

EASTERN PINE

by True North Design

Ryerson University



TEAM PROFILE

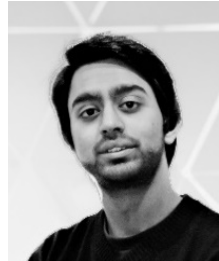
PRESENTERS



Mark Flynn



Madison Dozzi-Perry



Umer Khan



Stacy (Xi) Sun

FACULTY ADVISORS



Mark Gorgolewski



Cheryl Atkinson

TEAM MEMBERS



Sadaf Mansour



Katherine Lishak



Xavier Mendieta



Shahrzad Soudian

INDUSTRY PARTNERS



Sustainable.TO
Architectural support



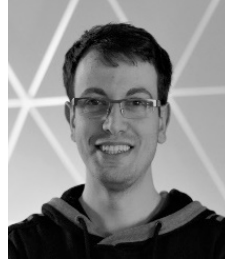
Greening Homes
Constructability support



Mahsa Hatefi



Dami Lee

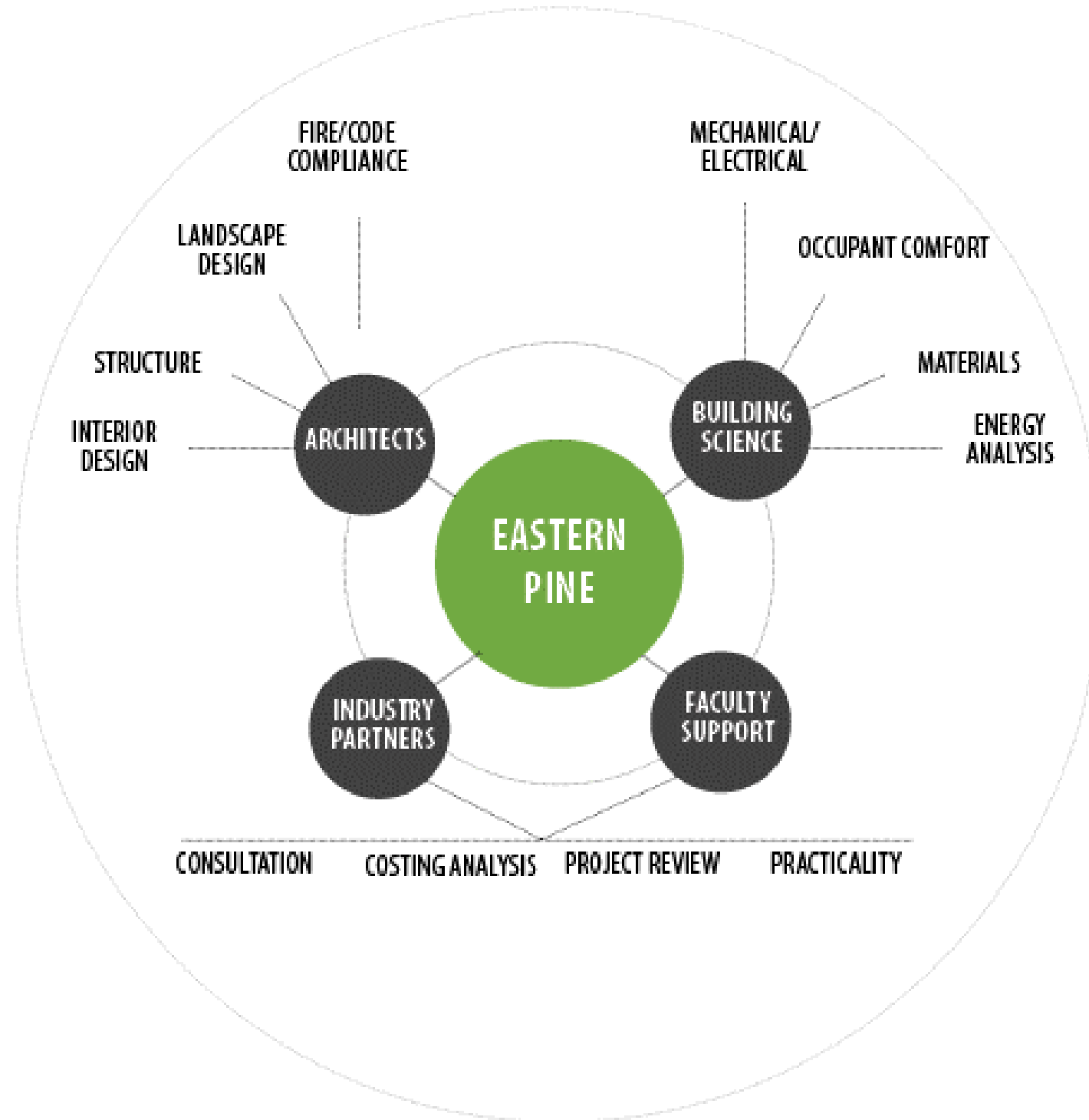


Vadim Novik



Christopher Marleau

INTEGRATED DESIGN PROCESS



PROJECT CONTEXT

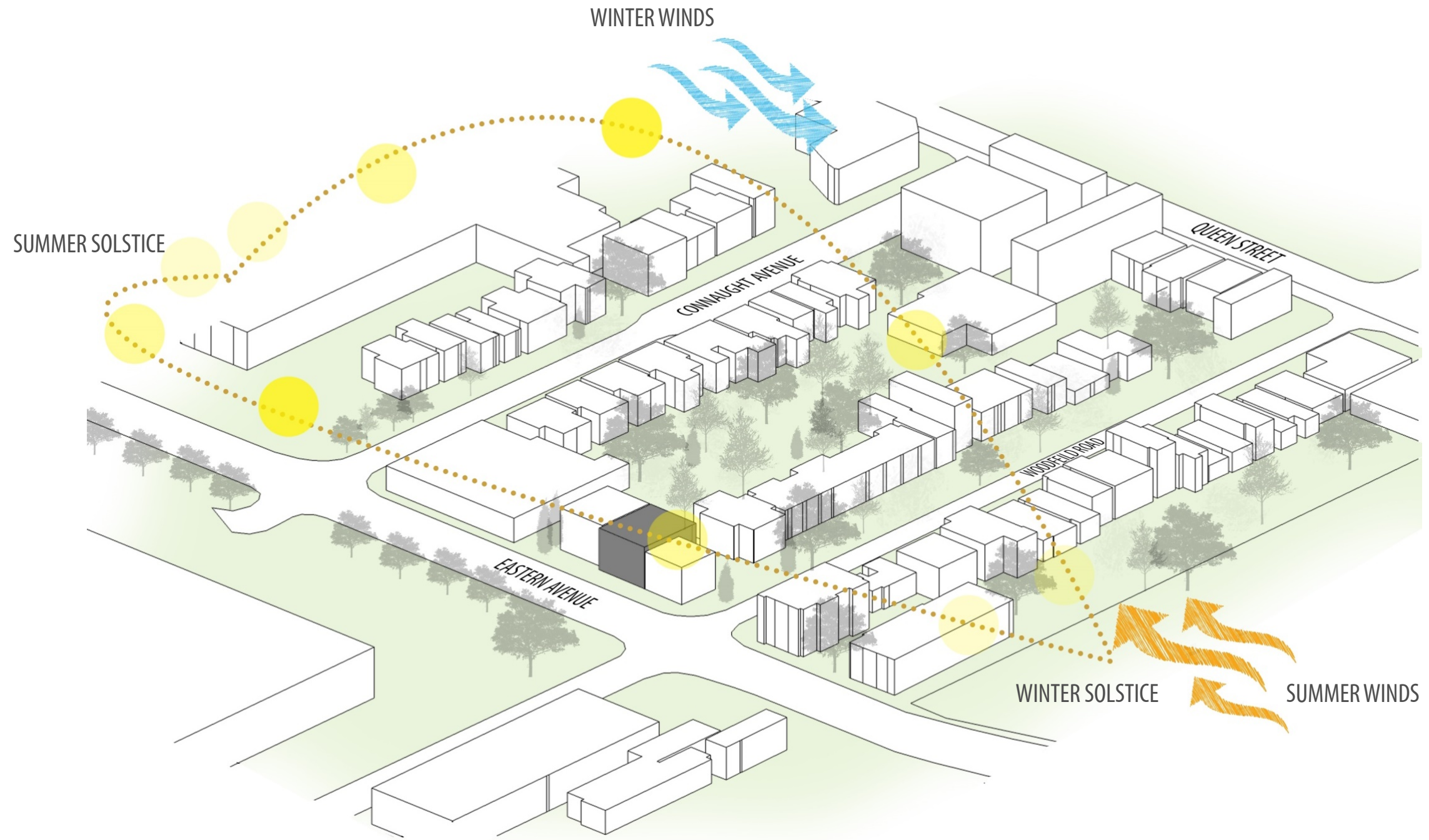


TORONTO, ONTARIO

CLIMATE FACTORS	VALUES
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- ASHREA Climate Zone6
- Heating Degree Days (base 65°F)3873
- Cooling Degree Days (base 65°F)306

