements. Workforce in manufacturing SIP panels is very different from framers assembling components. Specialized equipment required in factories- and often jigs and work around's are required for details on site. Requires accurate design drawings. See CASE STUDY analysis by John Straube and Building Science Corporation.

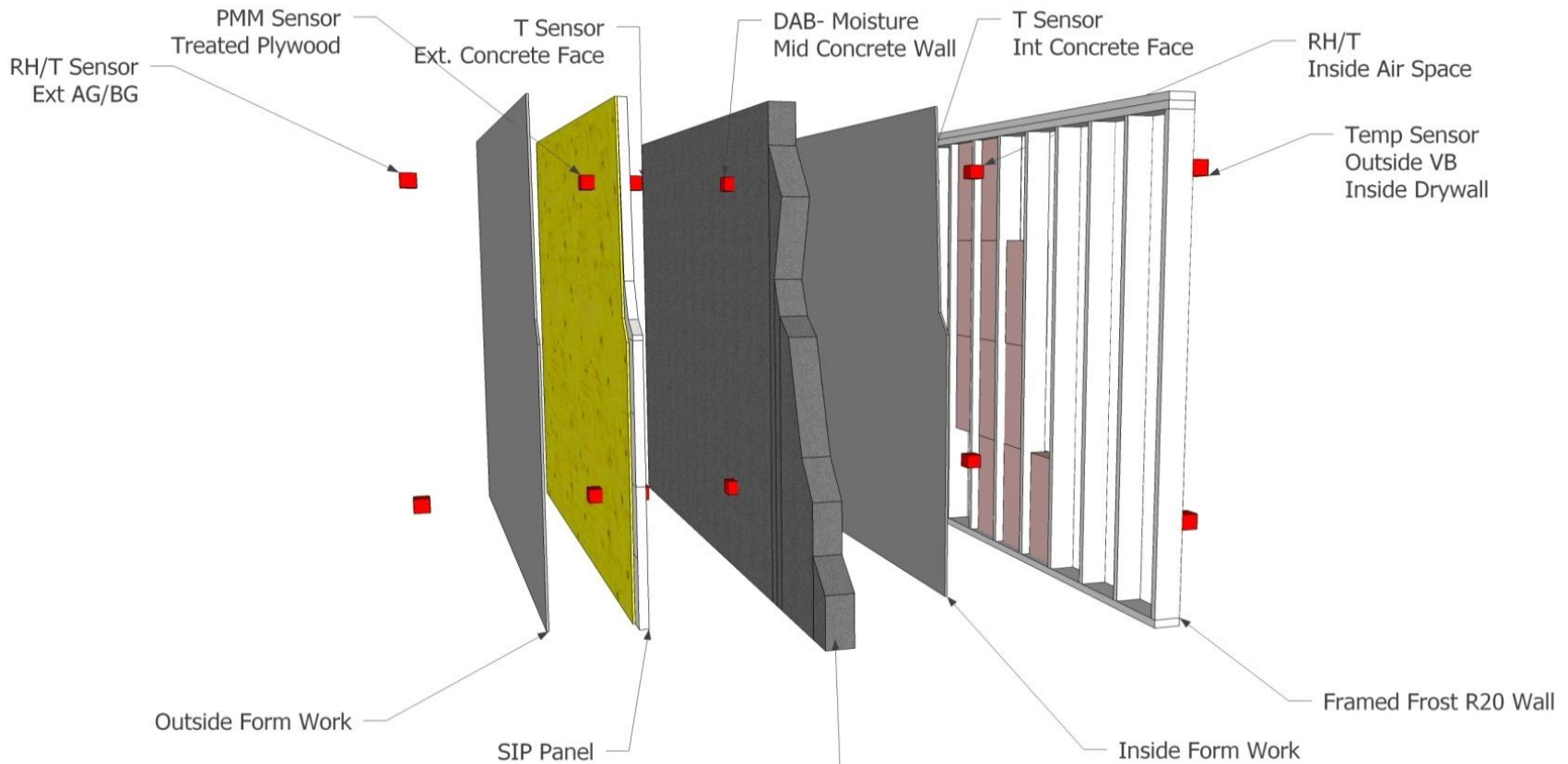
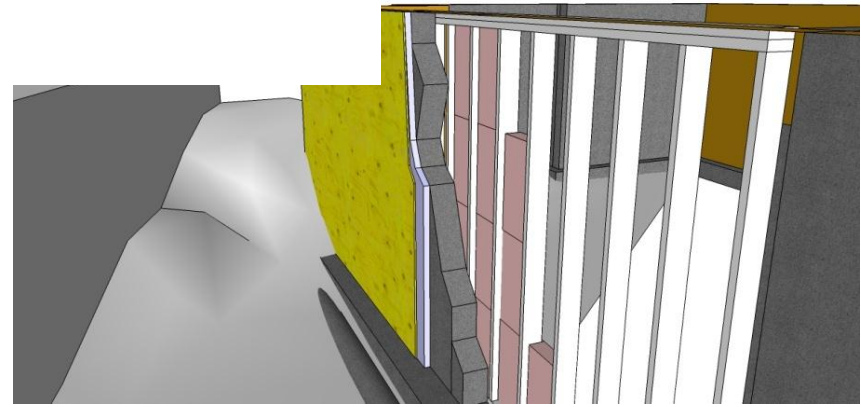
Time Management

Higher performance panels delivered to site, unloaded by zoom boom or forklift but can be manhandled individually. Reduced theft on site due to size and scale of products. Once crews are familiar- set up and lock up times tend to be faster. Alterations are difficult and oddities for structural connections with availability of SIP/GRK screws and star bits may delay or frustrate new framers.

Professional Services

Full engineered plans, manufacturing specs, details and letters are required for building science details, structural assessment and inspections. There is limited information of standards and

