



THE HARVEST HOME

U.S. DEPARTMENT OF ENERGY
CHALLENGE HOME STUDENT DESIGN COMPETITION

2014 Grand Award



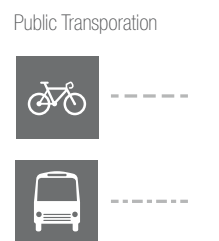
Matthew Tokarik, Patrick Andres , Matt Carlsson , Antonio Cunha , Mark Grimsrud , Denver Jermyn , Moe Otsubo, Matthew Suriano, Filip Tisler, Germán Vaisman. They were supported by faculty - Mark Gorgolewski, Paul Floerke, Russell Richman, Vincent Hui, Vera Straka from The Department of Architectural Science at Ryerson University.



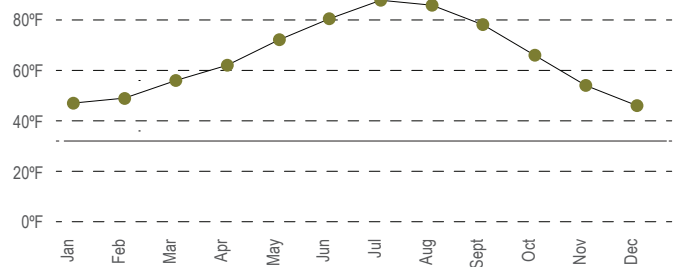
Aerial View to South West



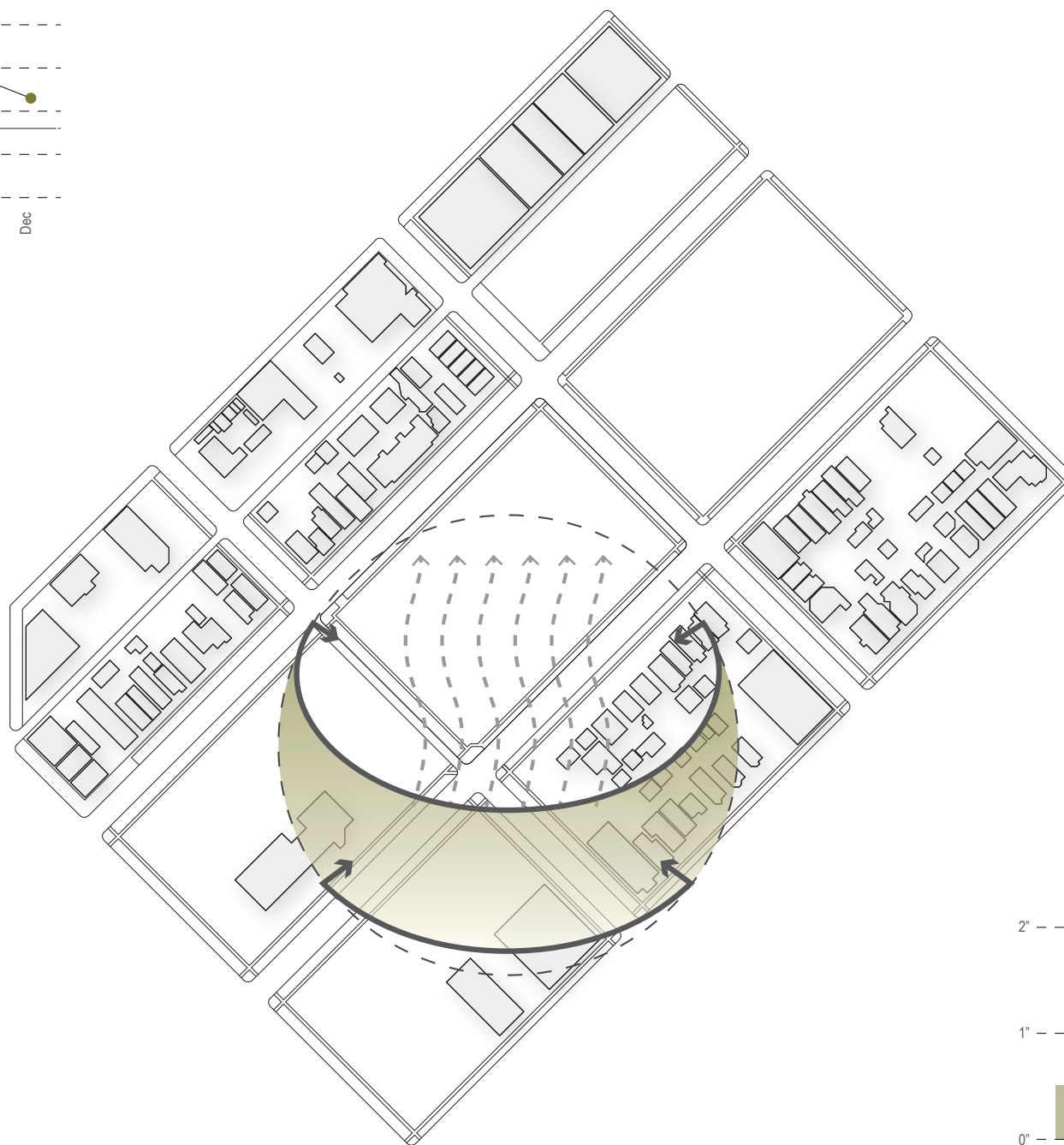
- Fire Station
- Urban Garden
- Place of Worship
- Restaurant & Bar
- Educational Facilities
- Gym & Fitness Center
- Arts & Entertainment Complex
- Employment and Office Centers
- Supermarket & Convenience Store



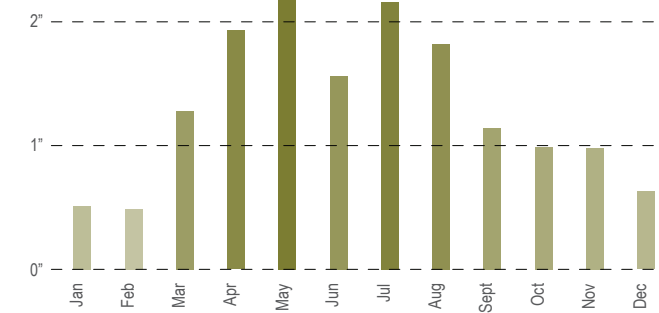
Area Plan - Existing



Monthly Average Temperature



Area Plan - Solar Orientation & Prevailing Winds



Monthly Average Precipitation



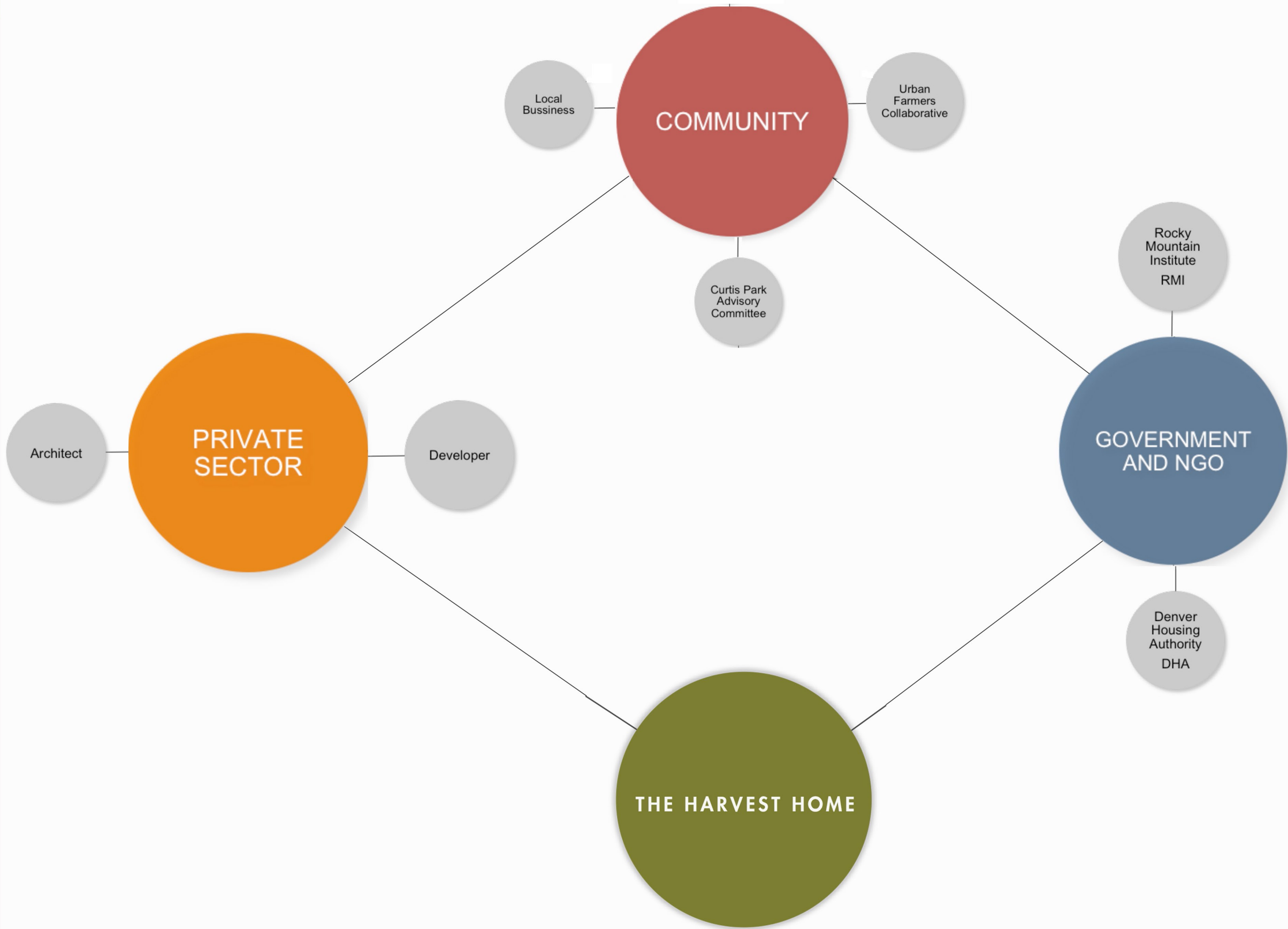


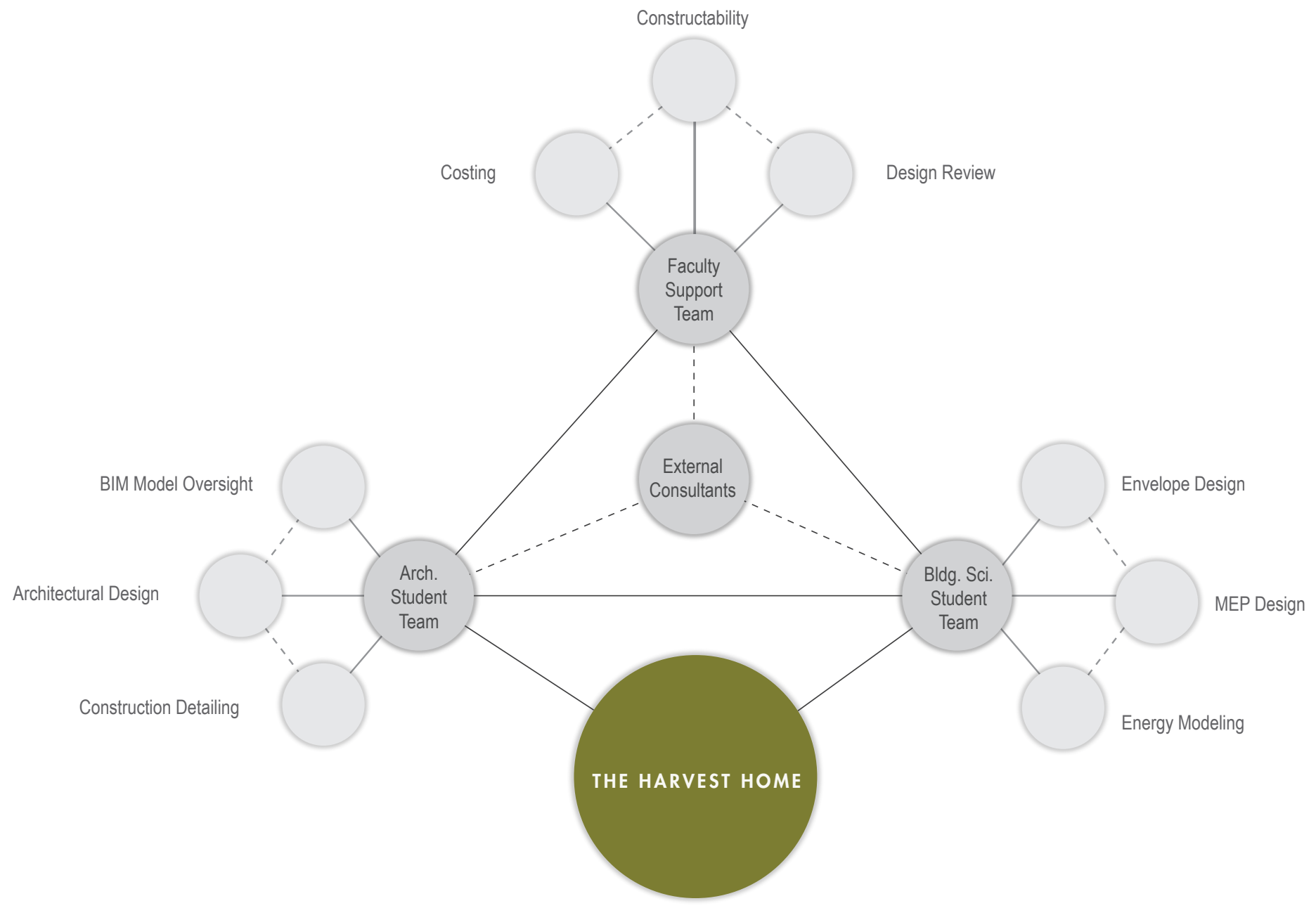




Area Plan - Proposed









Design a **cost-effective** response allowing the average Denver family to purchase, operate and maintain a sustainable home.



Incorporate **flexible** interior



Meet or exceed the requirements and standards outlined for certification by the **Passive House** Institute United States (PHIUS+).



Create a **net-zero ready** home



Employ **traditional construction methods** coupled with readily available on-the-market materials, finishes, equipment and appliances..