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

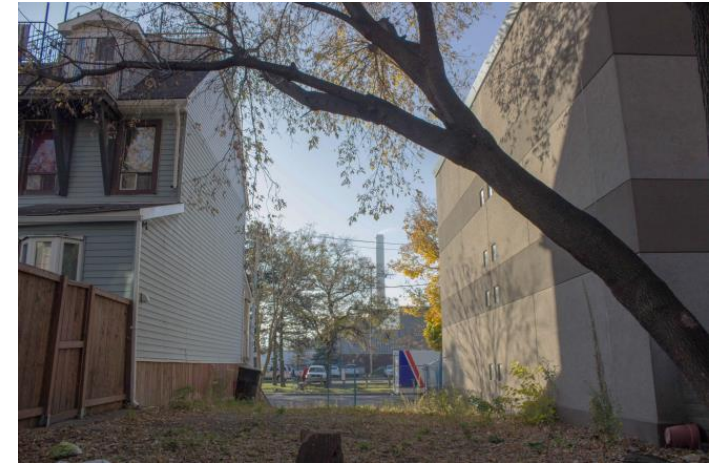


PUBLIC TRANSIT

PROJECT CONTEXT



PROJECT CONTEXT



DESIGN GOALS

ECO-CONSCIOUSNESS



LOW ENERGY



CONTEXT + COMMUNITY



LOW CARBON



ECONOMY + RESILIENCE



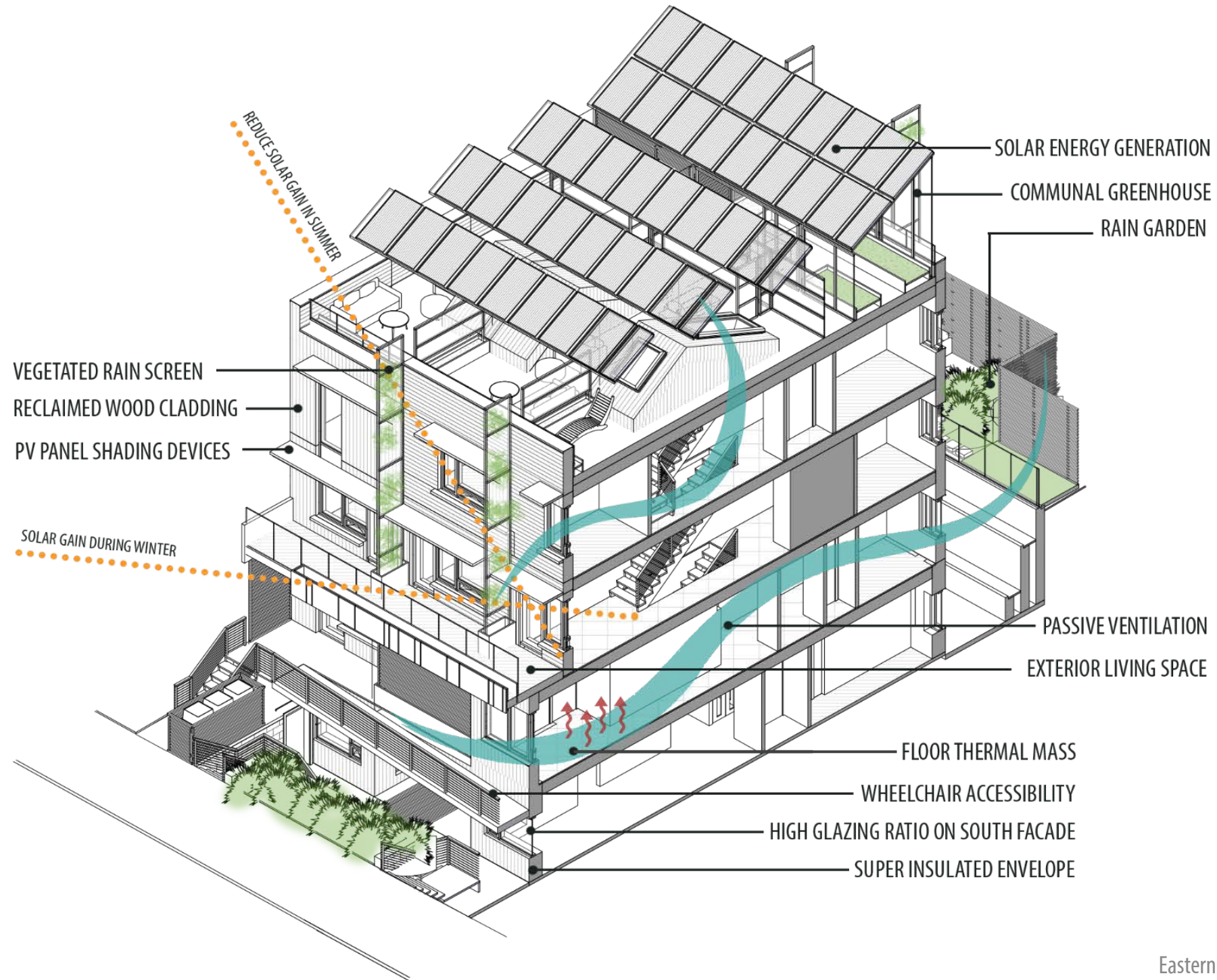
DYNAMIC DESIGN
+ ACCESSIBILITY



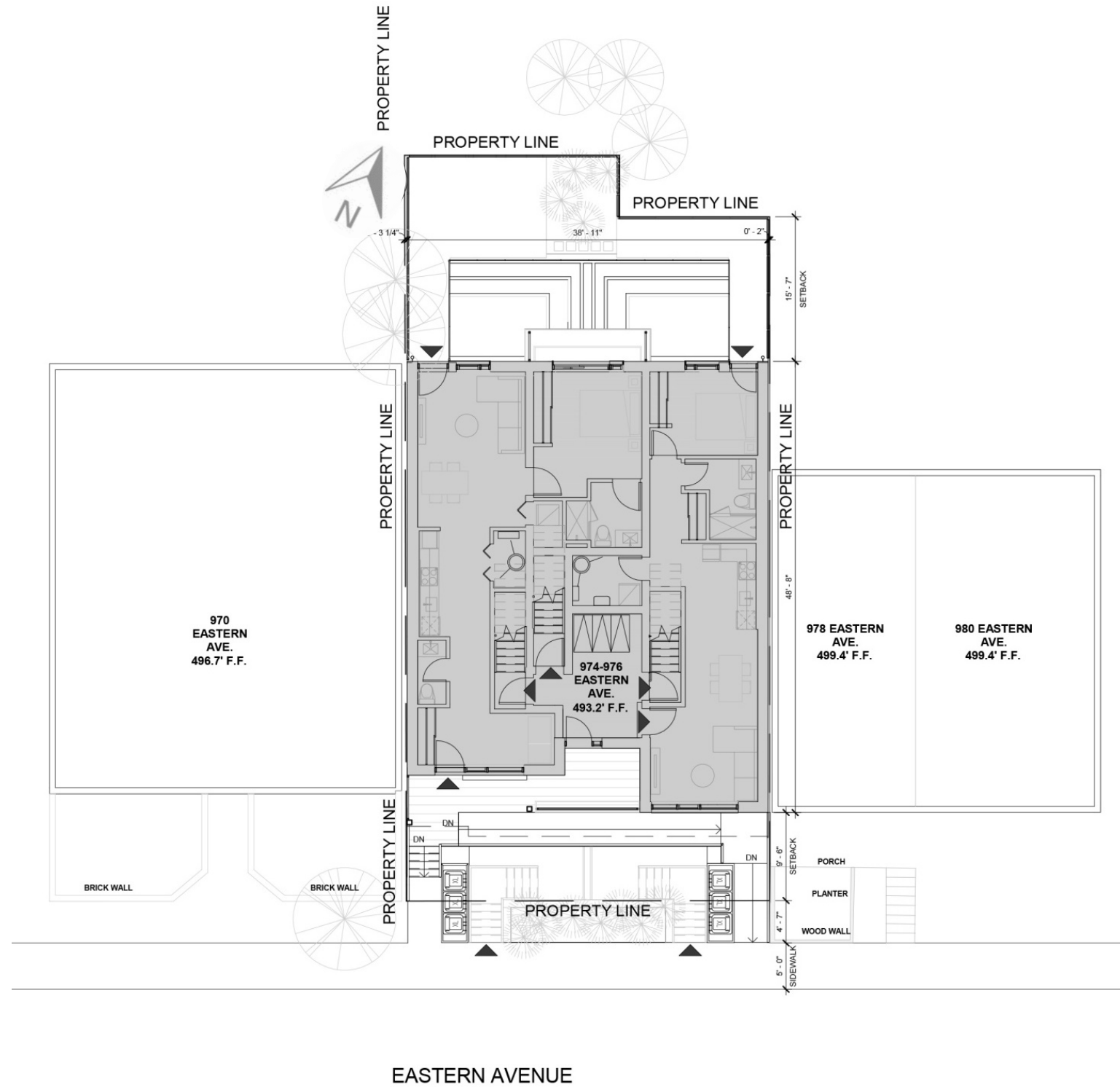
OCCUPANT COMFORT
+ HEALTH



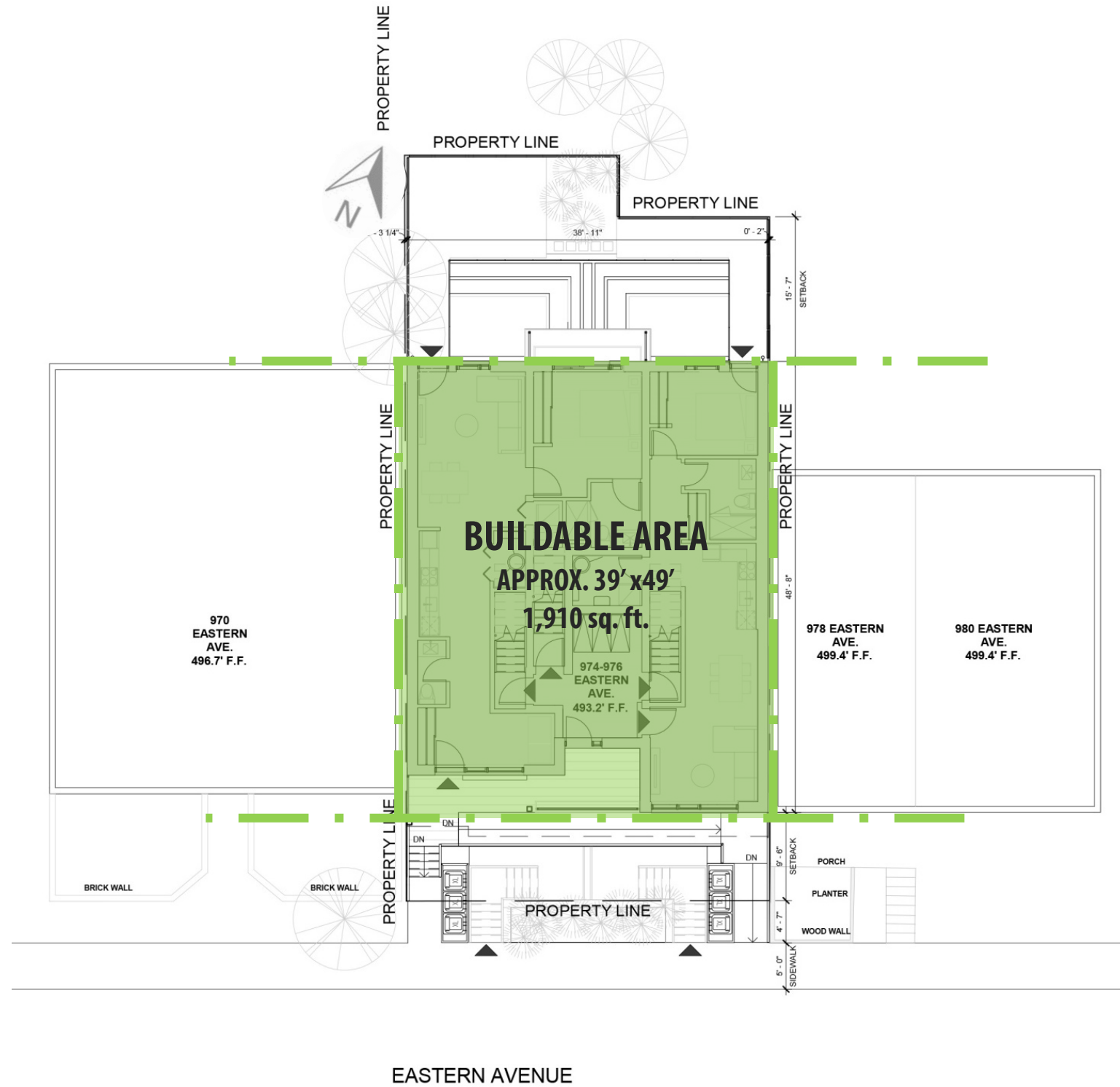
BUILDING FEATURES



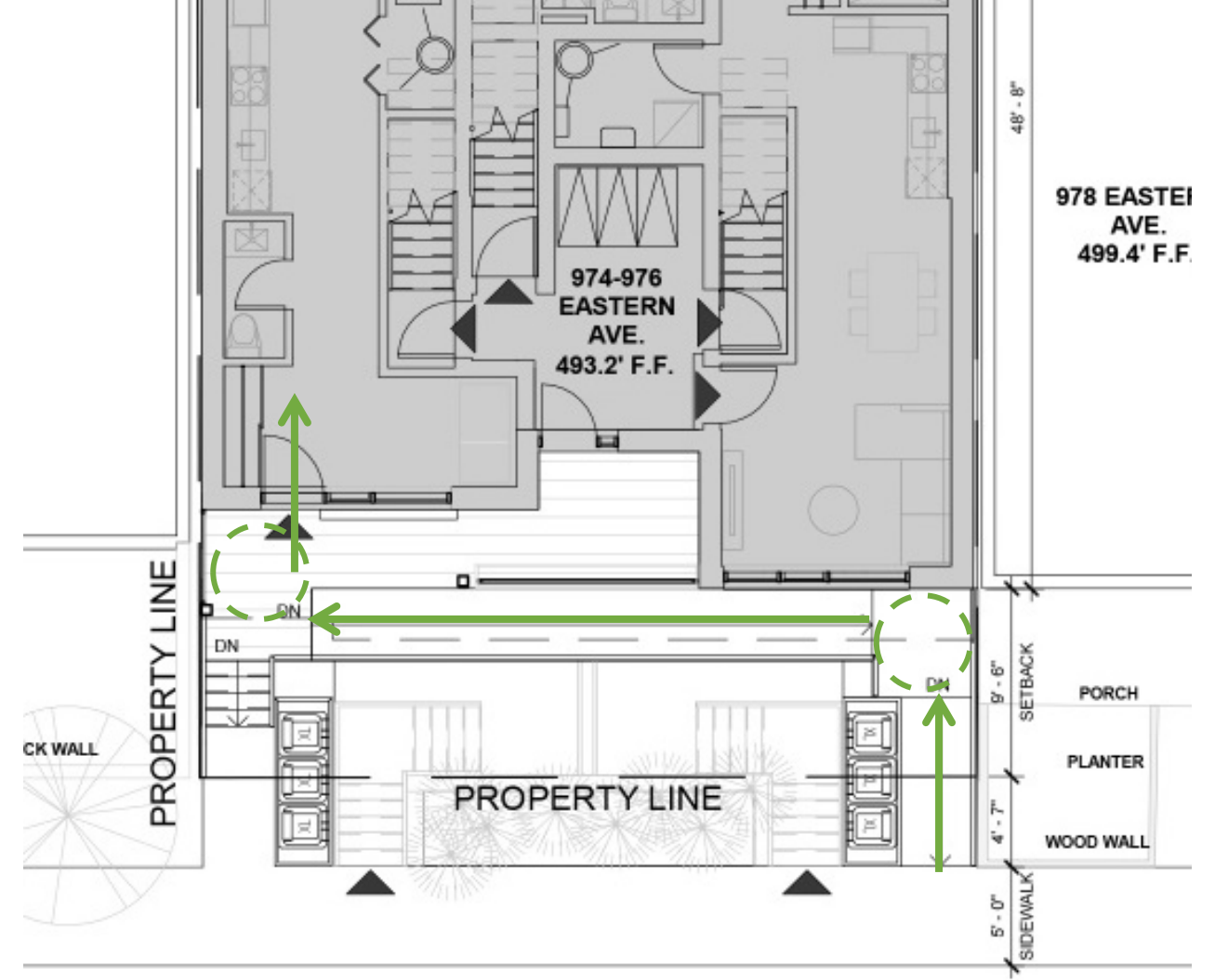
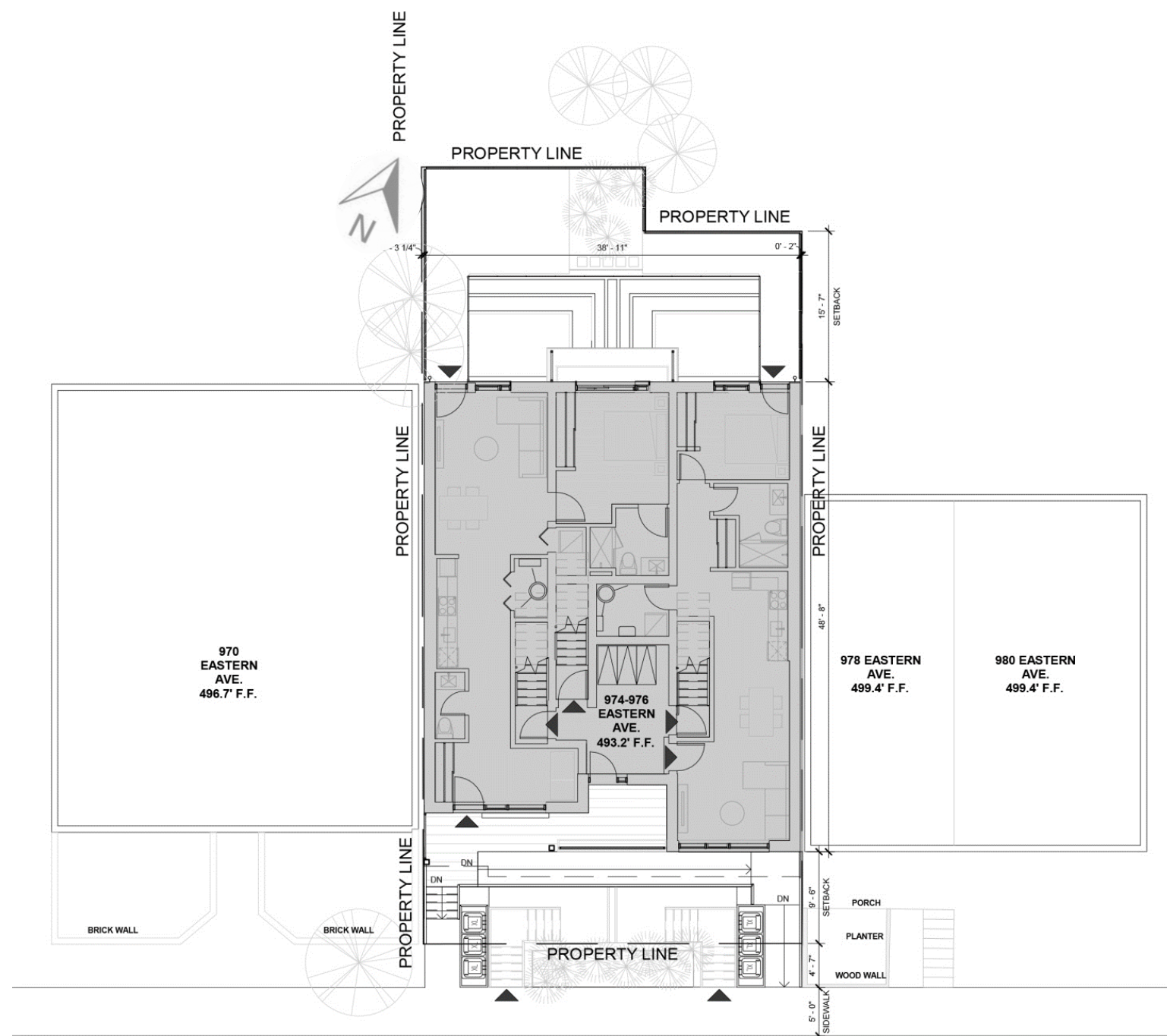
PROPOSED SITE PLAN