In Situ/ Environmental Testing



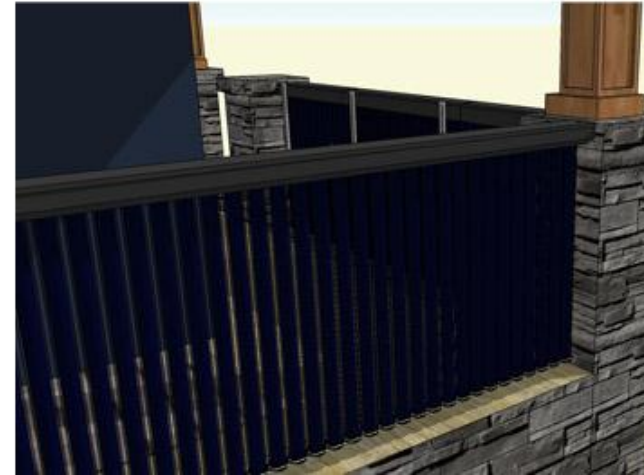
Typical Installation



Product Photograph



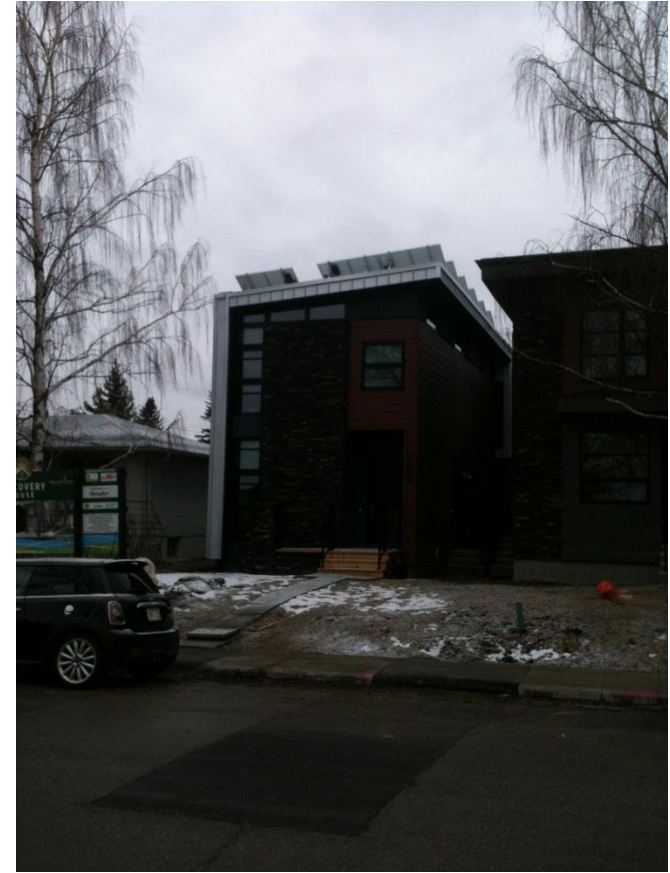
Proposed Installation



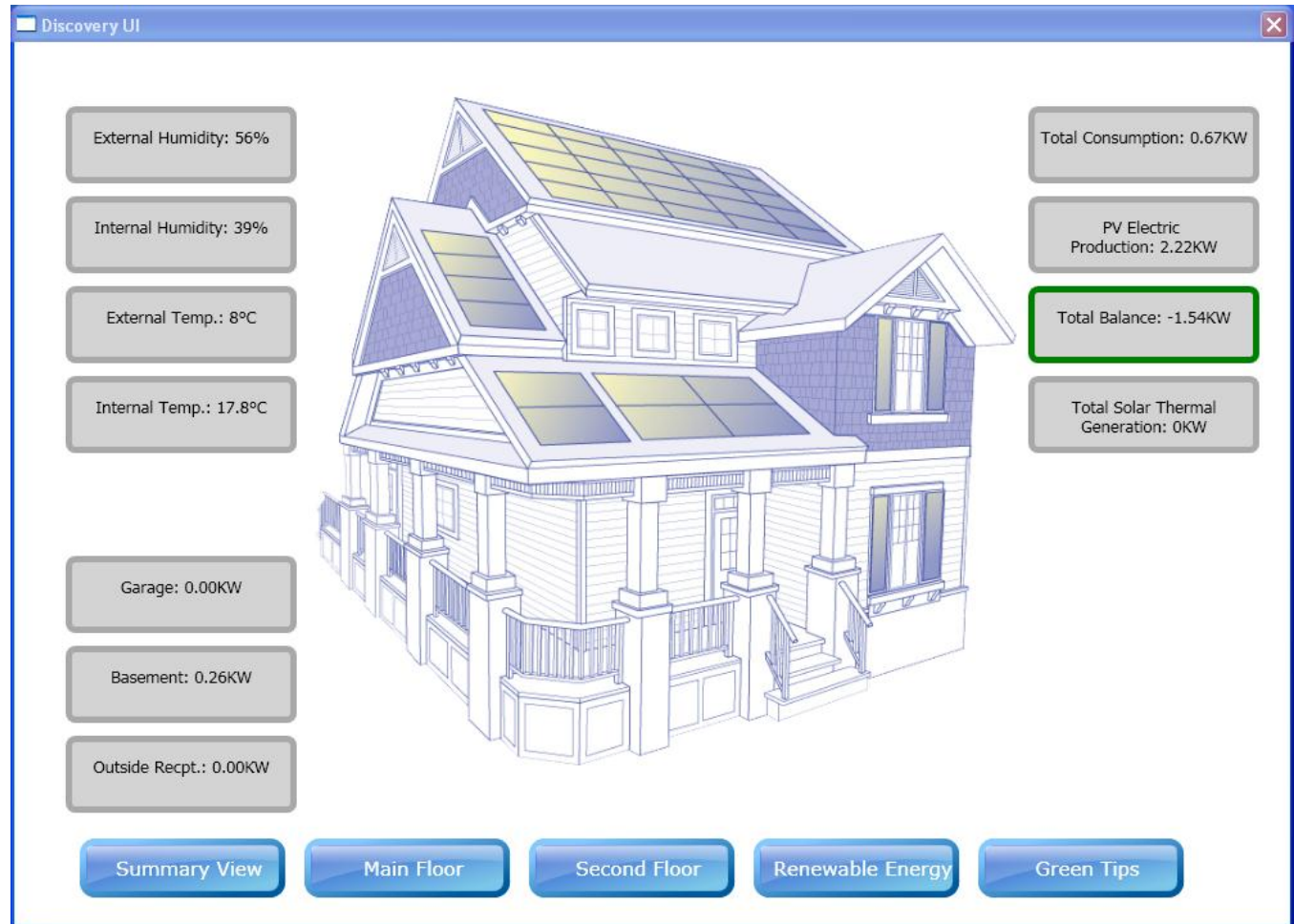
Solar Photovoltaic Discovery 4



Solar Photovoltaic Discovery 5



GBT: Home Energy Management Dashboard User Interface



Welcome to Discovery 5

Weather
Outside Air Temp 12.4 °C
Humidity 47.0 %

From Concept Design to Finished Product



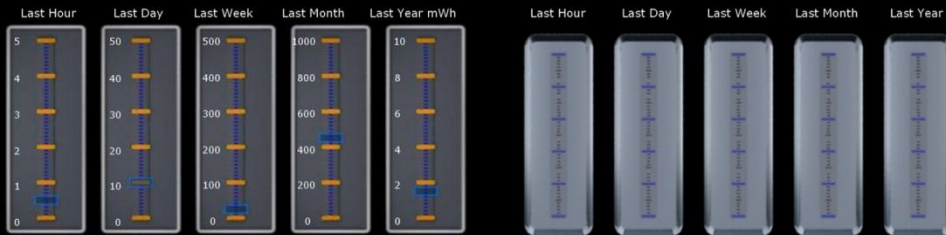
- Zone Heating
- Energy
- Green Tips
- Rain Water
- Alarms

The latest implementation of innovative design, architecture and green building technologies including Solar PV, Solar Thermal heating, Rain Water Harvesting, a Green Roof balcony and a Building Integrated Living Wall.



Power Usage (kWh)

Solar PV Input (kW)



Real Time (kW)