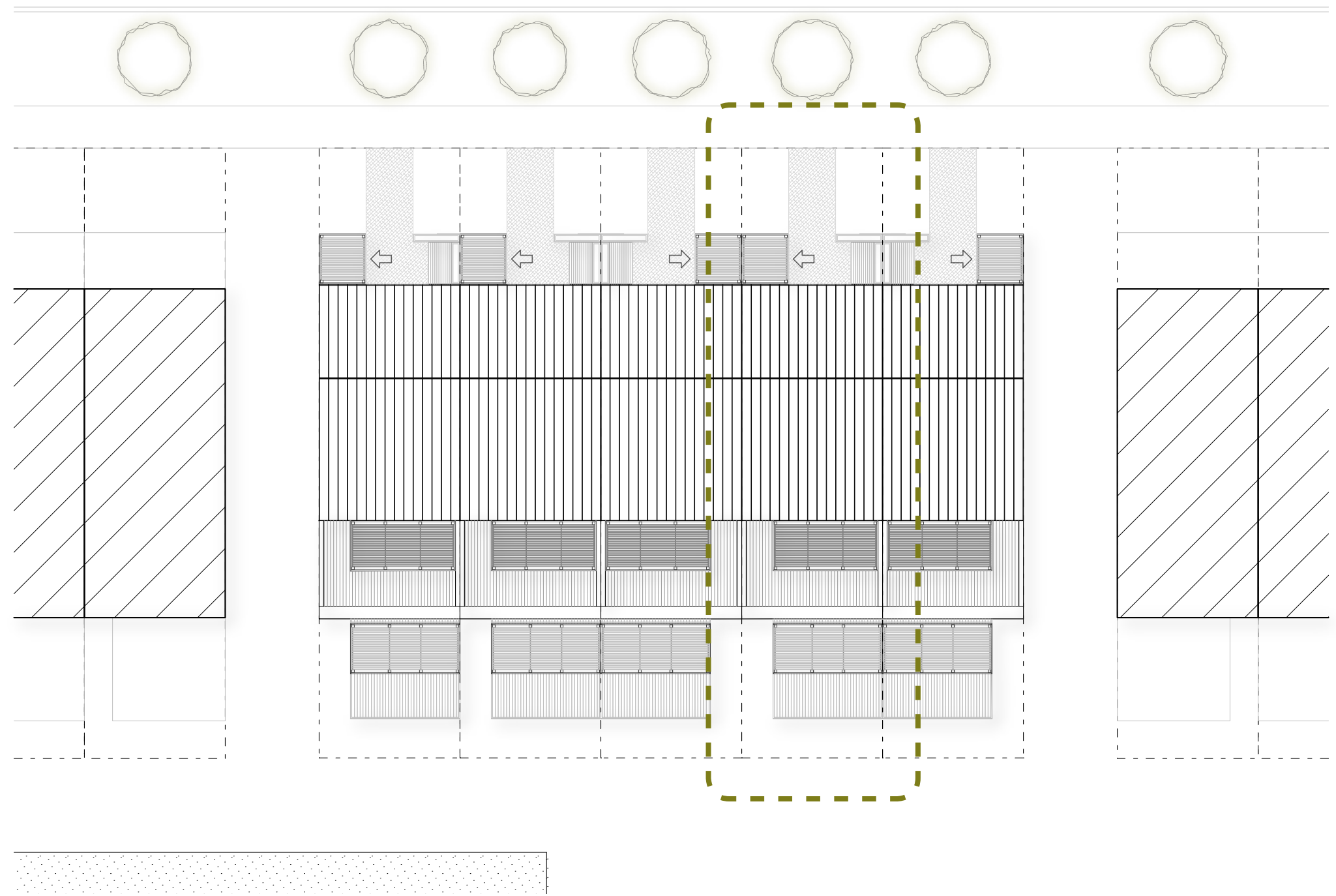


Design the **building envelope** to be air-tight and thermal bridge free throughout.



