

# EASTERN PINE

by True North Design

Ryerson University



# TEAM PROFILE

## PRESENTERS



Mark Flynn



Madison Dozzi-Perry

## FACULTY ADVISORS



Mark Gorgolewski



Cheryl Atkinson

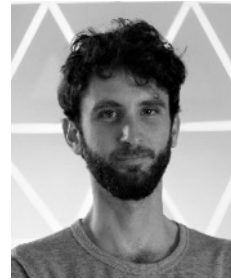
## TEAM MEMBERS



Sadaf Mansour



Katherine Lishak



Xavier Mendieta



Shahrzad Soudian



Stacy (Xi) Sun



Mahsa Hatefi



Dami Lee



Vadim Novik



Christopher Marleau



Umer Khan

## INDUSTRY PARTNERS

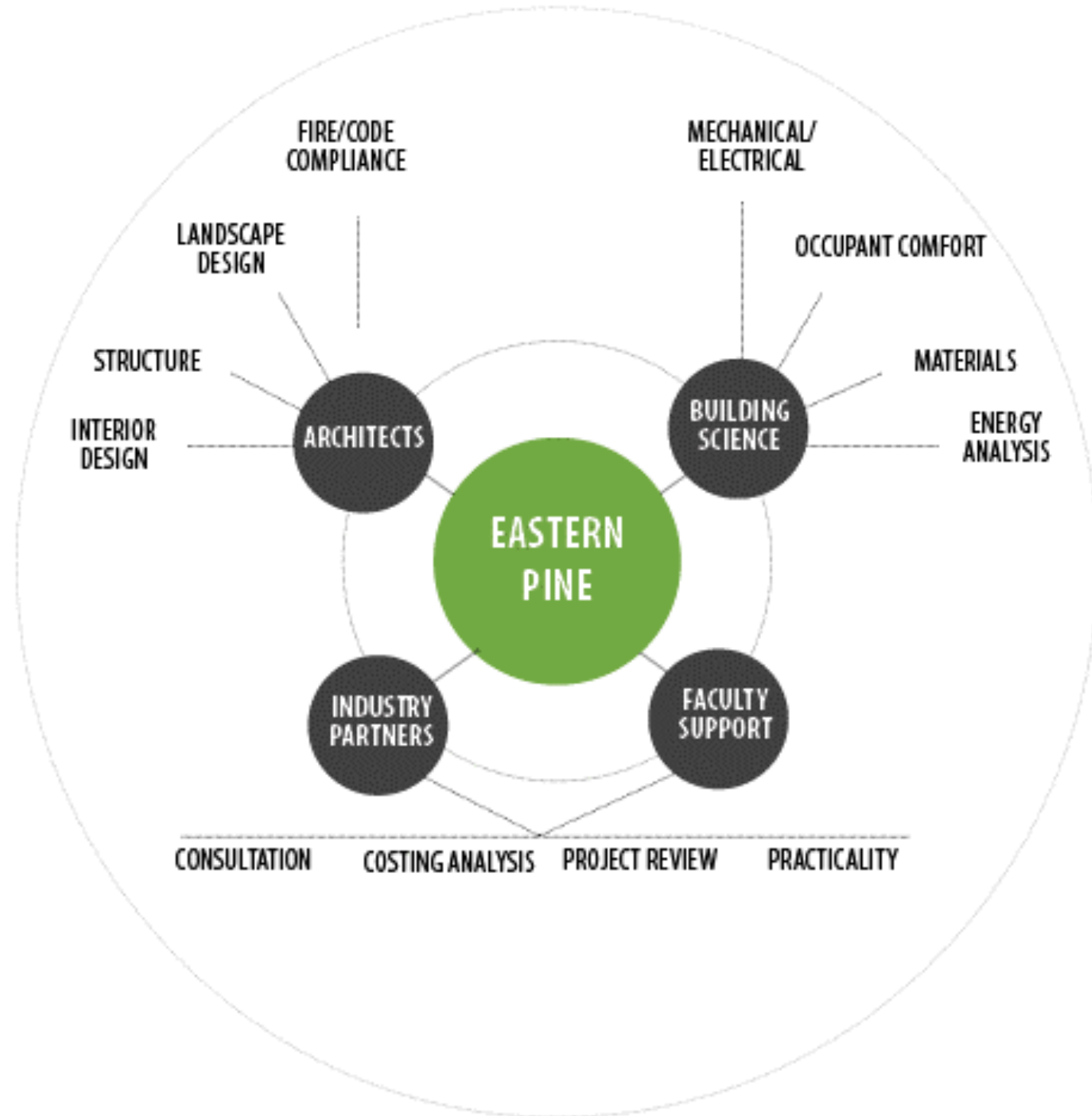


Sustainable.TO  
Architectural support



Greening Homes  
Constructability support

# INTEGRATED DESIGN PROCESS



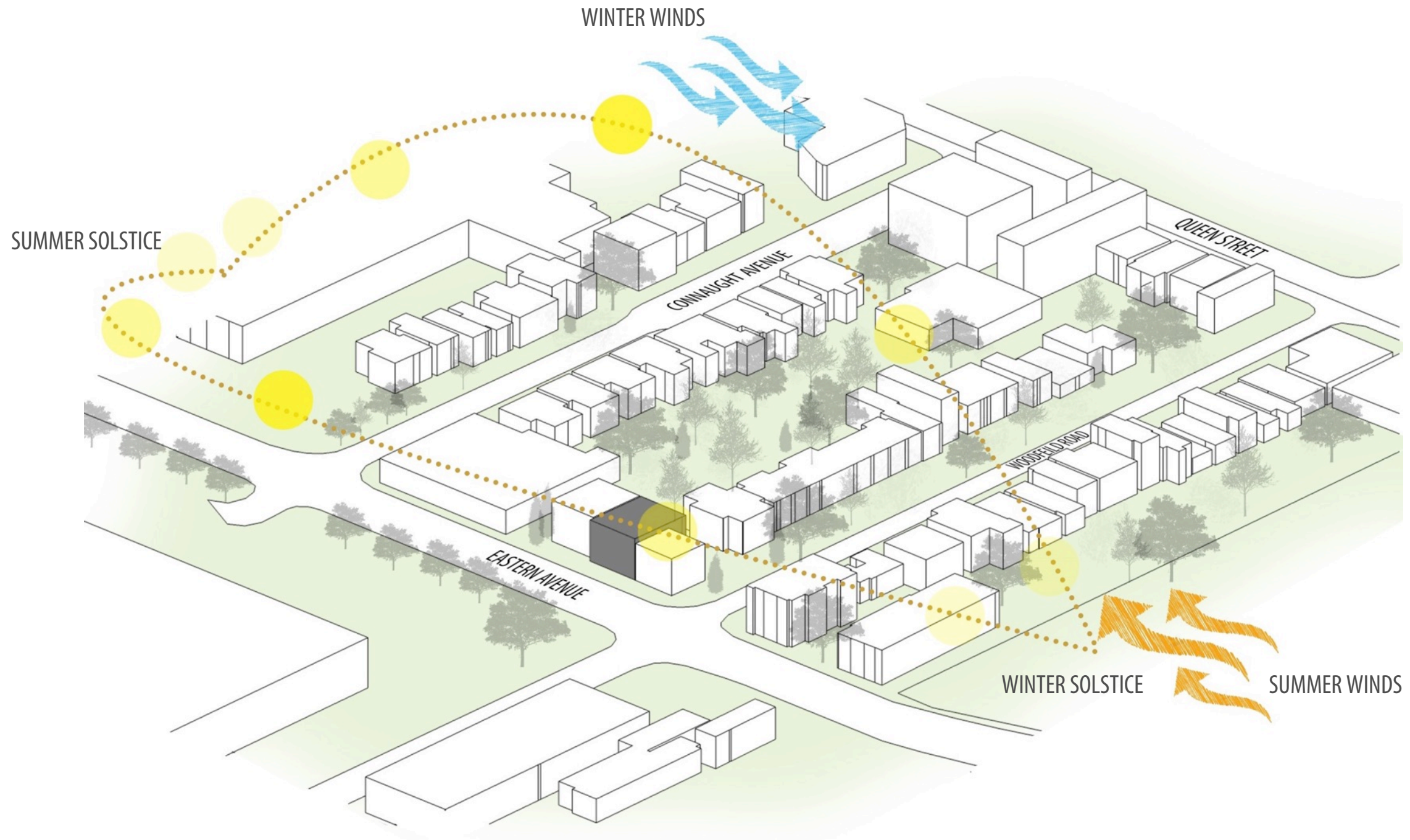
# PROJECT CONTEXT



## TORONTO, ONTARIO

CLIMATE FACTORS	VALUES
• ASHREA Climate Zone . . . . .	6
• Heating Degree Days (base 65°F) . . . . .	6698
• Cooling Degree Days (base 65°F) . . . . .	427