Loads



- Main Menu
- Zone Heating
- Green Tips
- Rain Water
- Alarms

Weather
Outside Air Temp 12.4 °C
Humidity 47.0 %

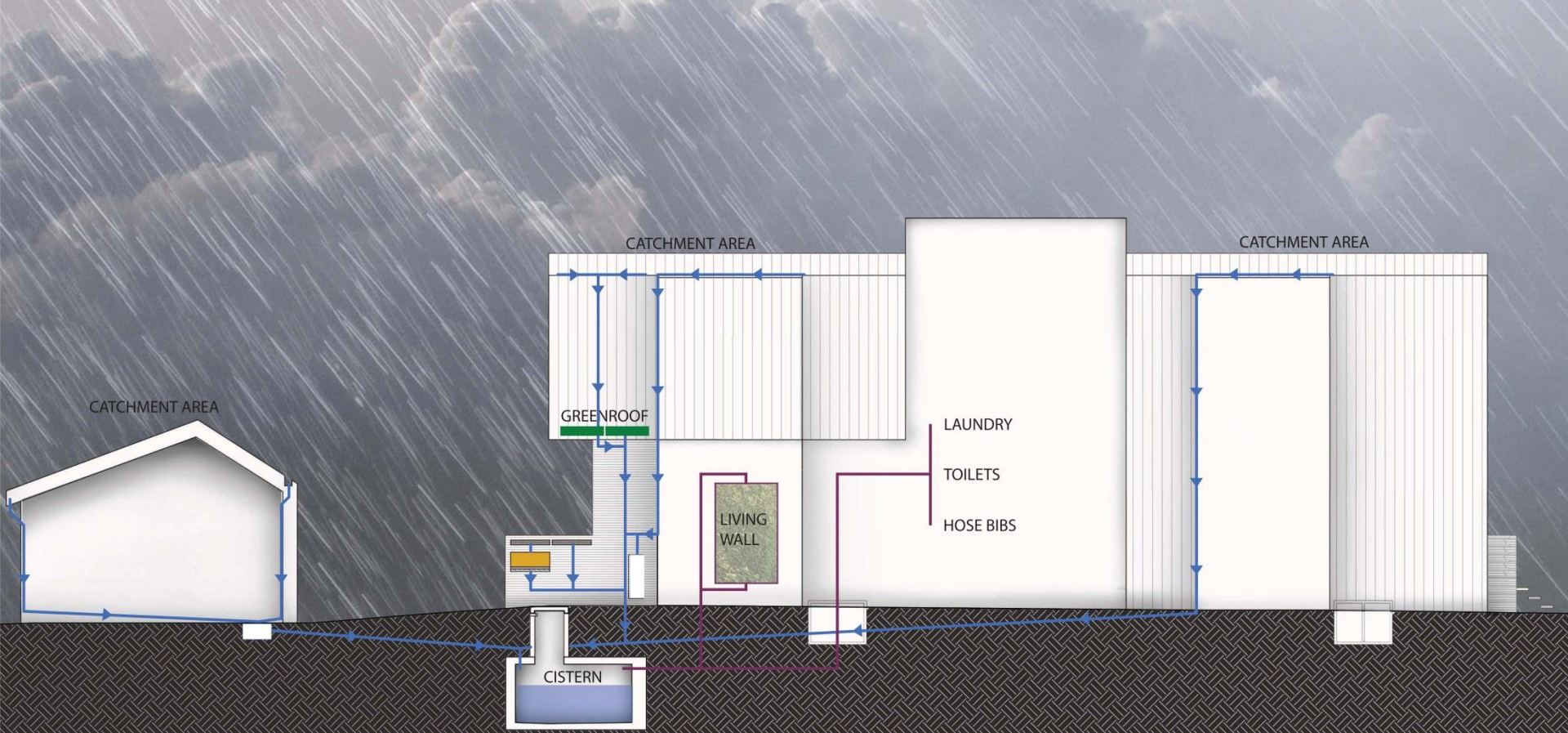


FURTHER YOUR PASSION



GBT: Architectural Ecology

Rainwater Harvesting



Non Potable Water



City of Calgary: DBA Rainwater Harvesting Brochure



What are the basic components of a rainwater harvesting system?

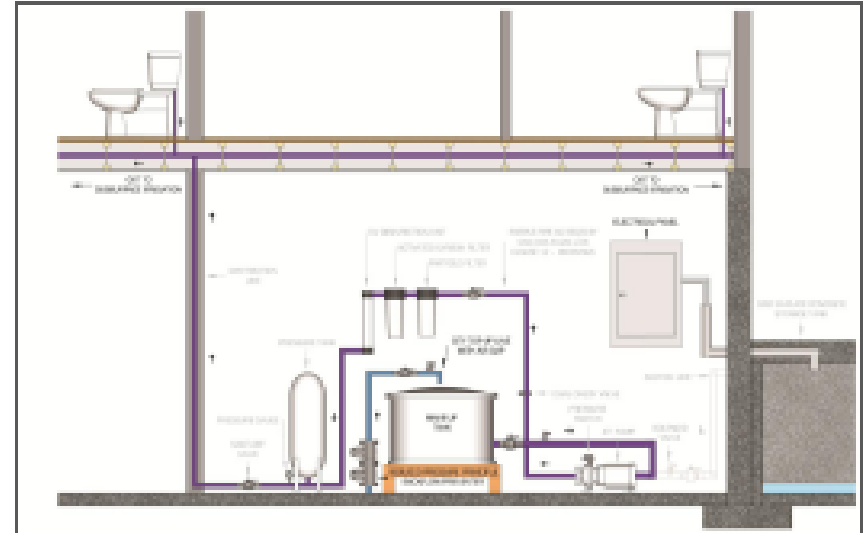


Figure 7 : Top-up and backflow prevention OPTION 1
(OPTION 2 to follow: depicting top-up drainage pipe attached directly to the storage tank)

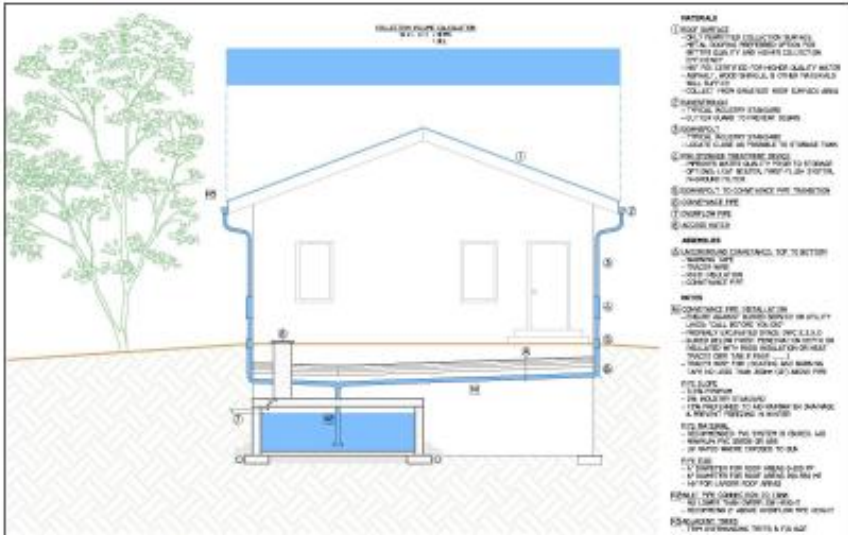


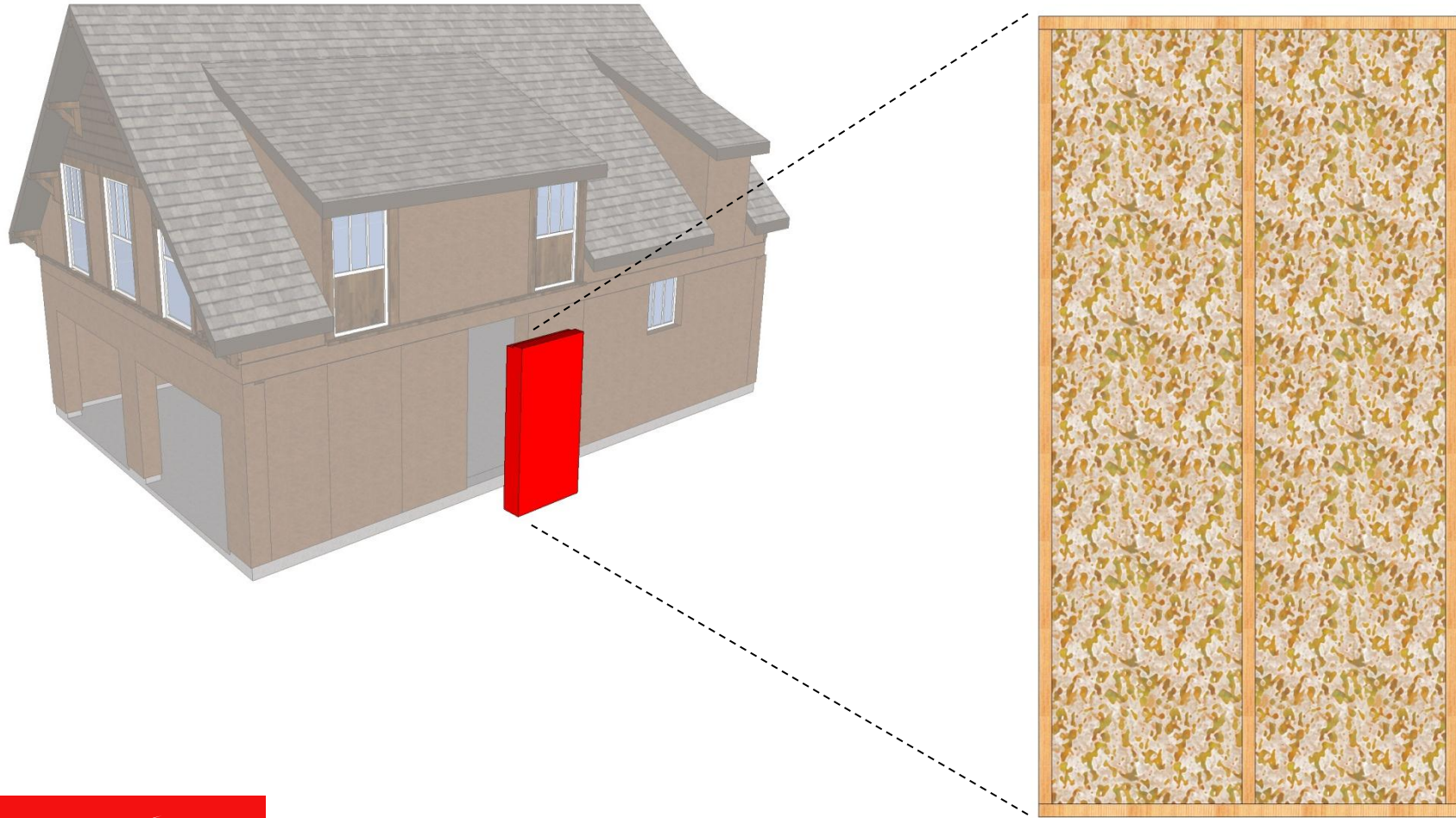
Figure 8 : Collection and conveyance system with potential volume of water on roof