Frontage at Lawrence Street

Lawrence Street



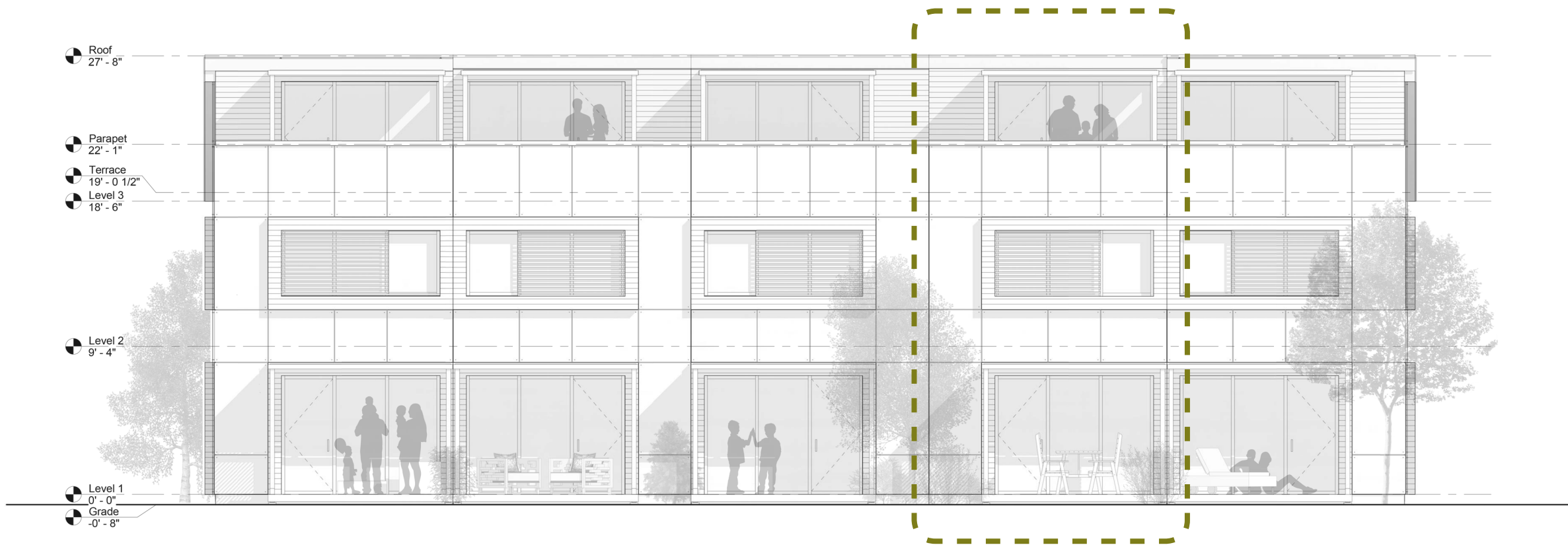
Site Plan - Proposed





Row Elevation - North

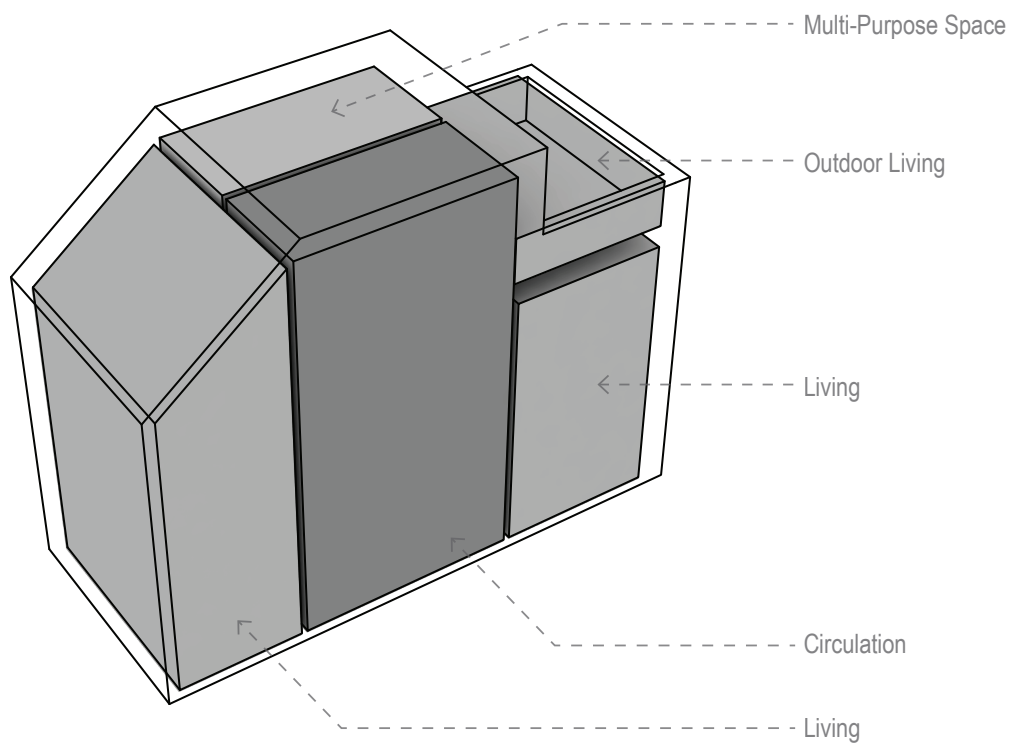




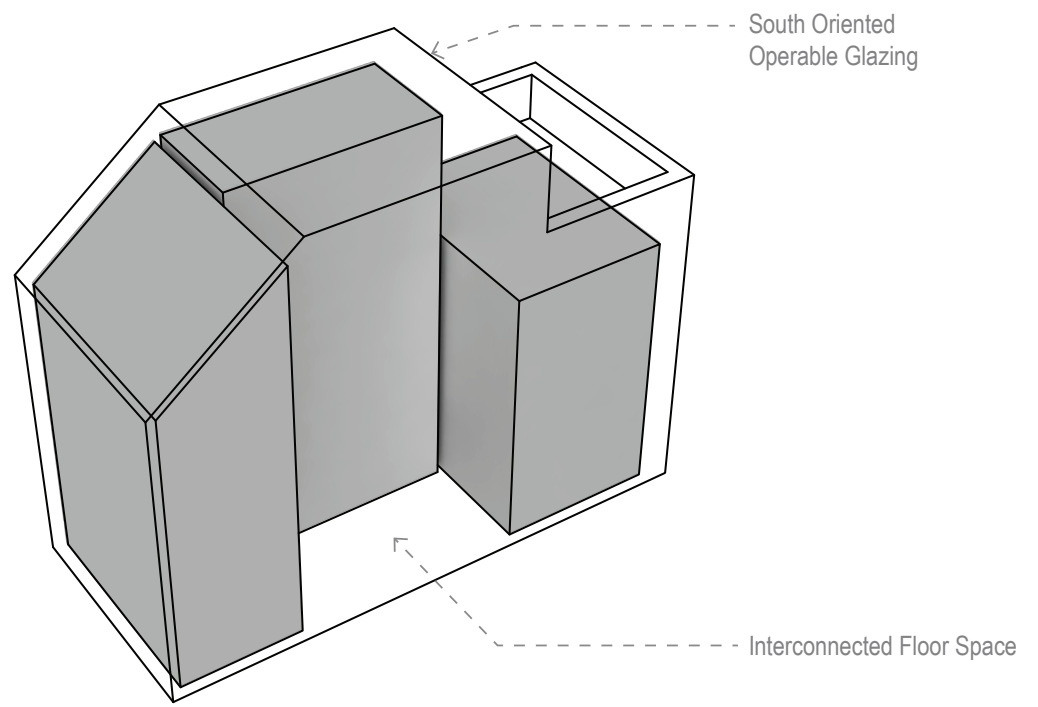
Row Elevation - South



CONCEPTUAL MASSING

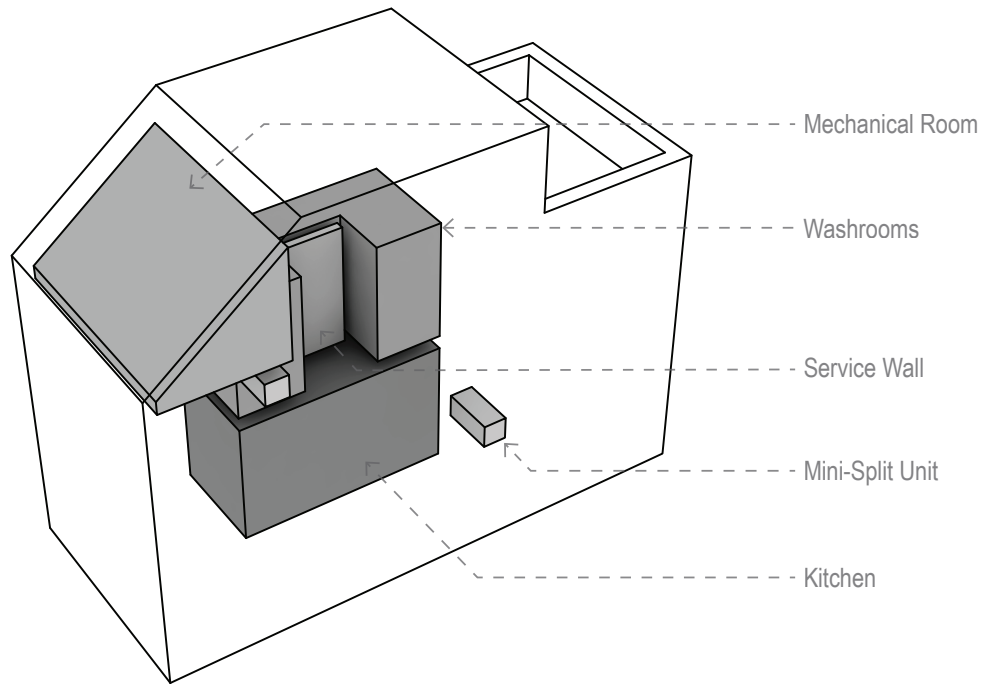


Interior Program Massing

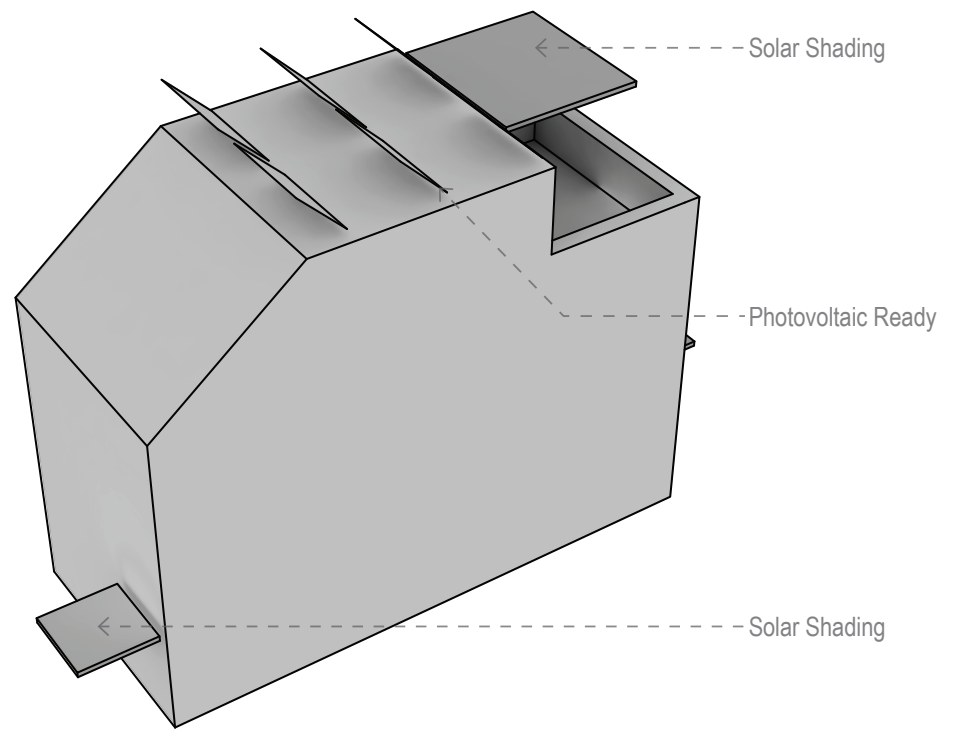


Central Stair

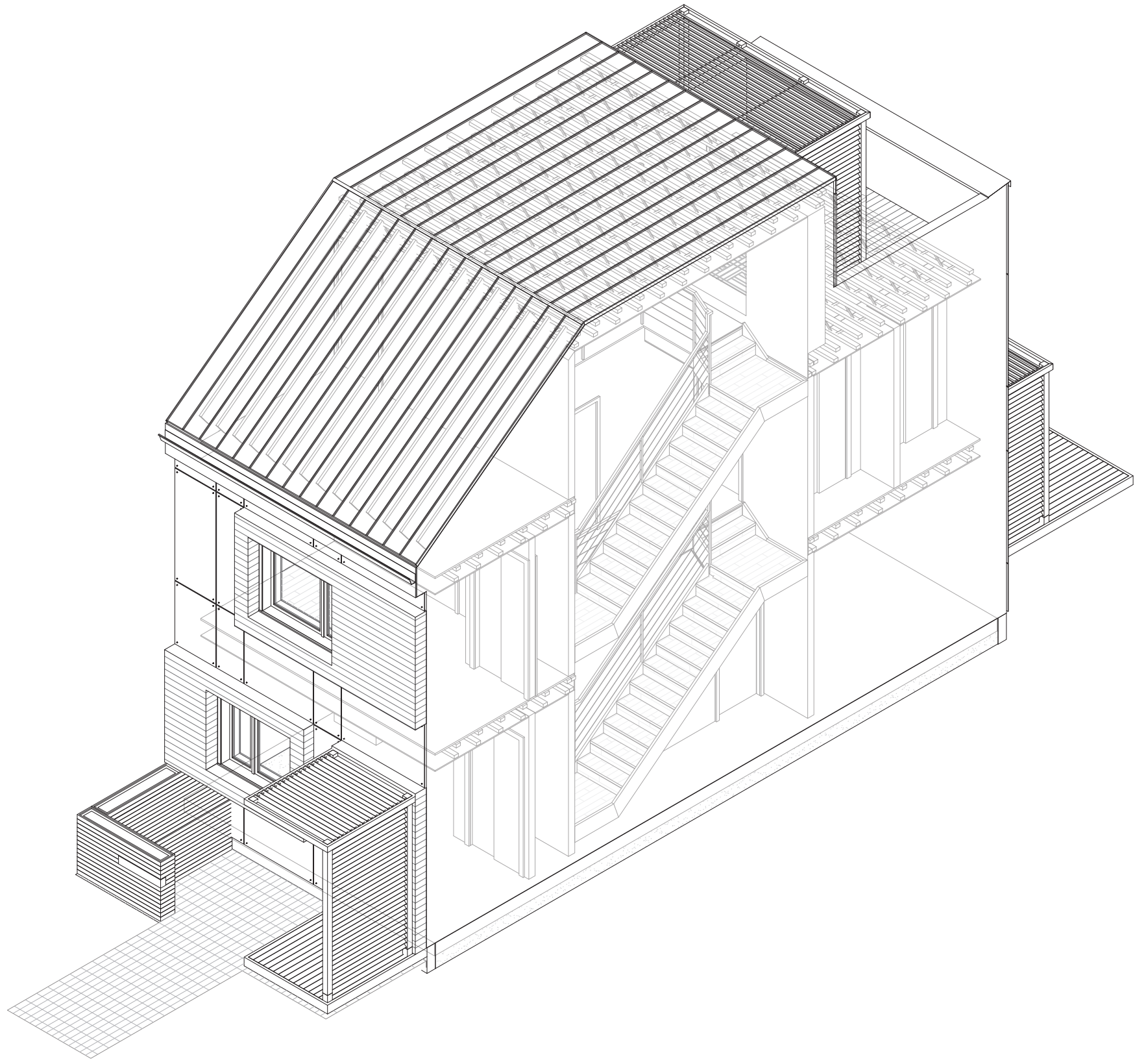
CONCEPTUAL MASSING



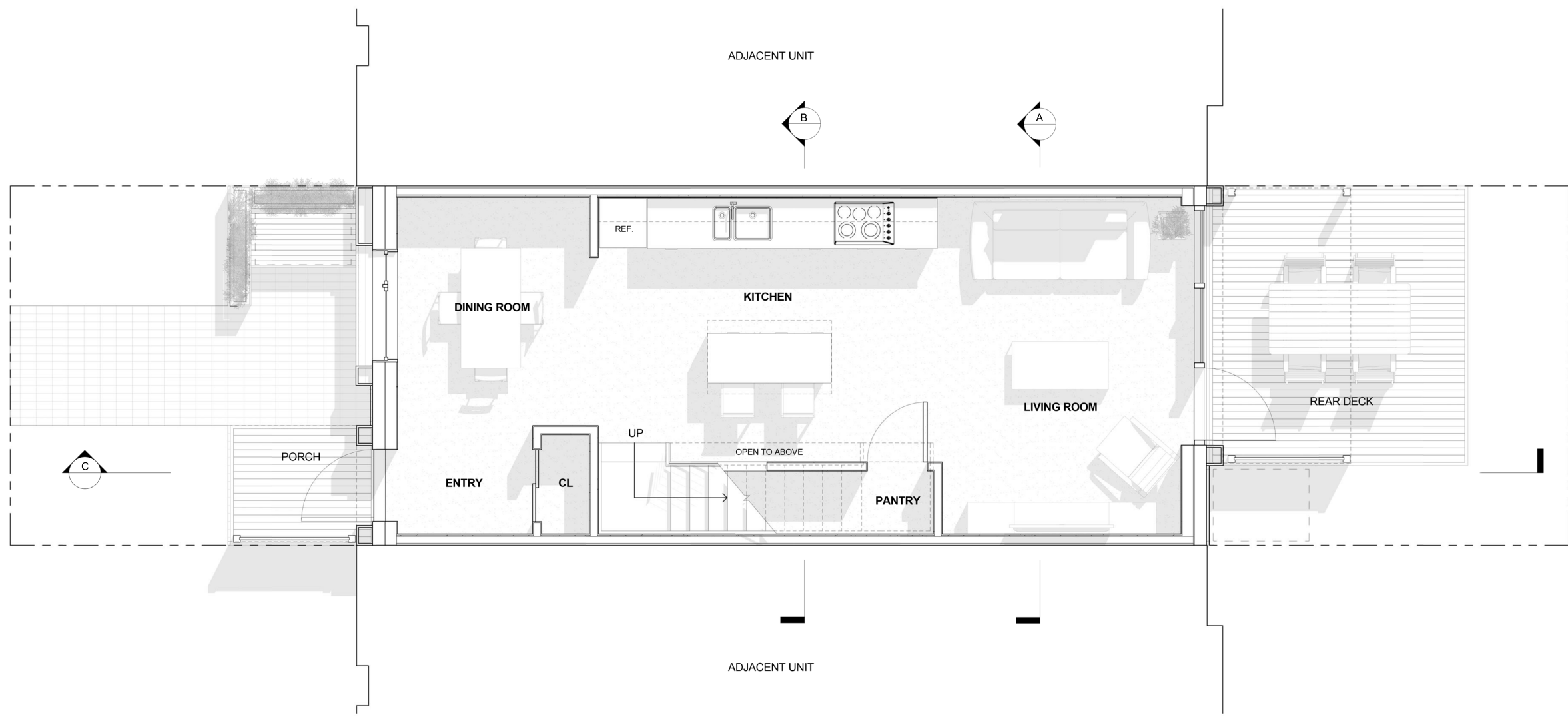
Building Services



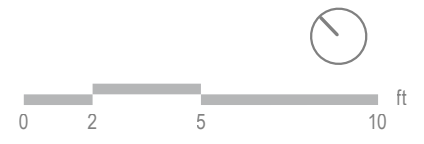
Polar Shading & PV Orientation

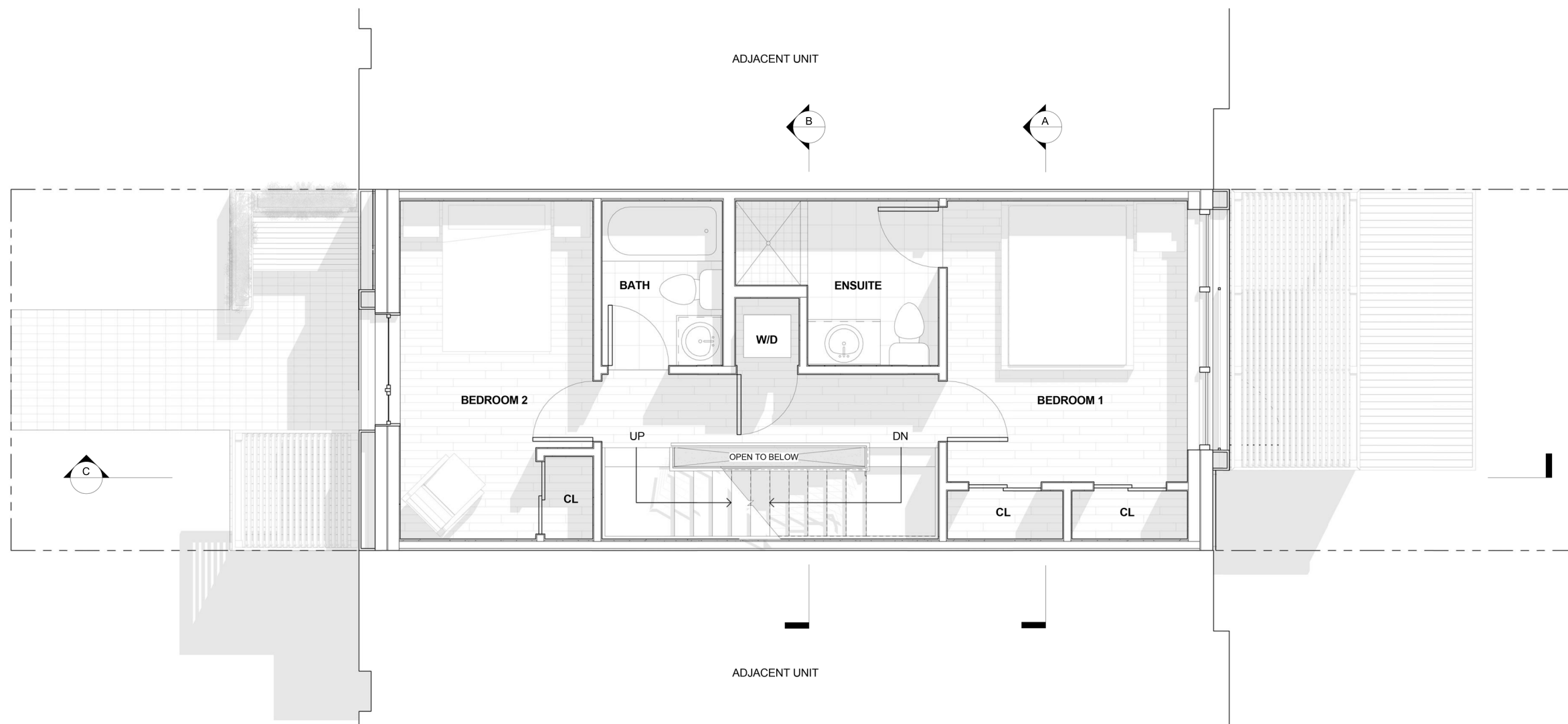


Building Axonometric



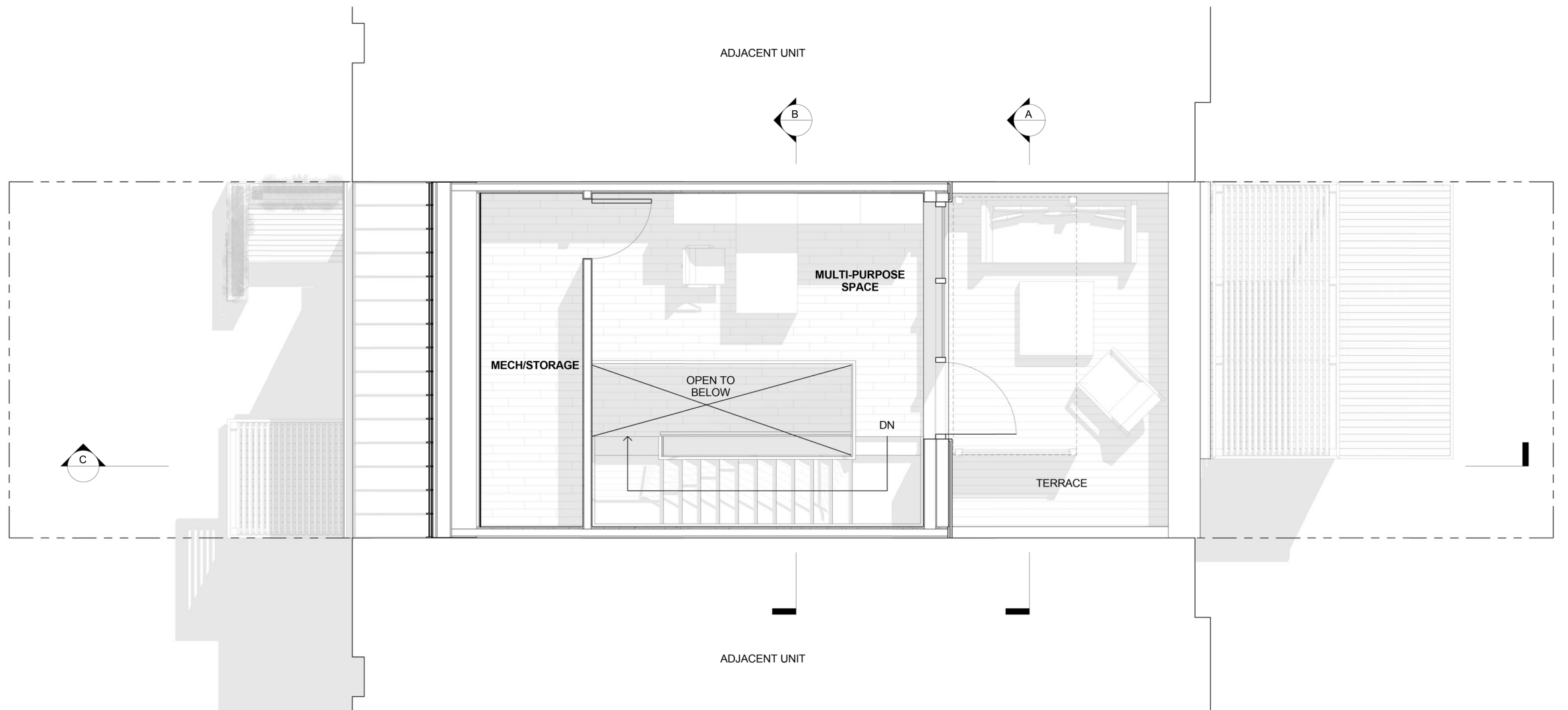
Floor Plan - Level One





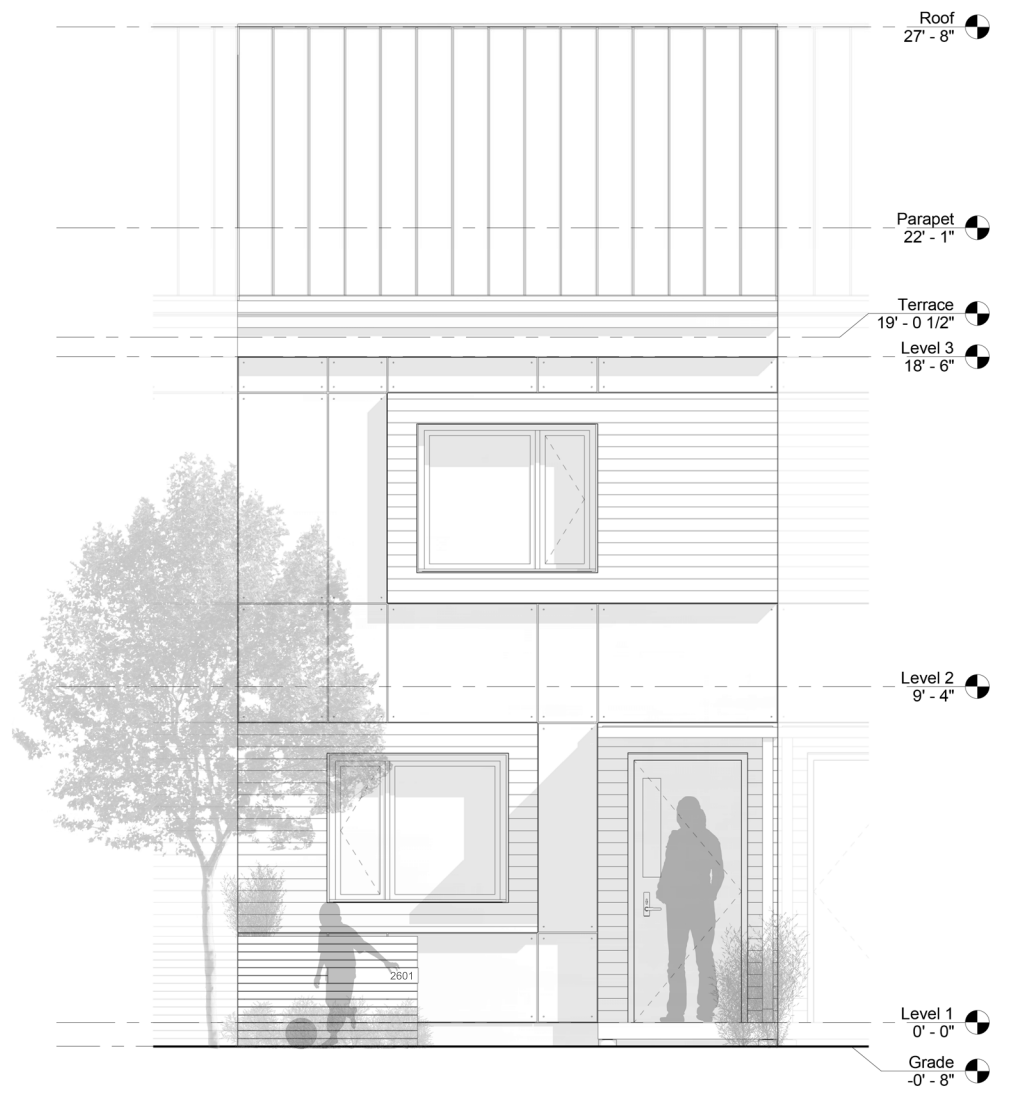