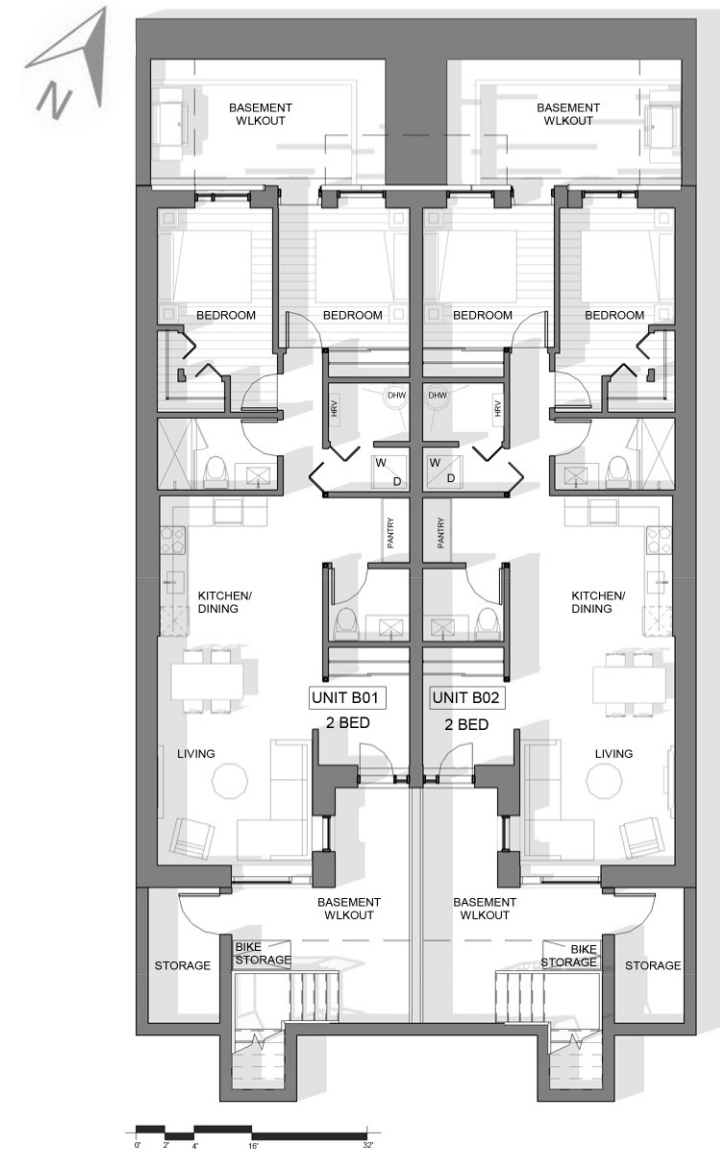
PROPOSED SITE PLAN



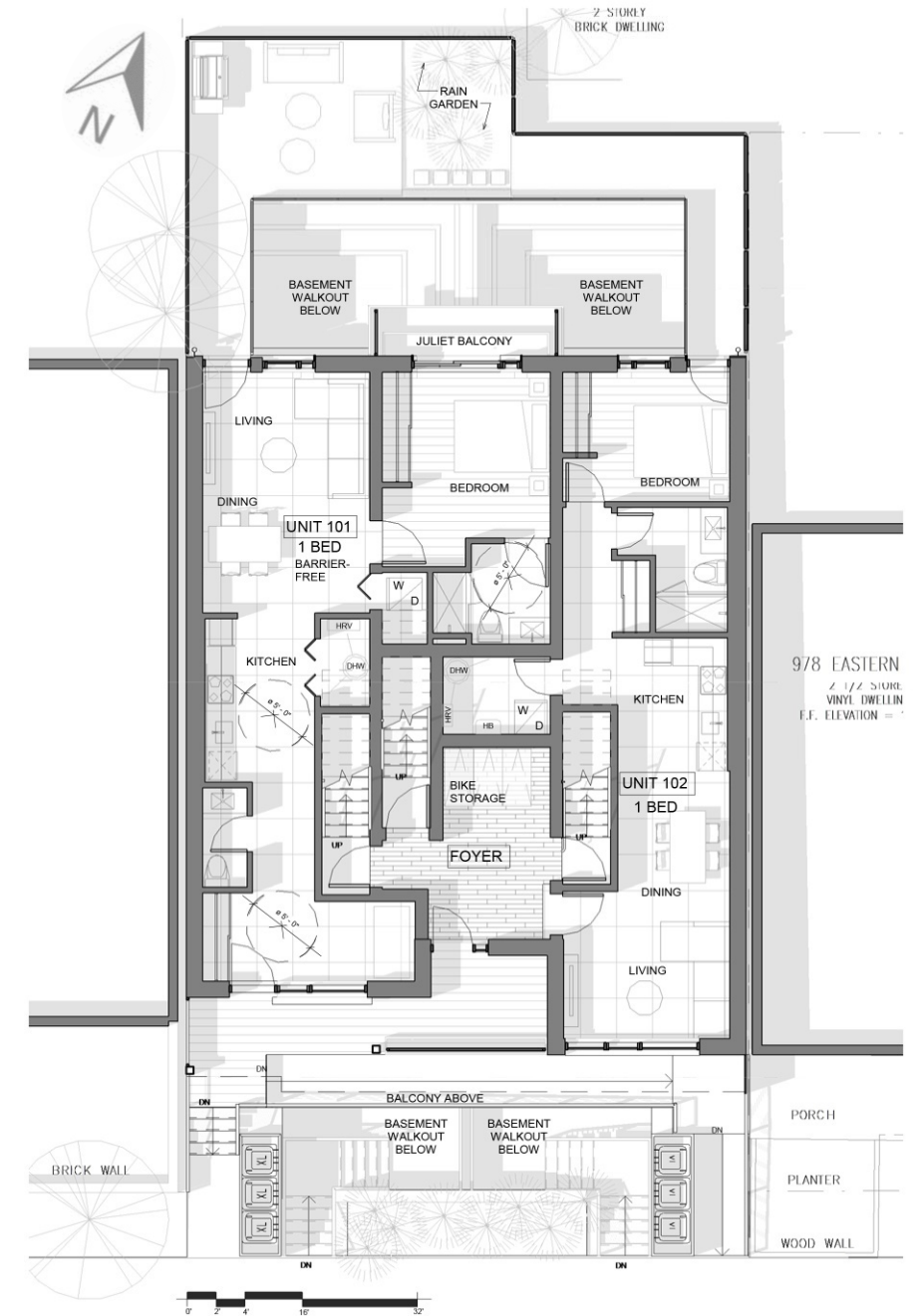
PROPOSED SITE PLAN



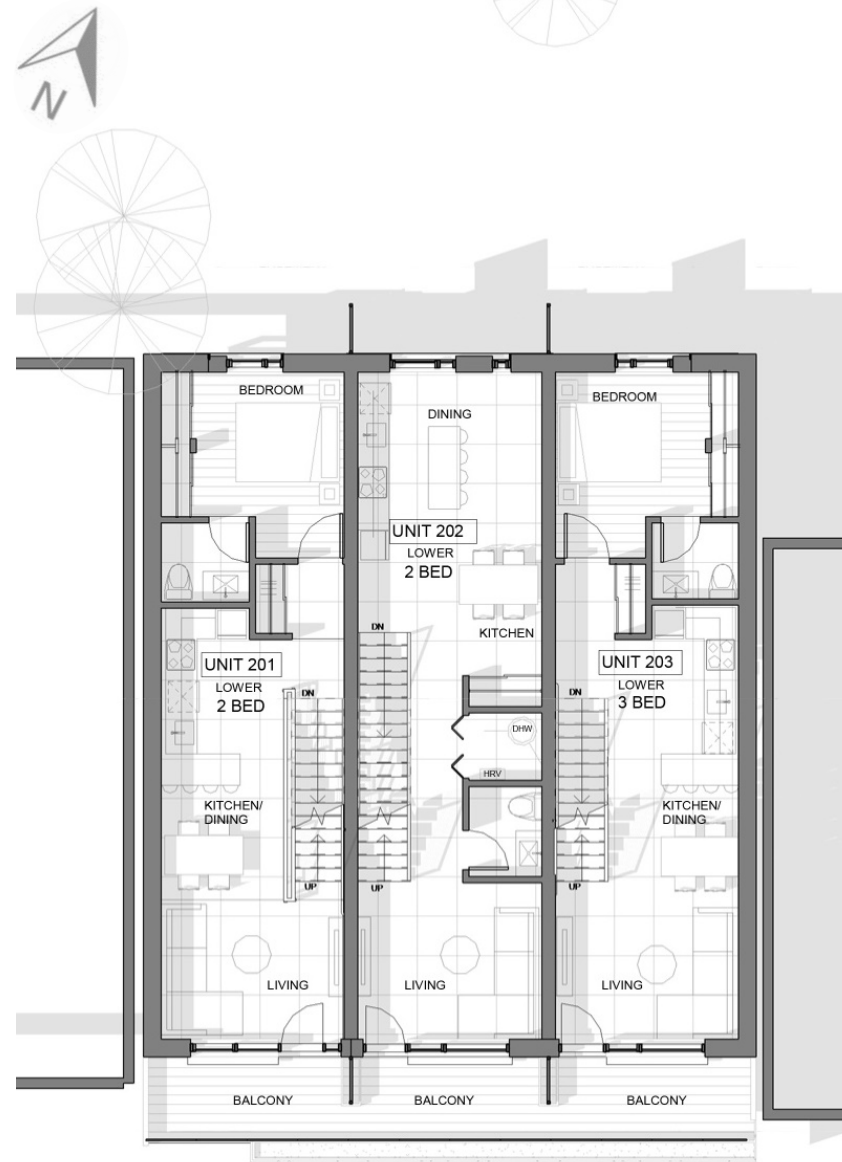
BASEMENT FLOOR PLAN



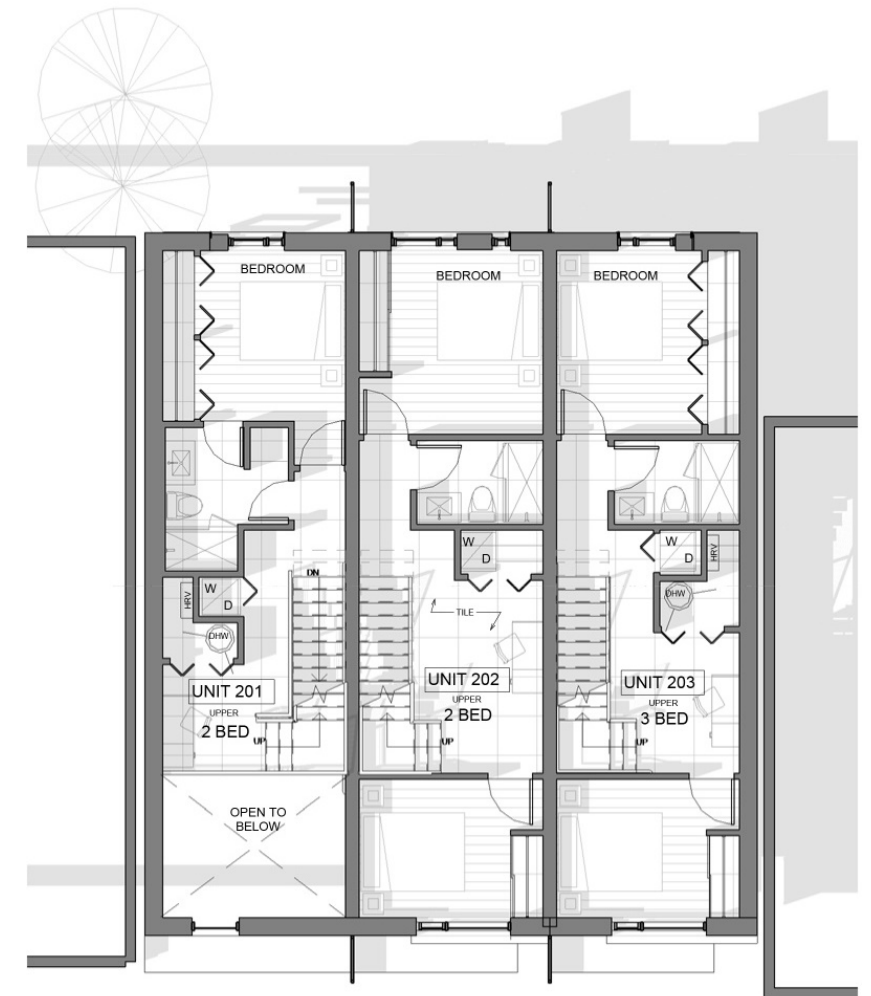
LEVEL ONE FLOOR PLAN



LEVEL TWO + THREE FLOOR PLANS



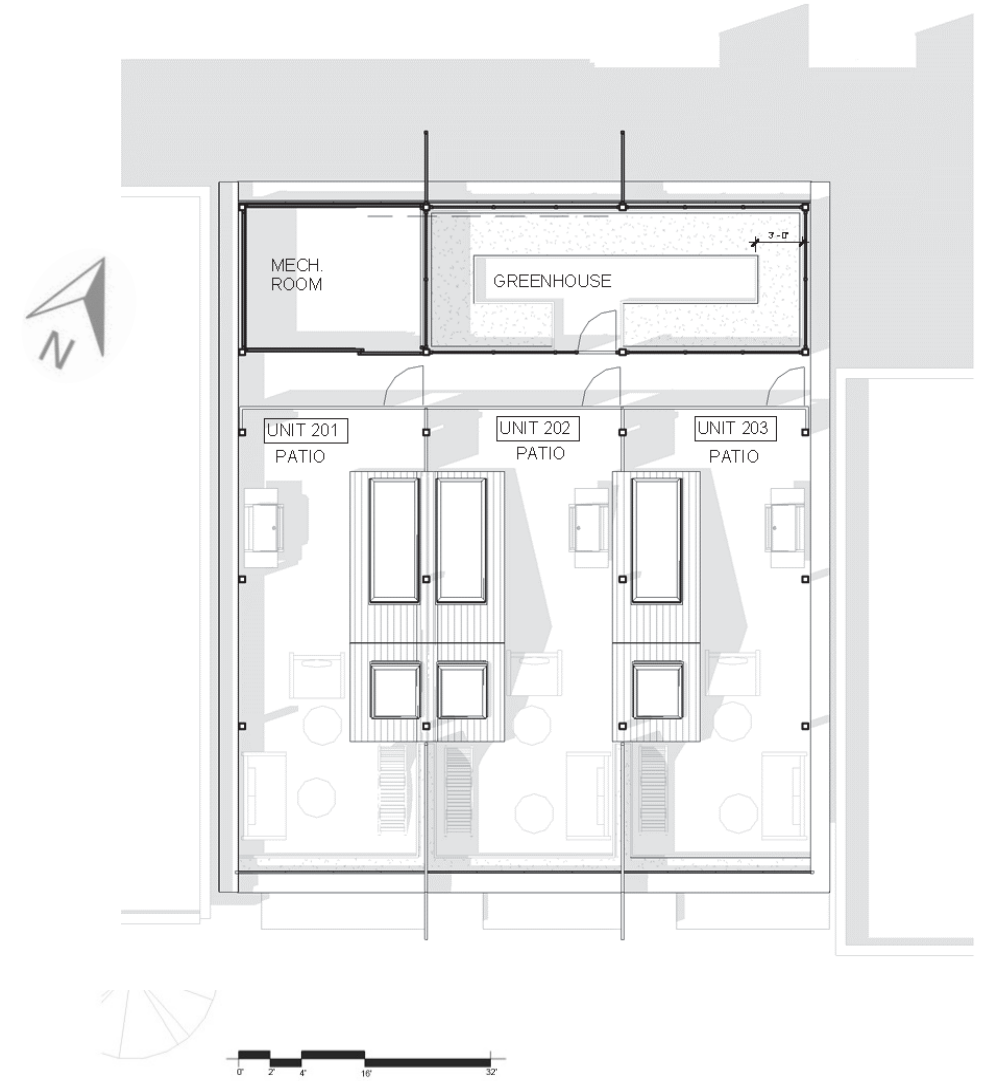
LEVEL TWO

A scale bar for the Level Two floor plan, showing measurements in feet: 0, 2, 4, 10, and 32.

LEVEL THREE

A scale bar for the Level Three floor plan, showing measurements in feet: 0, 2, 4, 10, and 32.

ROOF PLAN



NORTH + SOUTH ELEVATION

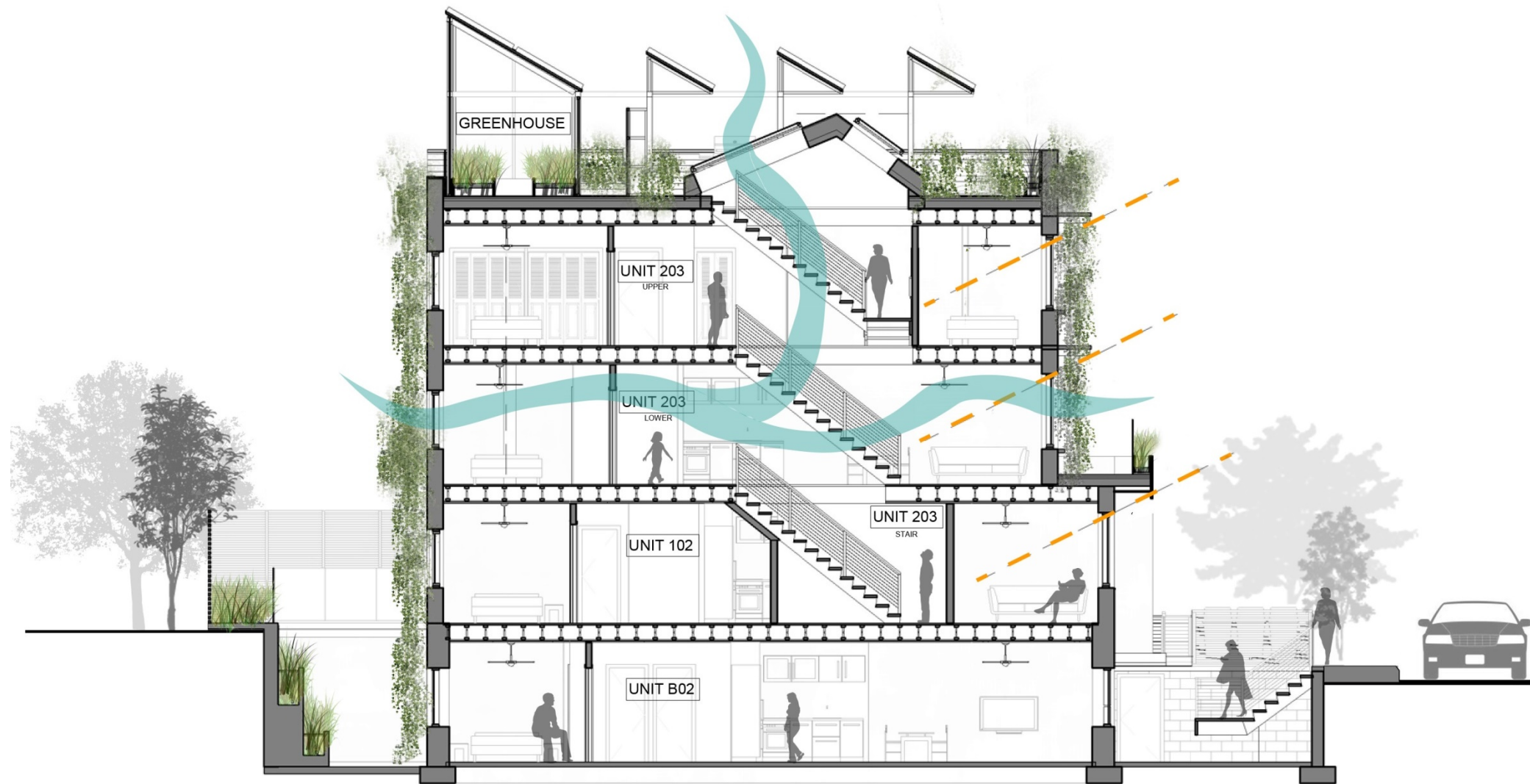


EXTERIOR DESIGN



- 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

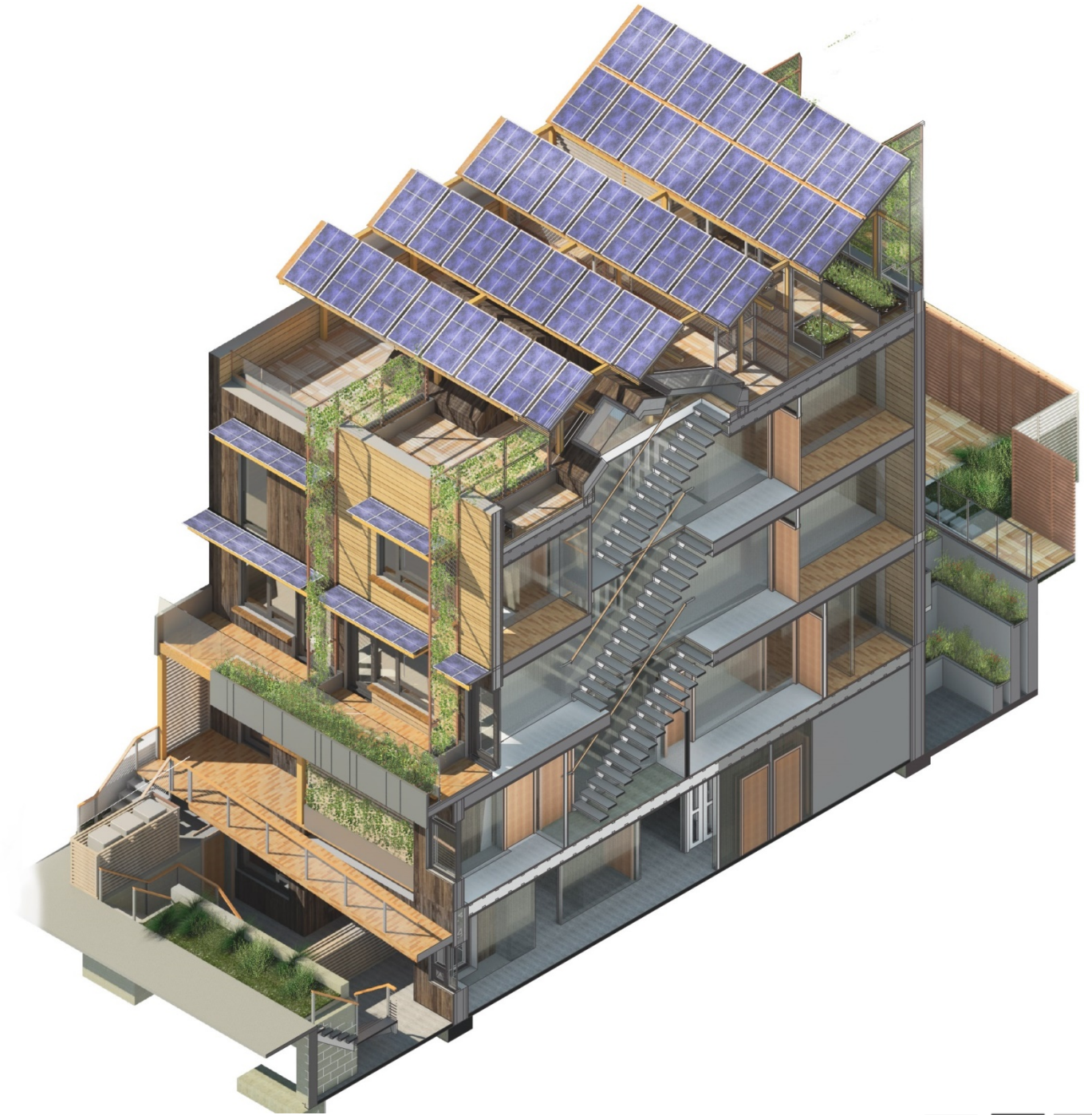
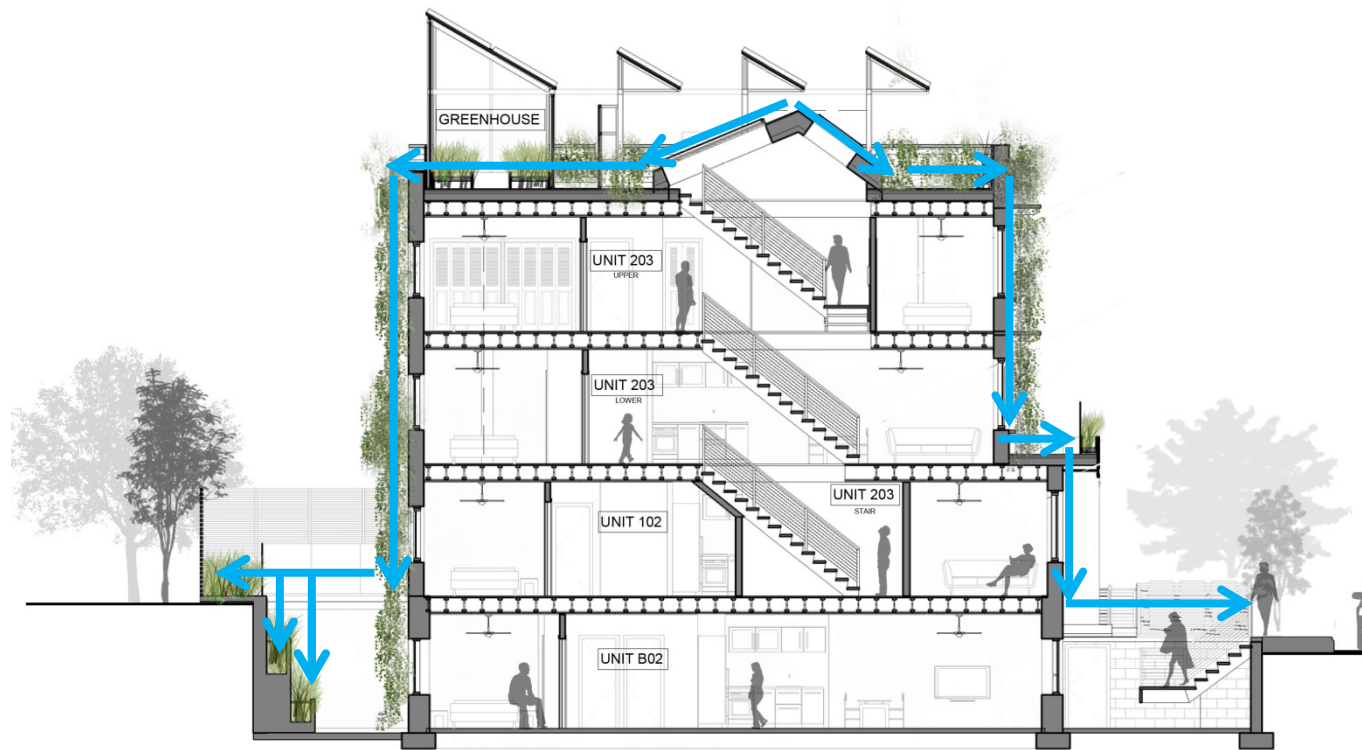


LANDSCAPE DESIGN



- Aesthetics + Occupant Health
- Building Becomes Part Of Nature
- Permeable Pavers
- 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