CODE, STANDARD, & REQUIREMENT	APPLICABLE CLASS, SECTION, CHAPTER, & ADDITIONAL INFO
Alberta Building Code (2006)	Section 7.3.1.2 (2) Plumbing Systems and Fixtures
National Plumbing Code (2000)	Section 7.3.10.15 Water Mainer Arresters; 2.4.1.12 Thermal Expansion; 2.4.2.1.01 Connection of Systems; 3.8.2.4 Permit Installation; 3.8.2.9 Air Gap; 3.7.1.3 Not Permitted
National Standards of Canada (2007) CAN/CSA-B125.2-04	Class 0 - Backflow Prevention Class 11.5 - Cross-Connection Test
National Standards of Canada (2007) CAN/CSA International B14.1-0	Appendix B - Table B1 Section 4.3.4.2 Pressure Isolation NOTE: NPC (2005) refers to CAN/CSA B64.30 (2001)
National Standards of Canada (2007) CAN/CSA International B14.1-0	Appendix B - Table B1 Section 5.3.4 Pressure Isolation
Alberta Guidelines for Residential Rainwater Harvesting Systems (November 2010)	Chapter 6: Make-up Water System and Backflow Prevention
Canadian Electrical Code (2009)	All equipment with electrical connections must be installed in accordance with relevant electrical code

Living Walls/ Rain Water Filtration



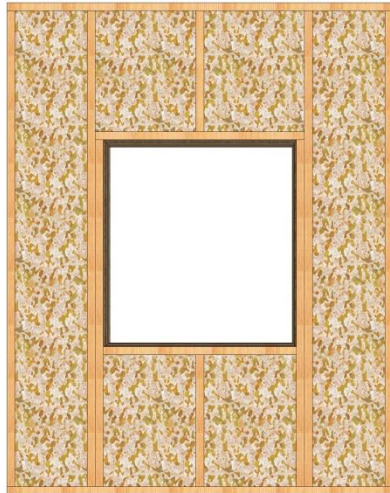
New Assembly Prototype and Fabrication



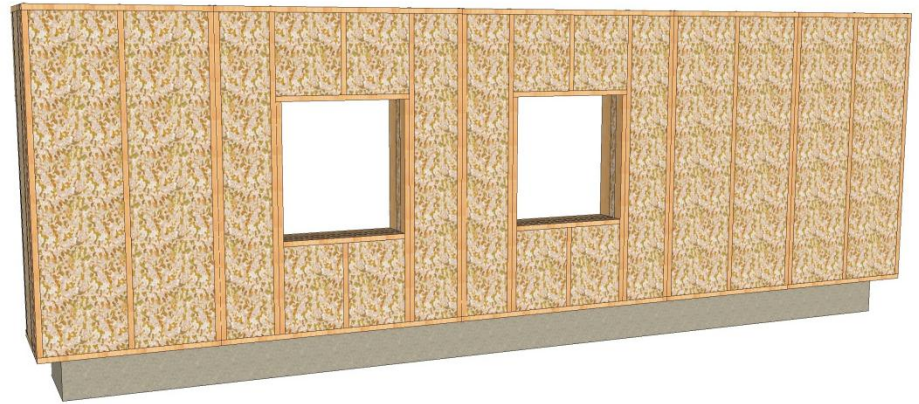
New Assembly Prototype and Fabrication



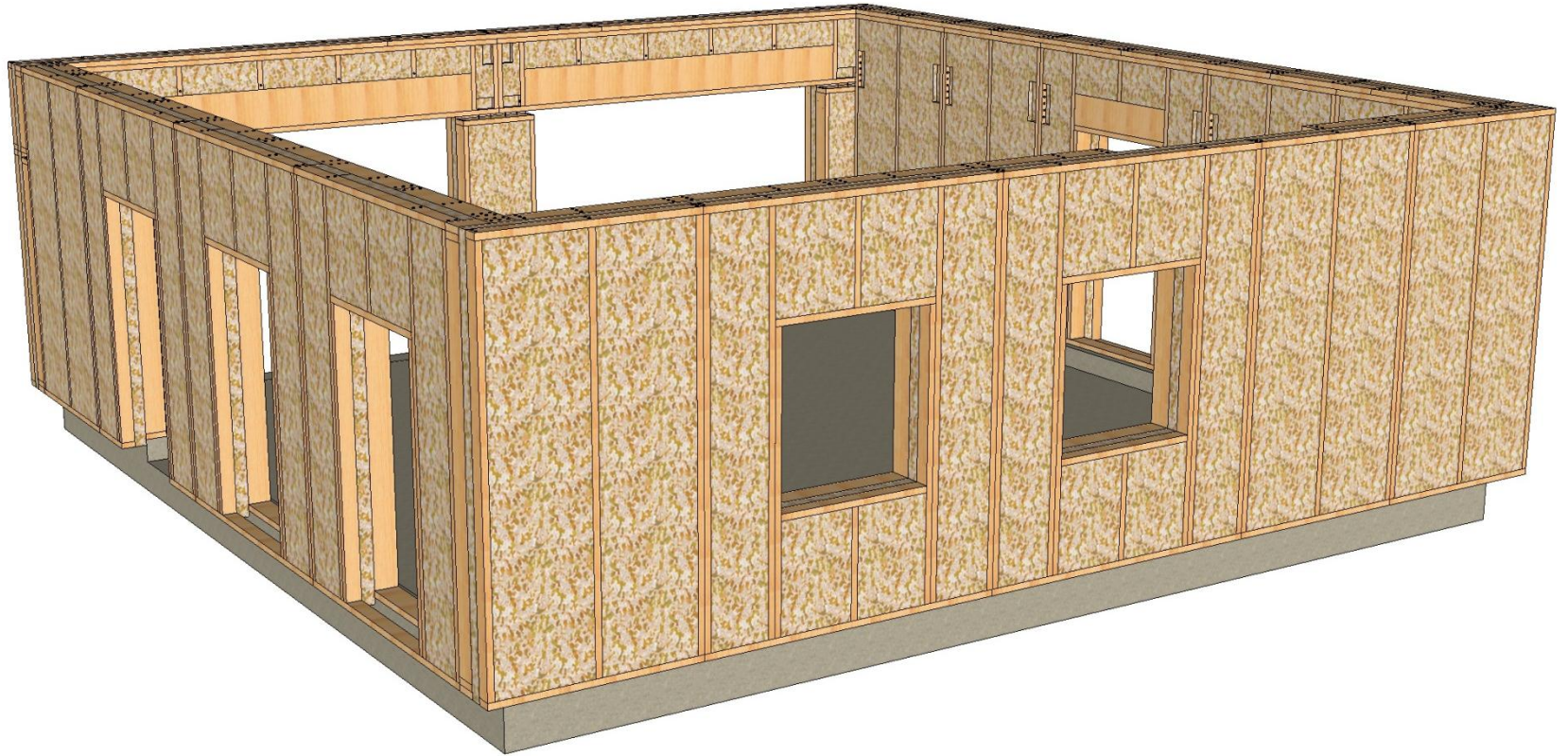
vs.



vs.