# SITE CLIMATE



## PROJECT CONTEXT



**2.6** MILLION PEOPLE IN TORONTO PROPER

**6.0** MILLION PEOPLE IN GREATER TORONTO AREA

INFLUX OF APPROX. **100,000** IMMIGRANTS PER YEAR

# PROJECT CONTEXT



## AMENITIES WITHIN 5 MIN. WALK



COMMUNITY CENTRE



MOVIE THEATRE



RECREATION + PARKS



RESTAURANT + BARS



ART GALLERY + SCHOOL



PHARMACY

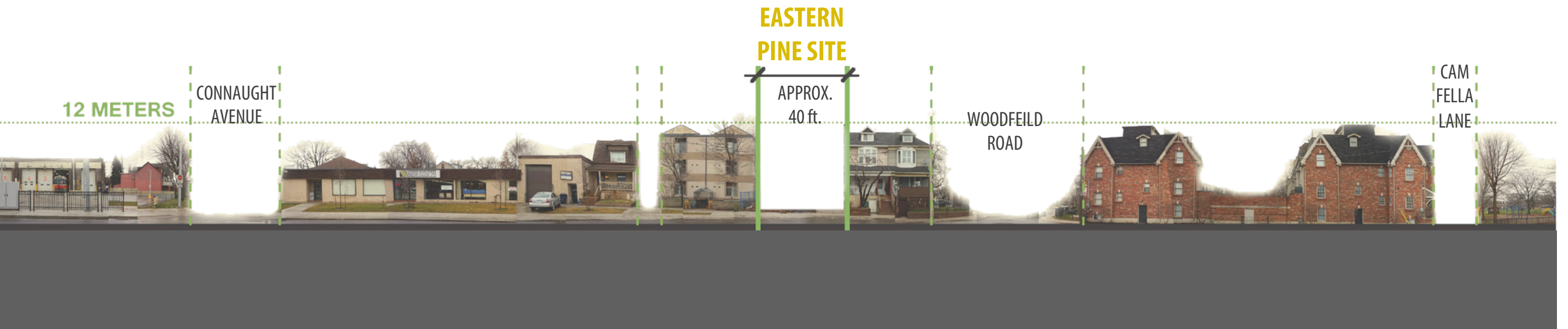


GROCERY STORE + MARKET



PUBLIC TRANSIT

# PROJECT CONTEXT





# PROJECT CONTEXT



# DESIGN GOALS

## ECO-CONSCIOUSNESS



LOW ENERGY



CONTEXT + COMMUNITY



LOW CARBON



ECONOMY + RESILIENCE



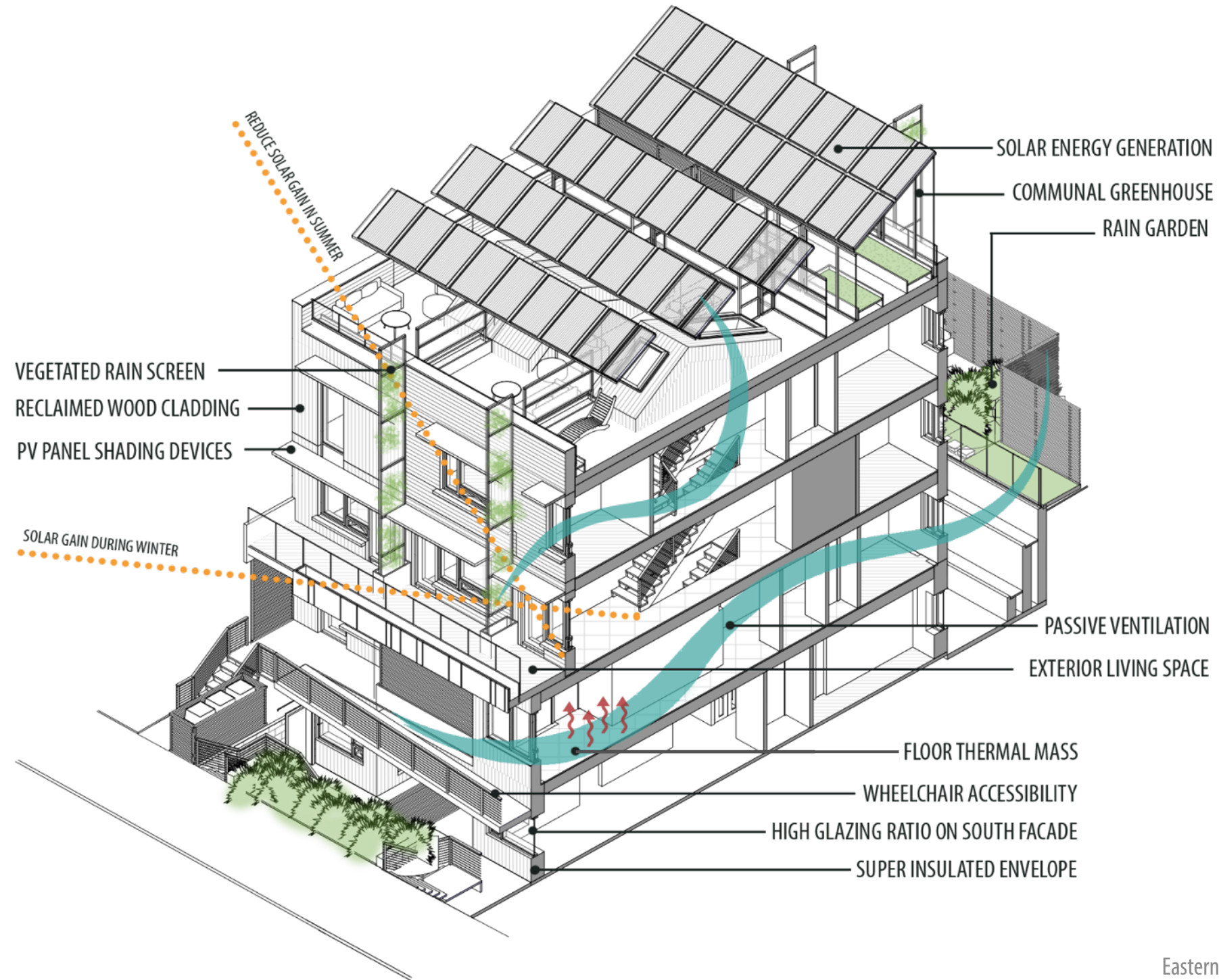
DYNAMIC DESIGN  
+ ACCESSIBILITY



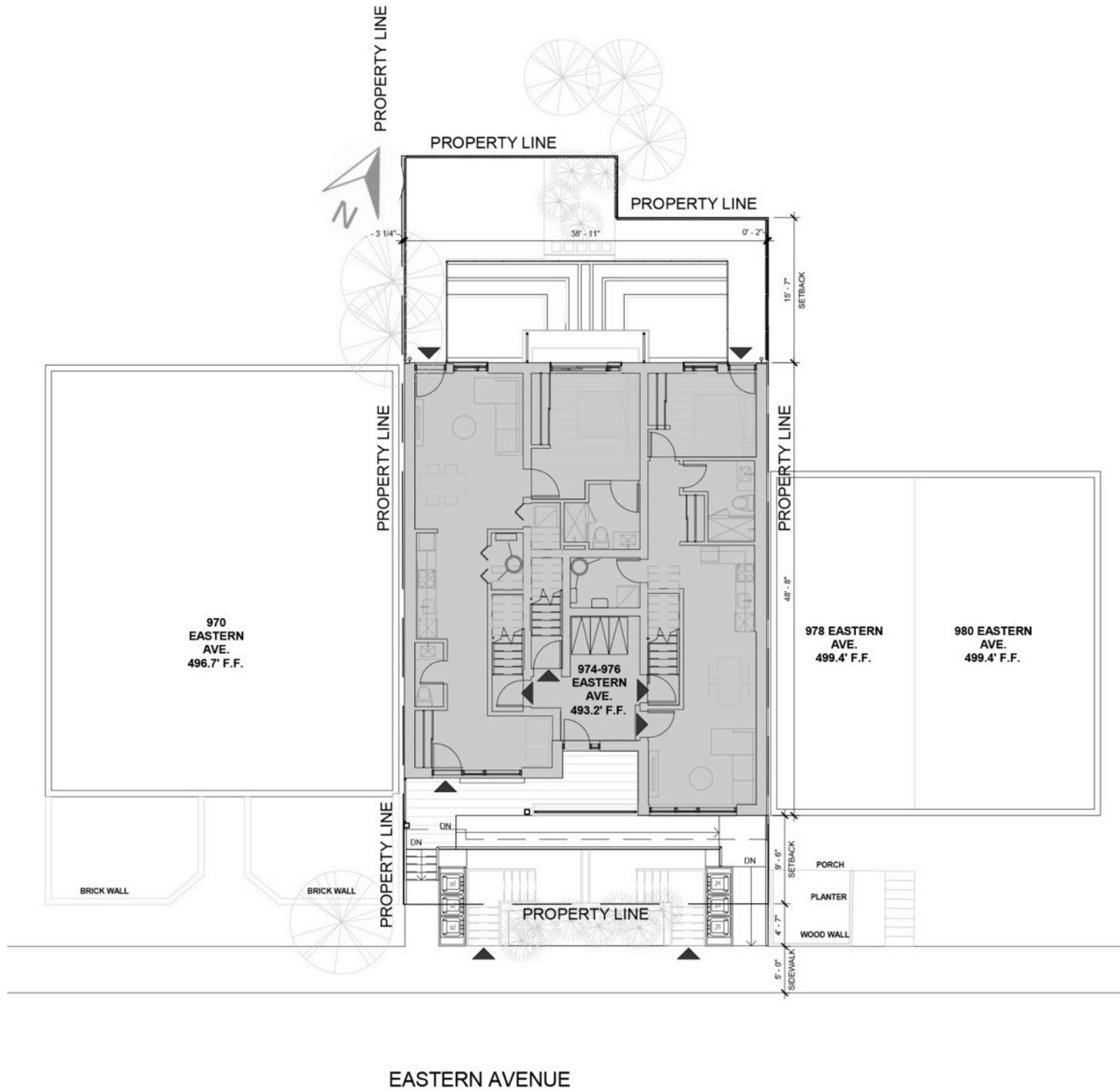
OCCUPANT COMFORT  
+ HEALTH



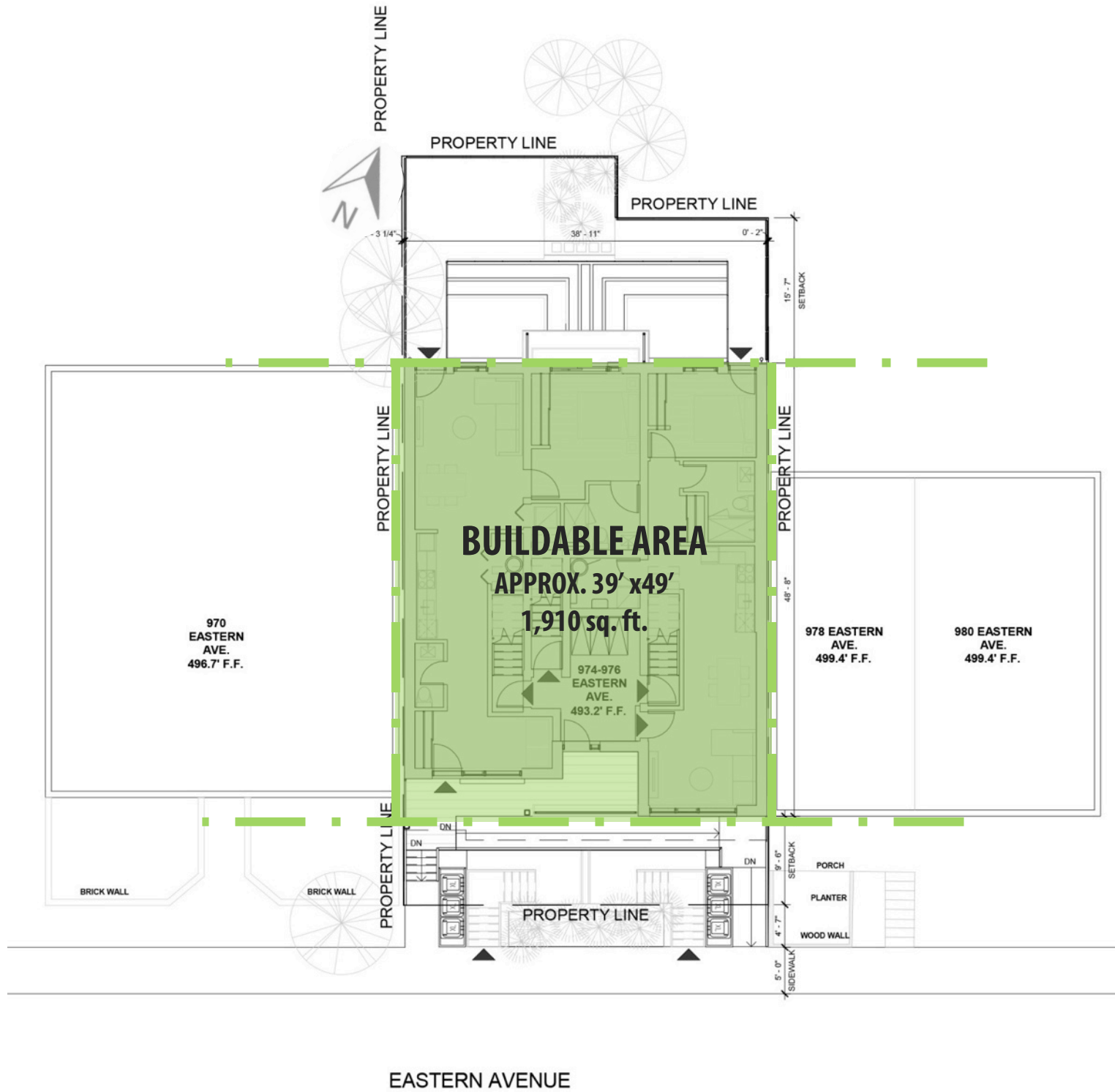
# BUILDING FEATURES



# PROPOSED SITE PLAN

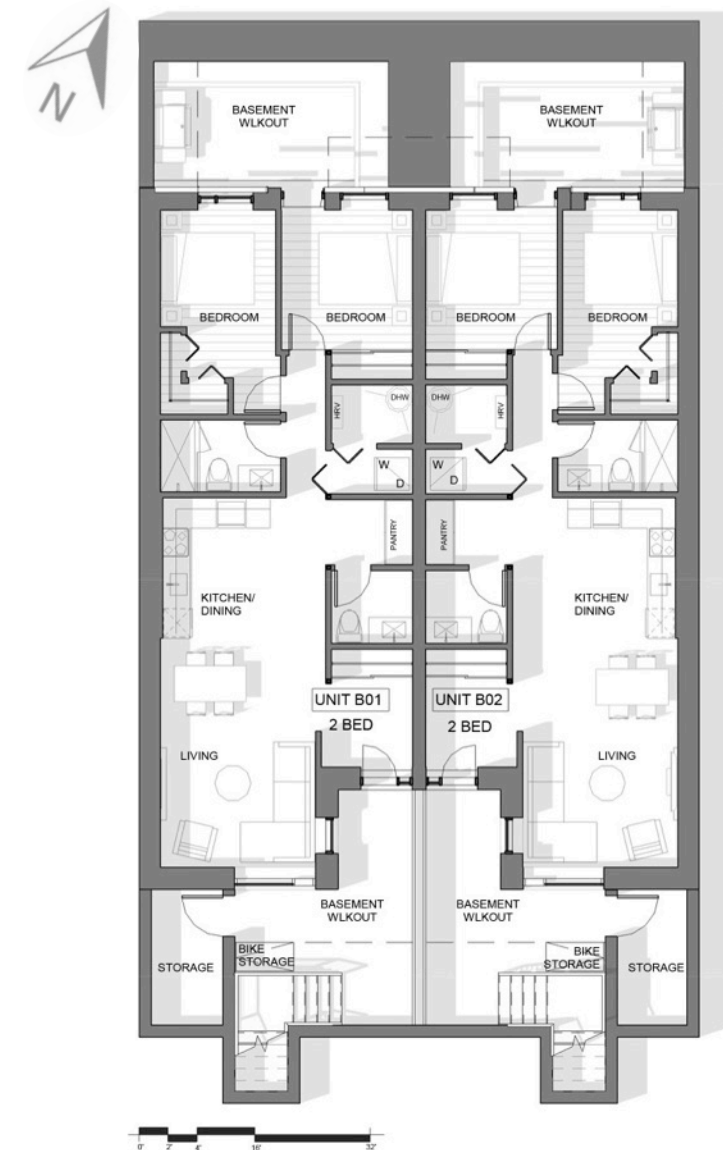


# PROPOSED SITE PLAN

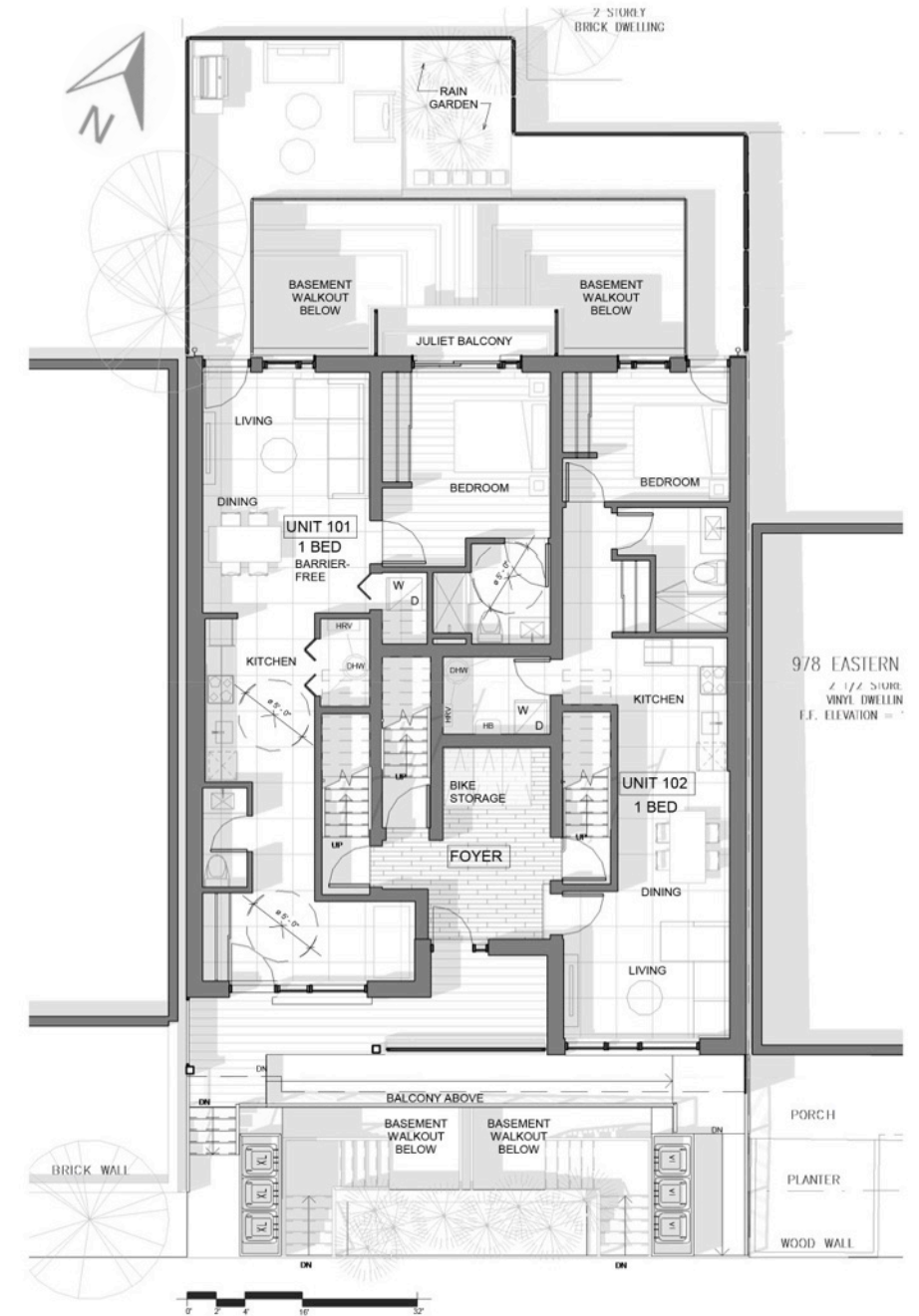




# BASEMENT FLOOR PLAN

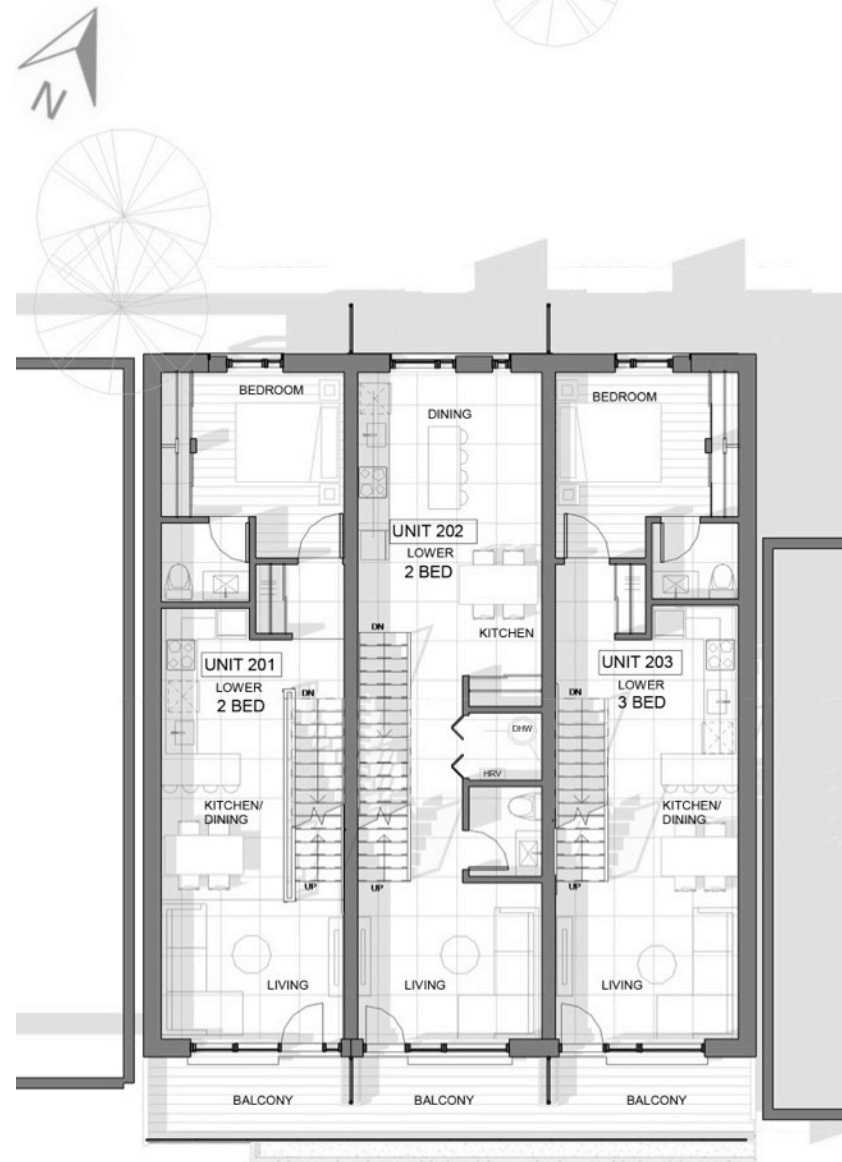


# LEVEL ONE FLOOR PLAN

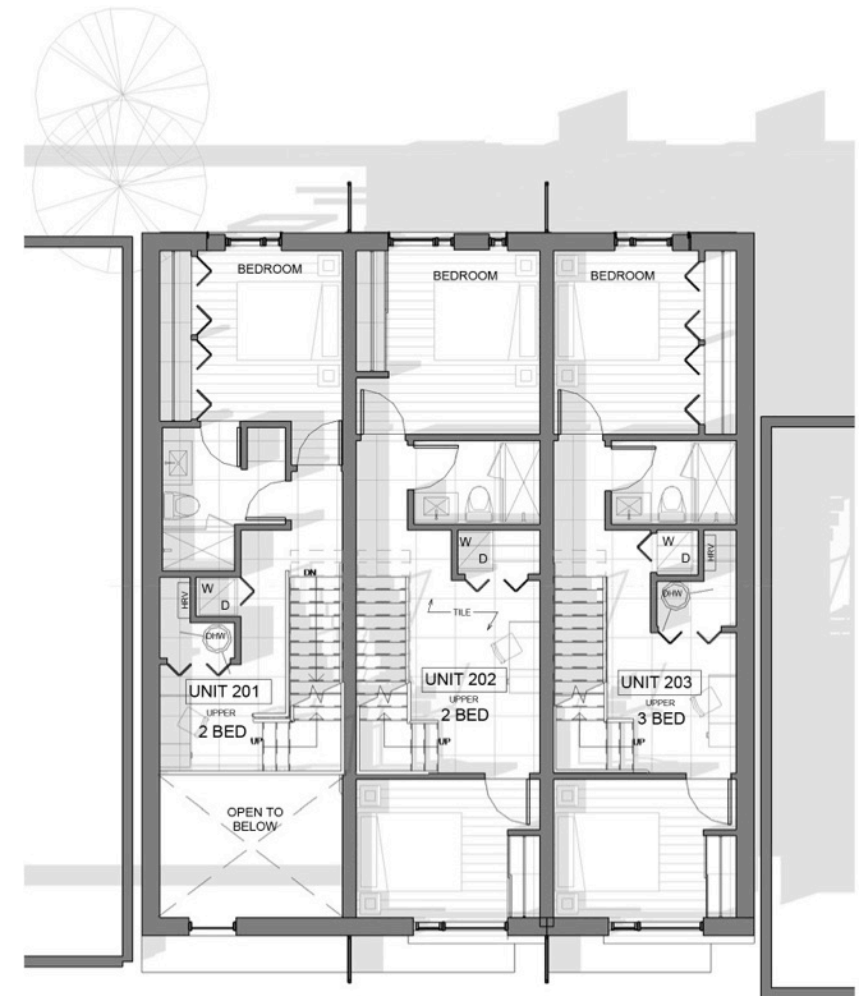




# LEVEL TWO + THREE FLOOR PLANS



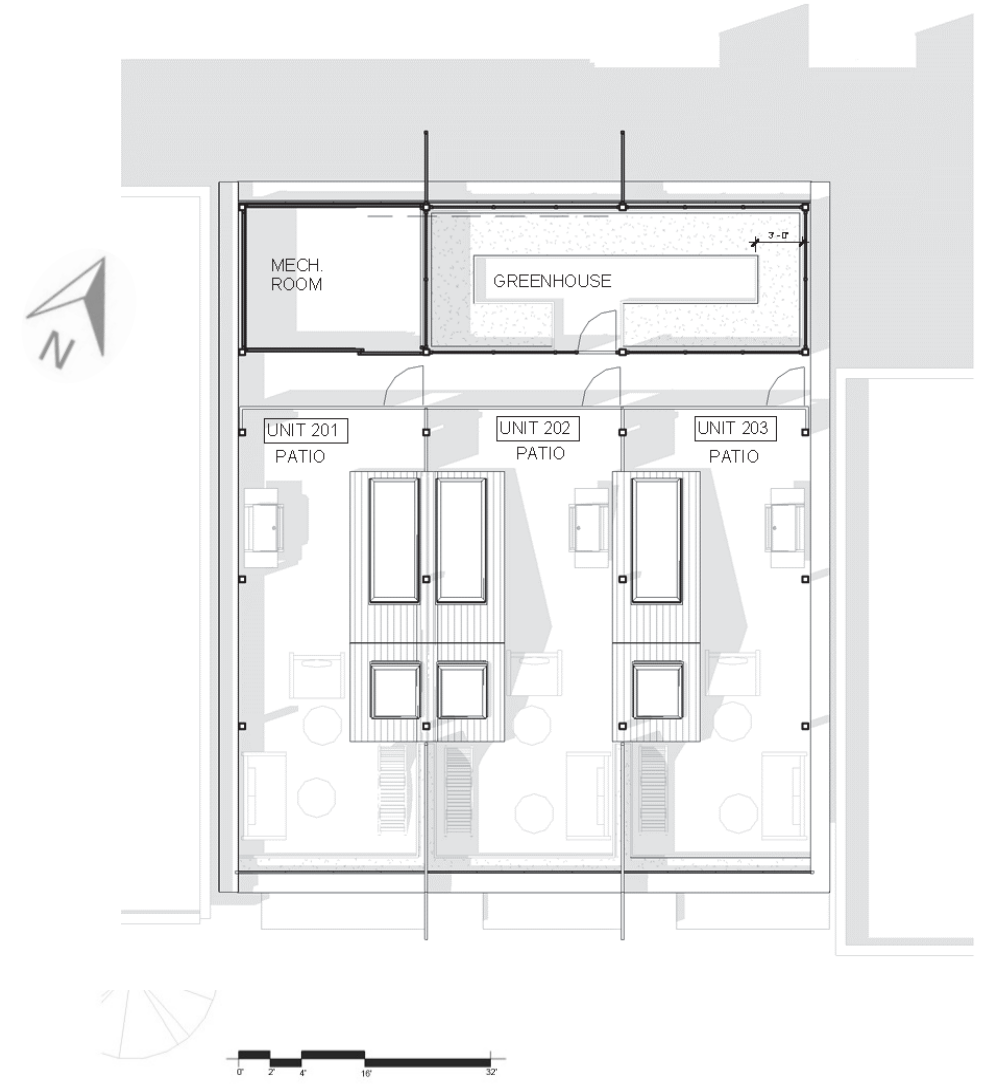
LEVEL TWO

A scale bar for the Level Two floor plan, showing measurements from 0 to 32 feet. The bar is marked at 0, 2, 4, 10, and 32 feet.