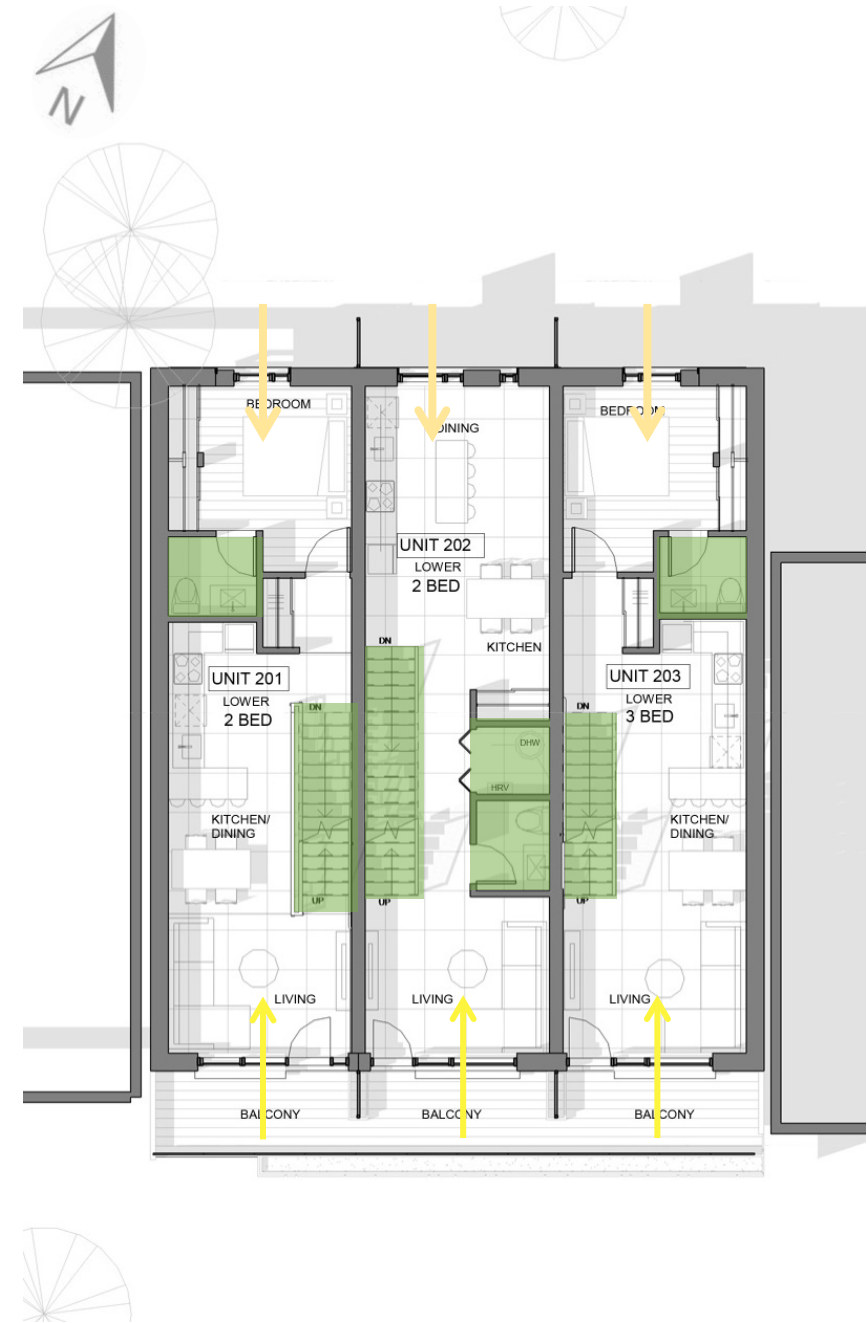


DAYLIGHTING

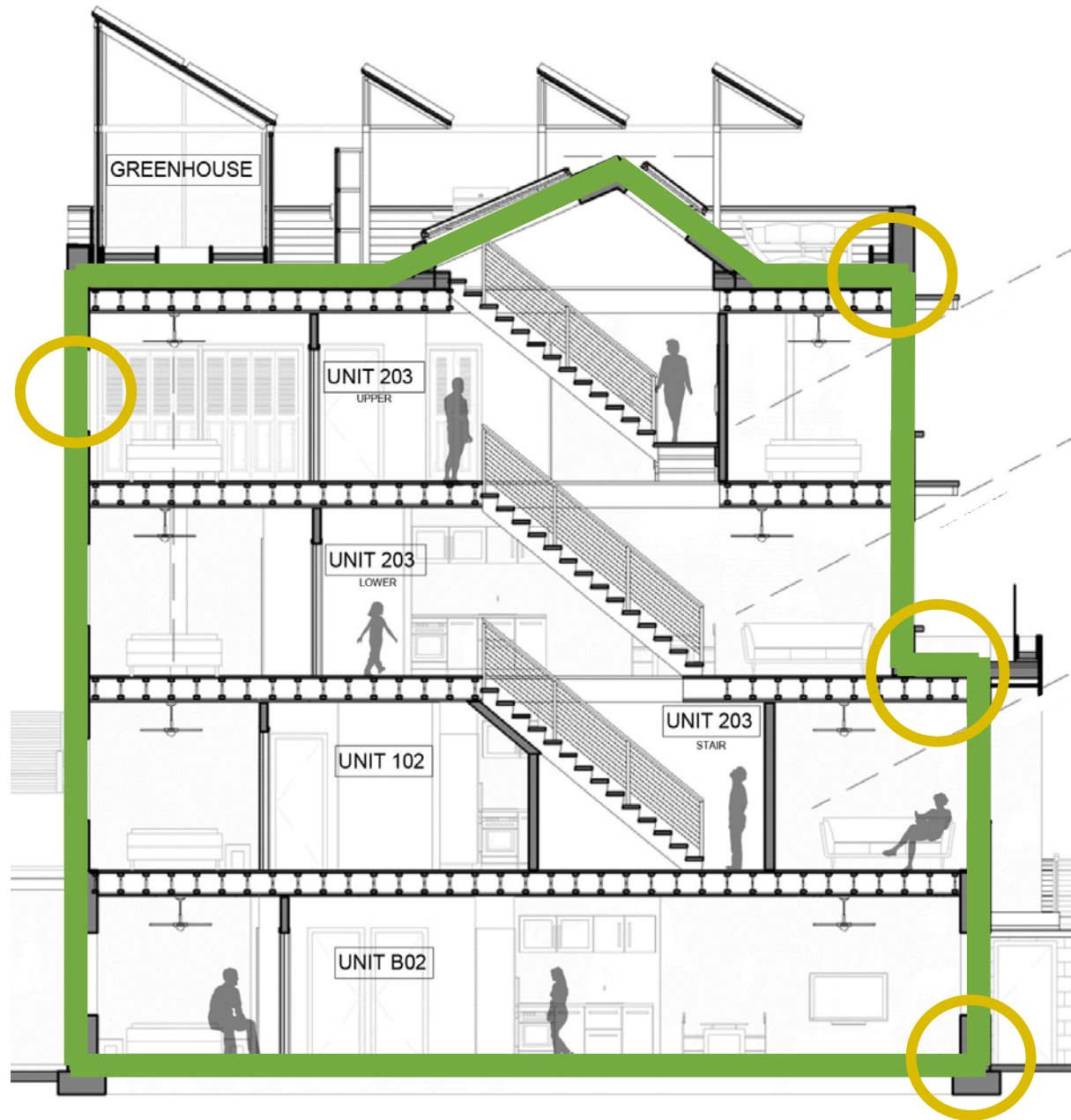


- Occupant Health
- Reduce Pollution and Energy Consumption
- Consolidate Service Spaces
- Living Spaces Access to Light
- Diffused light – North facade
- Window - Wall Ratio for Energy Efficiency
- Overheating (Summer) + Solar Heat Gain (Winter)

DAYLIGHTING



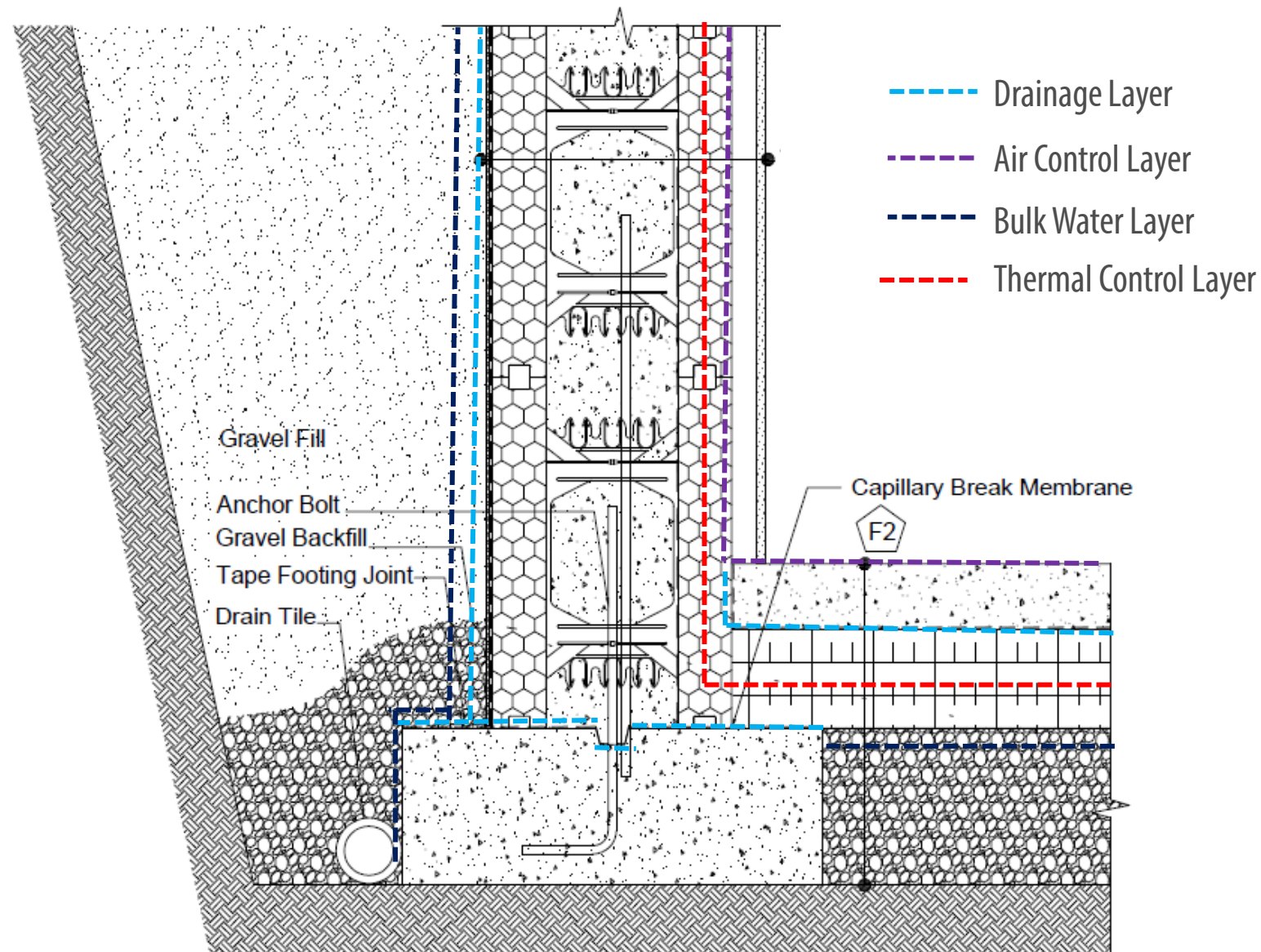
ENVELOPE DESIGN



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



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)

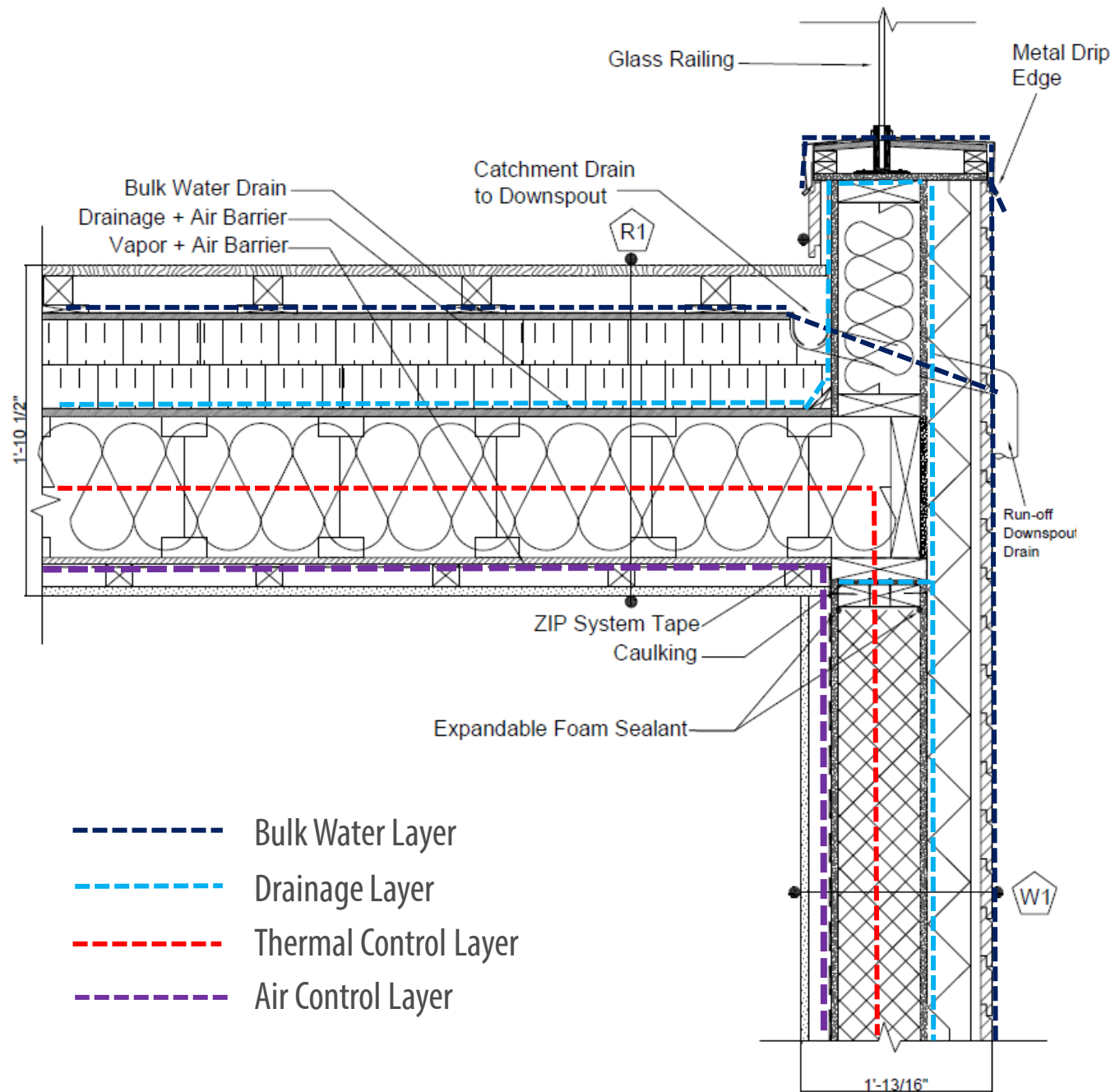
Structure : 8" Concrete

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)

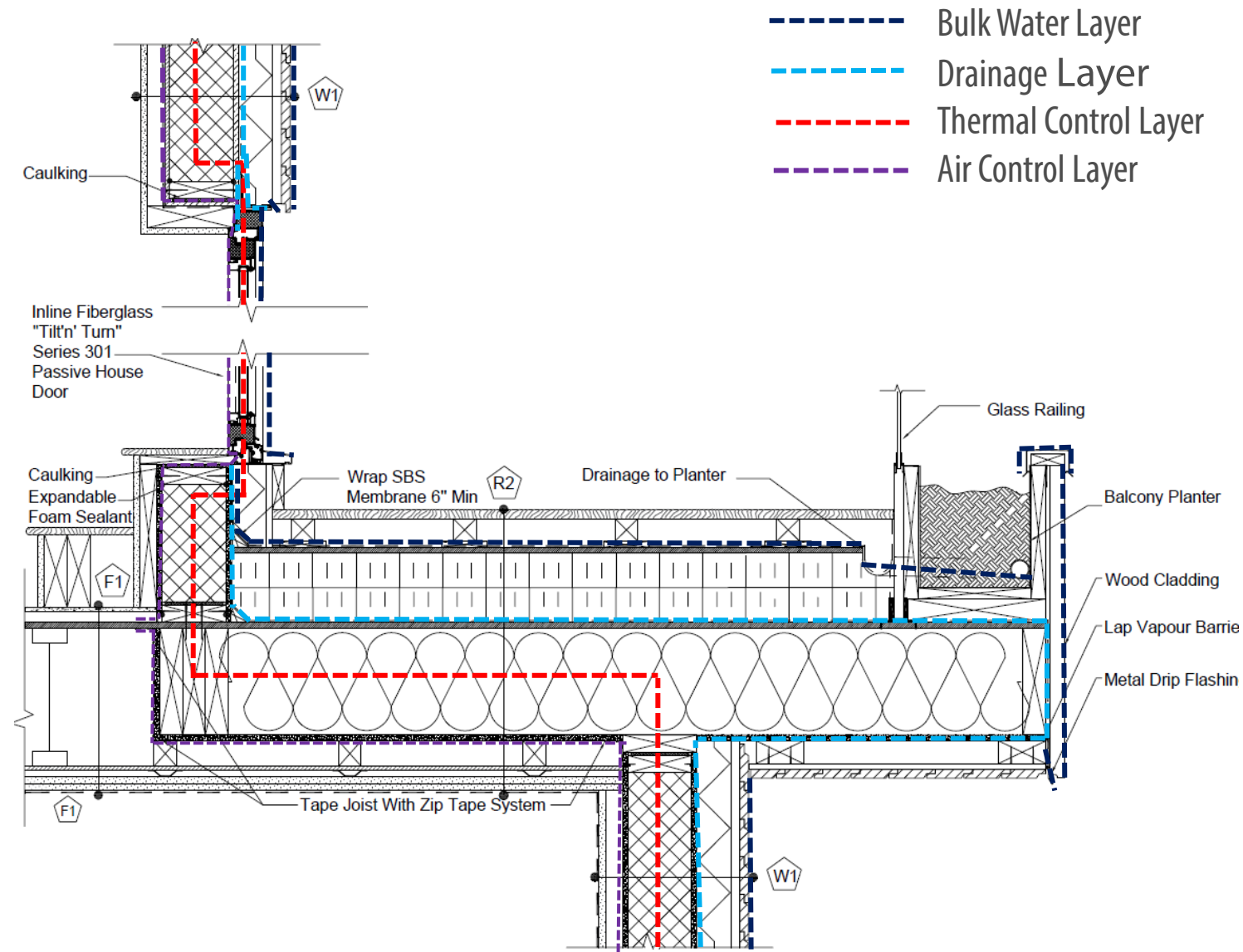
Structure : 6.25" Structurally Insulated Panels