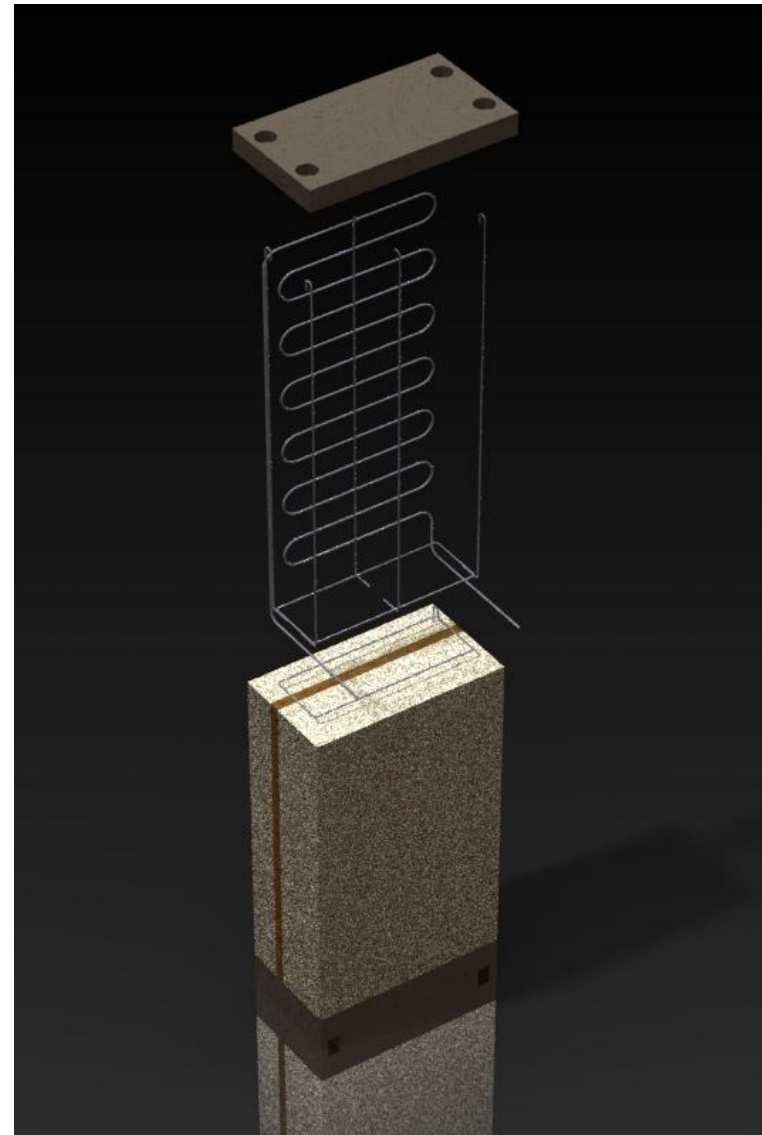
New Assembly Prototype and Fabrication



New Assembly Prototype and Fabrication

ACTIVE / PASSIVE MODULAR WALL

- RAMMED EARTH
- STRAW BALE
- HEMPCRETE

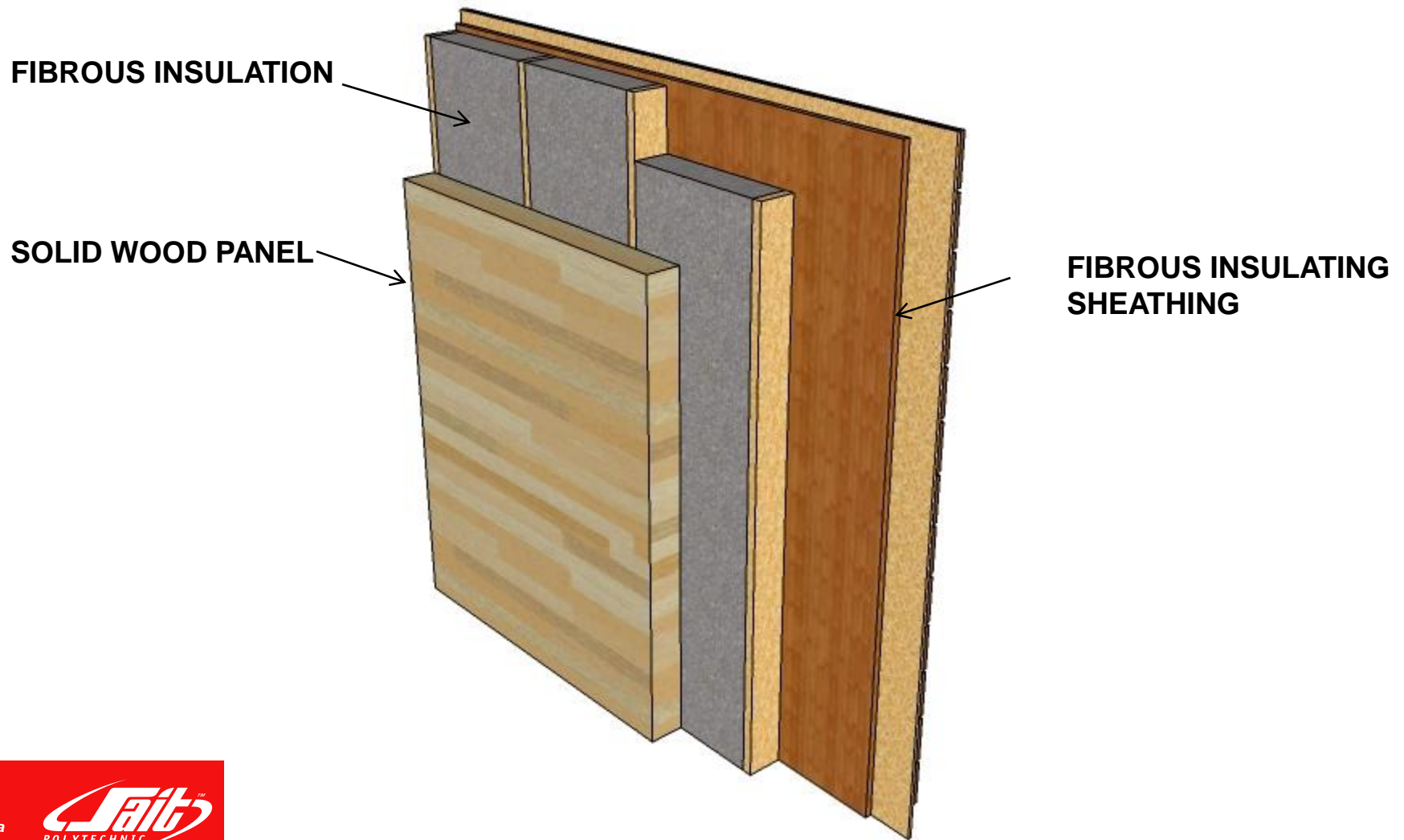


New Assembly Prototype and Fabrication



PHOTO CREDIT:
<http://www.haventimberhomes.com/>

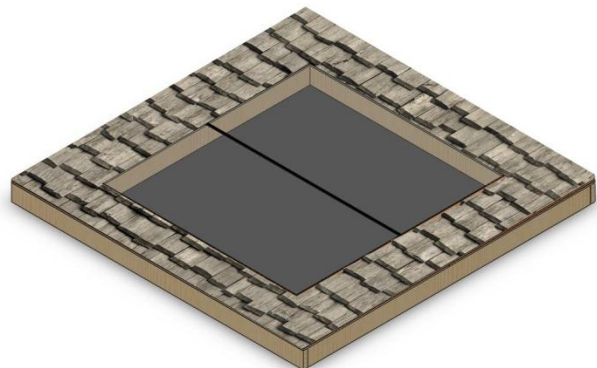
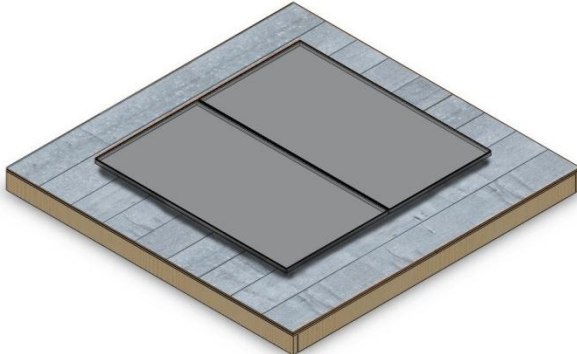
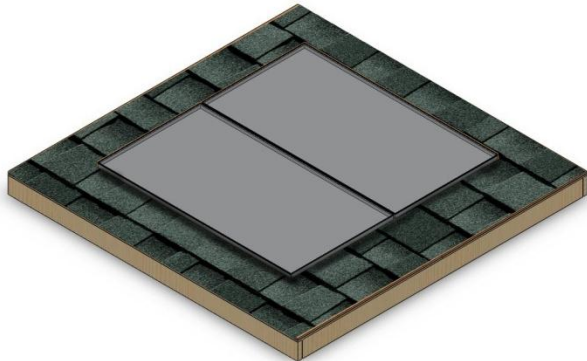
New Assembly Prototype and Fabrication