LEVEL THREE

A scale bar for the Level Three floor plan, showing measurements from 0 to 32 feet. The bar is marked at 0, 2, 4, 10, and 32 feet.

# ROOF PLAN



# NORTH + SOUTH ELEVATION

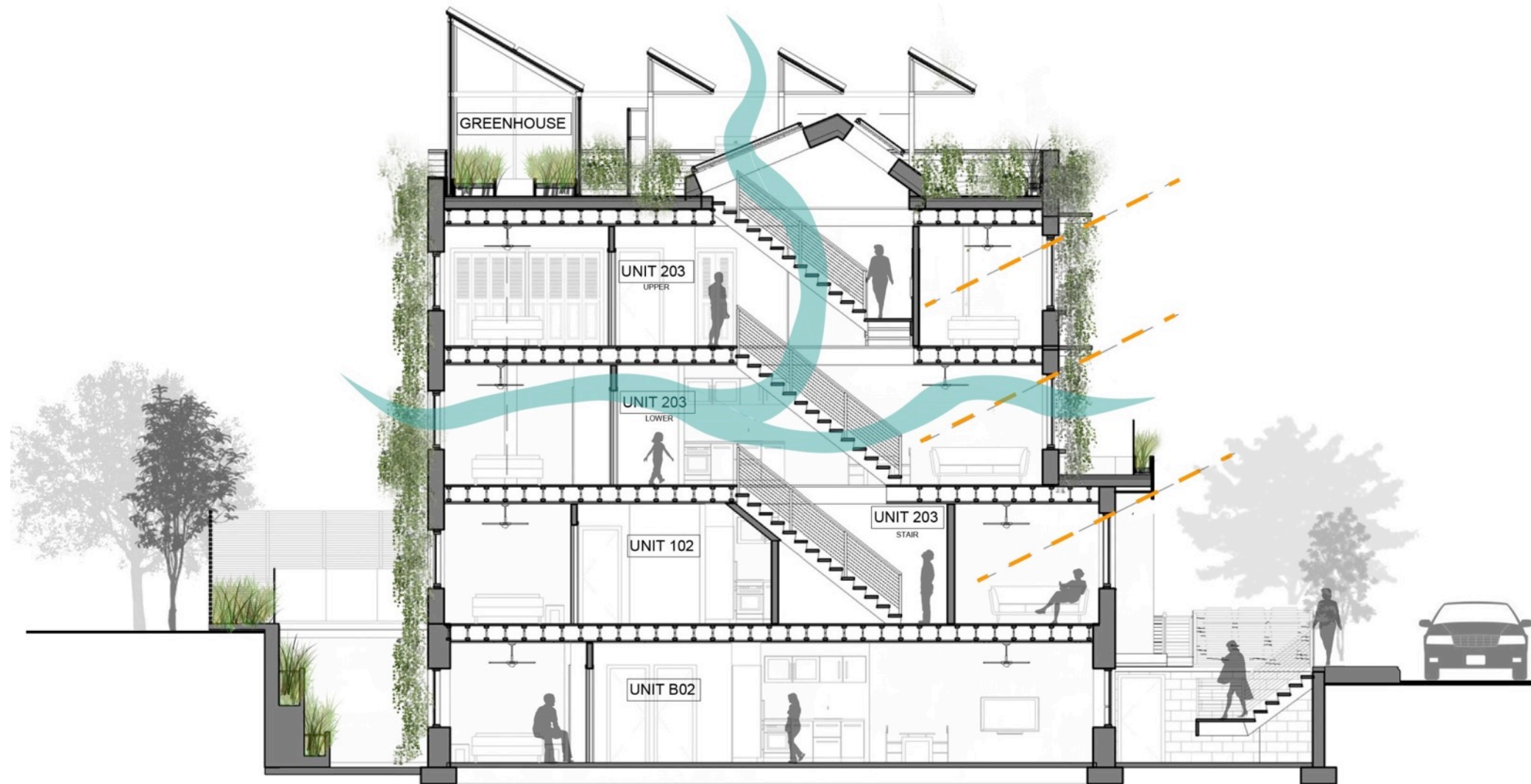


# EXTERIOR DESIGN



- Thermally Modified Beetle Kill Ash Wood
- COR-TEN Vegetation Living Walls
- Window Shading Devices With Solar Panels
- Integrated Water Run-off System (Fins)

# EXTERIOR DESIGN

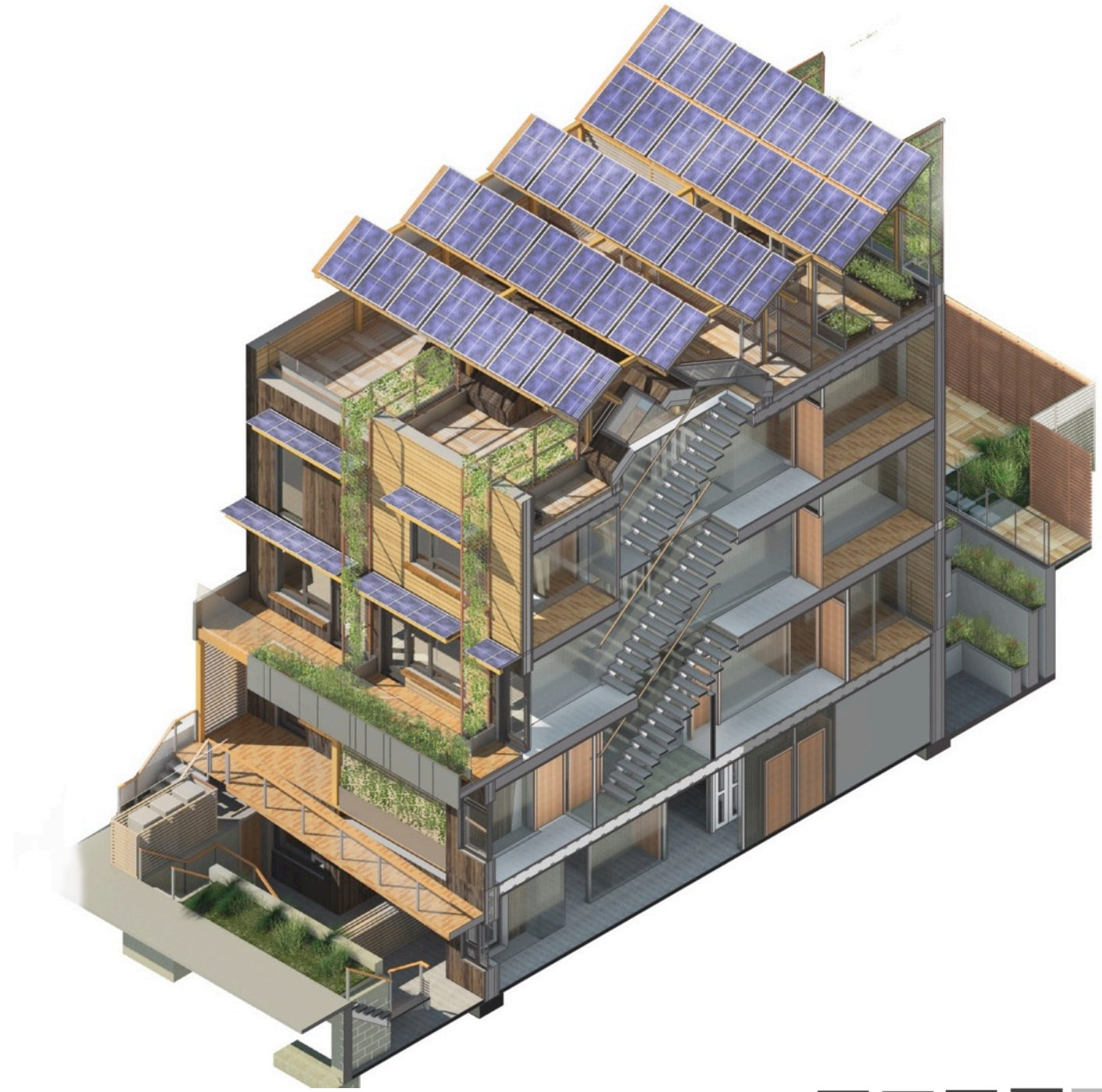
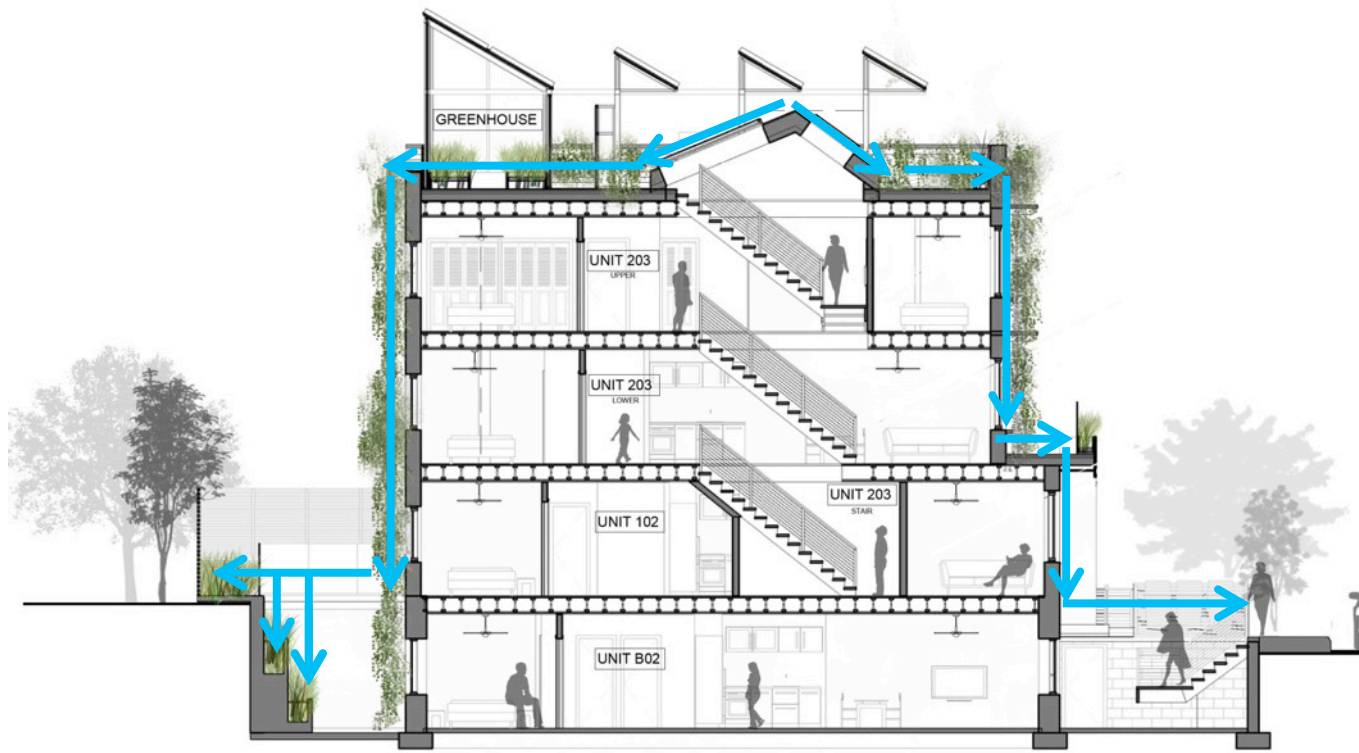


# LANDSCAPE DESIGN



- Aesthetics + Occupant Health
- Building Becomes Part Of Nature
- Permeable Paving
- Native Drought Resistance Planting
- Low Maintenance + Water Usage
- Integrated Rain Water Run-off System

# LANDSCAPE DESIGN



# INTERIOR DESIGN



- Emulate + Reflect Natural Elements
- Light Penetration + Diffusion
- Integrated/Built-in Furniture
- Open Concept Design
- Healthy + Durable Materials



# INTERIOR DESIGN



## MATERIAL CRITERIA

- **RAW MATERIALS**  
Resource Management / Recycled or Reclaimed Products / Organic Materials / No use of VOC Emitting Materials
- **DURABILITY**  
High Life Expectancy and Warranty
- **WASTE**  
Waste Management Programs / Recyclability / Biodegradable