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

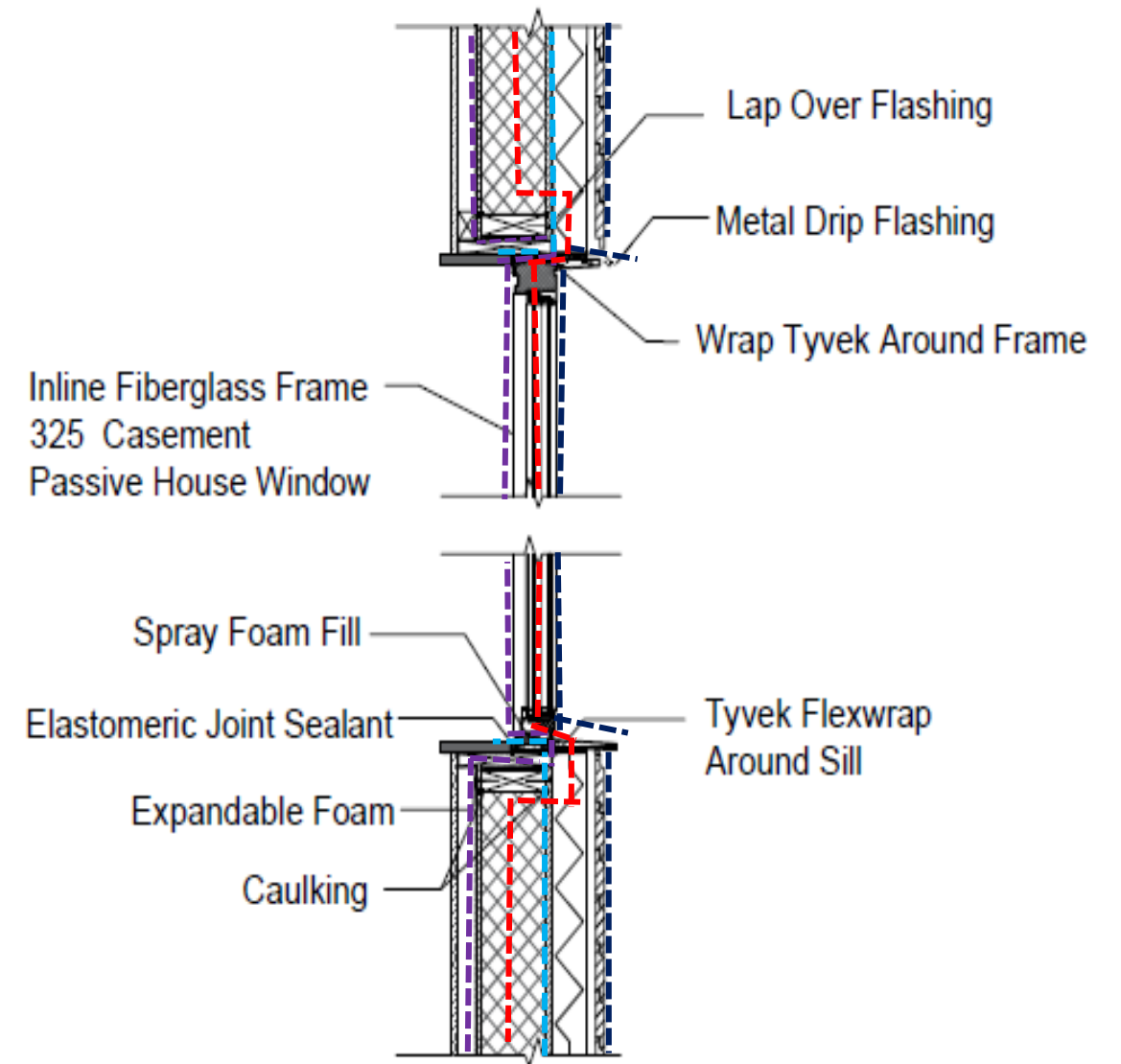
Air : SIPs + Tyvek House-Wrap

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

ENVELOPE DESIGN

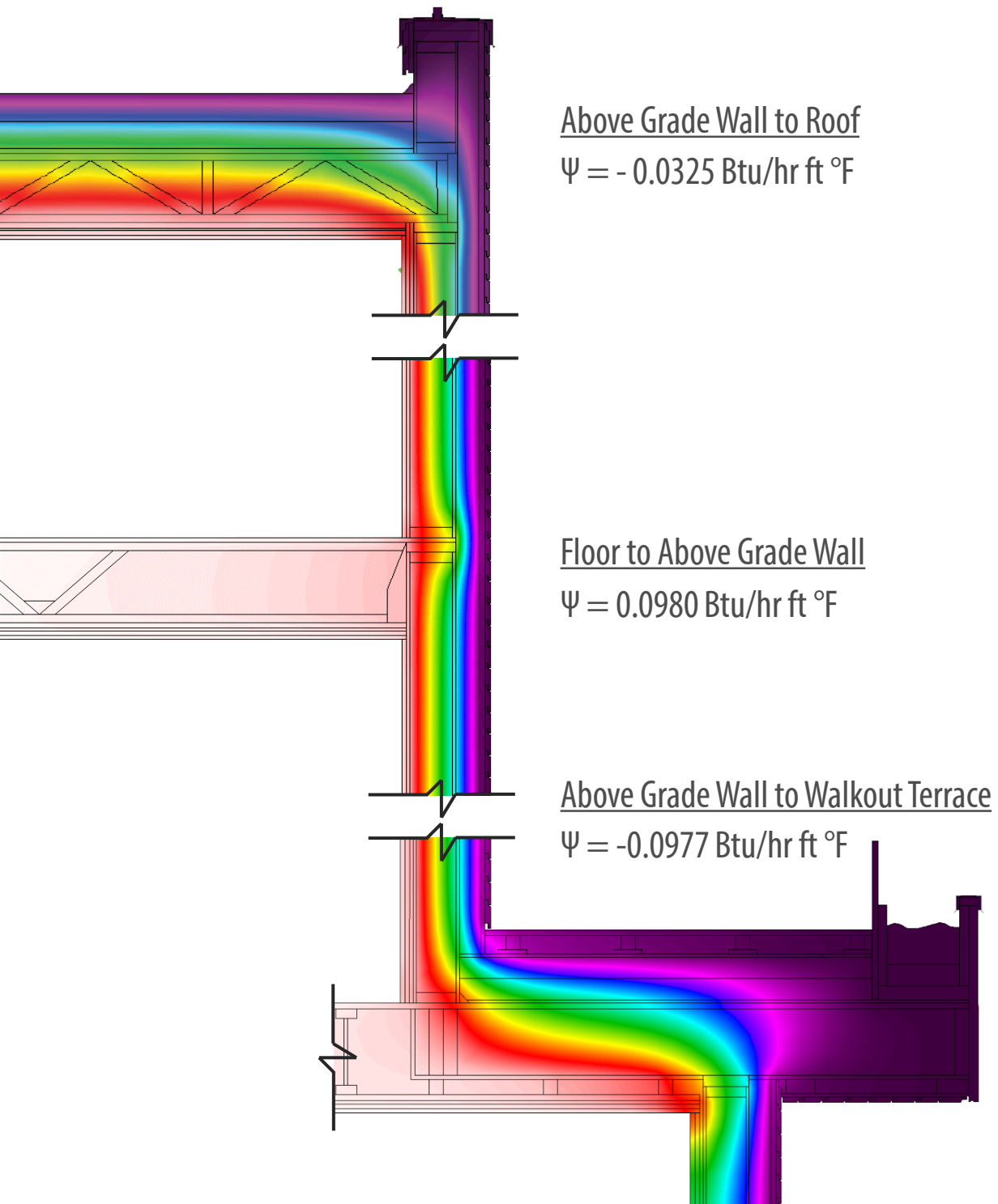


ABOVE GRADE WALL WINDOW-BALCONY DETAIL



ABOVE GRADE WALL WINDOW DETAIL

ENVELOPE DESIGN



THERMAL BRIDGING MITIGATION STRATEGIES

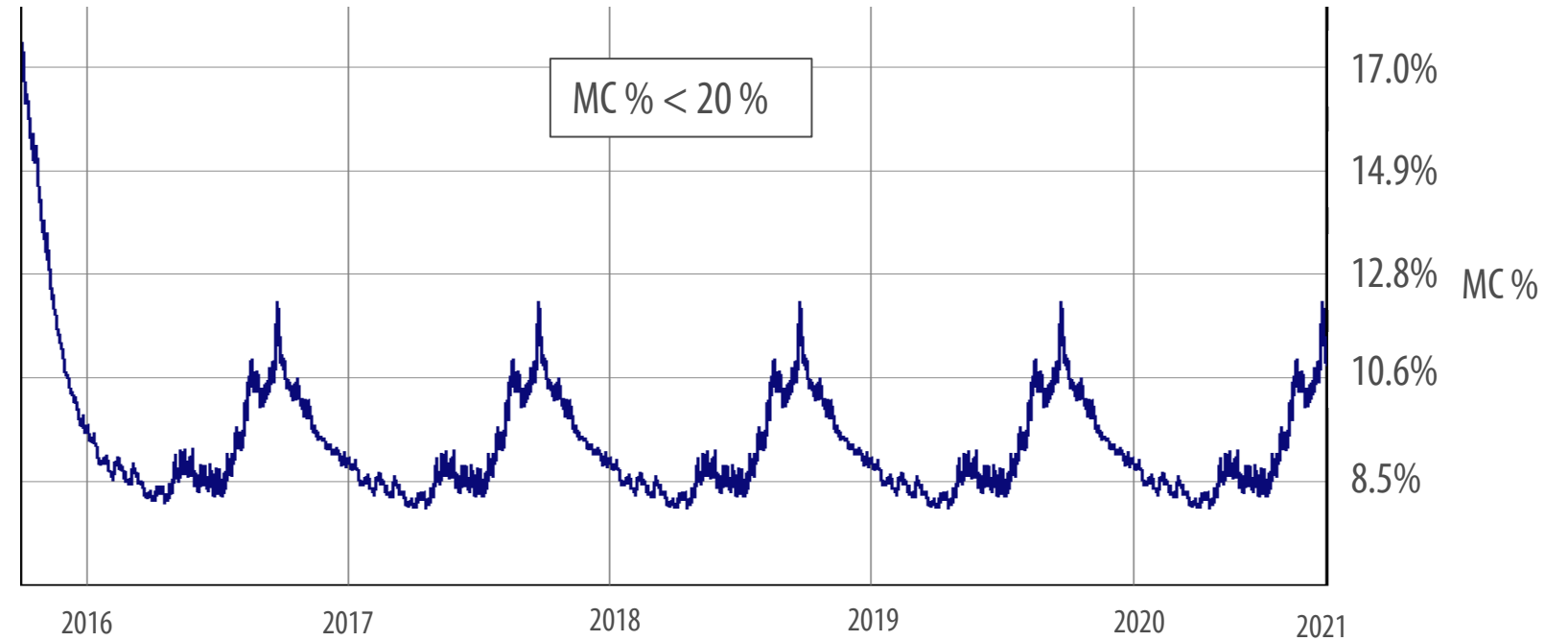
- Continuous Exterior Insulation
- Eliminate Framing Factor
- Maintain Thermal Continuity
- Assessed Locations with THERM