SAIT GBT Solar Labs



SAIT GBT Solar Roofing Modules



SAIT CADMUS Trailer



sait.ca  **FURTHER YOUR PASSION**

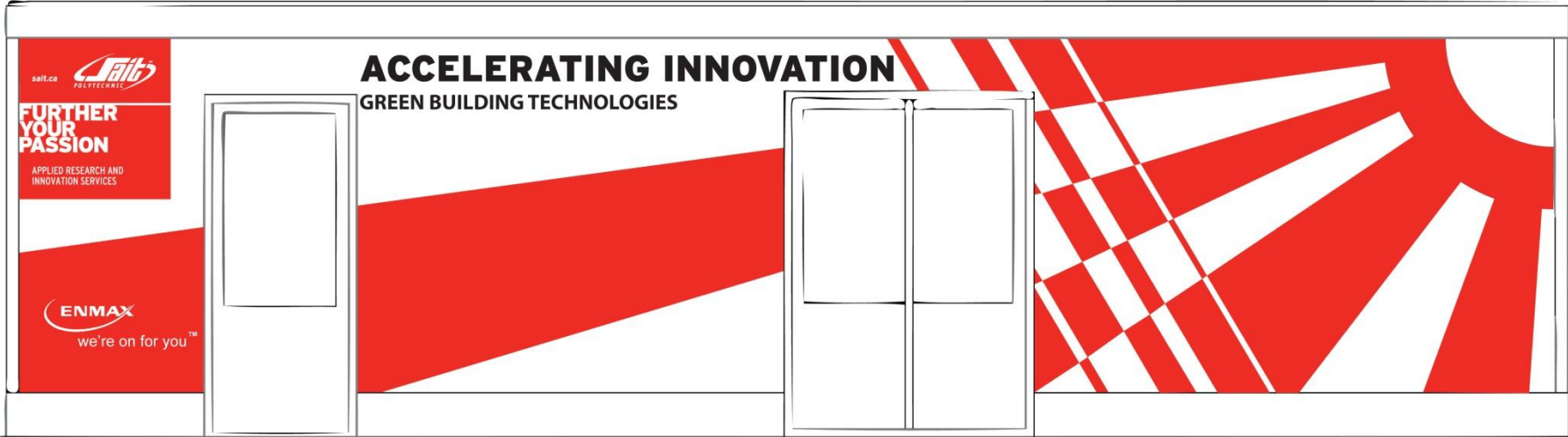
SAIT GBT Wind



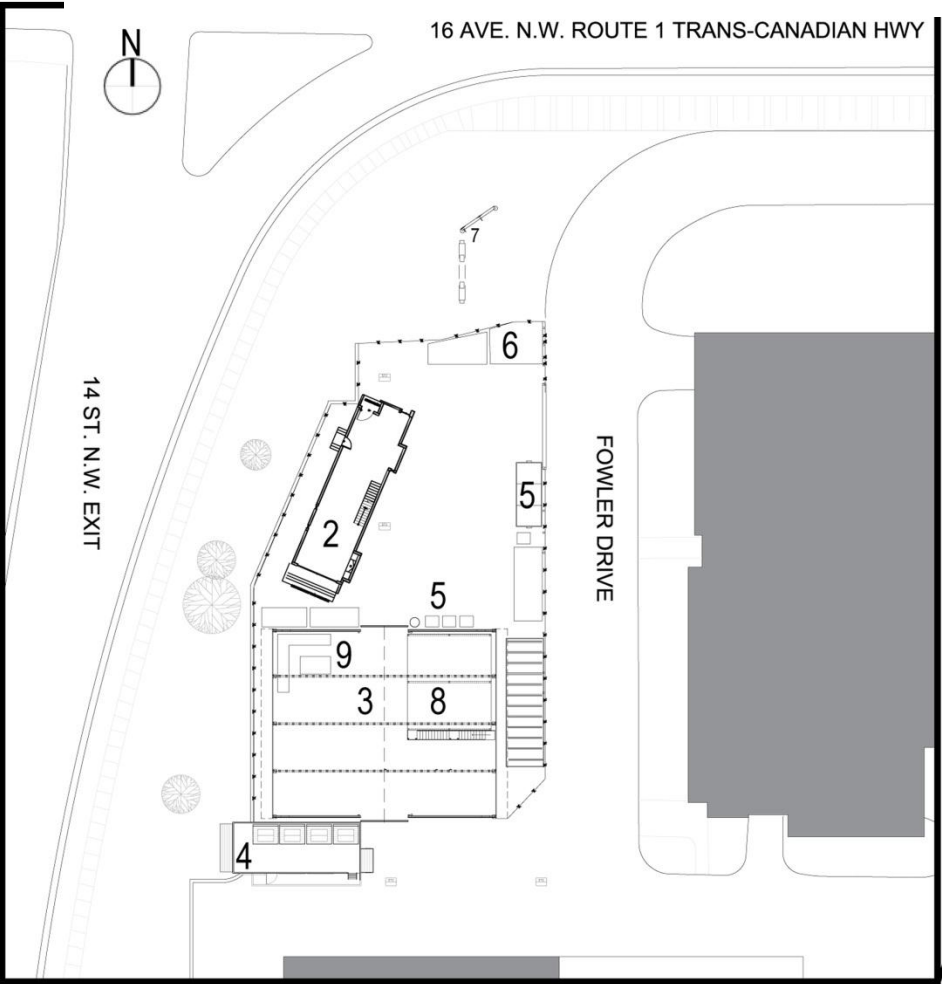
**FURTHER
YOUR
PASSION**



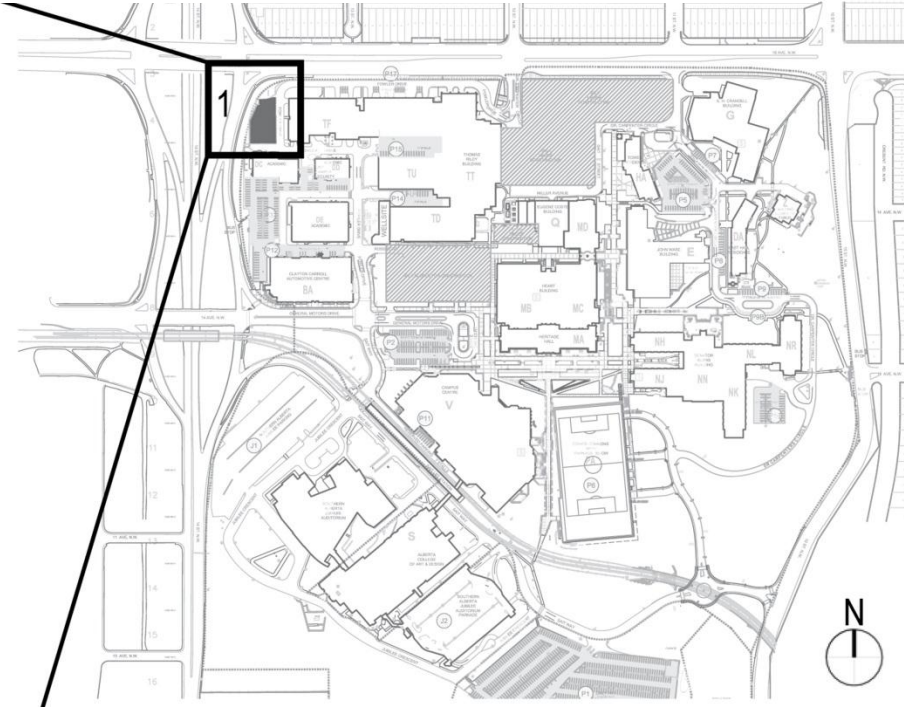
SAIT GBT Construction Safety Office



GBT Proposed Infrastructure



SITE PLAN



KEY PLAN