Floor Plan - Level Two



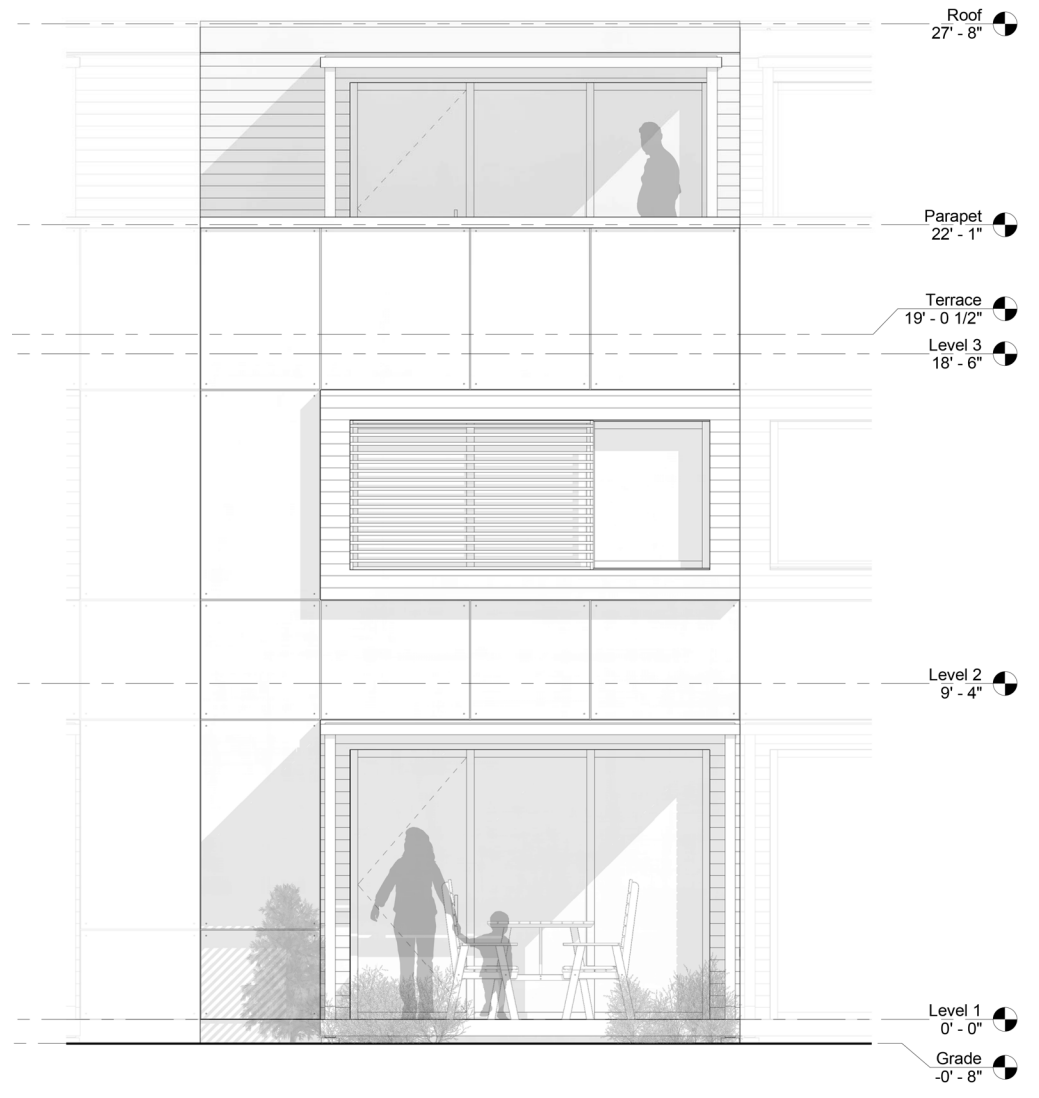


Floor Plan - Level Three



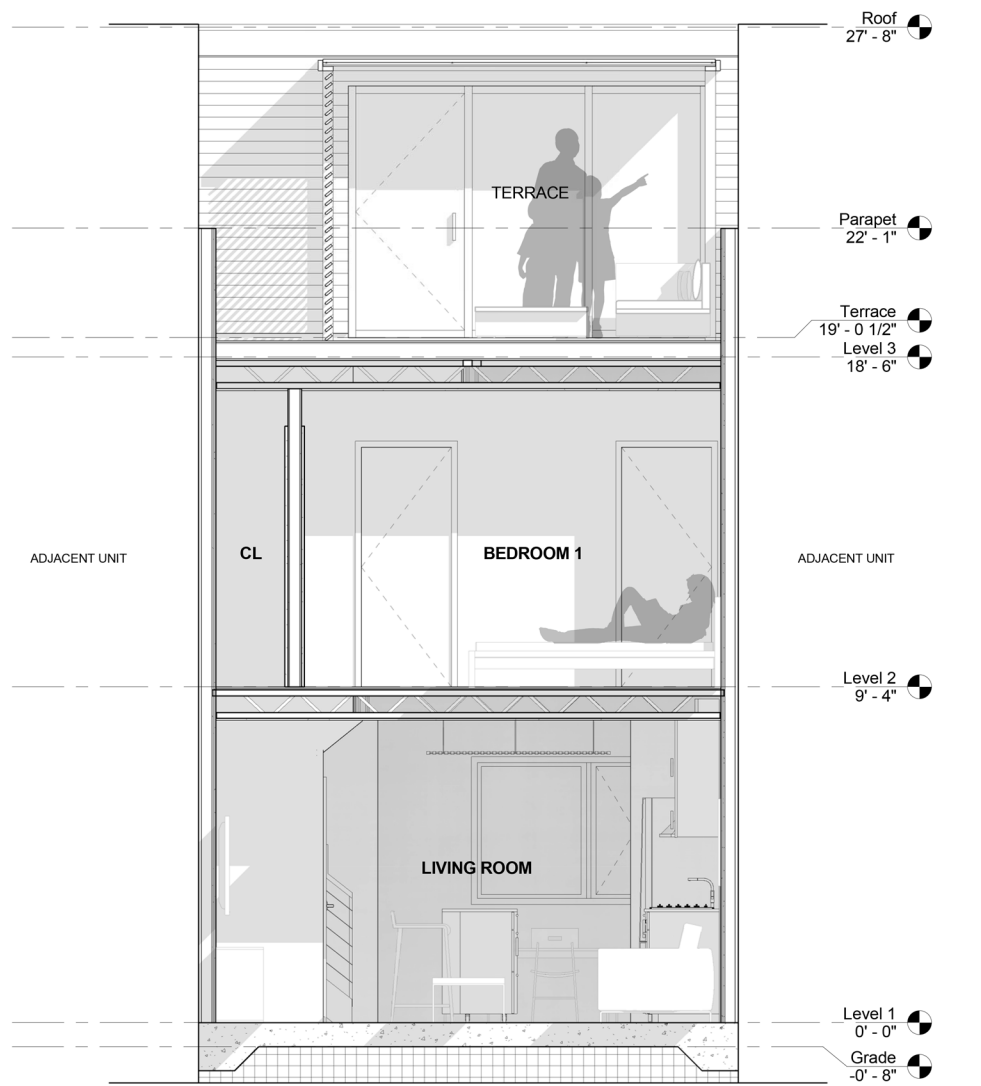


Unit Elevation - North

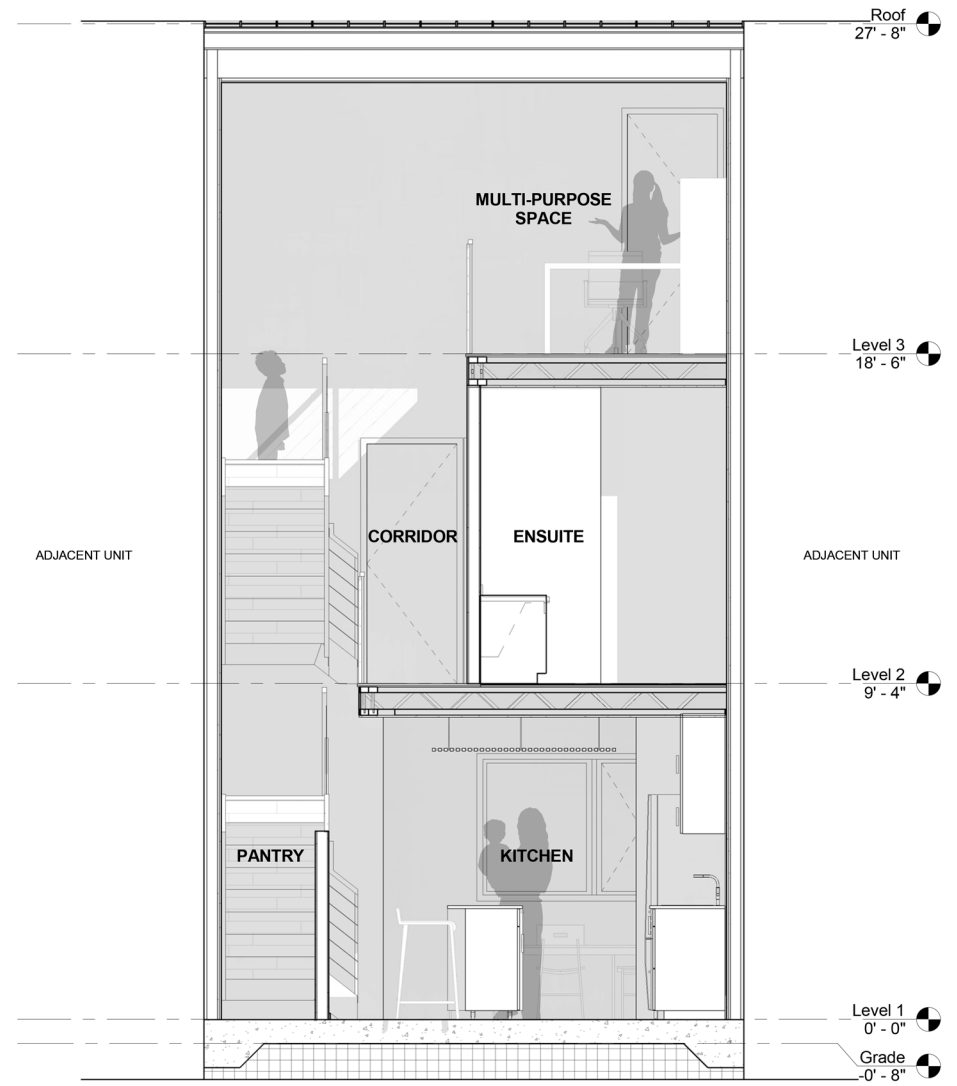


Unit Elevation - South



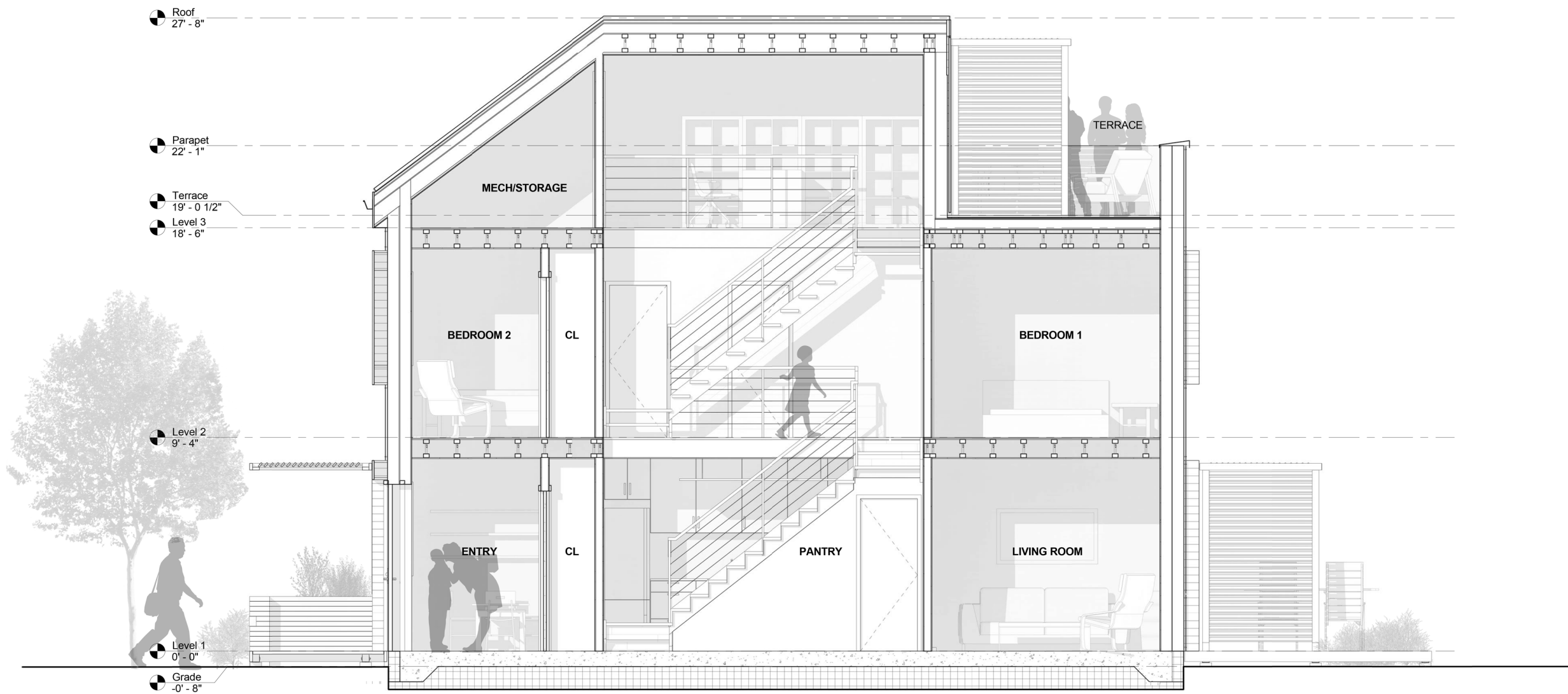


Building Section - A



Building Section - B



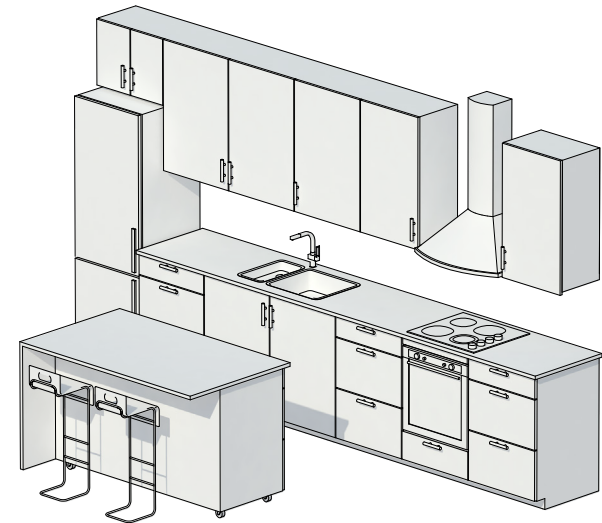


Building Section - C

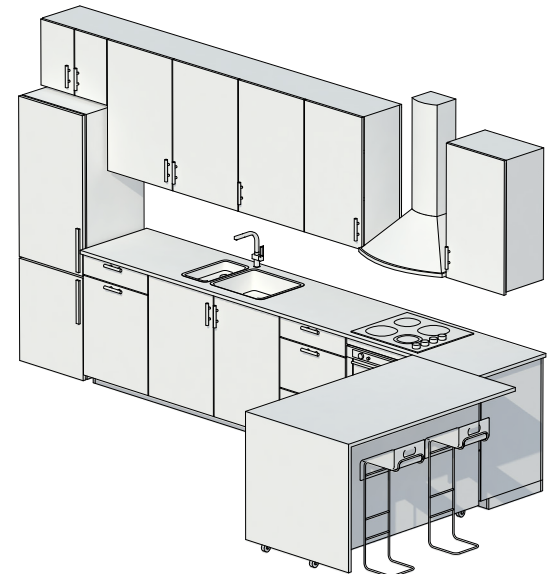




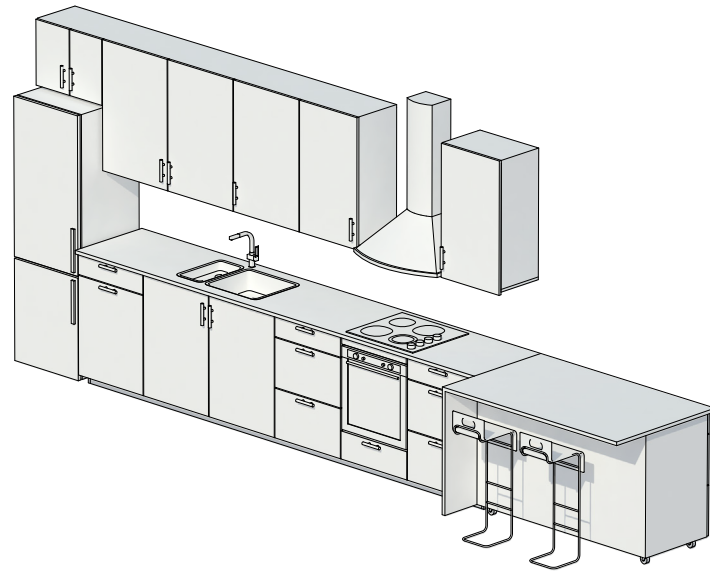
THE FLEXIBLE WORKSPACE



Centralized Island



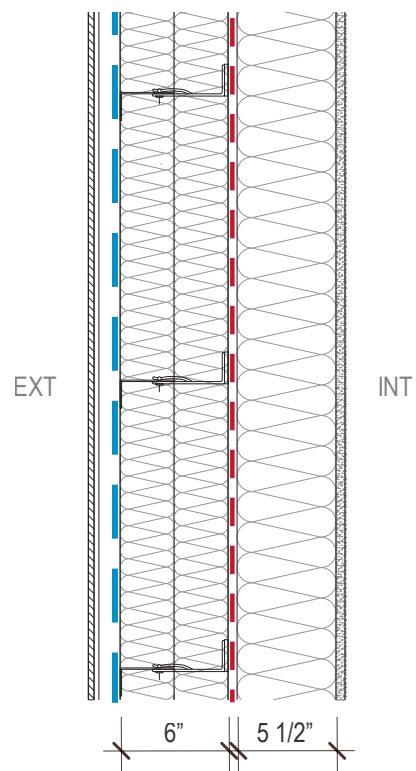
Peninsula Counter



Work Surface Extension



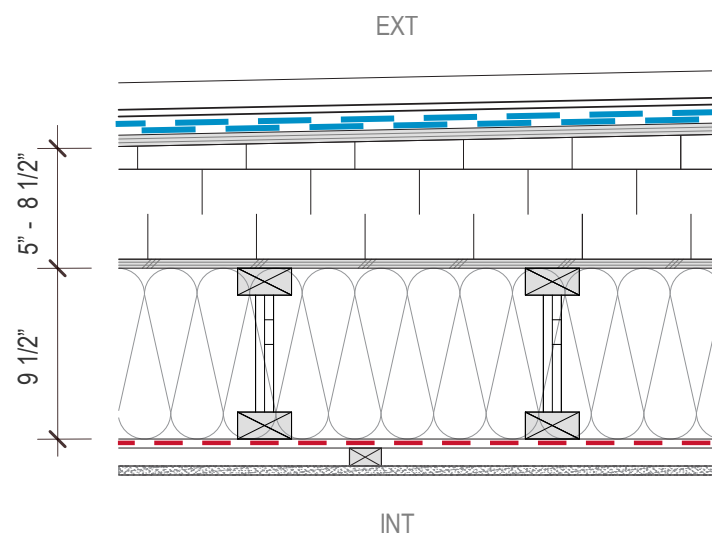
ENVELOPE ASSEMBLIES



Vertical Wall Assembly (R-44)

- Fibre Cement "Ecoclad" Panel
- 1" Air Cavity