ENVELOPE DESIGN

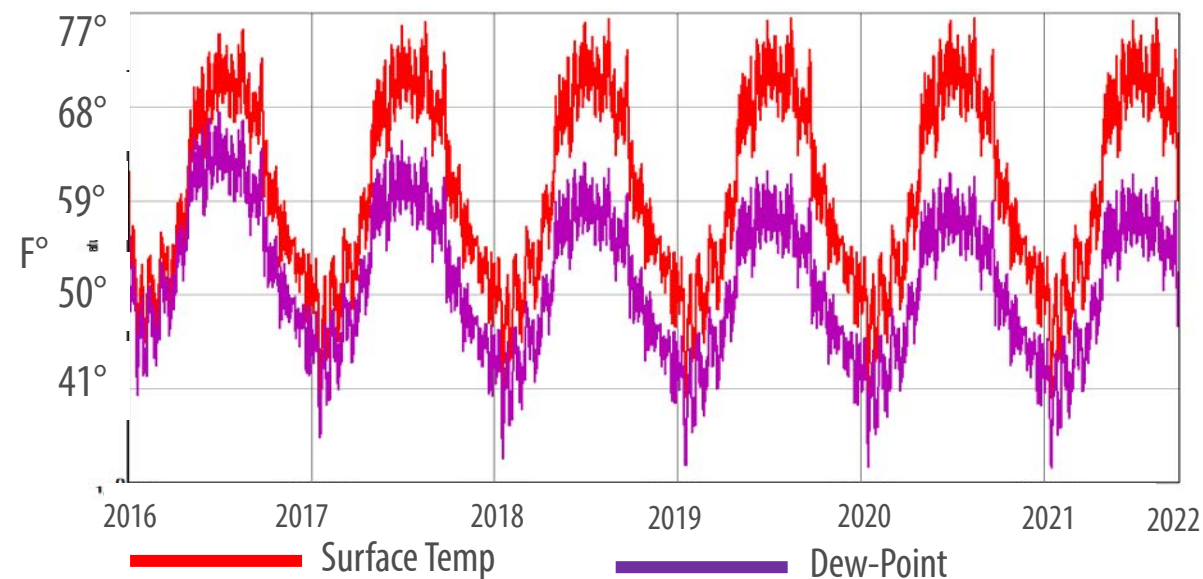
ENVELOPE DURABILITY STRATEGIES

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

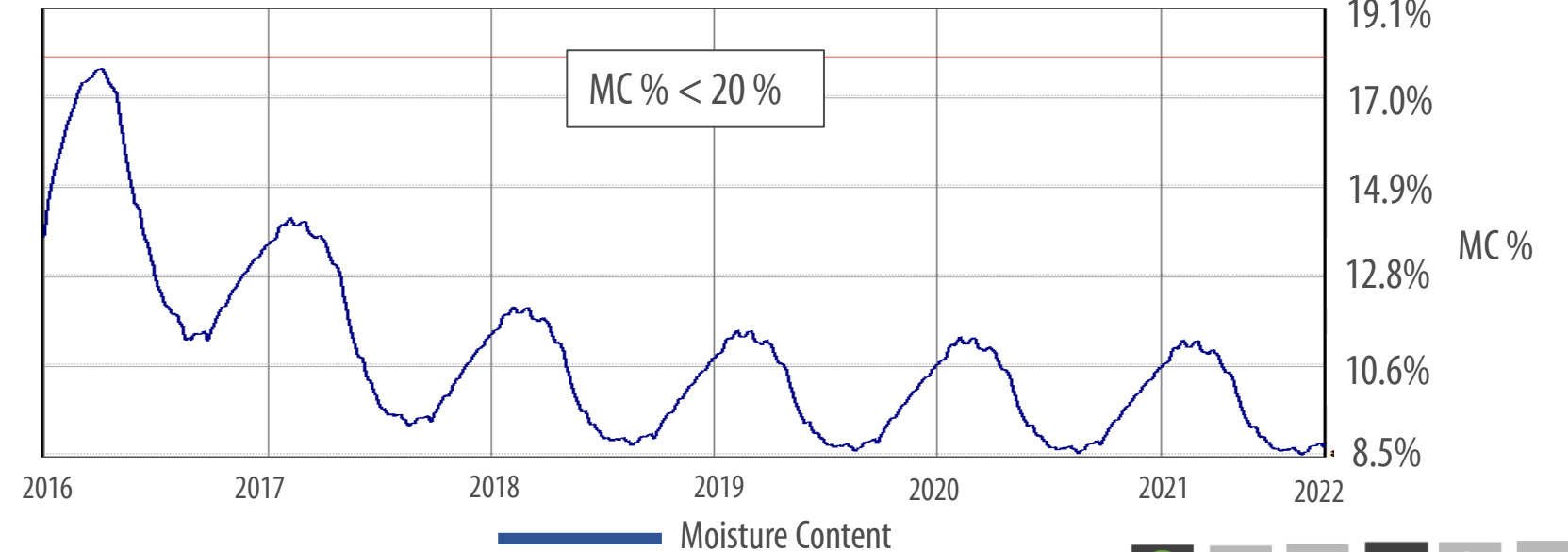
EXTERIOR OSB - SIPS



ROOF SHEATHING



ROOF SHEATHING

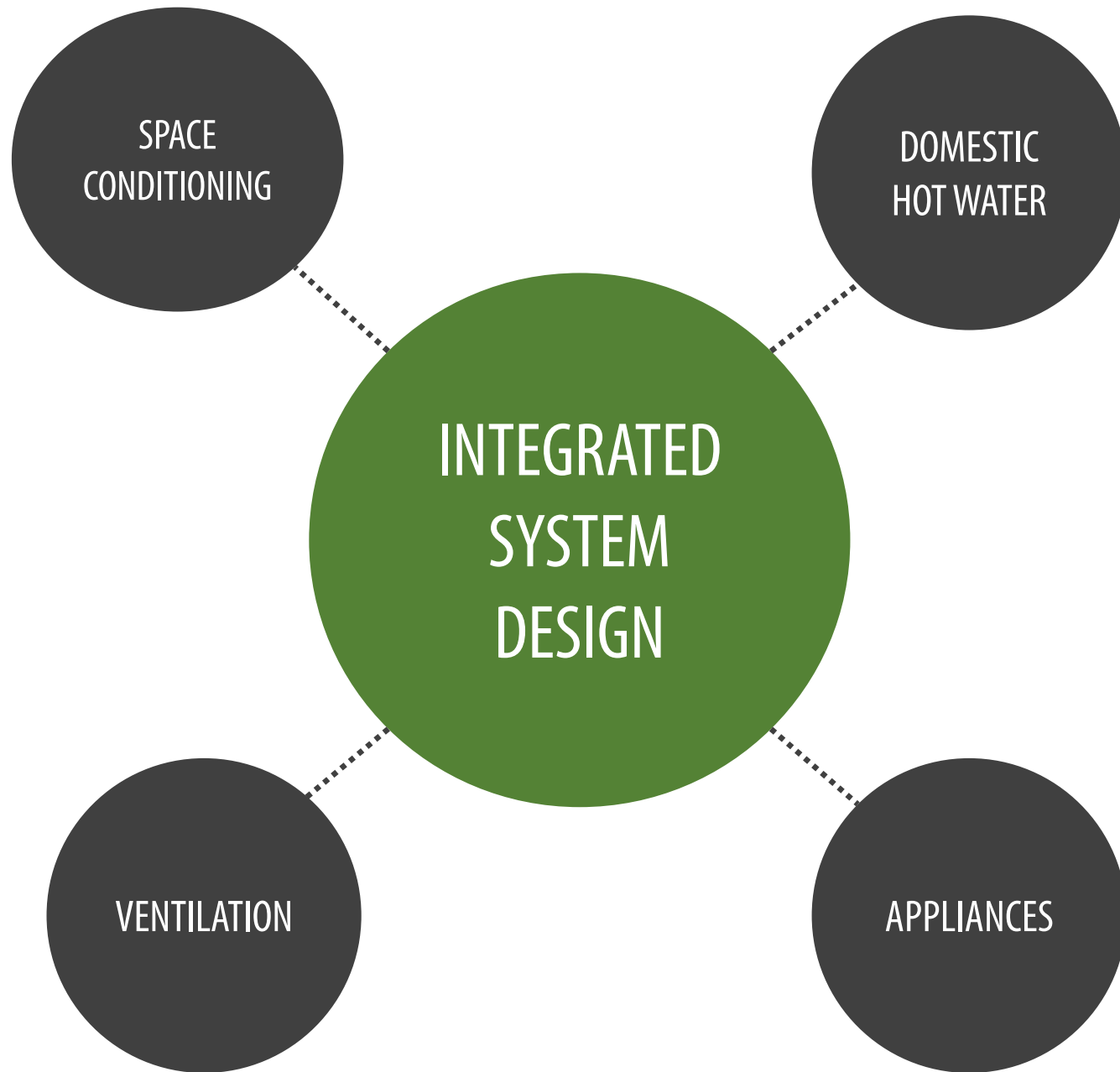


CONSTRUCTION AND QM STRATEGIES

- 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

TRUE NORTH DESIGN – EASTERN PINE
Q3 - QUALITY MANAGEMENT PLAN

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



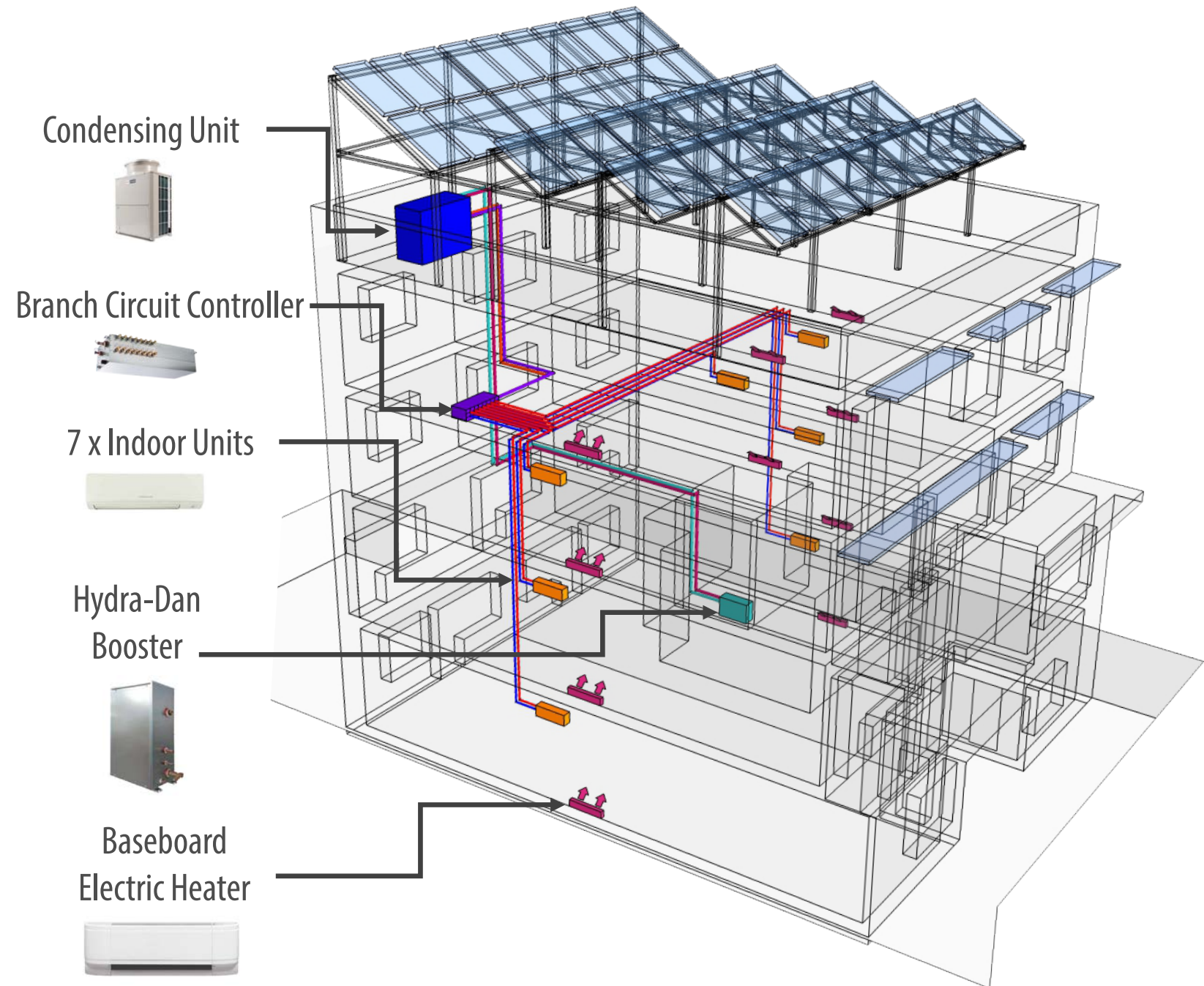
SYSTEM DESIGN GOALS

- High Performance System and Reduce Energy & Water Consumption and Emissions
- Efficiently Distribute Filtered and Fresh Air to All Units
- Meet EPA WaterSense Requirements
- Optimize the Integration of the DHW with Mechanical System
- Selection of ENERGYSTAR Qualified Products

SPACE CONDITIONING

VARIABLE REFRIGERANT FLOW SYSTEM

- Energy Efficiency
 - Inverter-driven Compressor
- Flexibility - Zoned Control
 - Maximum Occupant Control
- System Superiority
 - Reduced Service Space
 - 2-Pipe Refrigerant System
- Integrated Smart Monitoring
 - Tenant Billing



DOMESTIC HOT WATER

HOT WATER SYSTEM

- Integrated PWFY Hydronic Heat Exchanger in VRF System
- Hydra-Dan Booster Feeds DHW Tank
- Back-up 3kW Electric Heater Element



OUTDOOR UNIT



BC CONTROLLER

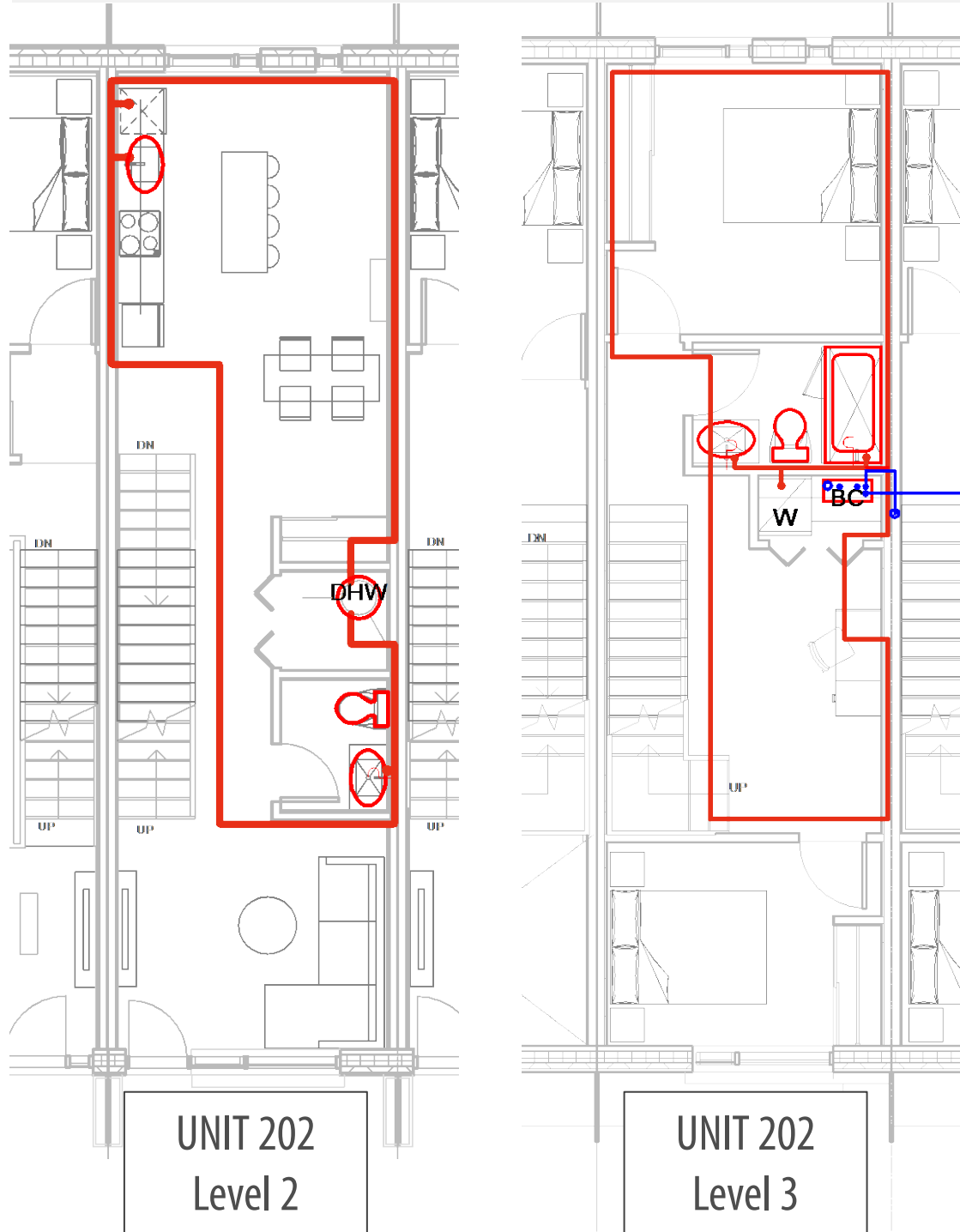


HYDRA-DAN BOOSTER UNIT



DAIKIN ALTHERMA DHW (52.8 GAL)

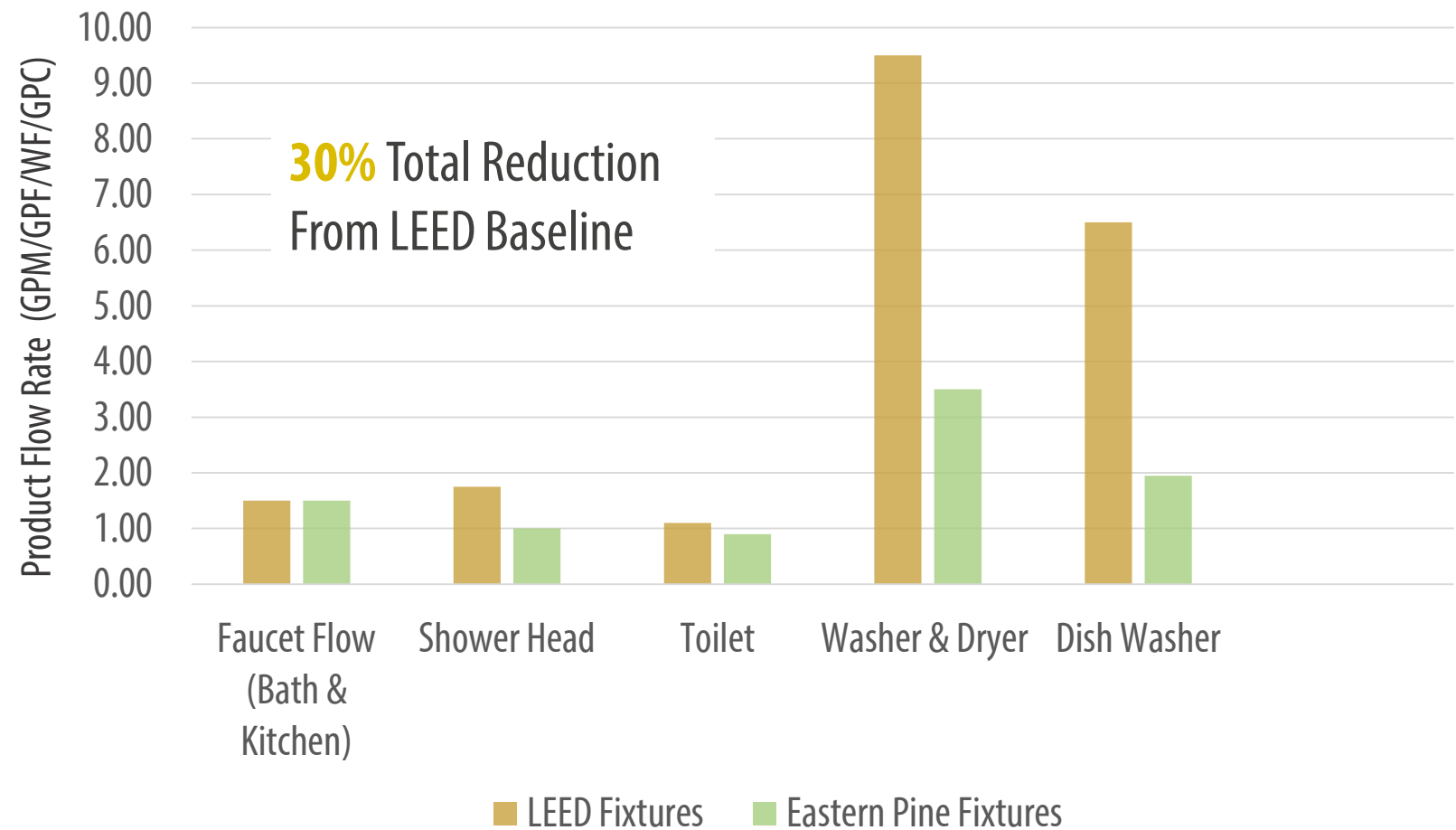
DOMESTIC HOT WATER



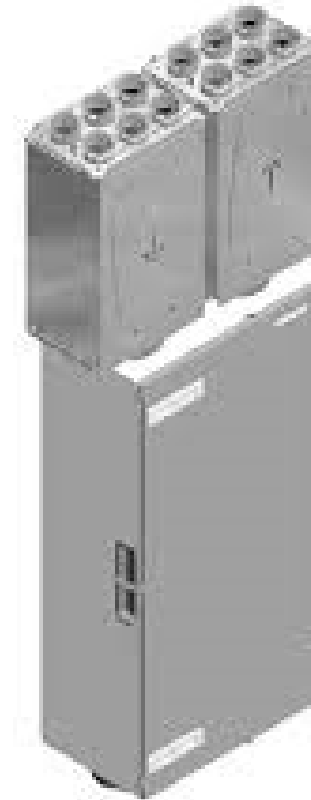
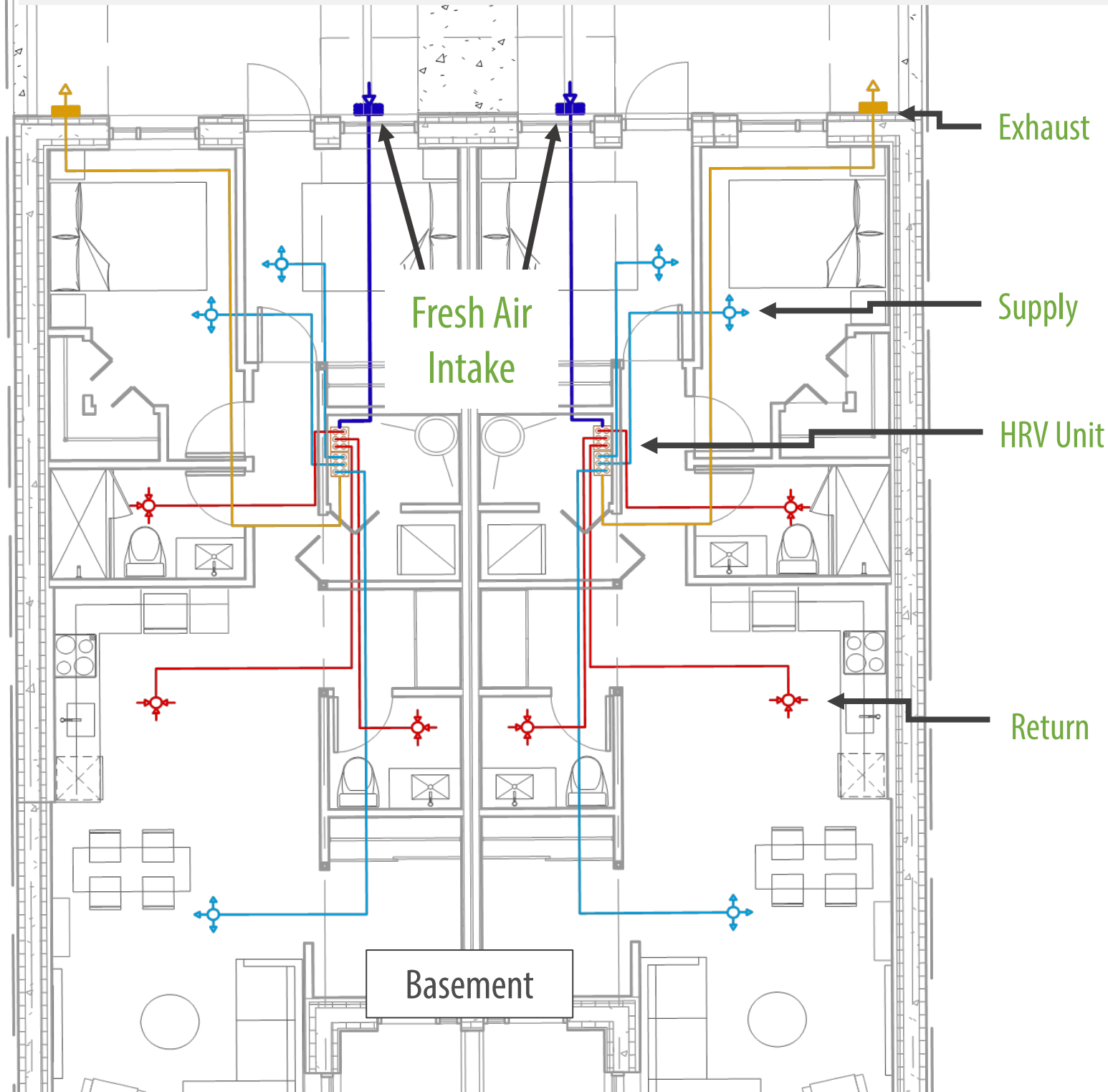
HOT WATER DISTRIBUTION

- Demand Initiated Recirculation System
- Meets EPA WaterSense Section 3.3 and ASPE standard