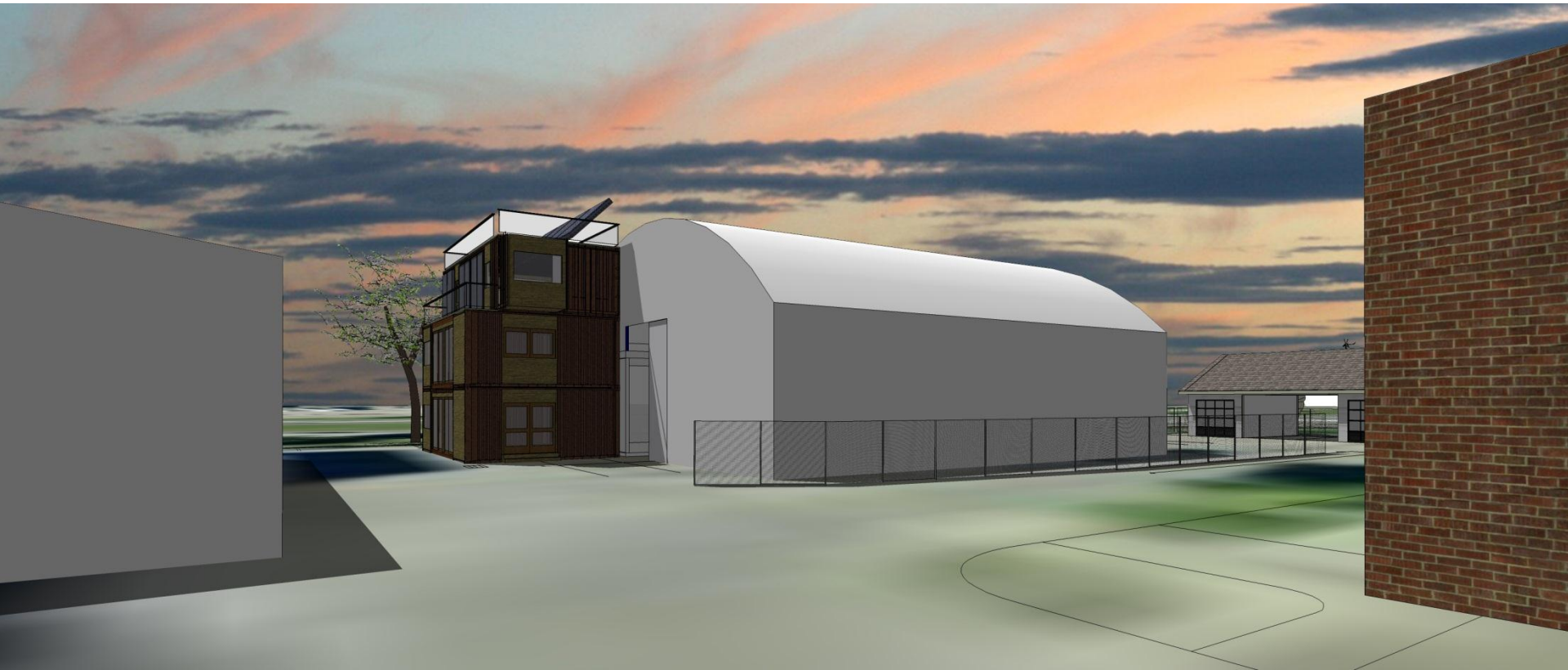
- 1. P16 Green Building Technologies (GBT) Lot
- 2. Net Zero Home Construction
- 3. GBT Work Shop (Pre-Engineered Tent Structure)
- 4. GBT Lab/ Shipping Container Office
- 5. On Site Recycling Centre
- 6. Solar Testing Station
- 7. Research Program Solar/ Wind Powered Billboard
- 8. Material Storage Mezzanine
- 9. Wood Shop