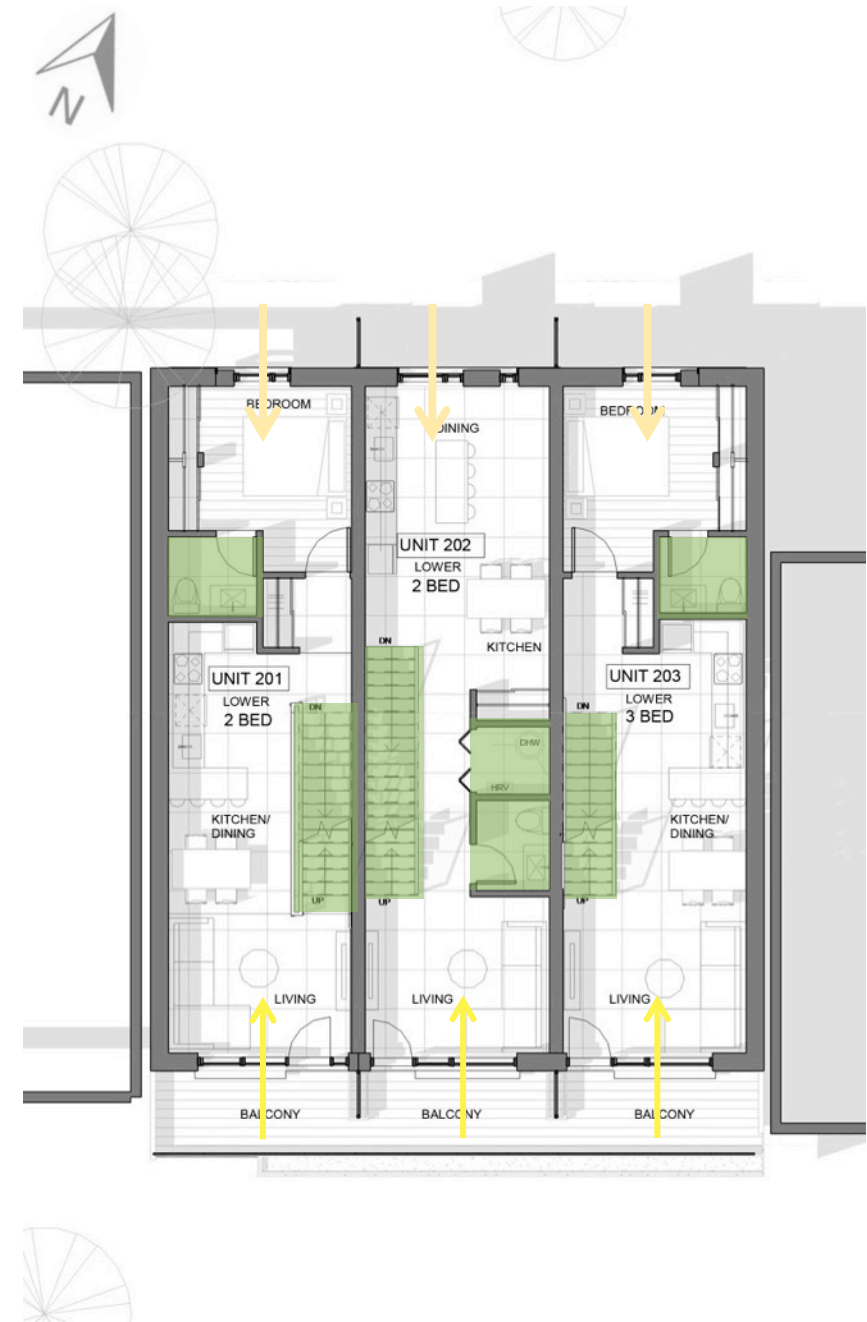


# DAYLIGHTING

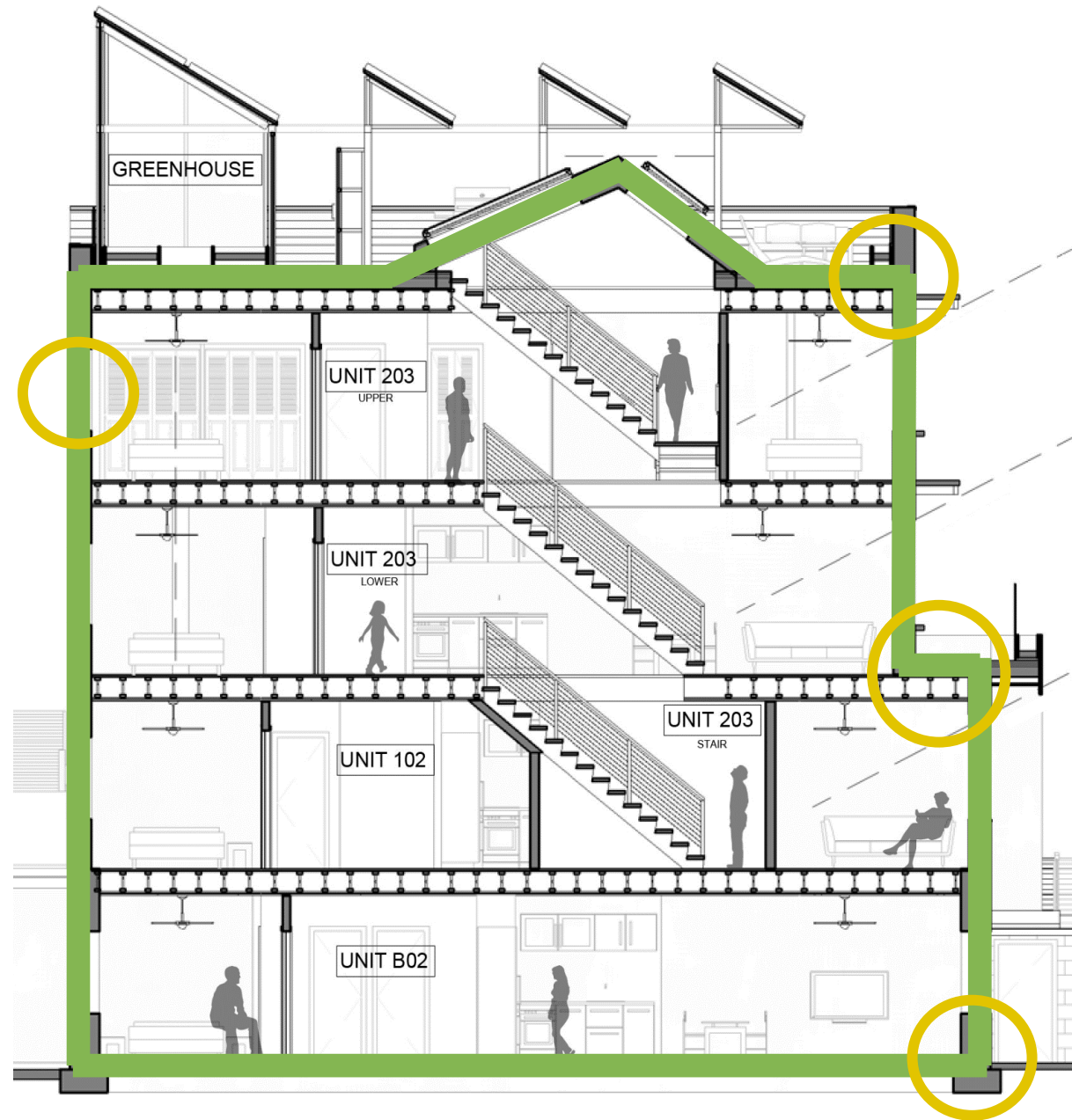


- Occupant Health
- Reduce Pollution and Energy Consumption
- Consolidate Service Spaces
- Living Spaces Access to Light
- Diffused light – North facade
- Window - Wall Ratio for Energy Efficiency
- Overheating (Summer) + Solar Heat Gain (Winter)

# DAYLIGHTING



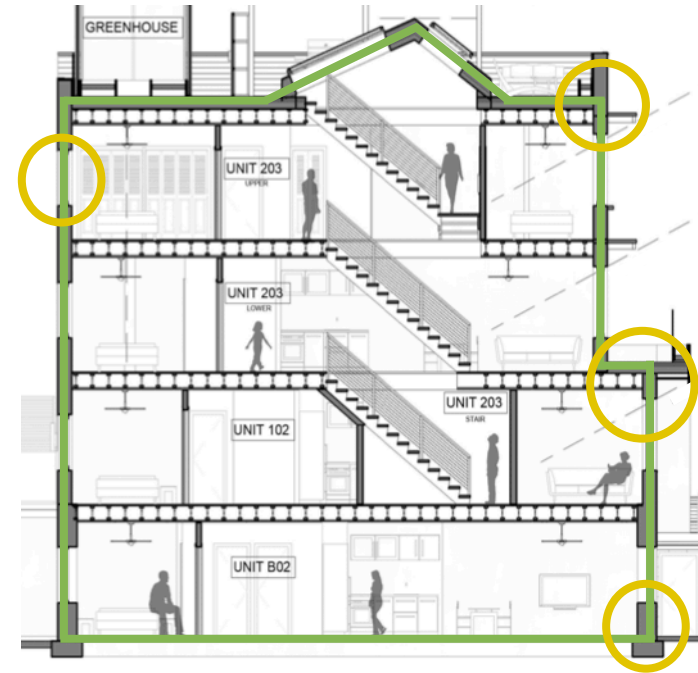
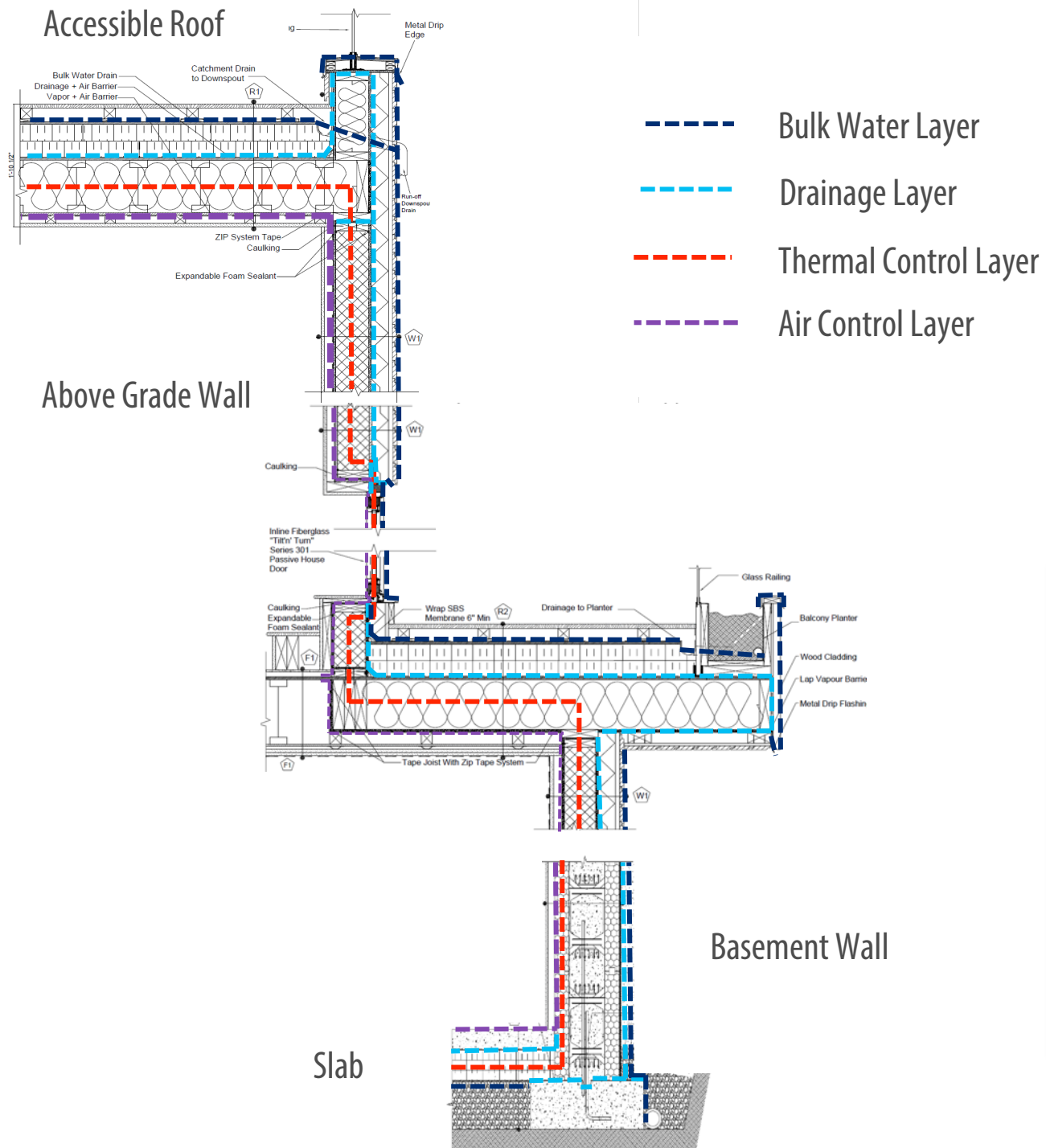
# ENVELOPE DESIGN



## DESIGN STRATEGIES

- Durable Enclosure
- Material and Construction Cost
- Maximize Living Space
- Ease and Speed of Construction
  - Multiple Function Components
- Acoustical and Fire Properties

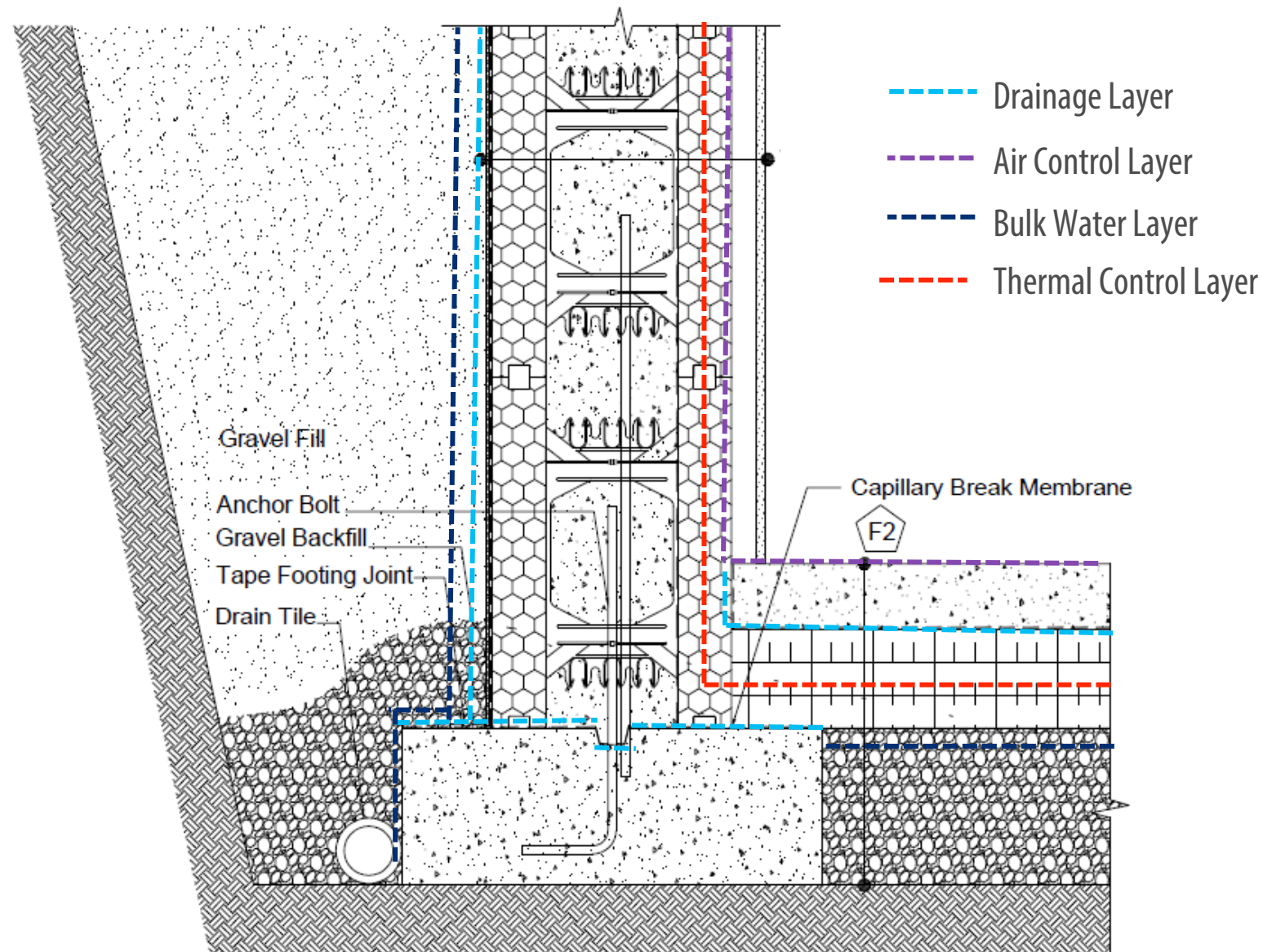
# ENVELOPE DESIGN



**Envelope Air Leakage**  
 $ACH50 \leq 0.6$

	System Type	Thermal Resistance
Roof	Accessible Flat Roof	R-73
Above Grade Walls	Structurally Insulated Panels	R-42
Basement Walls	Insulated Concrete Forms	R-30
Slab	Floating Concrete Floor	R-30
Windows	Passive House Grade	U-0.17

# ENVELOPE DESIGN



## BASEMENT SLAB – POLISHED CONCRETE FLOOR (R-30)

Structure : 4" Polished Concrete

Heat: 6" XPS Insulation

Air: Concrete + Poly. Barrier

Moisture: Crushed Gravel Underlay  
Polyethylene Barrier

## BASEMENT WALL – INSULATED CONCRETE FORMS (R-30)

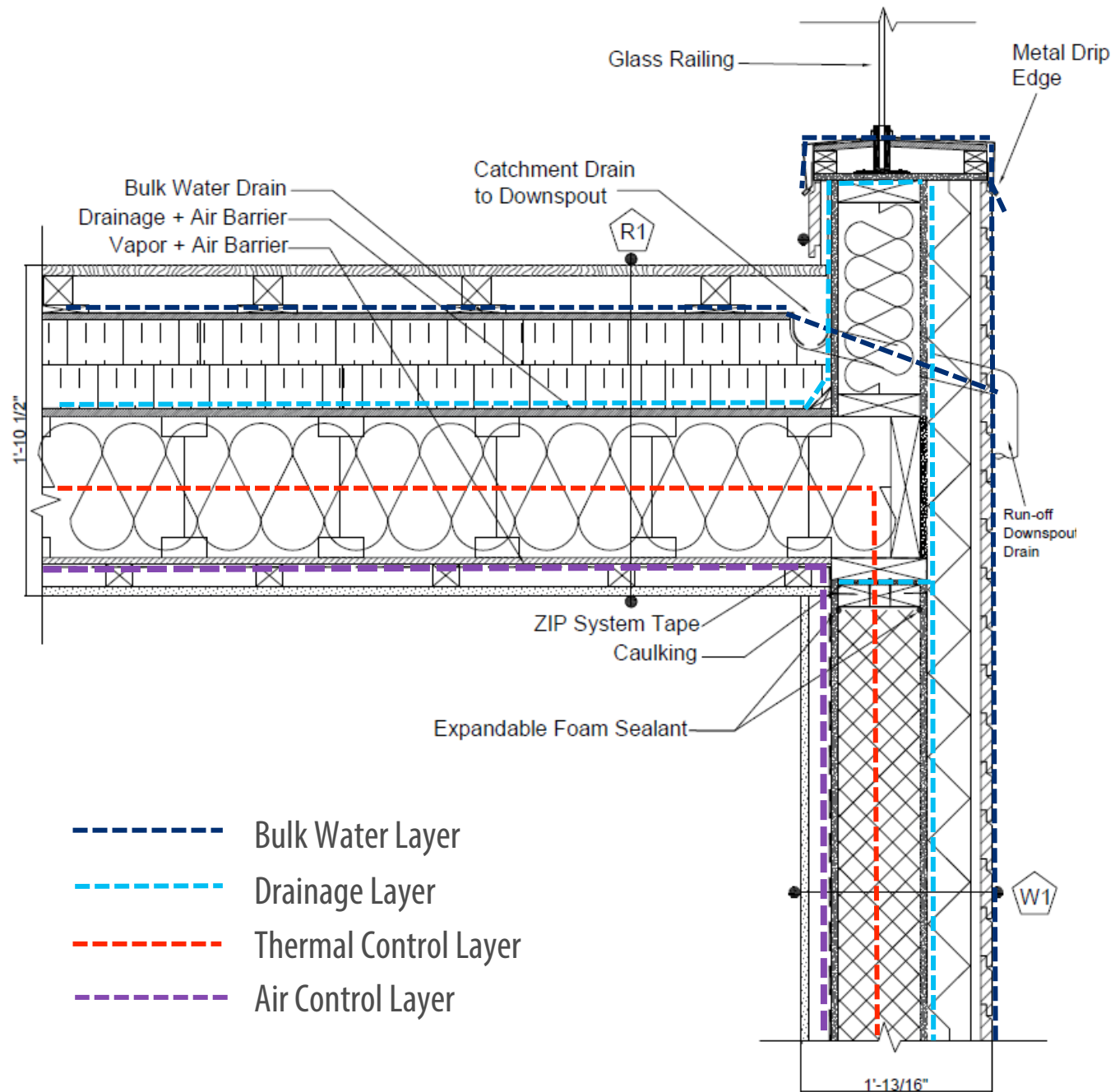
Structure : 8" Concrete

Heat: (2) 3.25" EPS - ICF

Air : EPS + Concrete

Moisture: Gravel Backfill  
Dimple Drainage Mat

# ENVELOPE DESIGN



## ROOF – ACCESSIBLE FLAT ROOF (R-73)

Structure : 9.5" Engineered Wood Joists

Heat : 9.5" Cellulose + 8" XPS (Ext.)