WATER CONSERVATION



VENTILATION



COMFOAIR 200 HRV



COMFOTUBES

VENTILATION DESIGN STRATEGIES

2012 IRC Ventilation Requirements

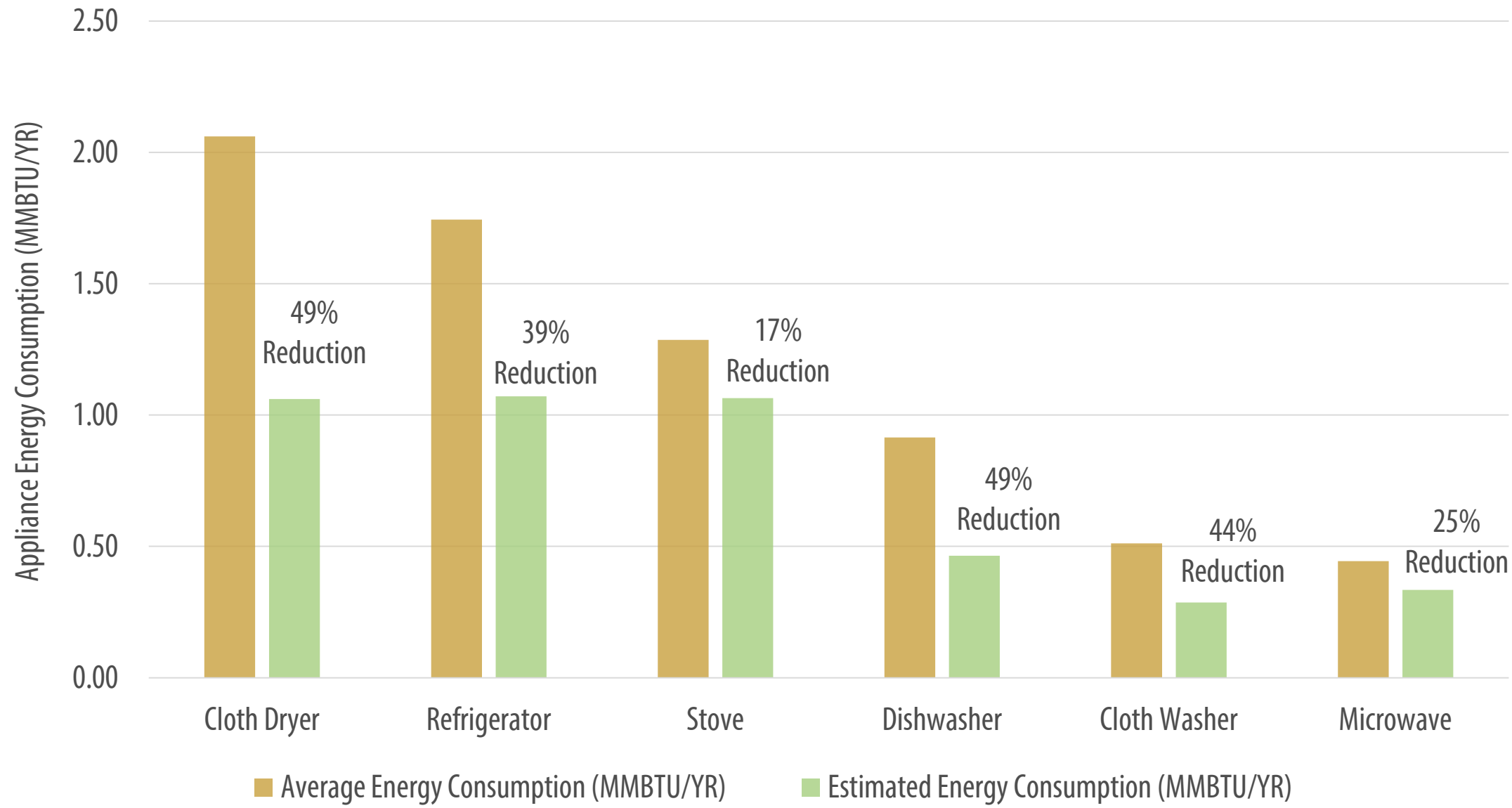
ComfoAir 200 HRV

- Exchangeable Core
- 92% Heat Recovery Eff.
- Optimal Exhaust Design
- 72 CFM at 60% Capacity
- Noise Mitigation
- CO₂ Sensors

Comfotubes

- Flexibility & Durable
- Ease of Installation

ENERGY SAVING APPLIANCES



- **38%** Reduction Compared to Average Appliances
- **18.8** MMBTU/year Energy Savings

ENERGY MODELLING

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

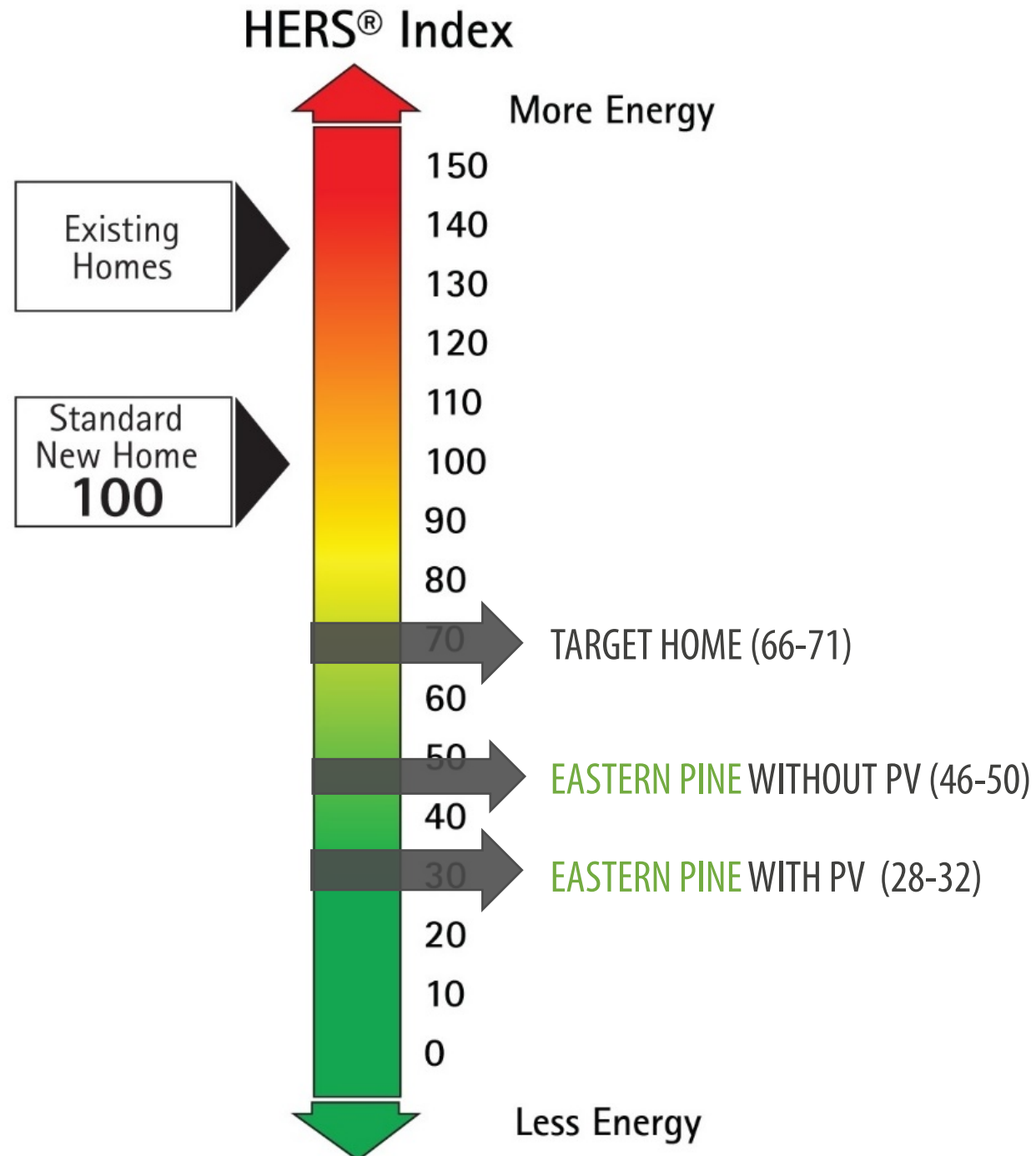
2. OPTIMIZATION MODEL

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

HERS RATING - REMRATE

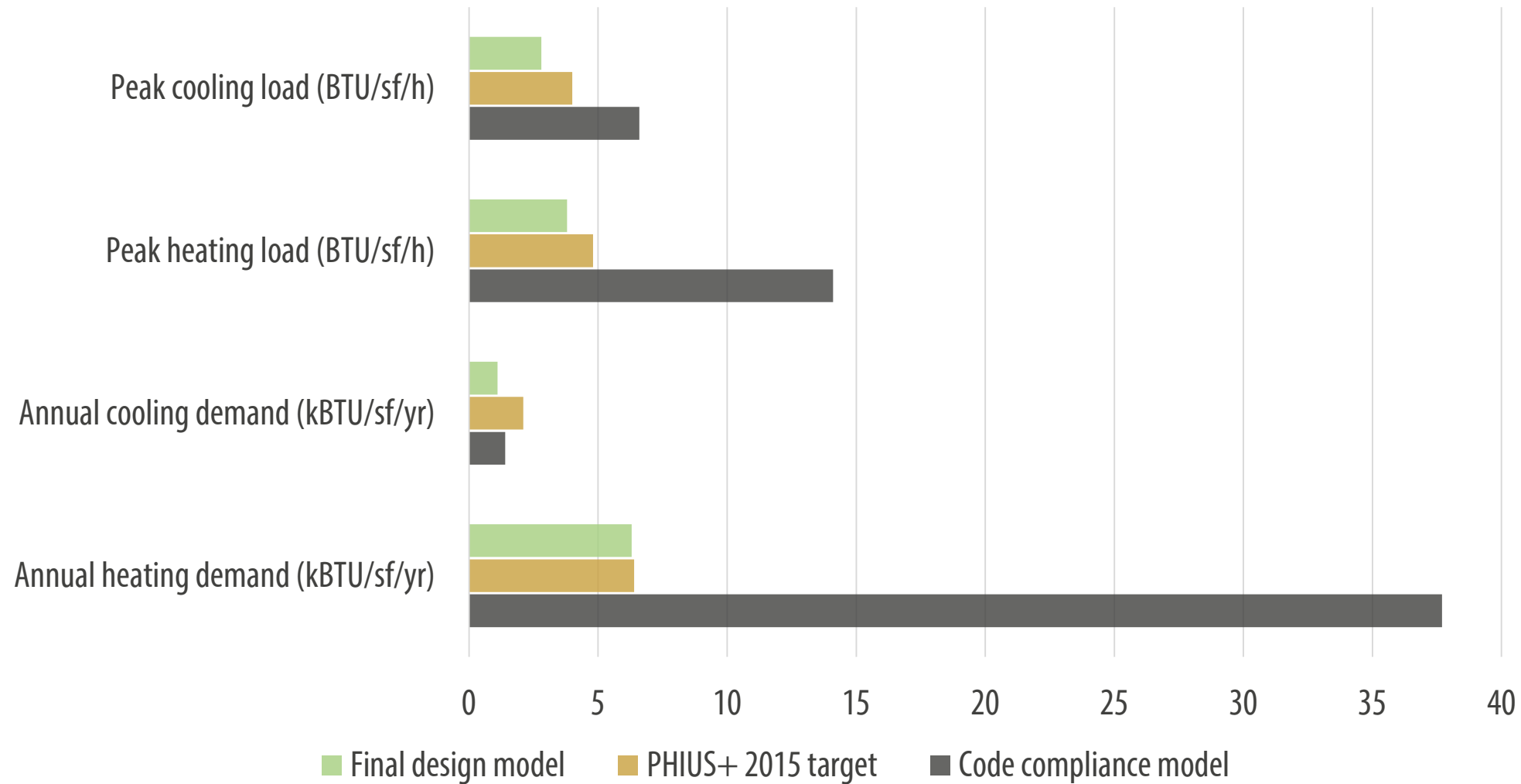


- Qualified for DOE **ZERO ENERGY READY HOME**
- **22** LEED scores



ENERGY RESULTS

Final Design Model vs. Code Compliance Model



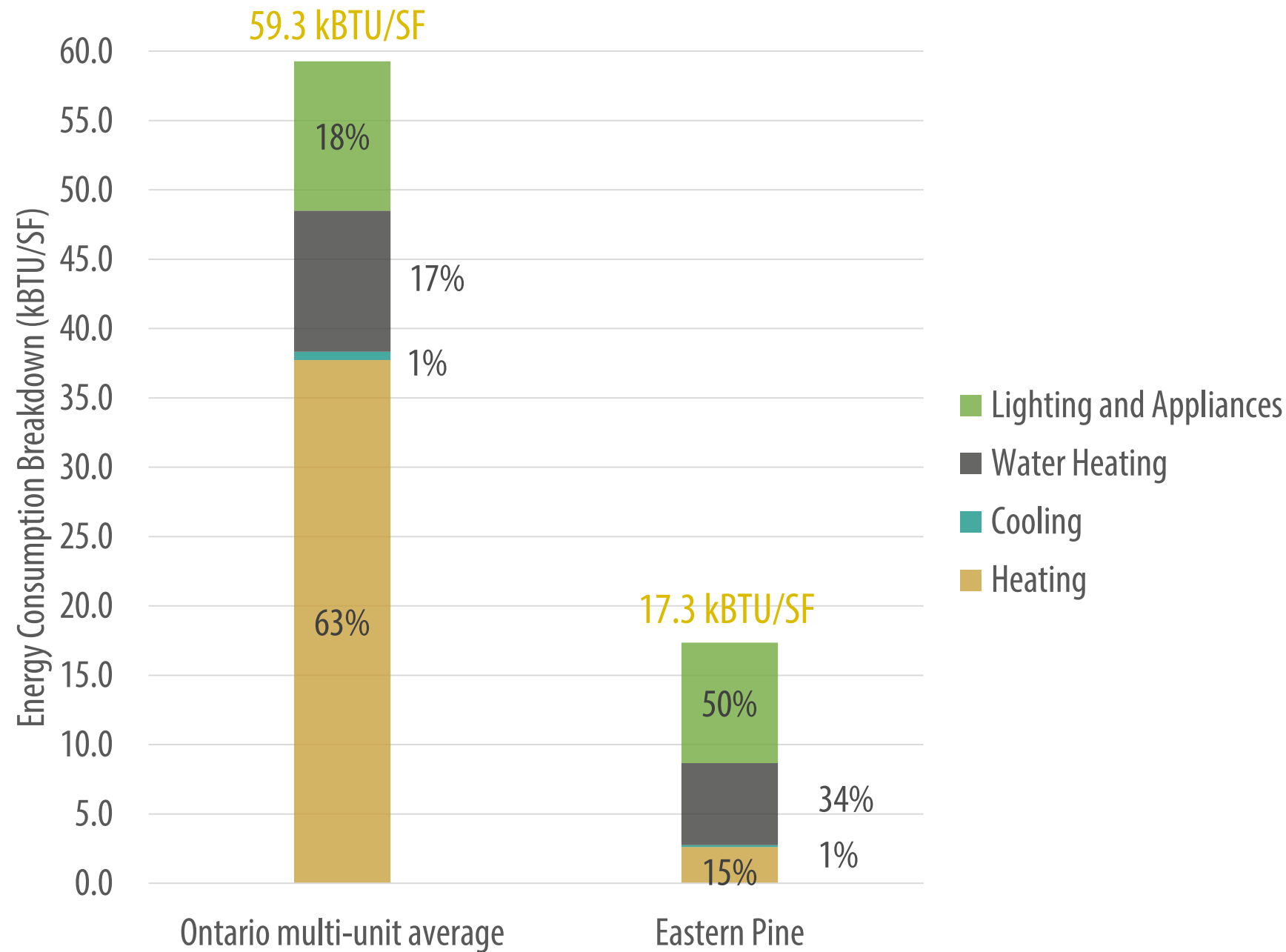
The Improvement is a Combination of

- **Well Insulated** Envelope
- **Better Sized** Systems
- **Optimized** PV Generation