- Tyvek Weather Barrier
- 2 Layers - 3" Roxul Rigid Insulation (R-25.8)
- 1/2" Zip System Air Barrier / Vapor Retarder
- 2 x 6" Structural Stud Wall (16" O/C)
- 5-1/2" Blown Cellulose Insulation (R-21)
- 1/2" Gypsum Wall Board
- Zero VOC Paint Finish

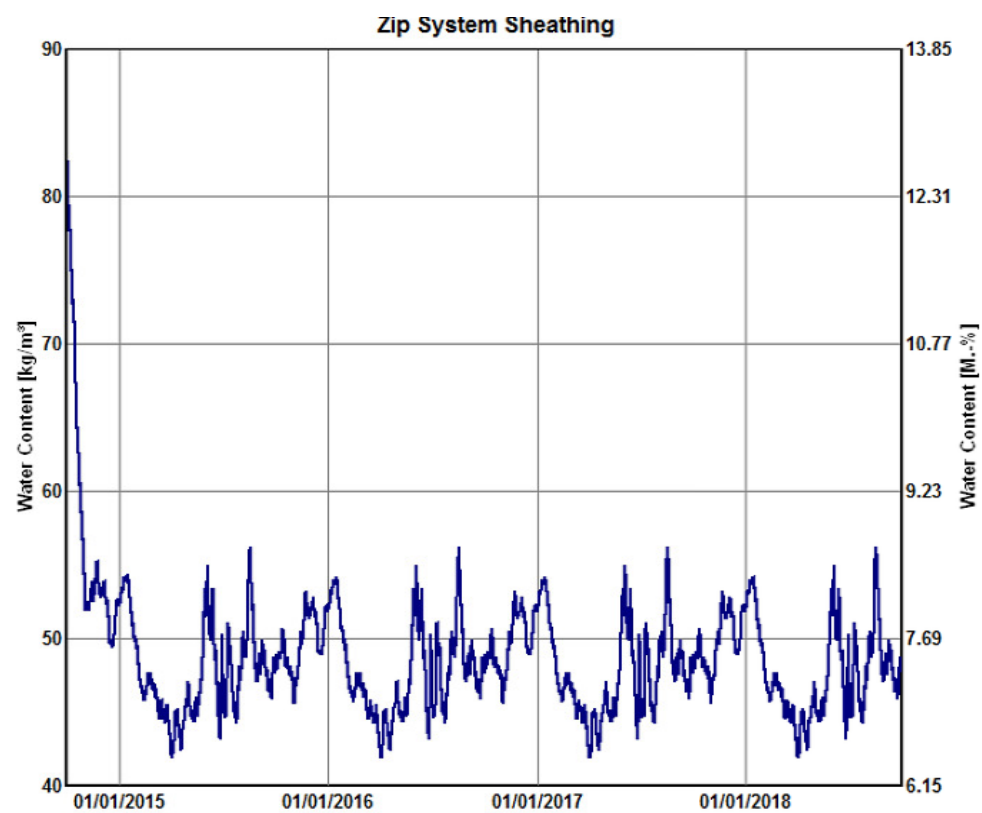
- - - - - Moisture Barrier
- - - - - Air Barrier / Vapor Retarder



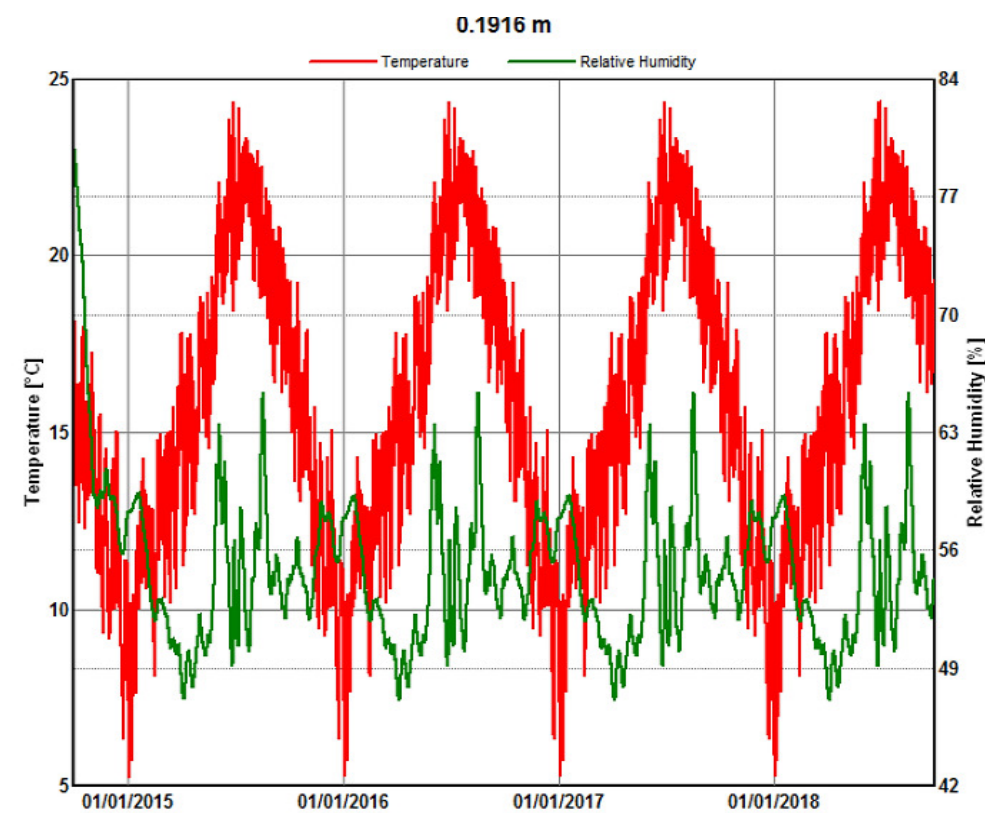
Roof Assembly (R-56)

- Standing Seam Metal Roof
- 1" Air Cavity
- 2 Layers - 15lb. Roofing Felt
- 5/8" Plywood Sheathing
- EPS Rigid Insulation (R-20)
- 1/2" Plywood Sheathing
- 2 x 10" Wood Joists (16" O/C)
- 9-1/2" Blown Cellulose Insulation (R-33.25)
- 1/2" Zip System Air Barrier / Vapor Retarder
- 1" Wood Furring
- 5/8" Gypsum Wall Board Type X
- Zero VOC Paint Finish