Air : ZIP Sheathing System + AB/WB Self Adhered Membrane

Moisture : 2 Ply SBS Membrane  
AB/WB Self Adhered Membrane

## ABOVE GRADE WALL- SIPS (R-42)

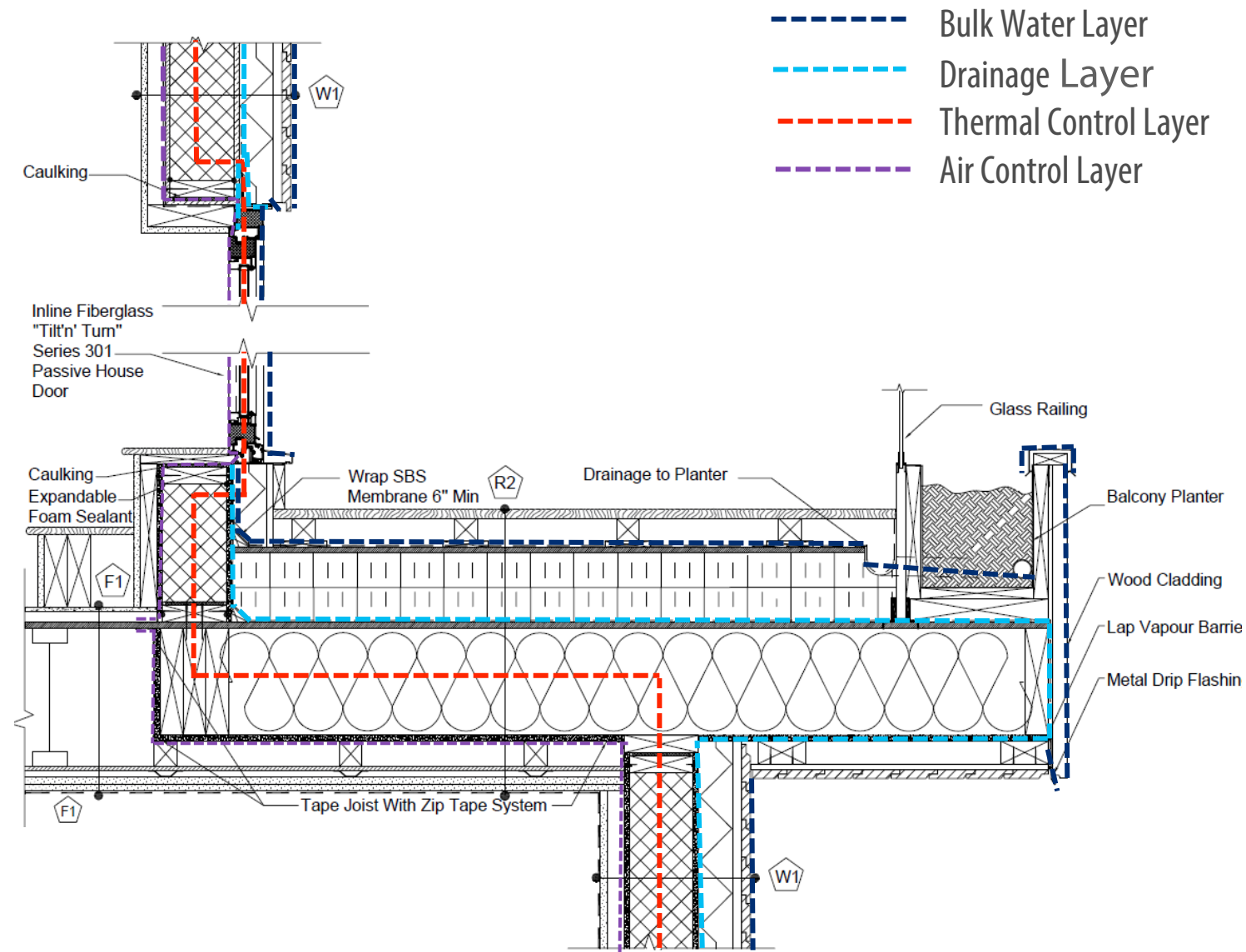
Structure : 6.25" Structurally Insulated Panels

Heat : 5.5" EPS Core + 3" Mineral Wool (Ext.)

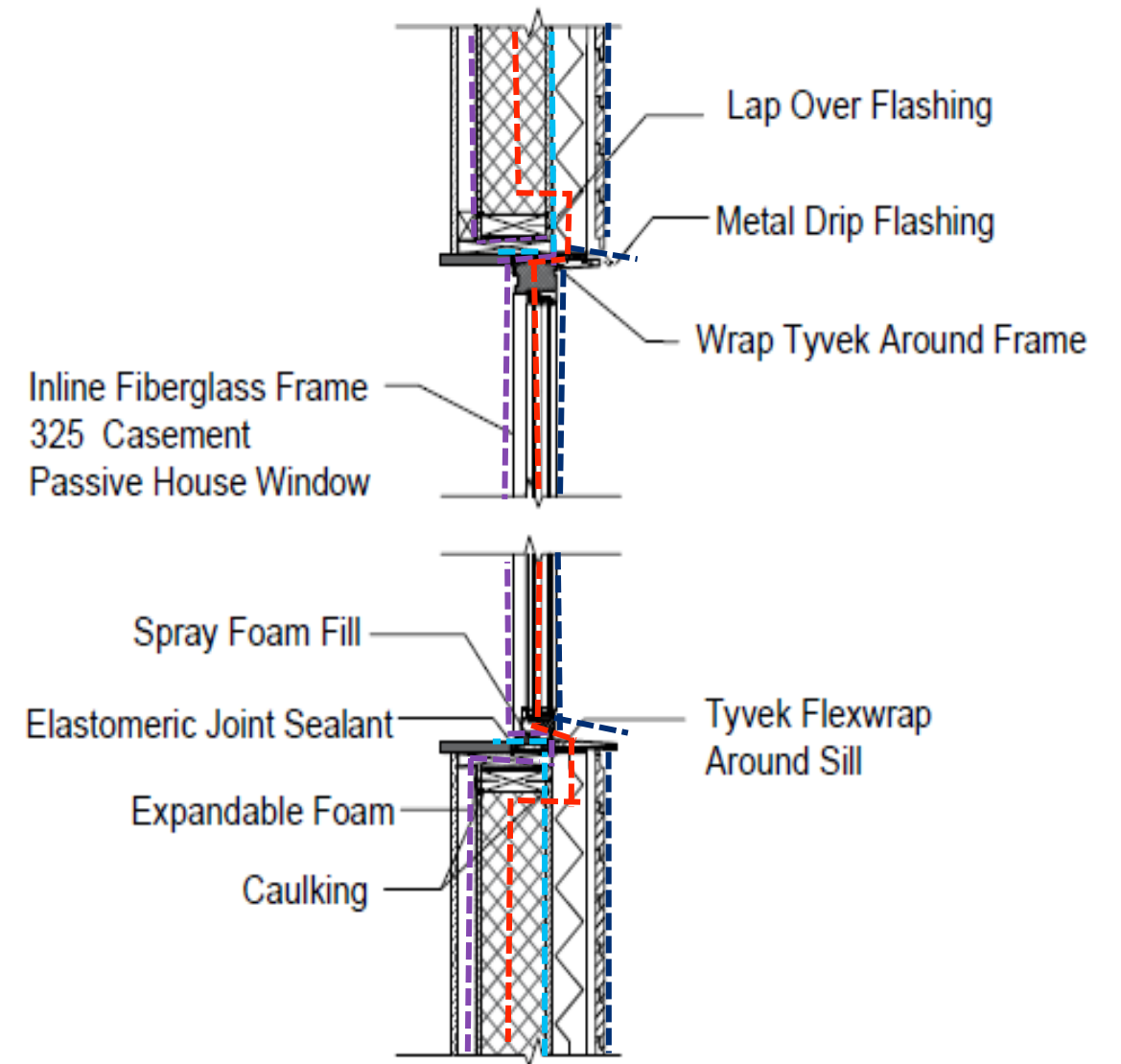
Air : SIPs + Tyvek House-Wrap

Moisture : Wooden Cladding (Rain Screen)  
Tyvek House-Wrap

# ENVELOPE DESIGN



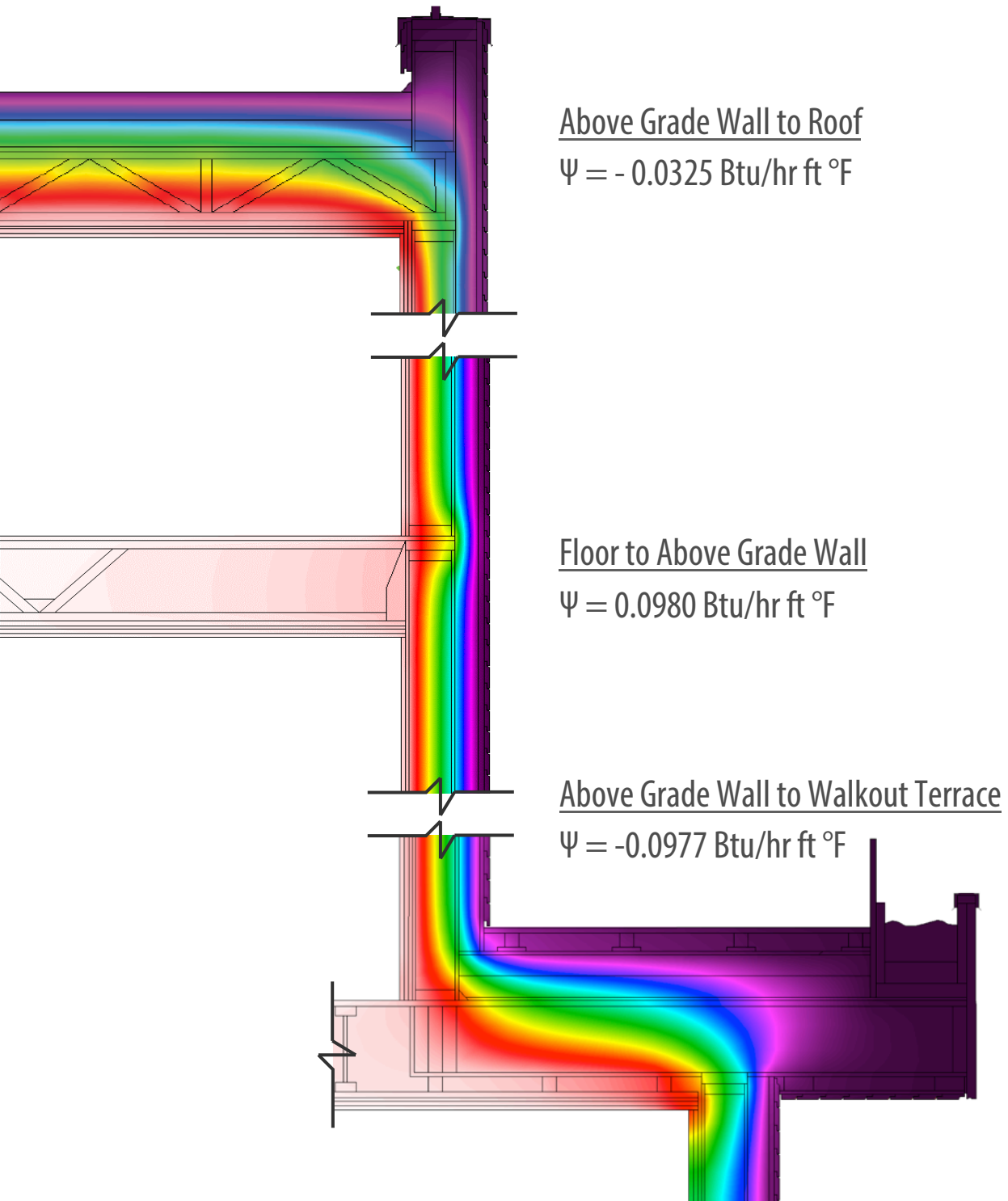
ABOVE GRADE WALL WINDOW-BALCONY DETAIL



ABOVE GRADE WALL WINDOW DETAIL



# ENVELOPE DESIGN



## THERMAL BRIDGING MITIGATION STRATEGIES

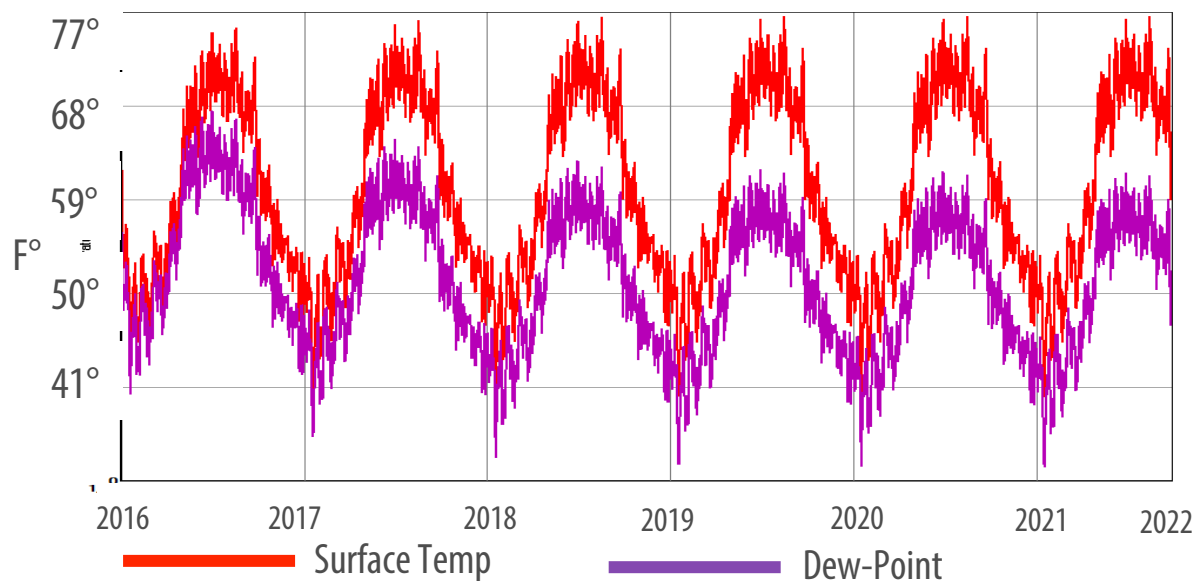
- Continuous Exterior Insulation
- Eliminate Framing Factor
- Maintain Thermal Continuity
- Assessed Locations with THERM

# ENVELOPE DESIGN

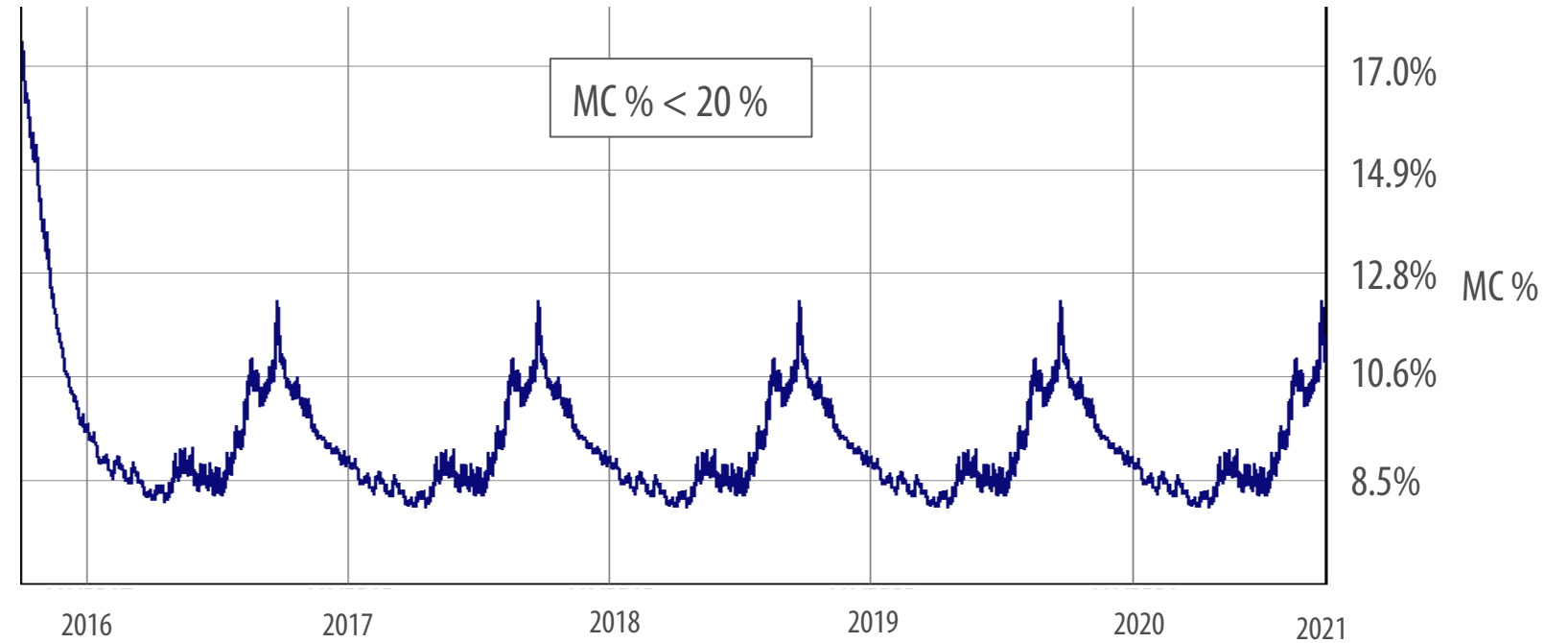
## ENVELOPE DURABILITY STRATEGIES

- Moisture Resistant (ICF)
- Vapor Open Assemblies
- Exterior Insulation
- Transitions and Joints Air Sealed
- Assessed Enclosure with WUFI Pro