ENERGY CONSUMPTION RESULTS

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

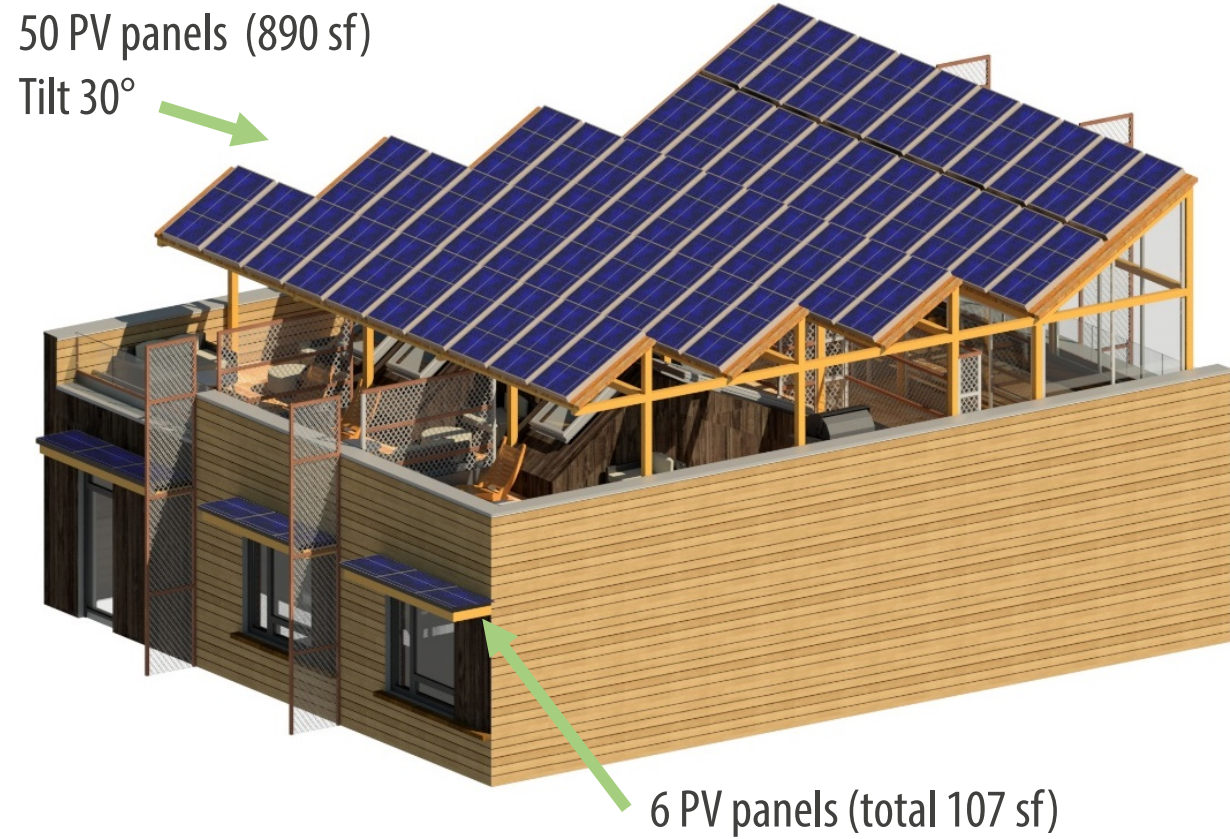


Total Energy Use

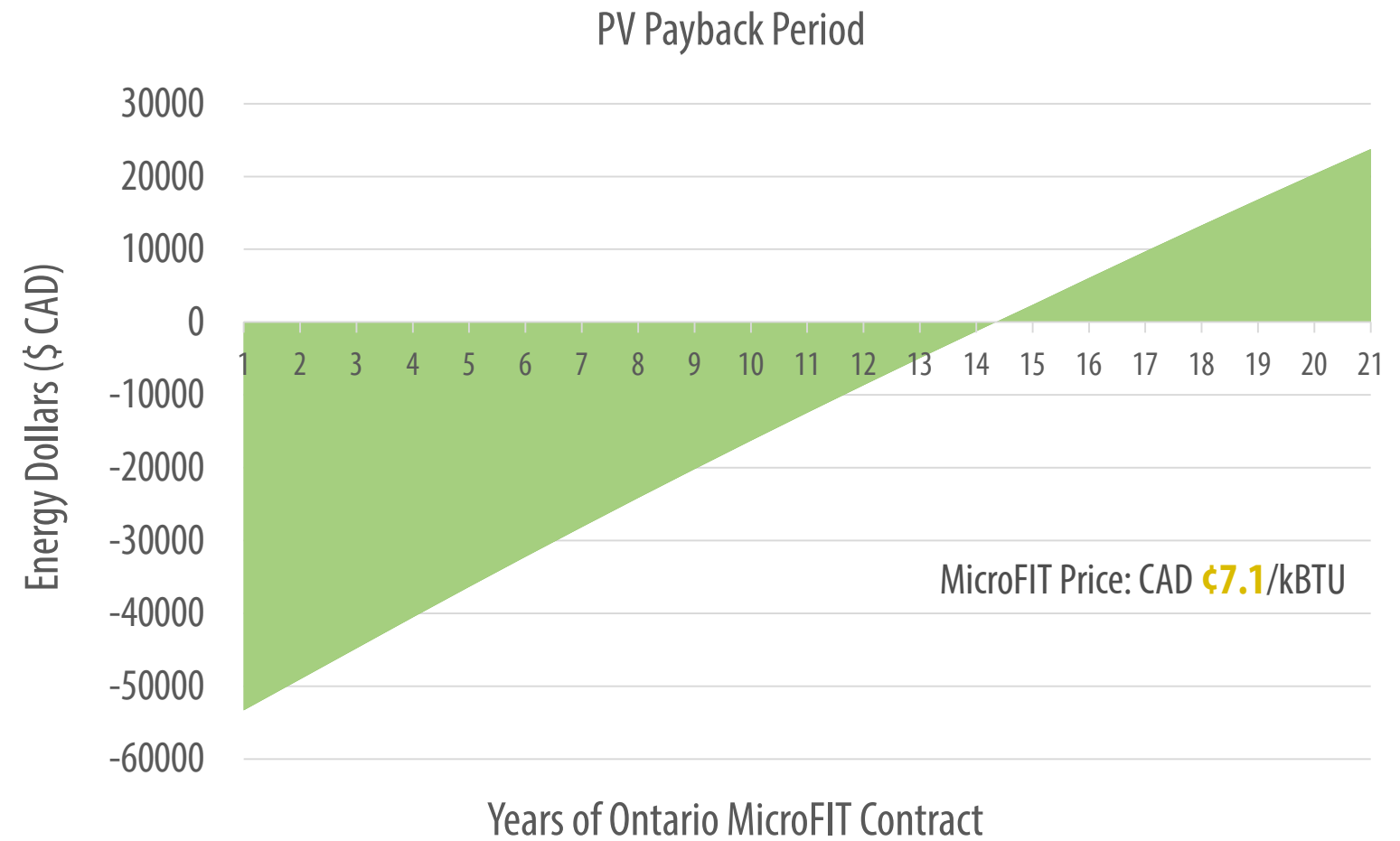
- **100.2** MMBTU/yr (with PV)
- **152.4** MMBTU/yr (without PV)
- **70% Reduction** from Ontario Average



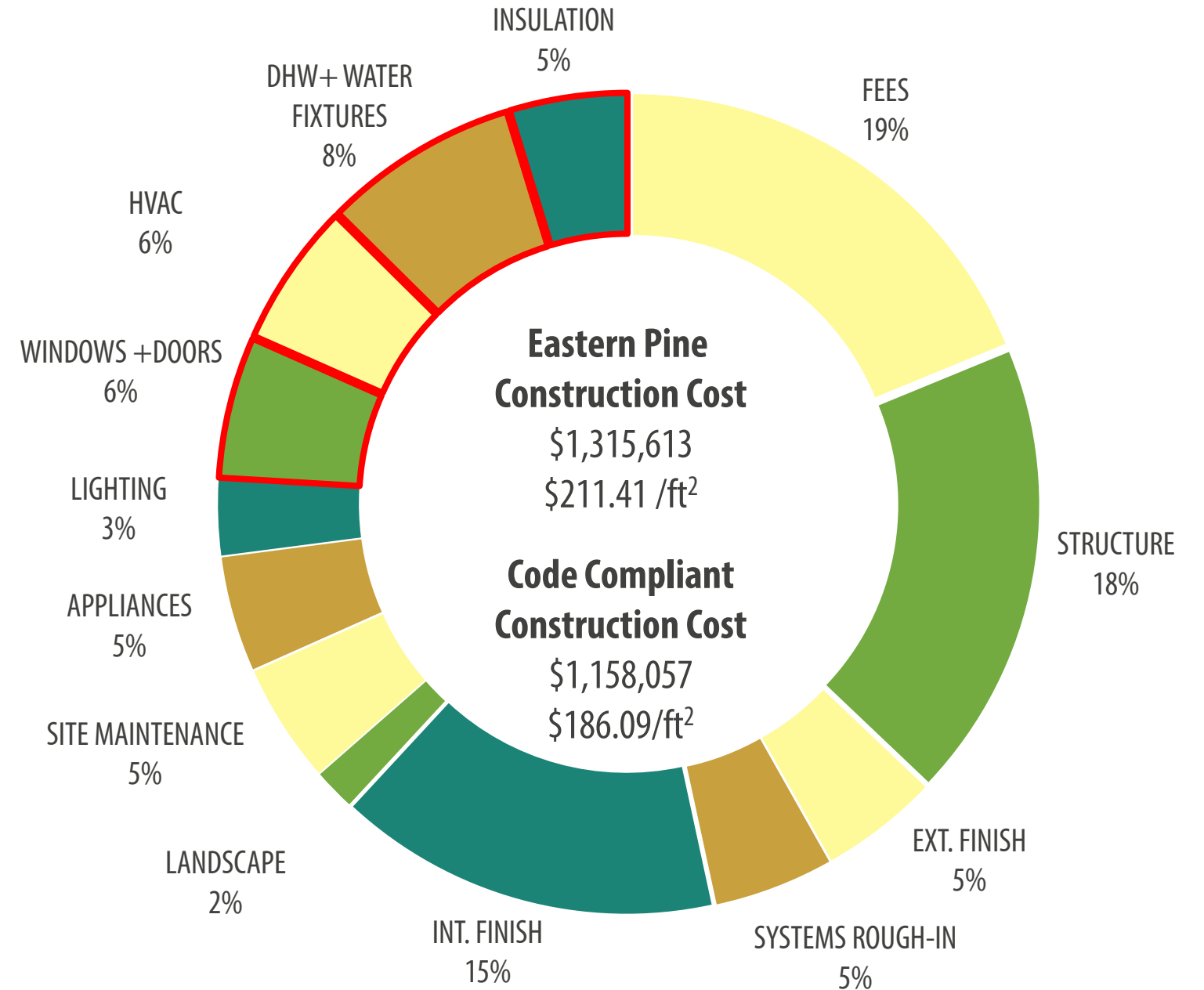
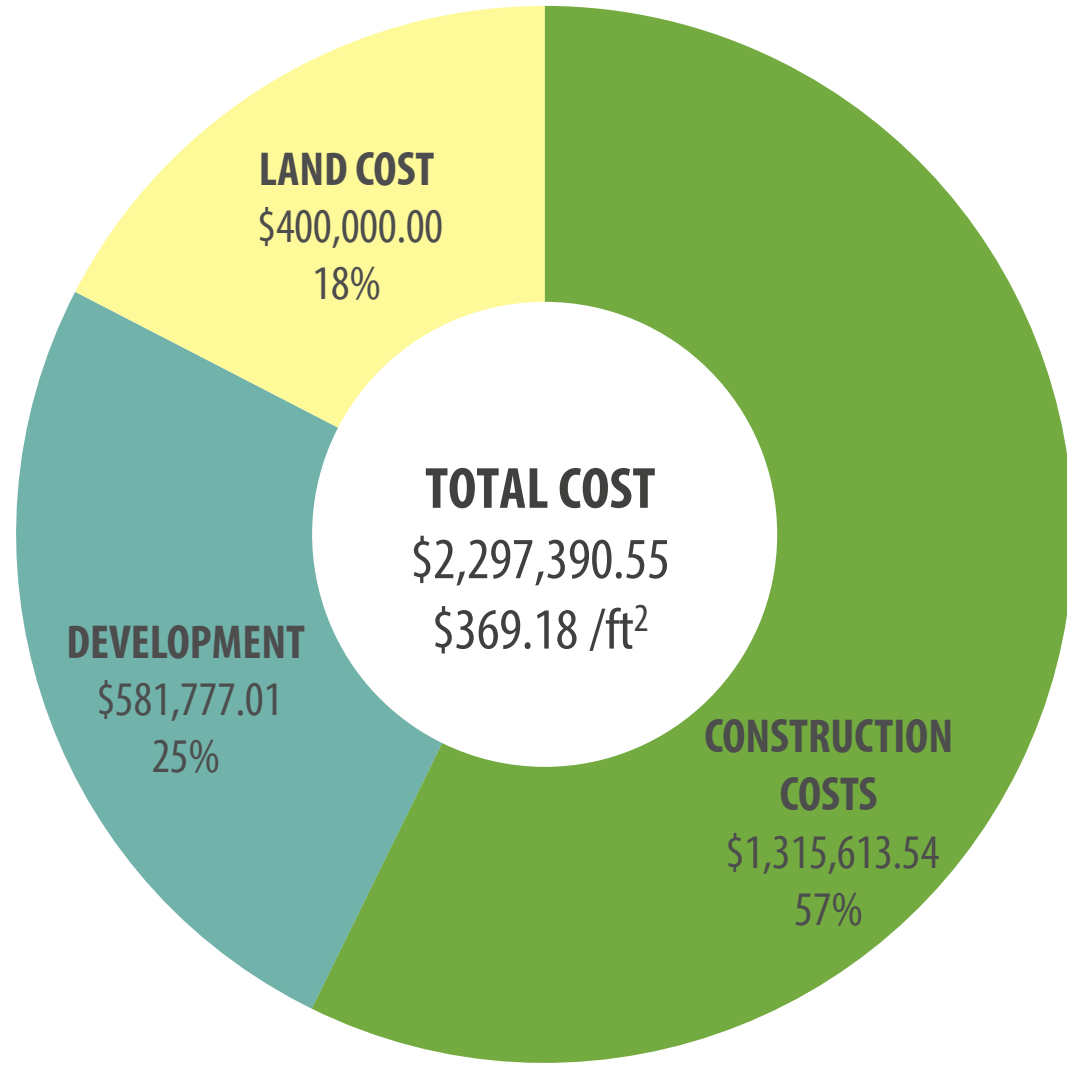
RENEWABLE ENERGY



- Total Generation: **52** MMBTU/year
- **33.3%** of Total Energy Consumption

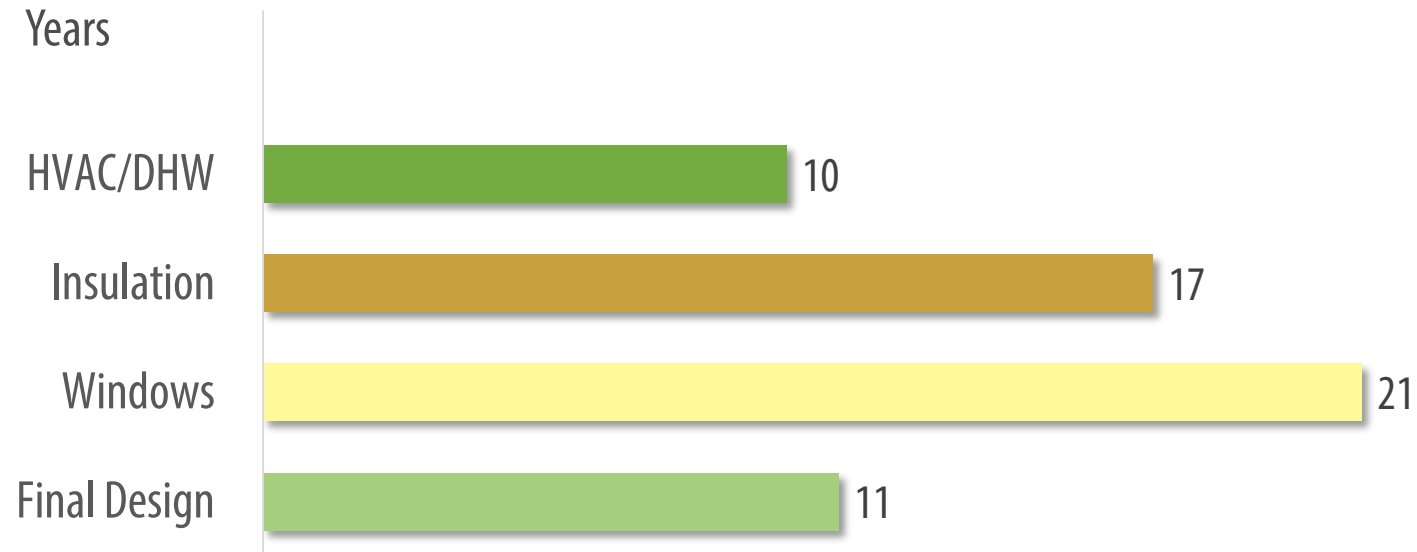


FINANCIAL ANALYSIS

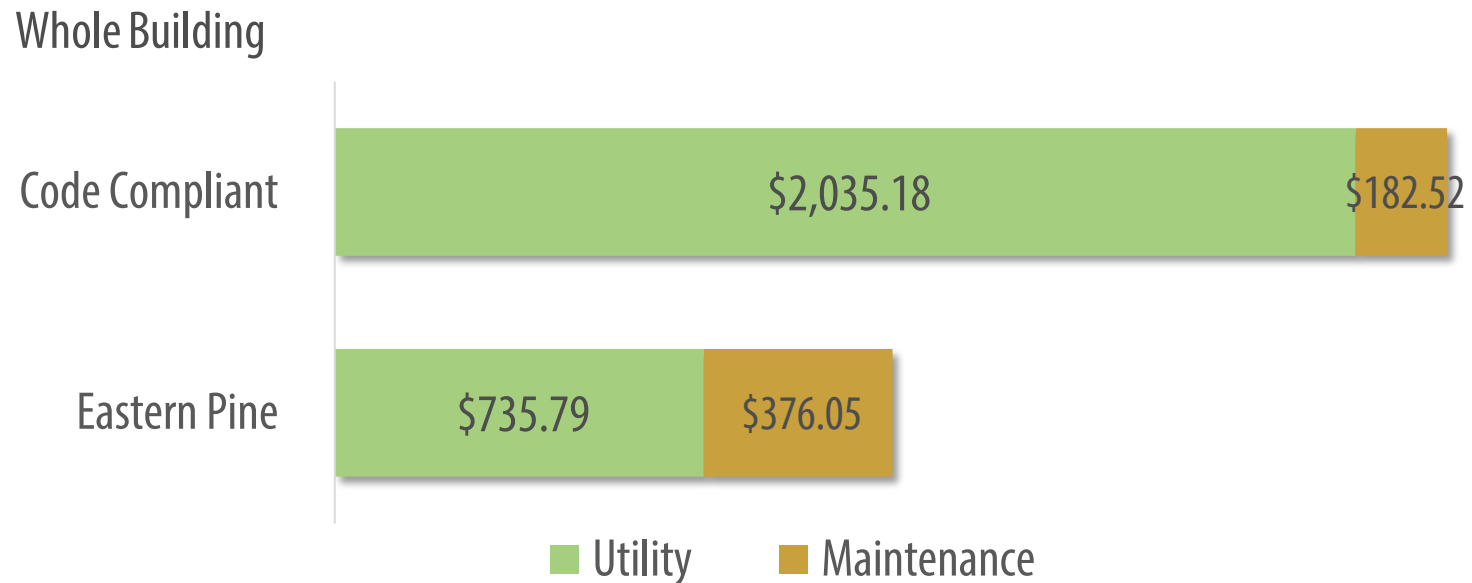


FINANCIAL ANALYSIS

COMPONENT PAYBACK

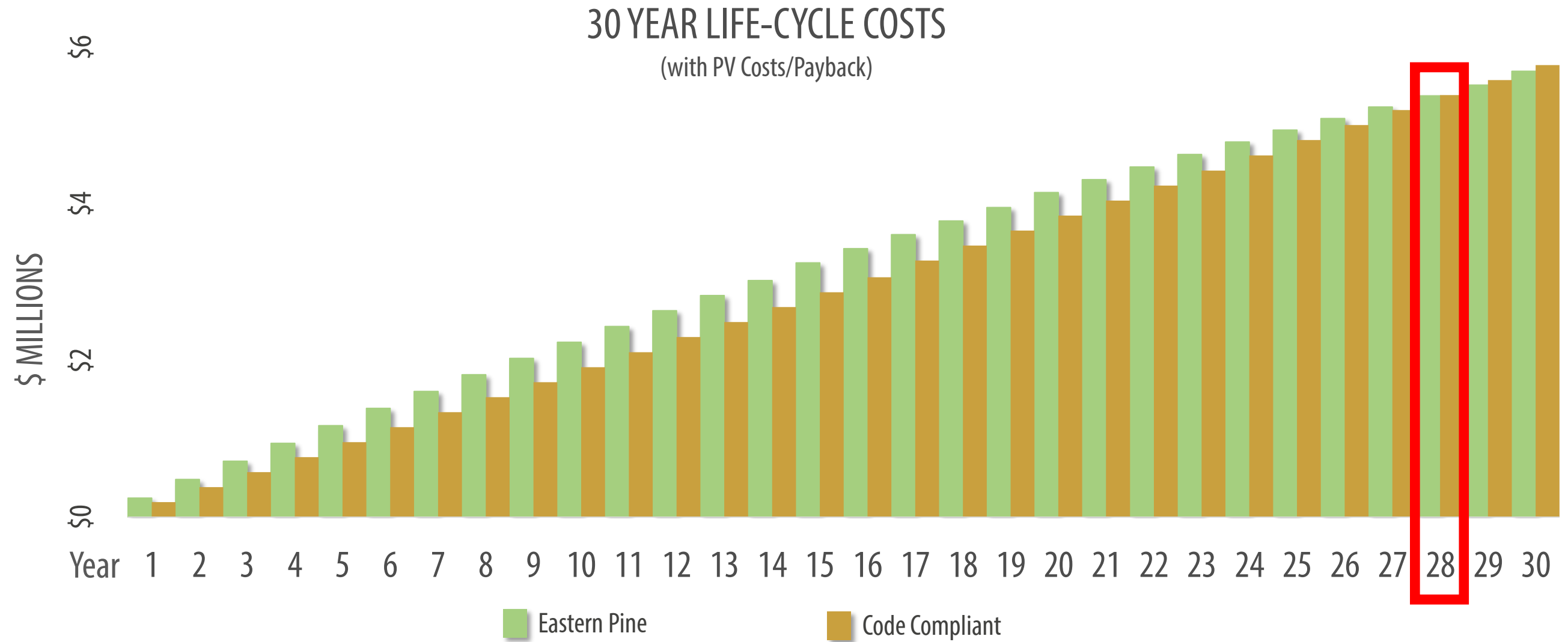


MONTHLY OPERATION



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]