GREEN BUILDING TECHNOLOGIES
laboratory/office

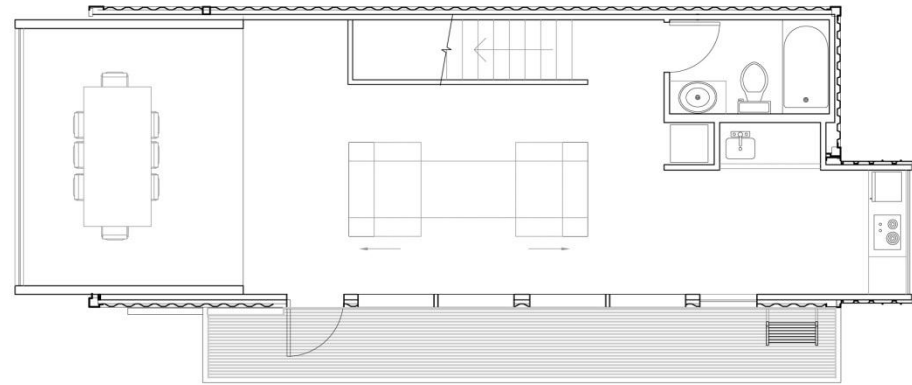
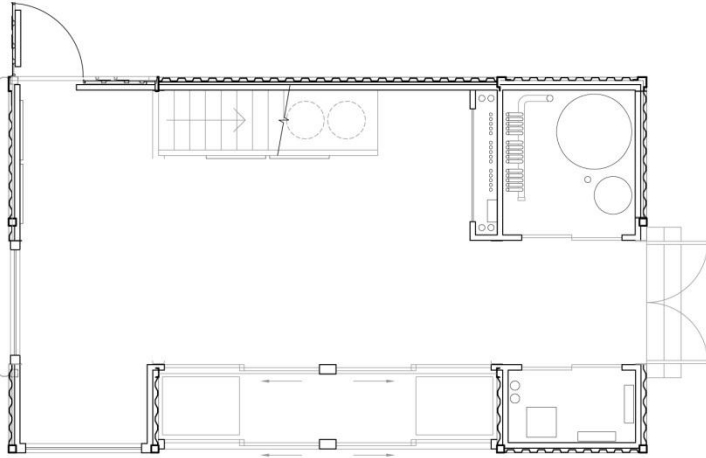
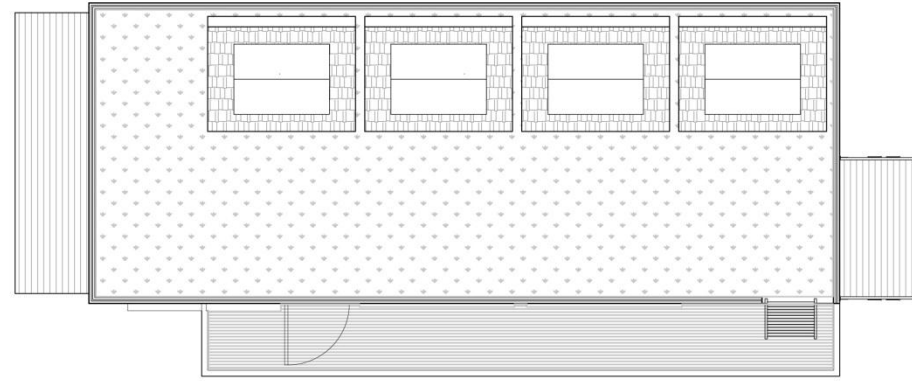
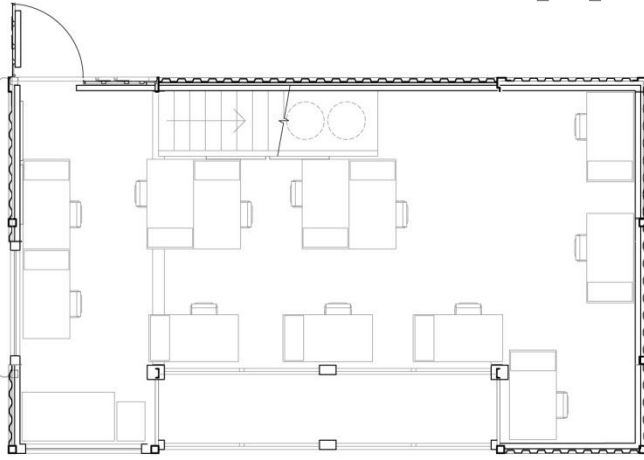
GBT Shipping Container Office/ Lab



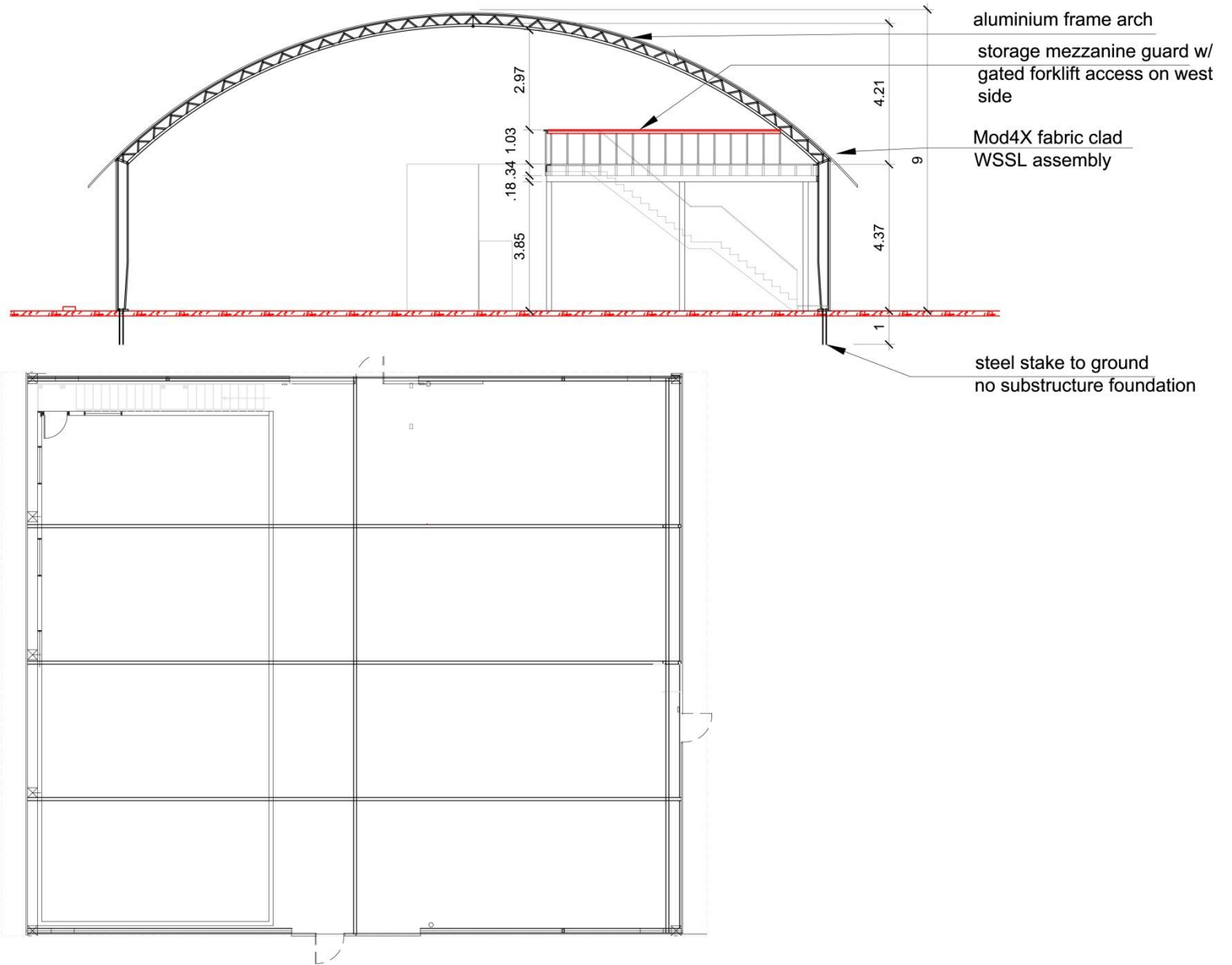
GBT Shipping Container Office/ Lab



GBT Shipping Container Office/ Lab



GBT Shipping Container Office/ Lab



1 FLOOR PLAN

Future Construction Association Projects

- CONSTRUCTION PROCESS IMPROVEMENT/ EFFICIENCY
- MACA: GLAZING/ NEW ENVELOPE COMPONENTS
- RENEWABLE ENERGY
- WATER CONSERVATION AND SYSTEMS
- LEED PROCESS INTEGRATION

Curriculum Integration/ Student Instructor Experience

- BSc. Construction Management
- Architectural/ Civil/ Electrical Engineering Technology
- GIS Mapping
- Trade Groups: HVAC, Plumbing, Electrical, Carpentry
- School of Construction
- Manufacturing and Automation
- MacPhail School of Energy

Applied Research and Innovation Services

David Silburn

david.silburn@sait.ca

Green Building Technologies
Room MD115, SAIT Polytechnic
1301 – 16th Avenue NW
Calgary, Alberta, Canada, T2M 0L4
P 403.284.7058 F 403.210.4373