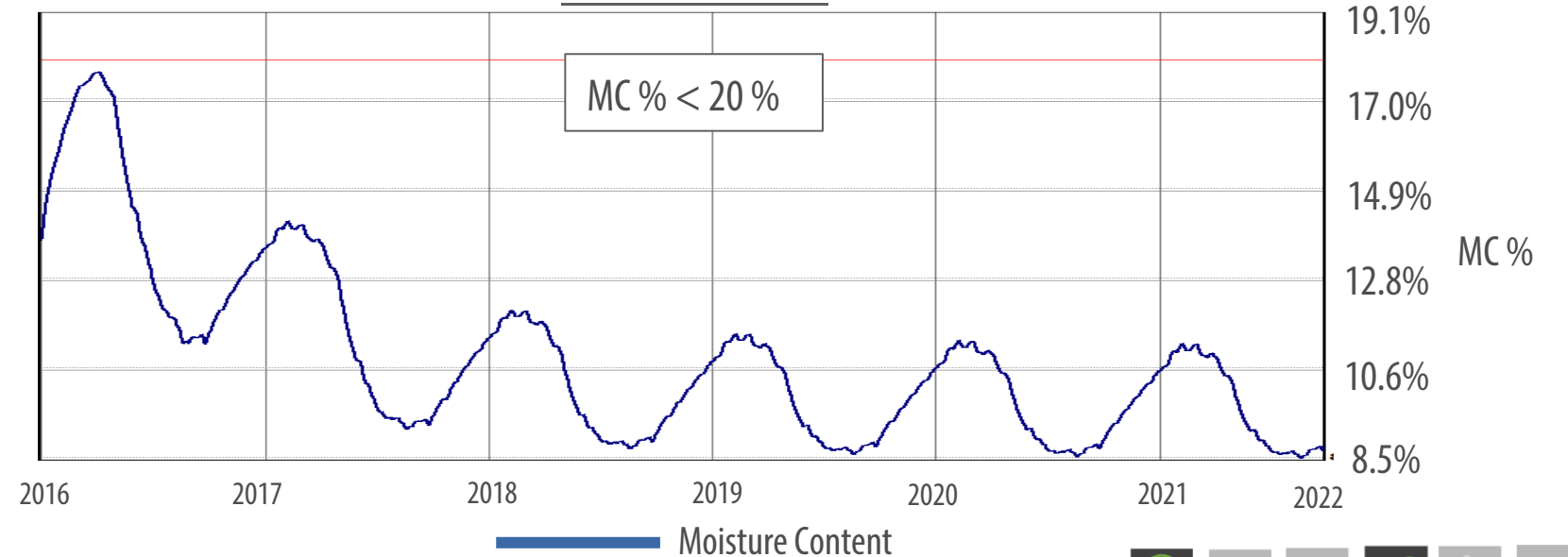
### ROOF SHEATHING



### EXTERIOR OSB - SIPS



### ROOF SHEATHING



## CONSTRUCTION AND QM STRATEGIES

- Construction Quality Management Plan Developed (QM3)
- Construction Schedule Outlined
- East and West Above Grade Wall Construction Procedure Developed
- Green Rating Checklists Included
  - PHUIS + Checklist
  - ENERGYSTAR Inspection Checklist

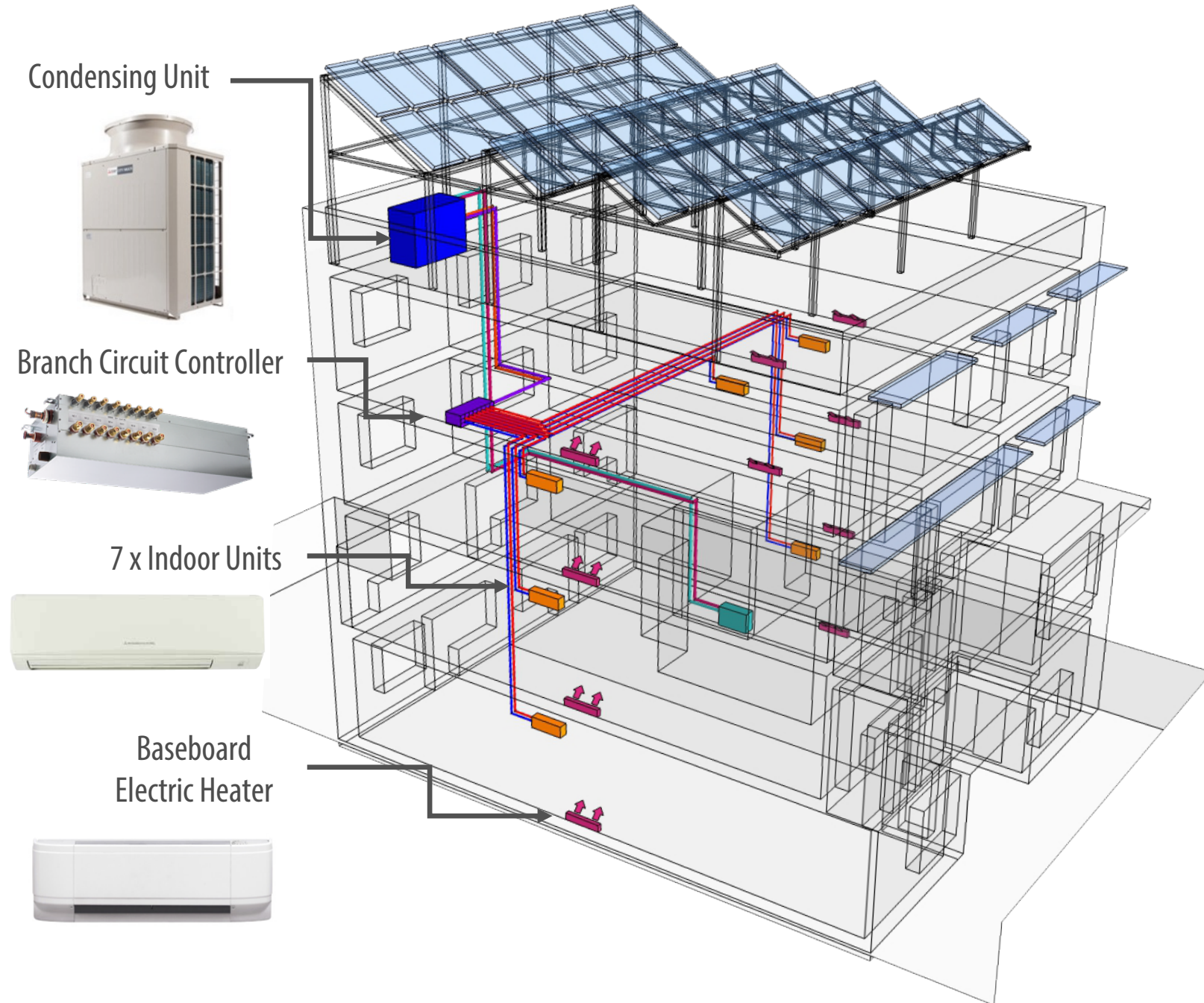
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**TRUE NORTH DESIGN – EASTERN PINE**  
**Q3 - QUALITY MANAGEMENT PLAN**

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Version Number: 1.0  
Version Date: 03/24/16

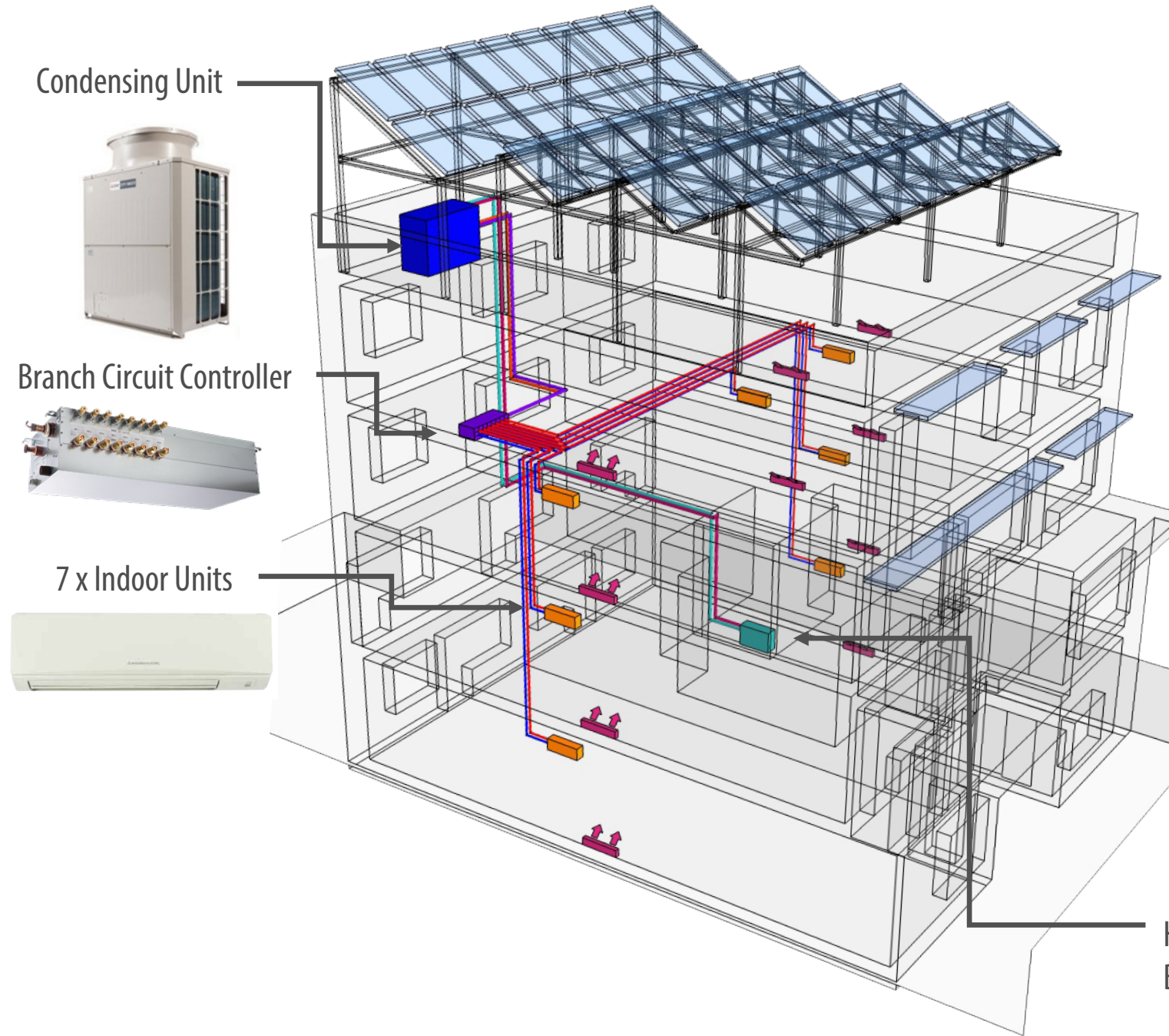
# SPACE CONDITIONING



## SPACE CONDITONING

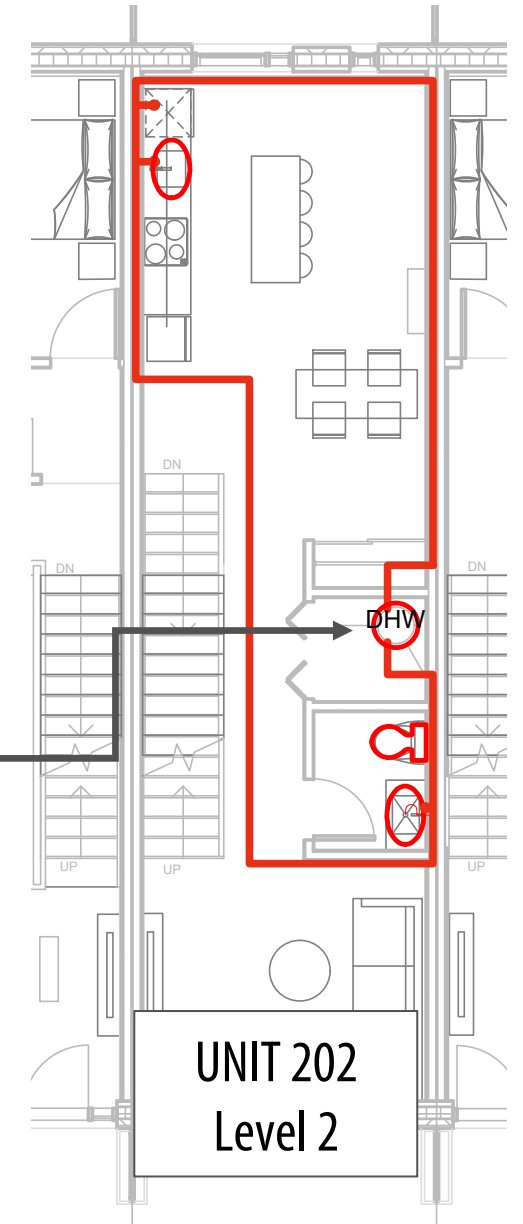
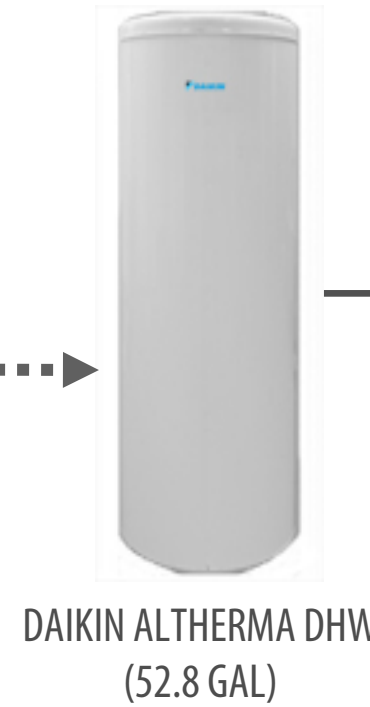
- Mitsubishi CITY MULTI ASHP System
- Multi-Split Variable Refrigerant Flow
- Individual Tenant Billing Automation
- Backup Resistance Heaters
- No Combustible Fuel

# DOMESTIC HOT WATER

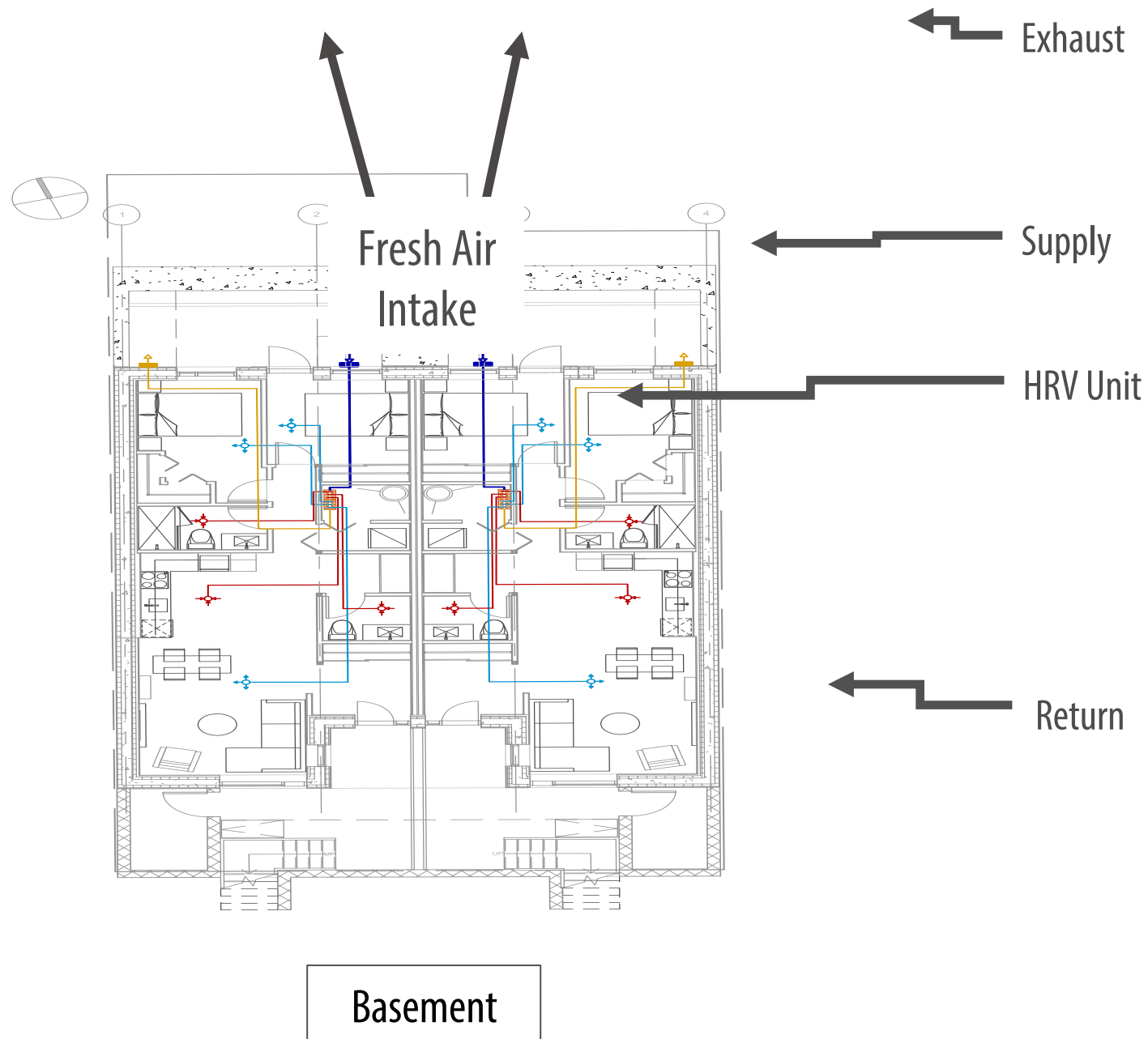


## DOMESTIC HOT WATER

- ASHP Integrated
- Demand Initiated Recirculation
- Built-in Backup Heater



# VENTILATION



COMFOAIR 200 HRV

## 2012 IRC Ventilation Requirements

Balanced Continuous Ventilation @ 72 CFM Per Unit

## ComfoAir System

- 92% Heat Recovery
- Noise Reducing Silencers
- Flexible Ducts

# ENERGY ANALYSIS

## 1. CODE COMPLIANCE MODEL

WUFI PASSIVE: Ontario Building Code (OBC) 2012 compliance model -  
A site specific model