HYGROTHERMAL ANALYSIS

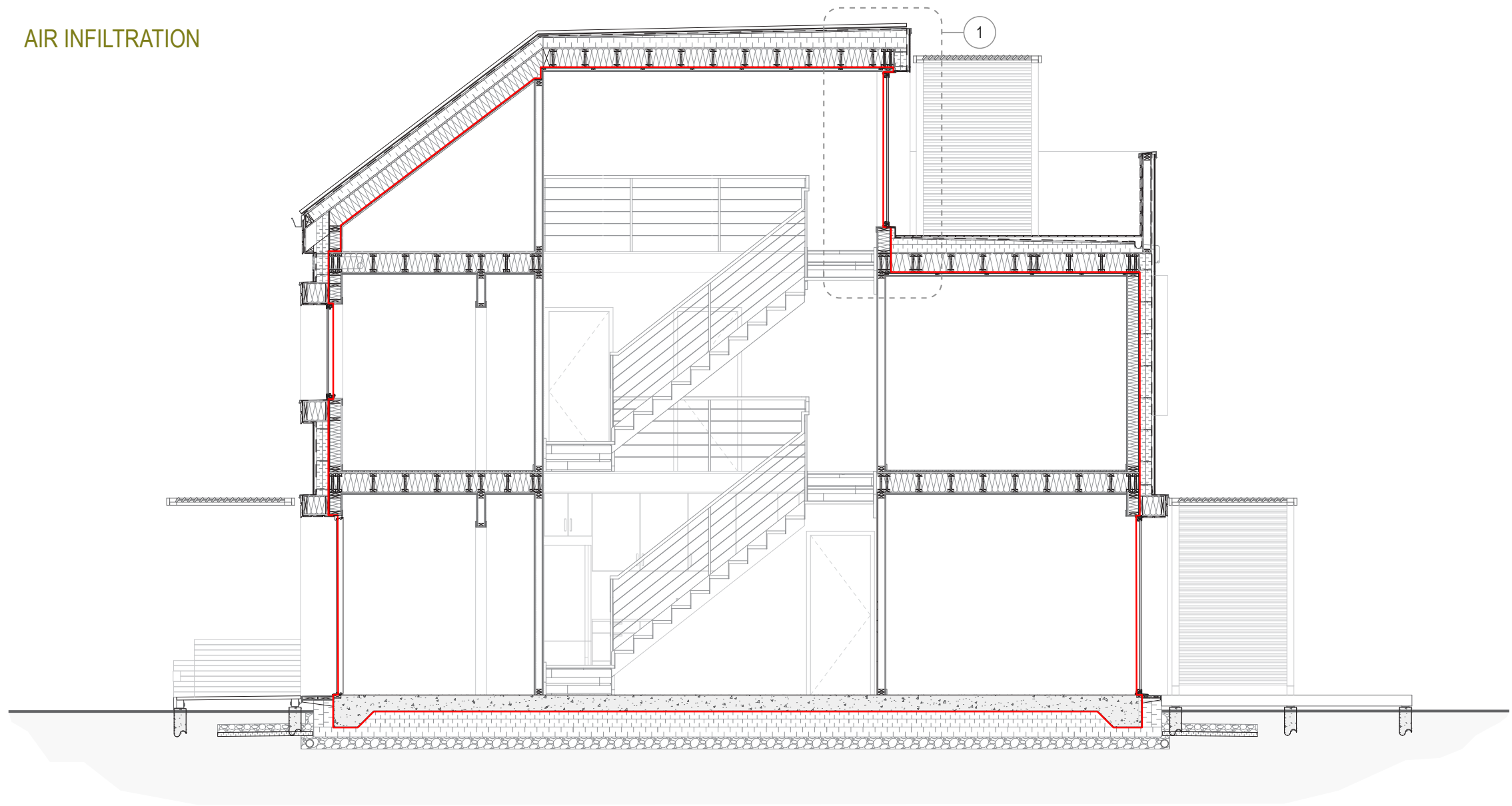


Exterior Sheathing Moisture Content

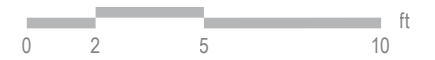


Exterior Sheathing Temperature & Relative Humidity

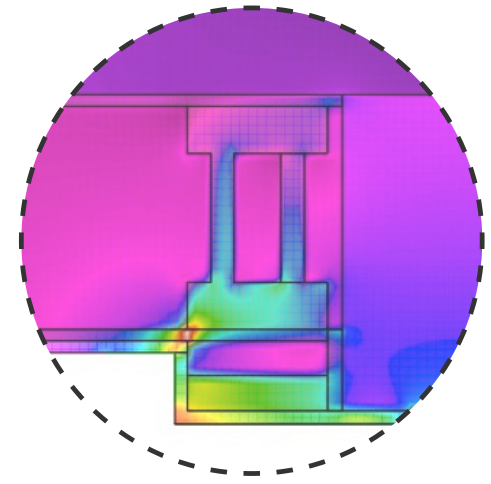
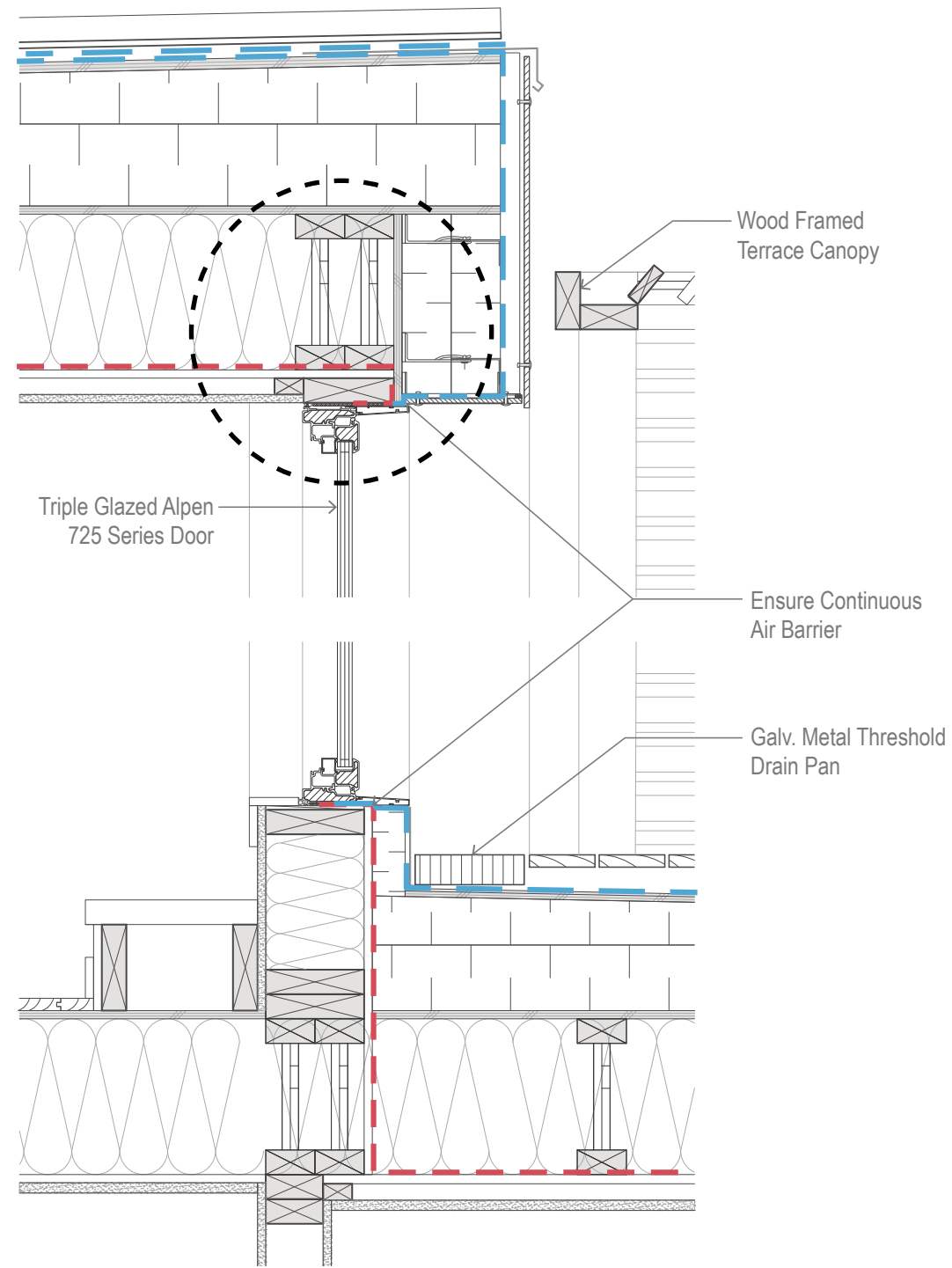
AIR INFILTRATION