% OF IMPROVEMENT

## 3. DESIGN MODEL

WUFI PASSIVE: Test different designs to meet PHIUS standard  
Update the geometry  
Collaborate with the Building Envelope and MEP

## 2. OPTIMIZATION MODEL

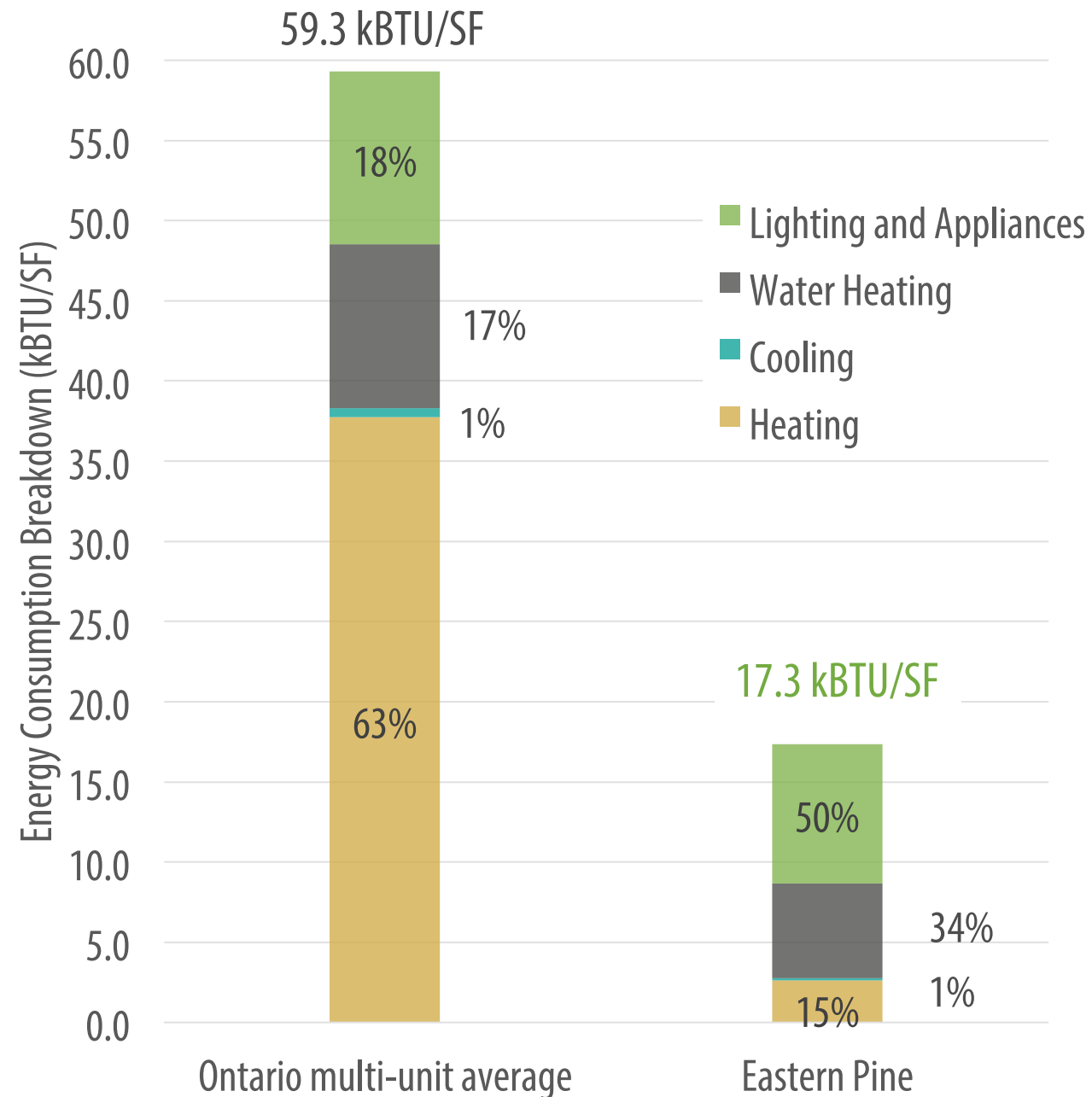
BEOPT: Obtain quotations for building products;  
A total of 12960 option combinations:  
3 Roof  
8 Wall  
4 Window  
9 Window to Wall Ratio  
5 Overhangs  
3 Wall sheathing

## 4. REMRATE MODEL

REMRATE: Generate a HERS rating for each unit  
Consistent input with WUFI Passive  
LEED energy score

# ENERGY ANALYSIS

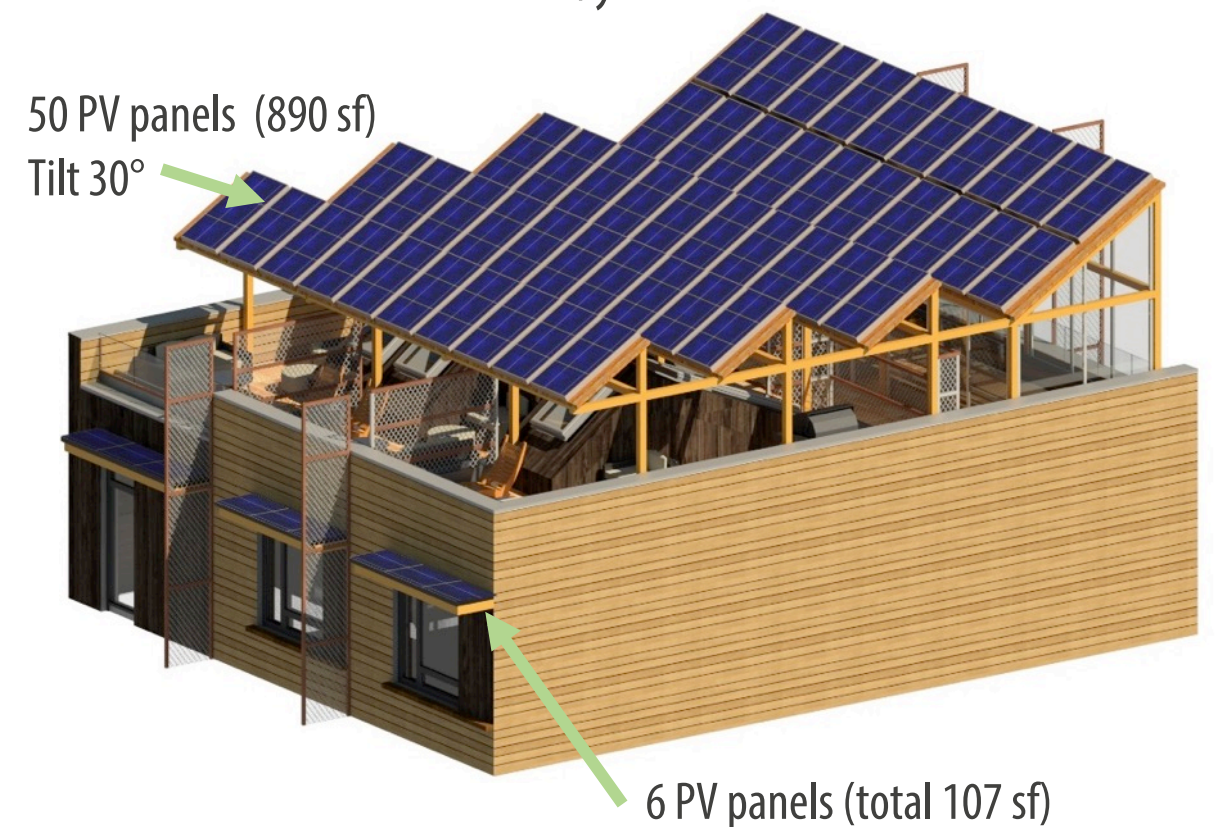
Eastern Pine vs. Ontario Multi-Unit Average (kBTU/SF)



## TOTAL ENERGY USE

- **100.2** MMBTU/yr (with PV)
- **152.4** MMBTU/yr (without PV)
- **70% Reduction** from Ontario Average