Detail Section



THERMAL BRIDGING



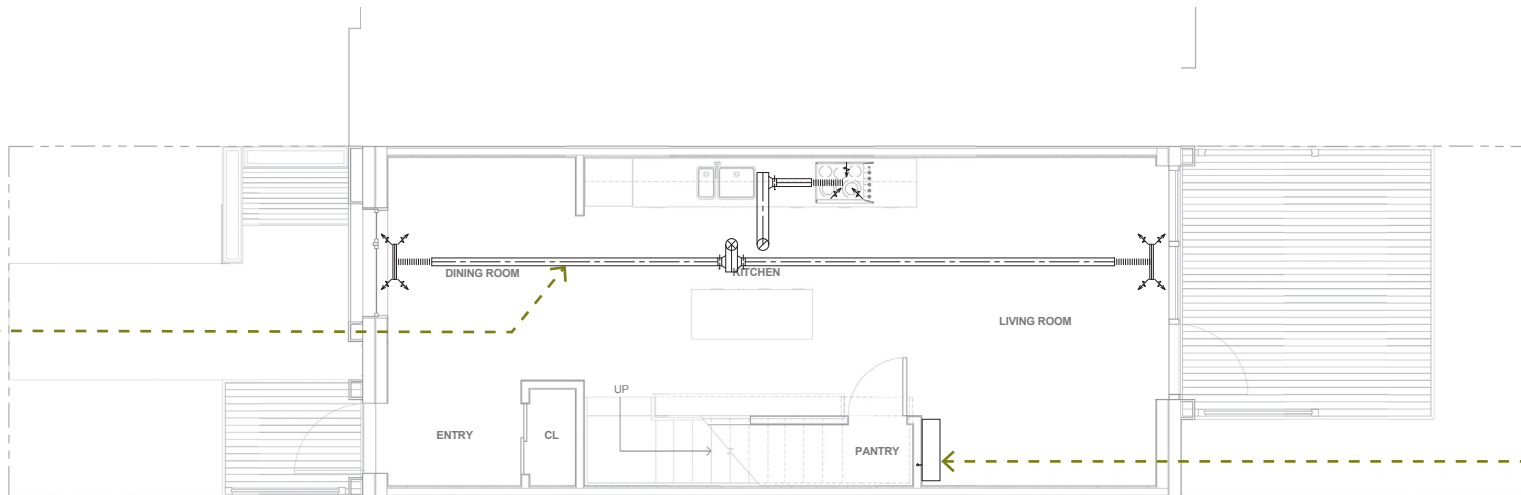
THERM Analysis

Section Detail - Third Level Terrace Door

- - - - - Moisture Barrier
- - - - - Air Barrier / Vapor Retarder



Ventilation Ductwork



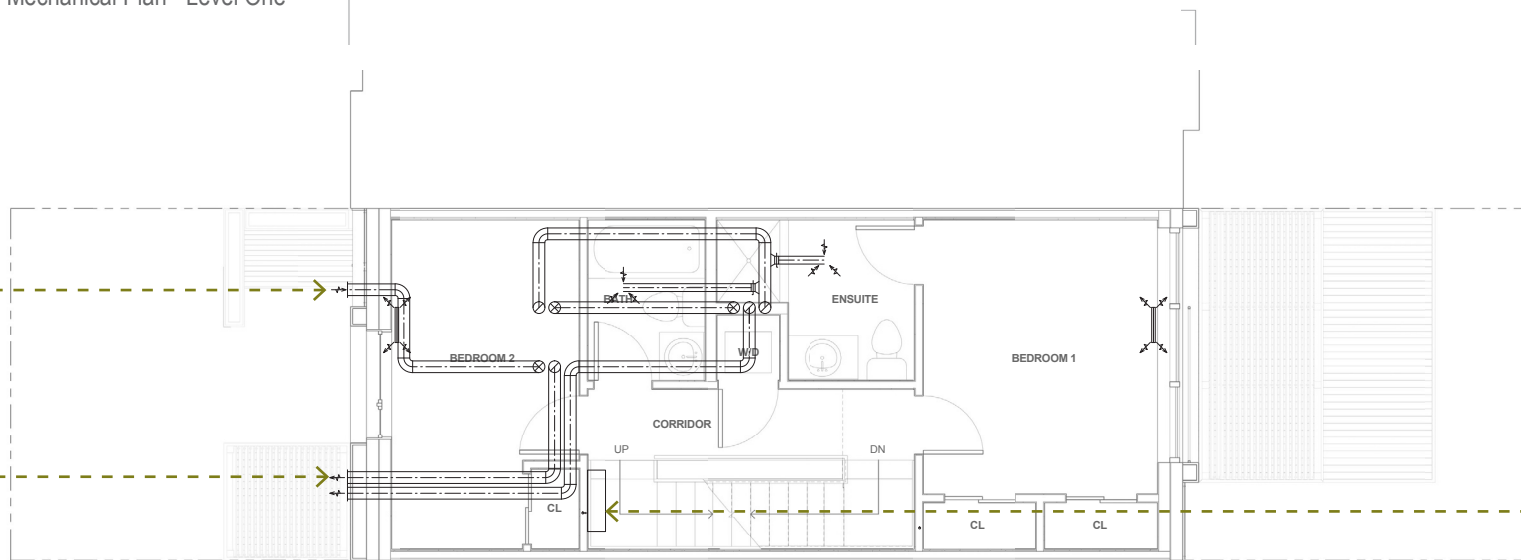
Mechanical Plan - Level One



Mitsubishi Mini-Split Heat Pump

Supply Air

Exhaust Air



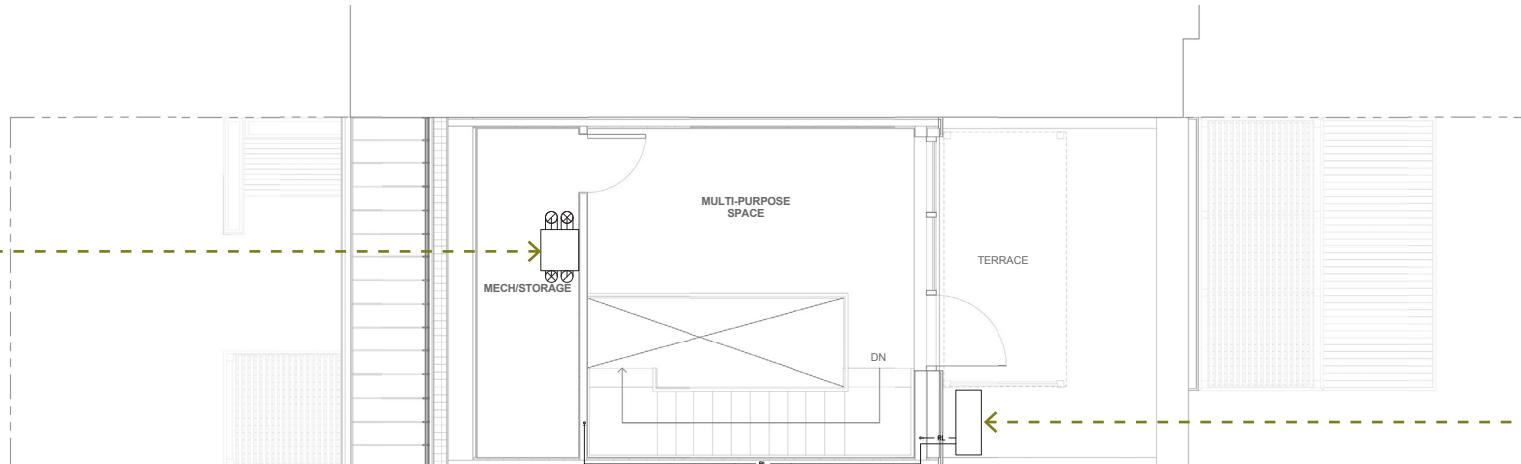
Mechanical Plan - Level Two



Mitsubishi Mini-Split Heat Pump



UltimateAir RecoupAerator ERV

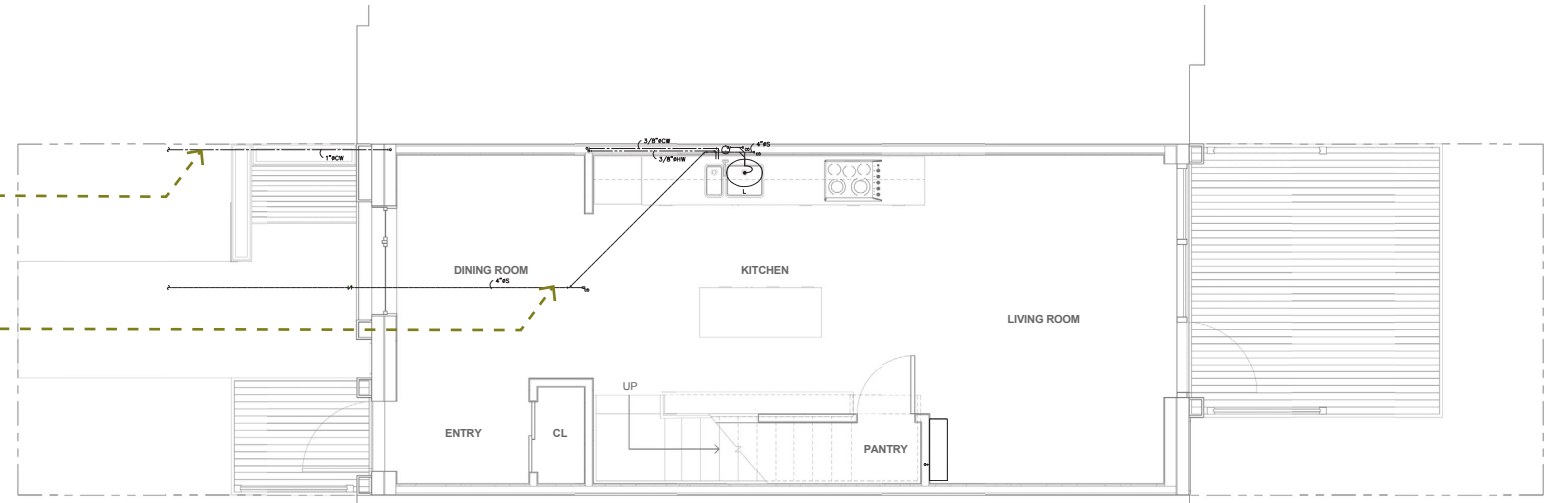


Mechanical Plan - Level Three

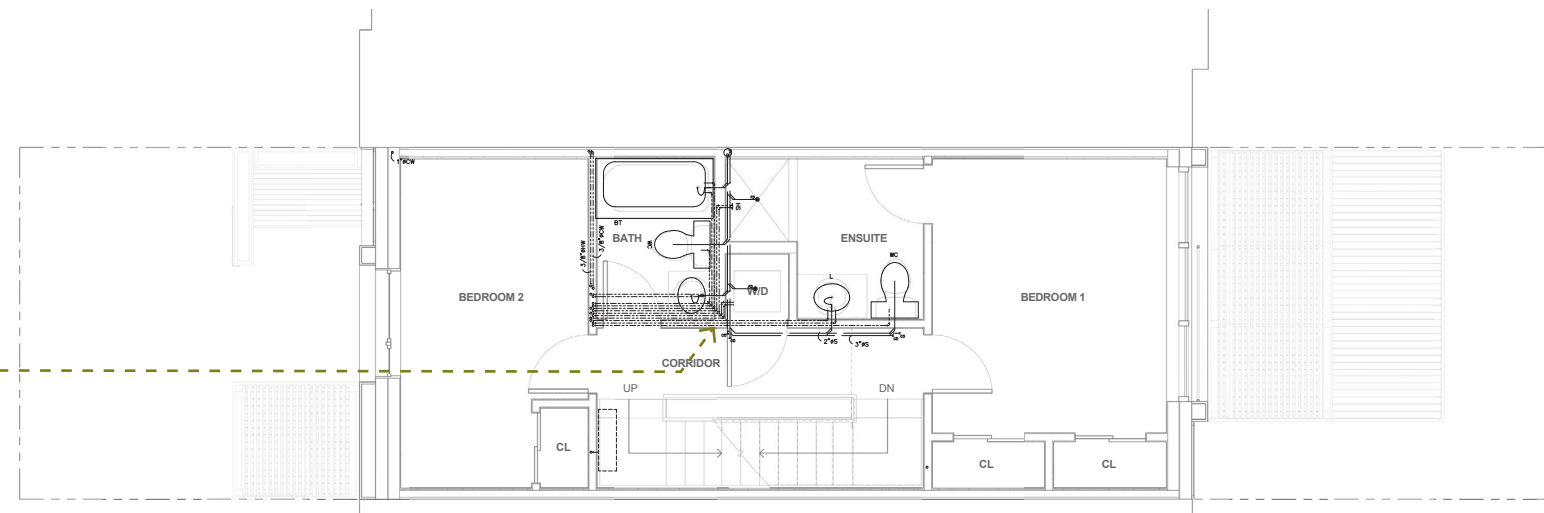


Condensing Unit

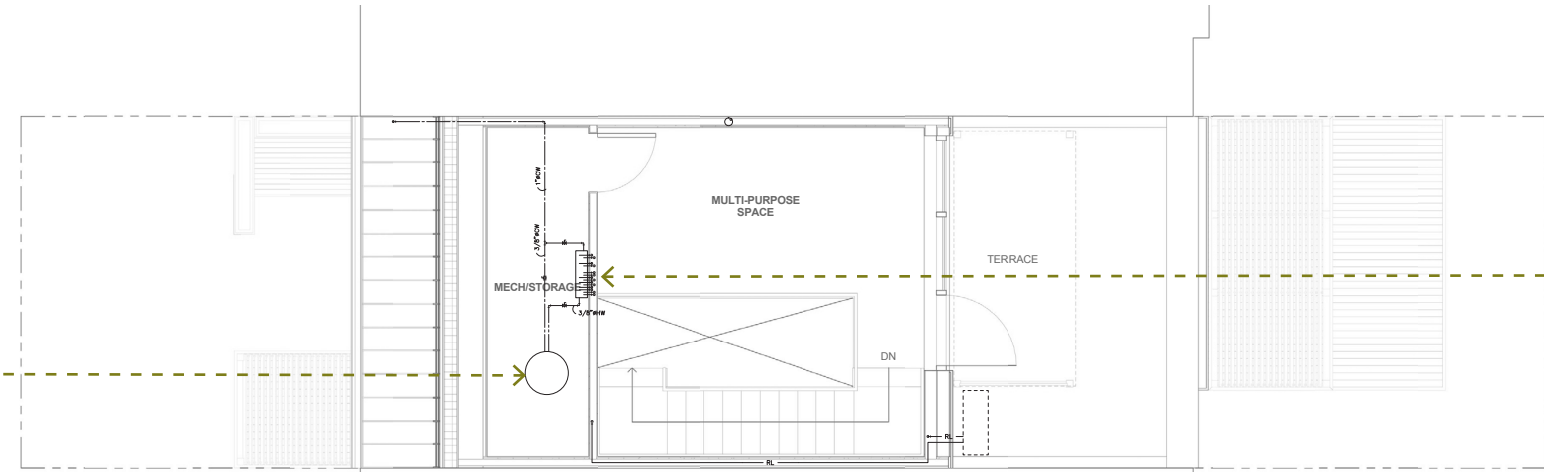
Sanitary Connection
Water Main Connection