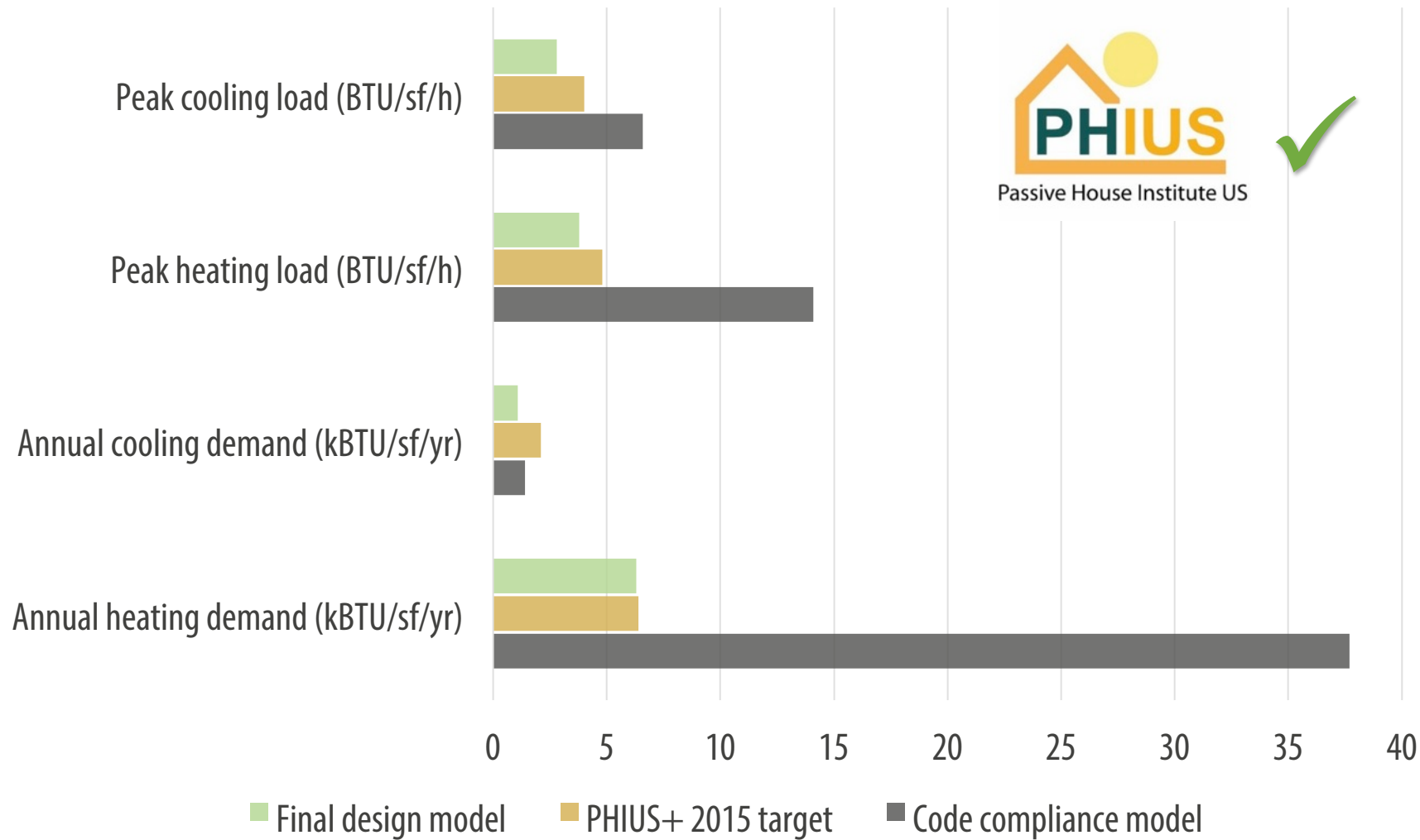
Total Generation: 52.2 MMBTU/yr



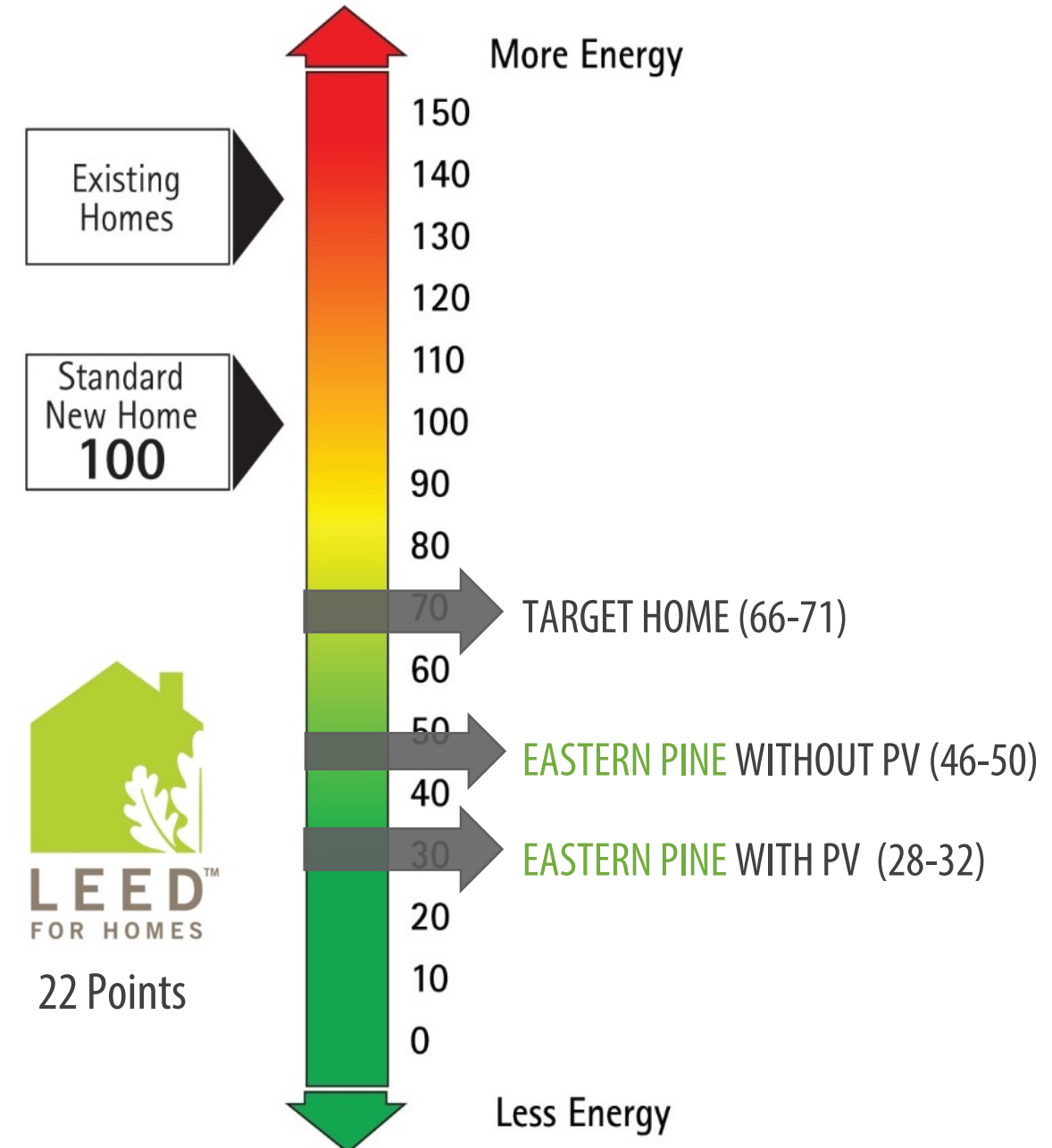


# ENERGY ANALYSIS

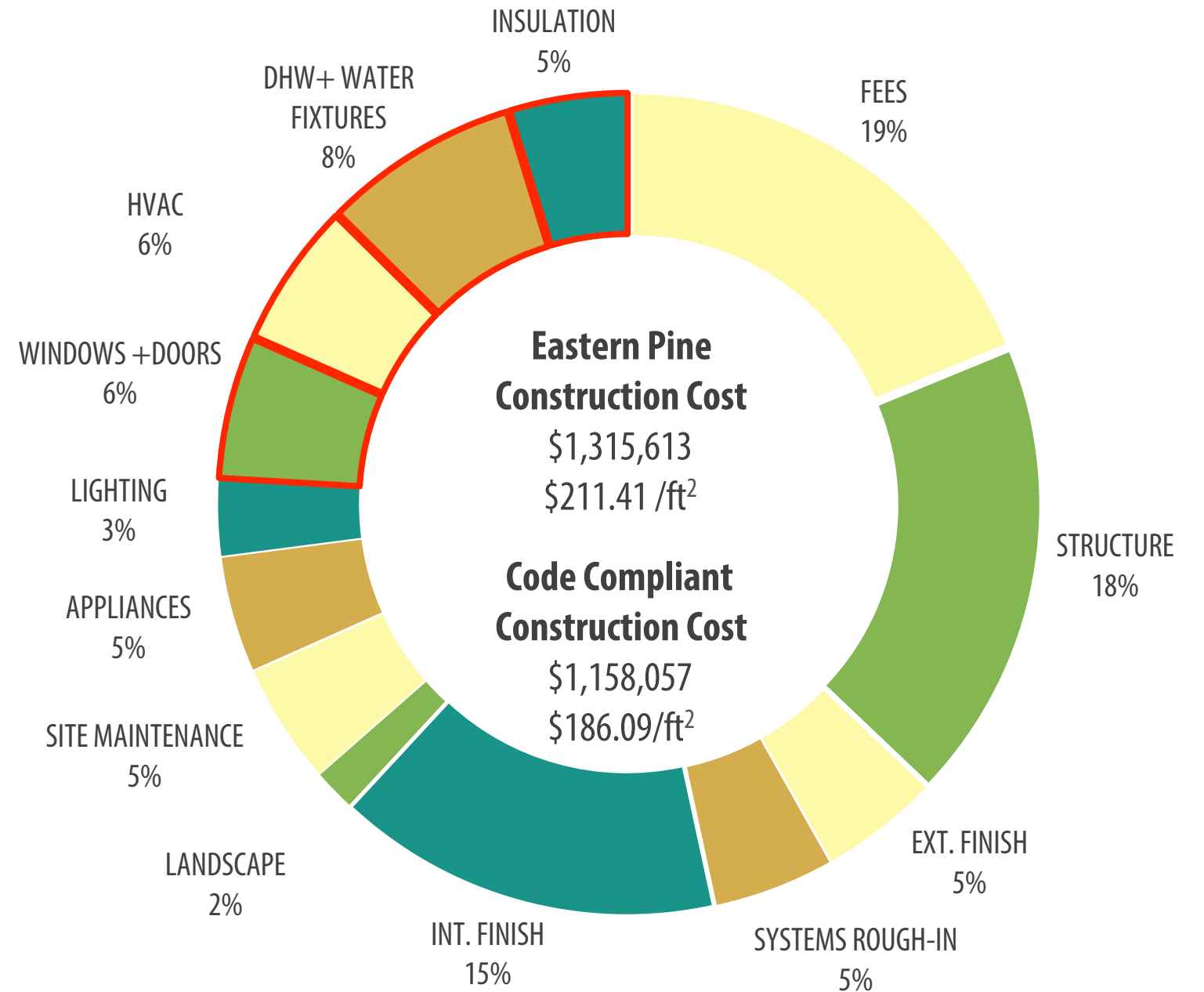
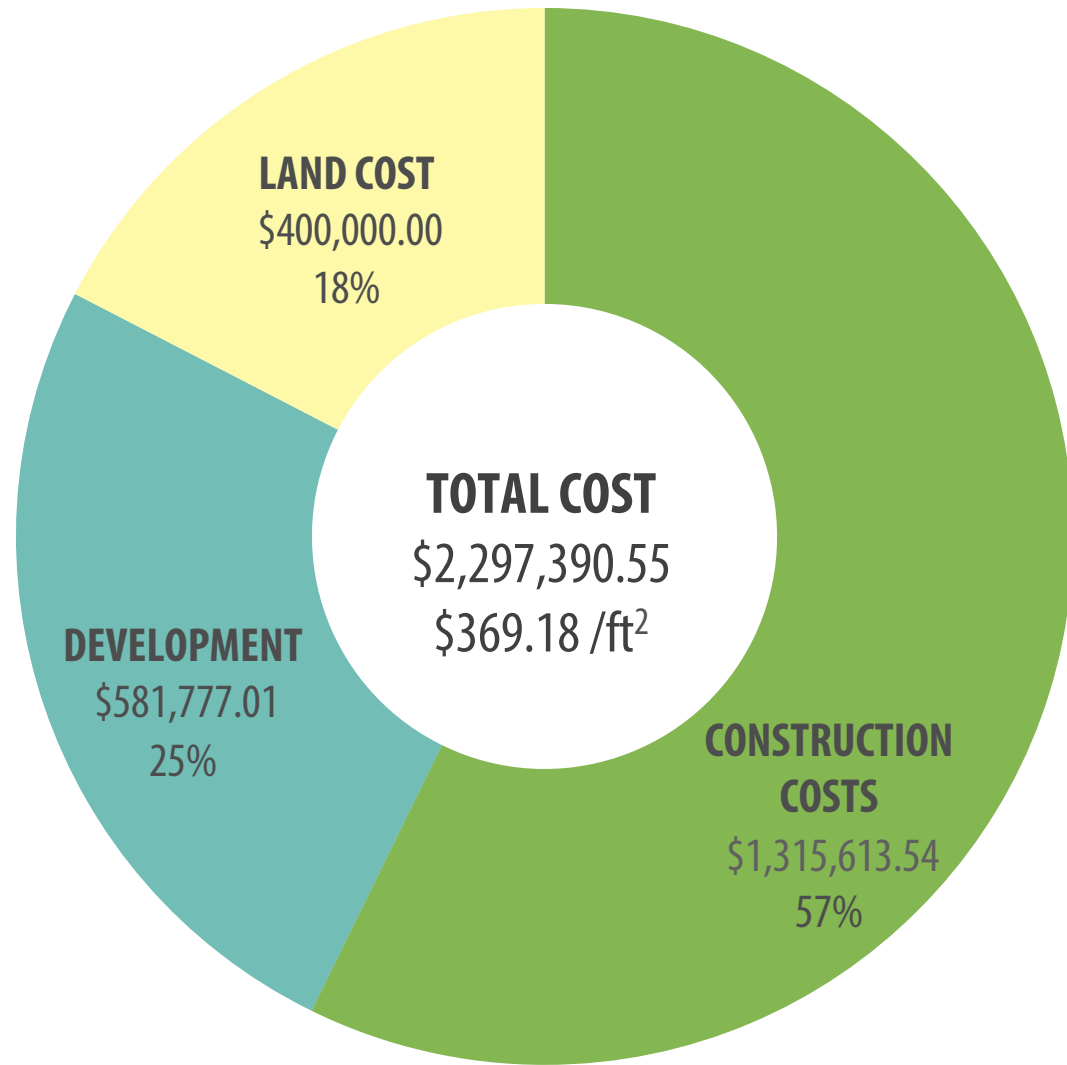
## Final Design Model vs. Code Compliance Model



## HERS® Index

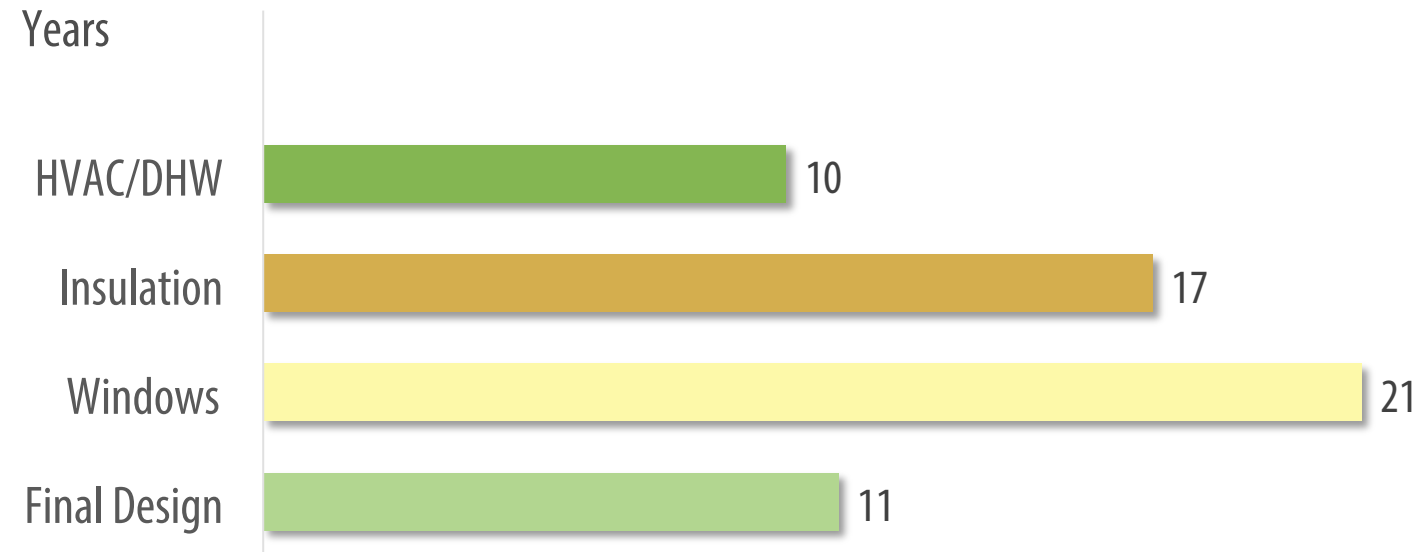


# FINANCIAL ANALYSIS

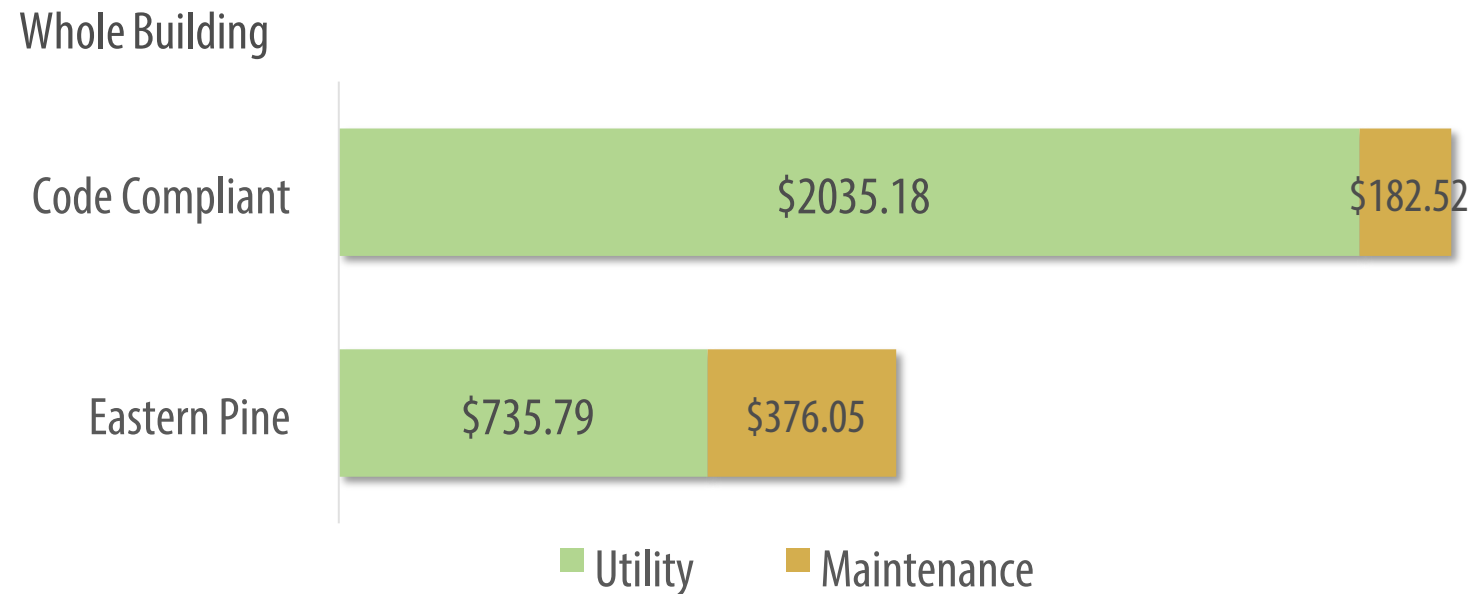


# FINANCIAL ANALYSIS

## COMPONENT PAYBACK

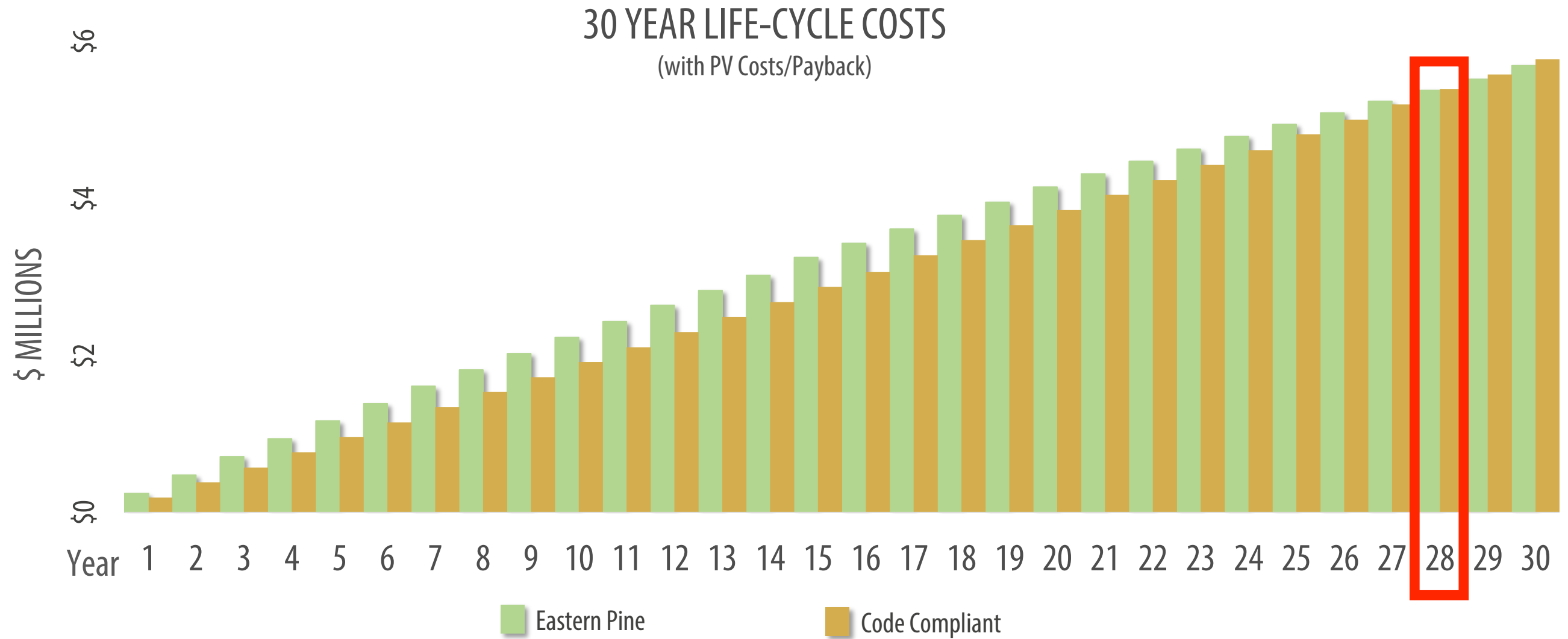


## MONTHLY OPERATION



## MONTHLY AFFORDABILITY ANALYSIS

Unit	Unit Cost	Expect. Income	Afford. Ratio
B01	\$298,661	\$93,693	27%
B02	\$298,661	\$93,693	27%
101	\$264,200	\$58,000	37%
102	\$206,765	\$58,000	31%
201	\$402,043	\$93,693	34%
202	\$402,043	\$93,693	34%
203	\$425,017	\$93,693	35%



## CONCLUSION

## ECO-CONSCIOUSNESS

*“Through innovative design, the form, fabric, and function of Eastern Pine develops a connection between inhabitants, their home, community, and the natural world.” – True North Design*



# SUMMARY

- HVAC Specifications: Mini-Split indoor units for heating and cooling and ASHP DHW system with integrated VRF system. Mitsubishi -PURY-P72TKMU Outdoor unit.
- Electric resistance backup heaters.
- Ventilation: HRV
- Zehnder ComfoAir200 with 92% Heat Recovery

	OBC 2012	ENERGYSTAR v3.1	Final Design
Exterior wall (exposed to air)	R24 (Rsi-4.33)	R20 (Rsi-3.55)	R42 (Rsi-7.4)
Exterior wall (exposed to earth)	R20 (Rsi-3.55)	R20 (Rsi-3.55)	R29 (Rsi-5.1)
Roof	R31 (Rsi-5.46)	R49 (Rsi-8.63)	R73 (Rsi-12.9)
Slab	R10 (Rsi-1.76)	R15 (Rsi-2.64)	R32 (Rsi-5.7)
Window	U-0.32 (U1.82)	U-0.27 (U1.53) any SHGC	U-0.17 (U0.97), SHGC 0.57
Skylight	U-0.49 (U2.78)	-	U-0.17 (U0.97), SHGC 0.37
Door	U-0.32 (U1.82)	Opaque: 0.17, <1/2 lite: 0.25, >1/2 lite: 0.3	U-0.28 (U1.6), SHGC 0.56

Table 9.0.1. OBC 2012 and ENERGYSTAR v3.1 requirement [2] [3]