Centralized Plumbing Stack



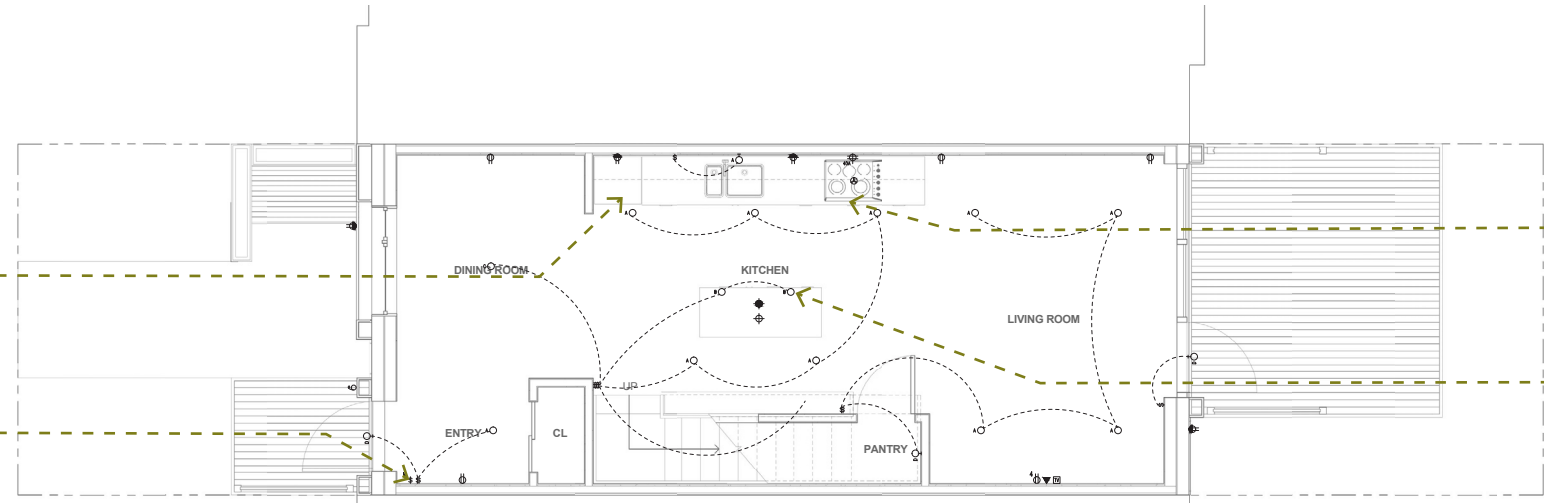
Hybrid Hot Water Heater



Home Run Manifold

\$ ☆ 🚪
 Compact Refrigerator

\$
 Master On/Off Switch

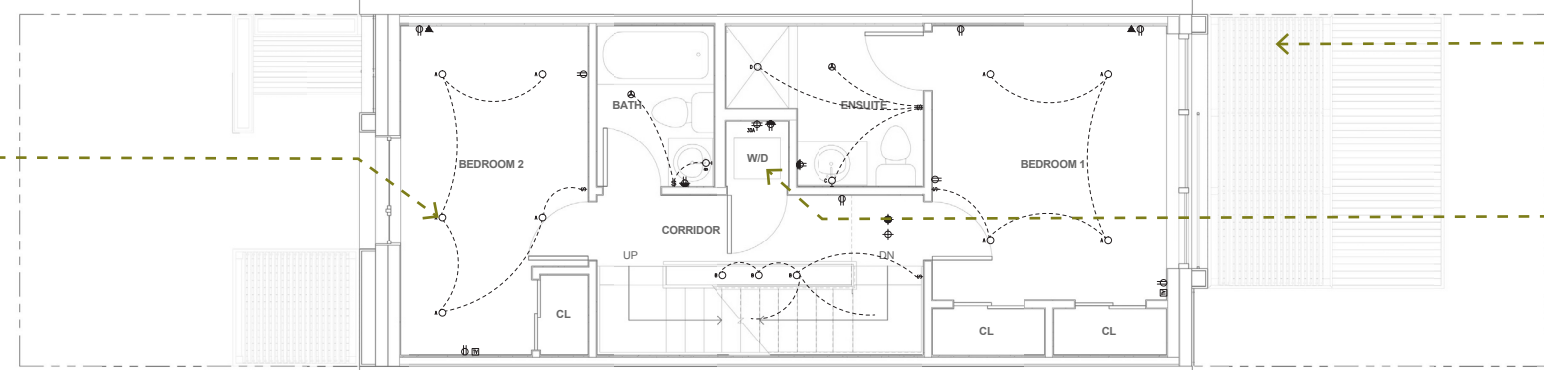


Electrical Plan - Level One

\$ ☆ 🚪
 Built-in Oven & Cooktop

\$ ☆
 Task Lighting

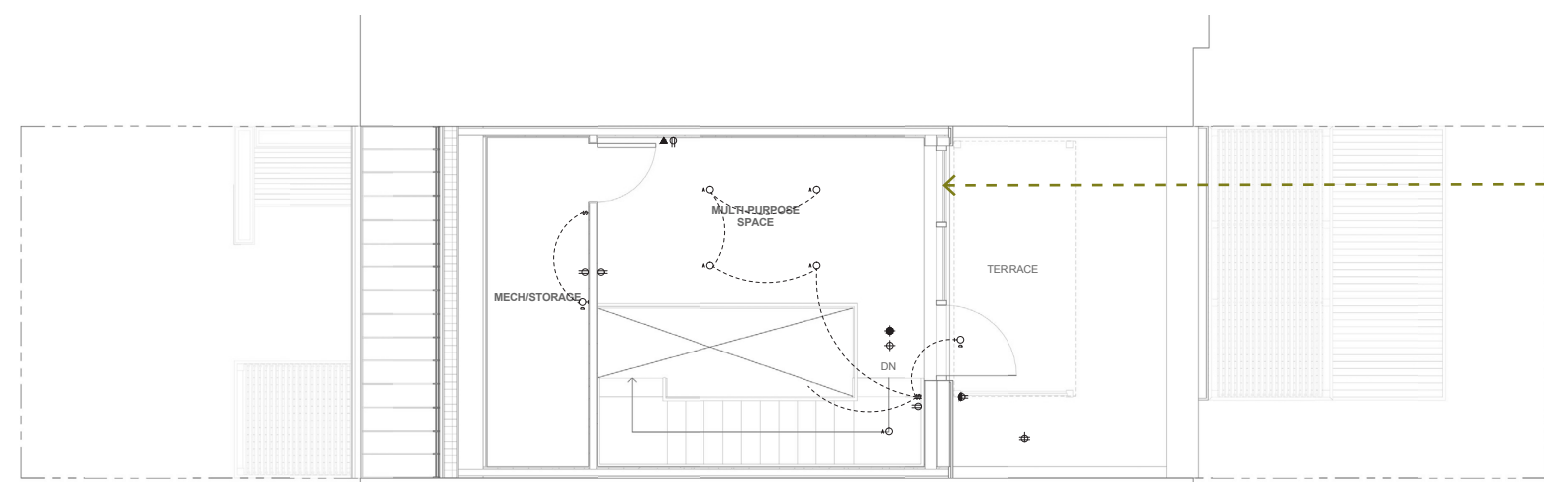
\$ ☆
 LED Pot Lighting



Electrical Plan - Level Two

\$ ☀️
 Shading Structure

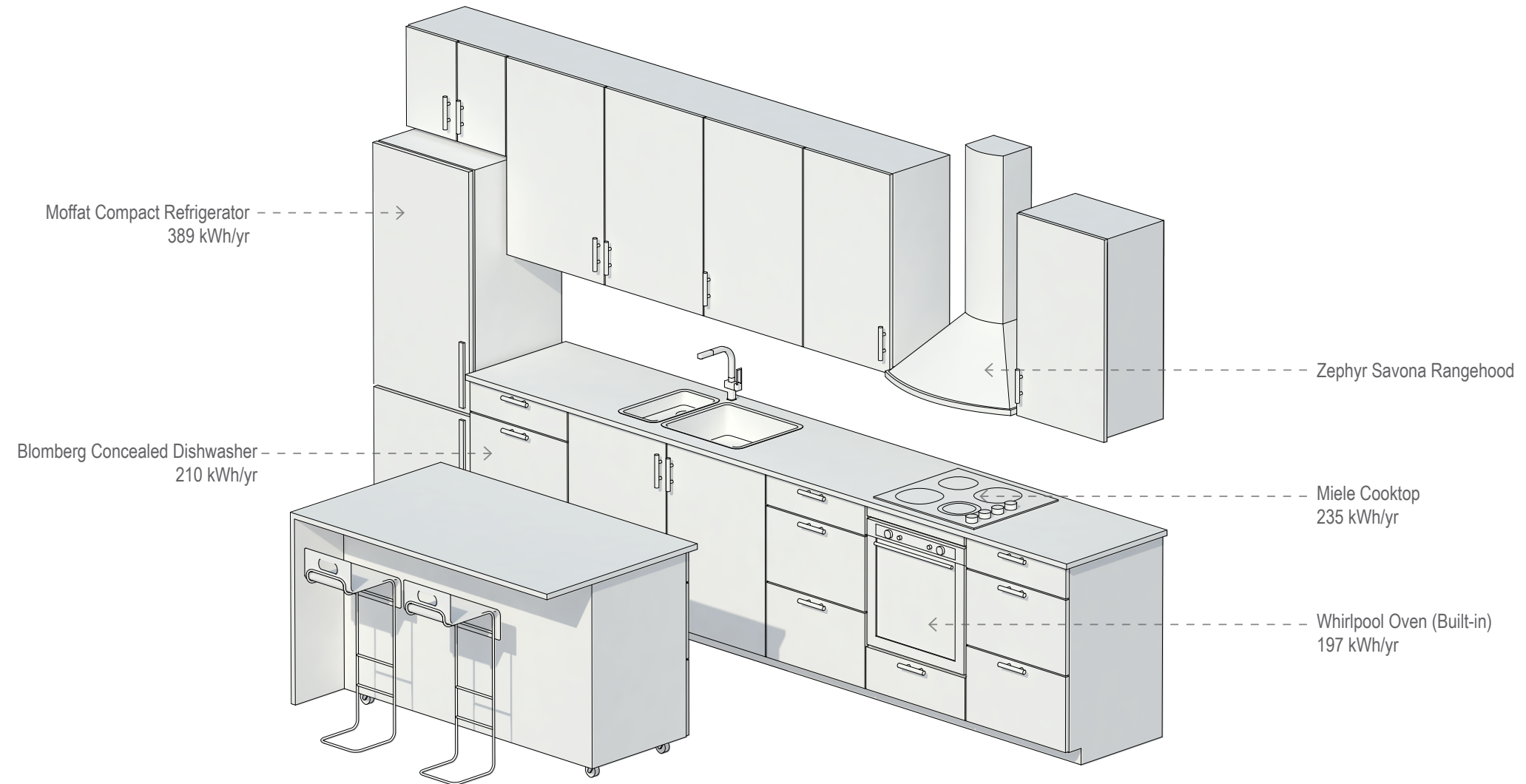
\$ ☆ 🚪
 Stacked Washer & Dryer



Electrical Plan - Level Three

\$ ☀️
 South Terrace Glazing

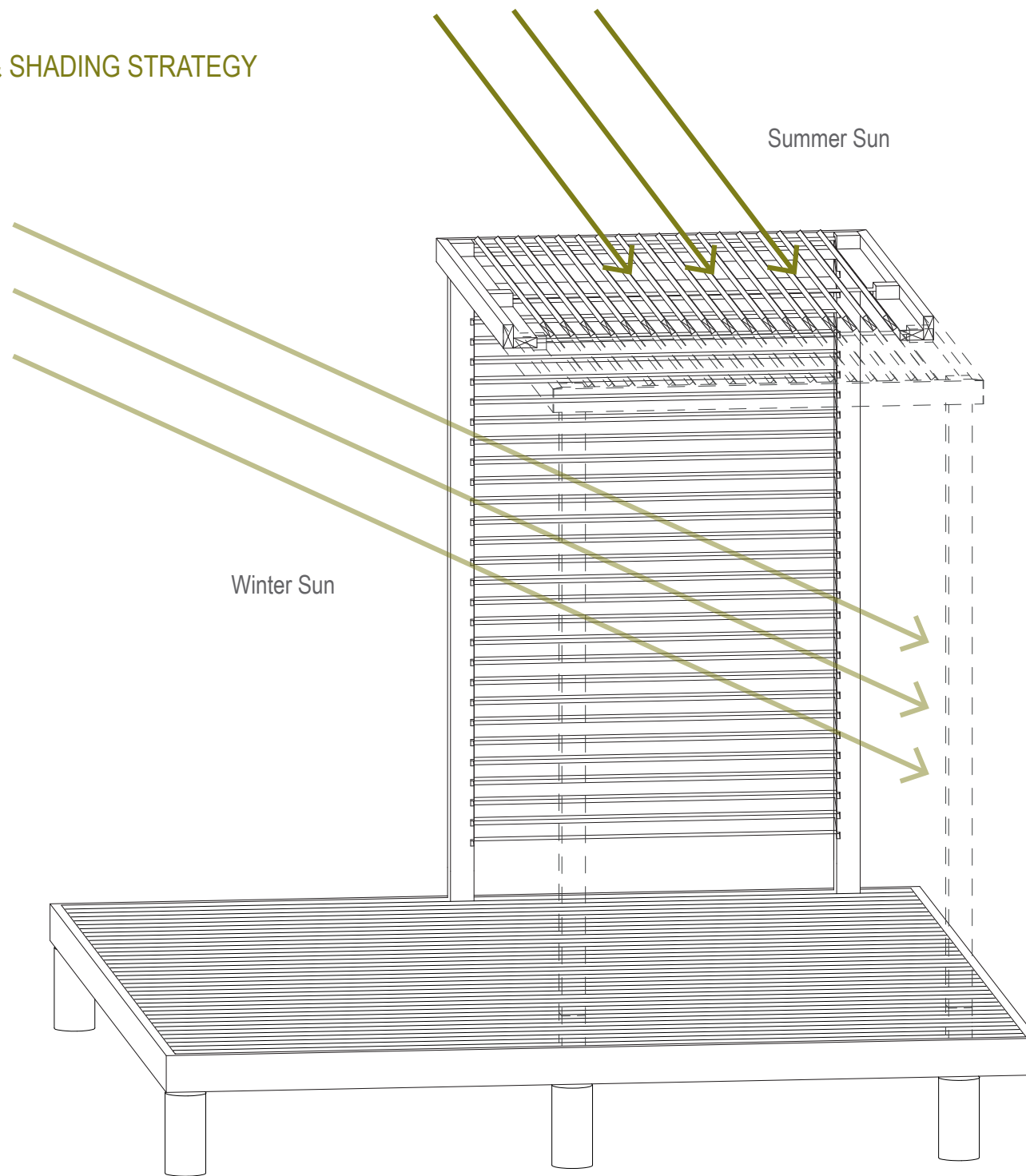
KITCHEN APPLIANCES



Annual Primary Energy Consumption **36.1 kWh/m² - yr**

Passive House Recommended **50.0 kWh/m² - yr**

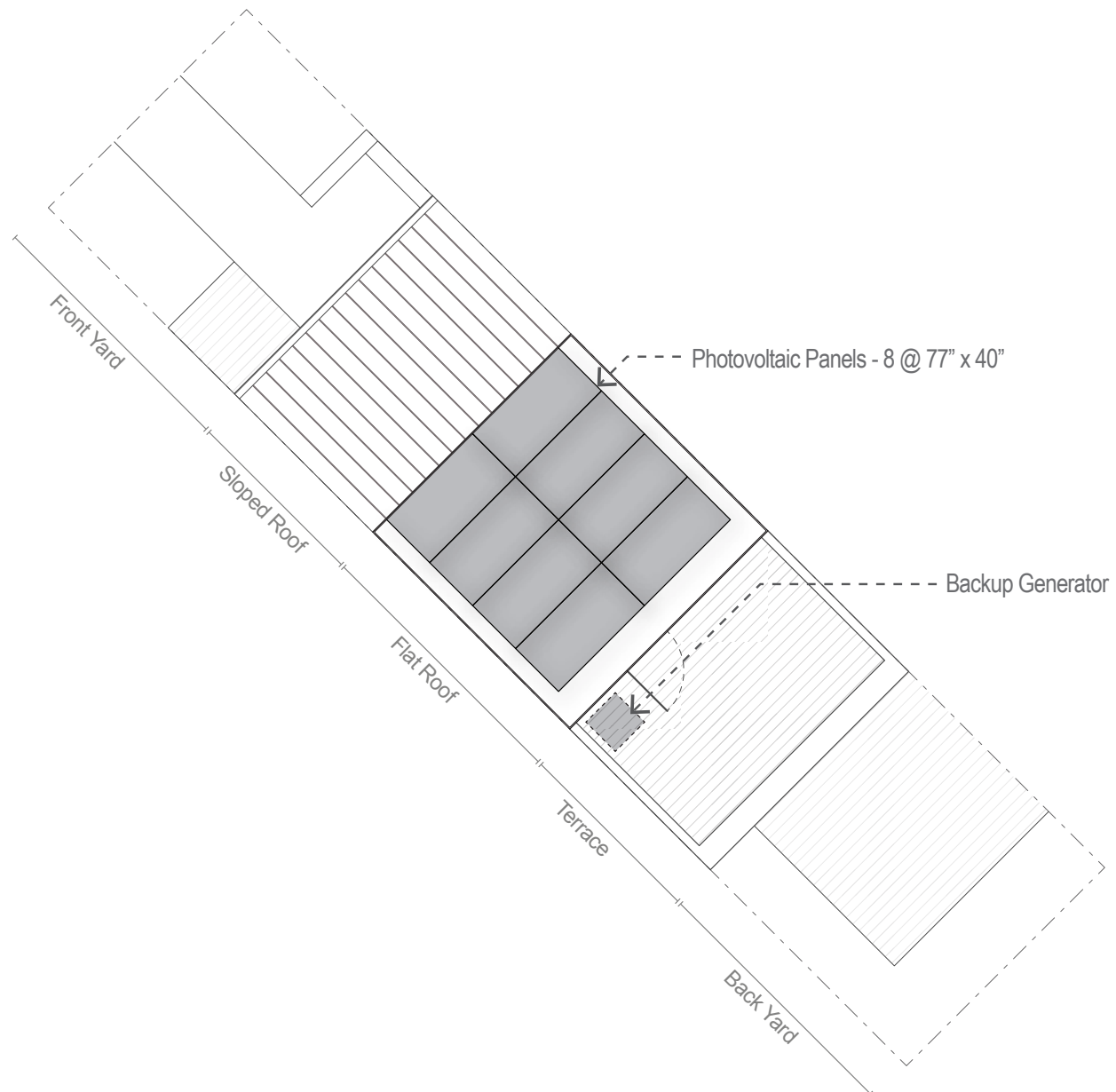
DAYLIGHTING & SHADING STRATEGY



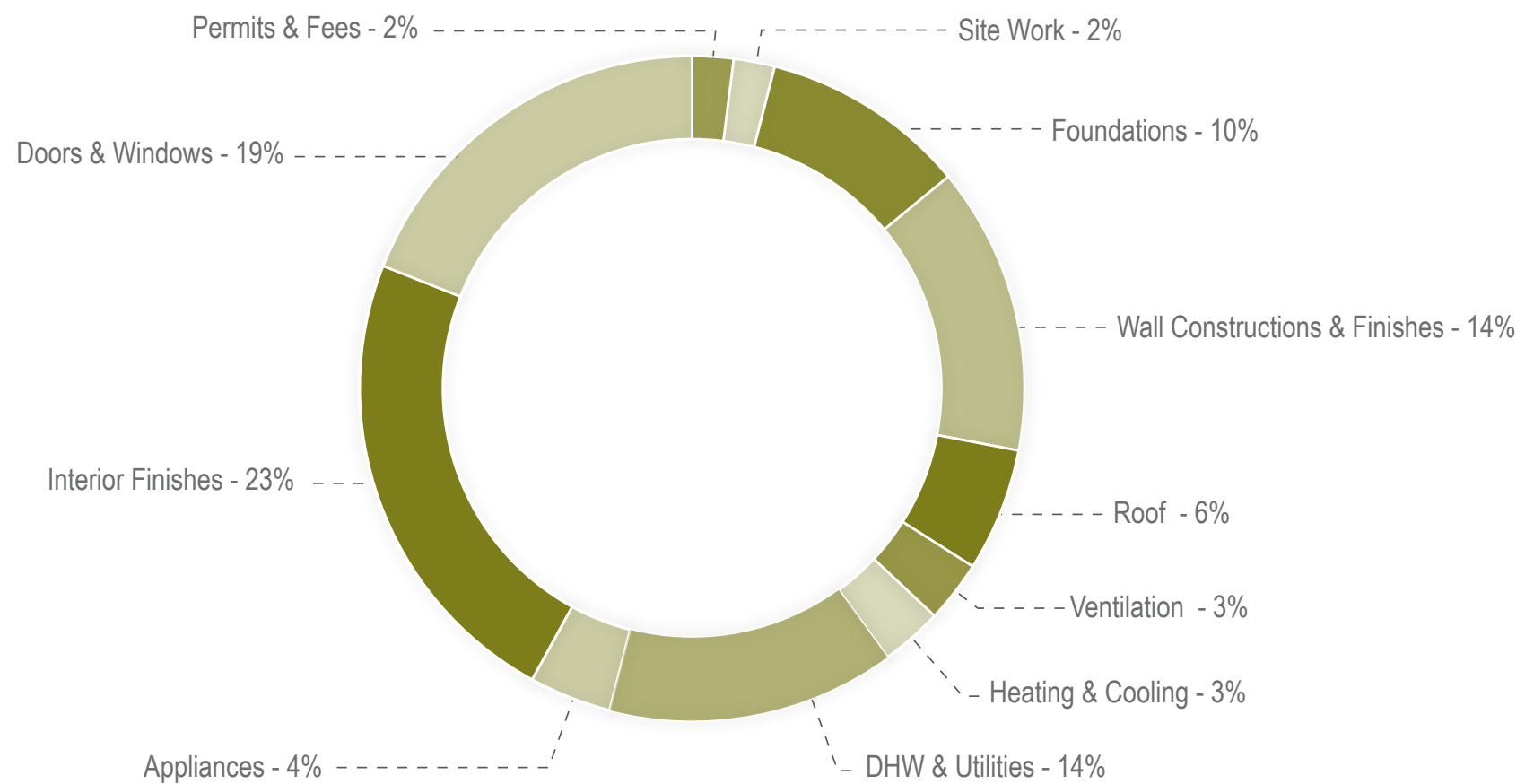
Solar Optimized Shading Canopies

PHOTOVOLTAIC INTEGRATION

Total Energy Consumption	3,800 kWh/yr
Total Energy Generation	3,010 kWh/yr
Total PV Capacity	2.4 kW
Gross Cost (Incl. Install & Tax Credit)	\$7,622
Pay Back Period	10 yrs
Net Cash Flow - 25 yrs	\$15,500



CONSTRUCTION COST ESTIMATE

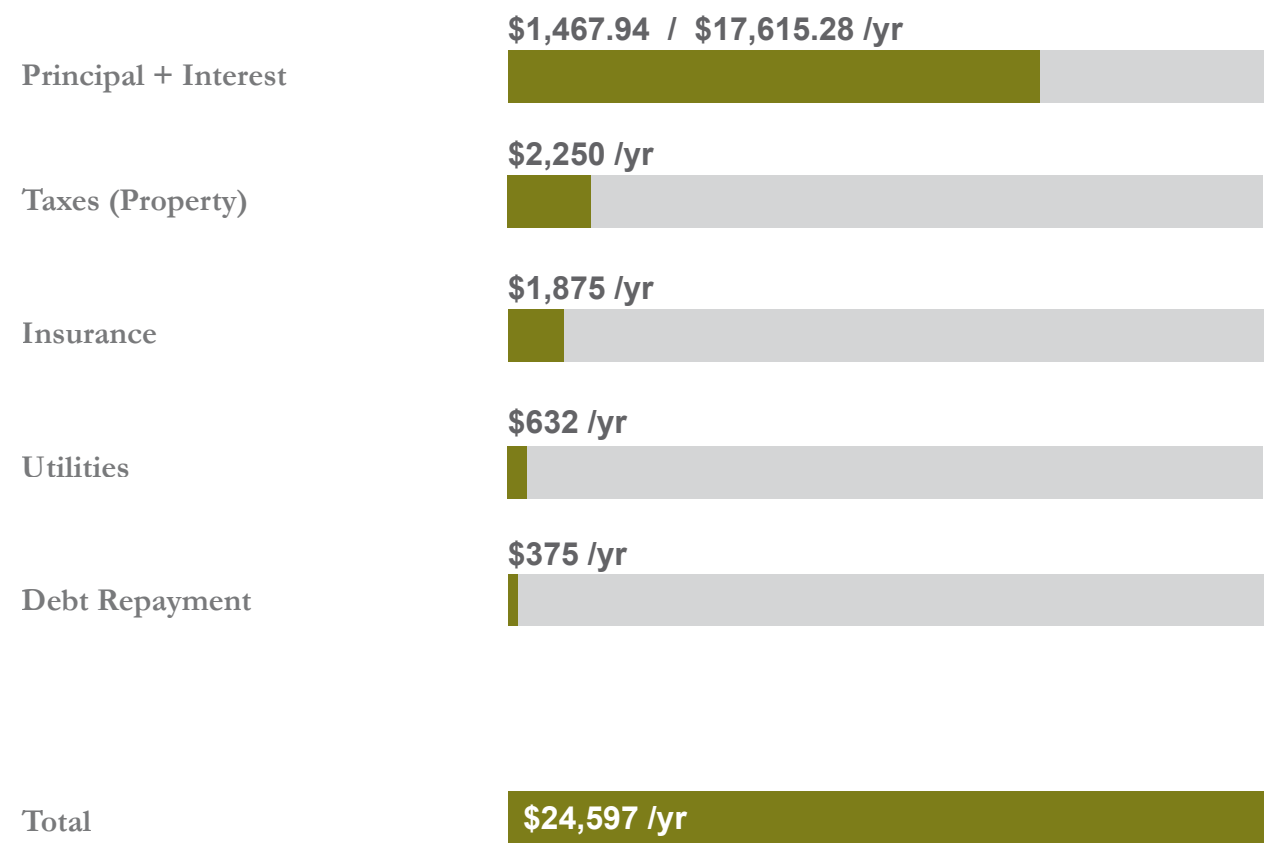


Total Construction Cost **\$181,000**

Cost / ft² **\$145**

High Performance Premium **9.0%**

AFFORDABILITY ANALYSIS - PITIU METHOD



AFFORDABILITY ANALYSIS - ANNUAL HOUSING EXPENSES

Median Family Income (MFI) **\$75,000**
City of Denver

Typical Housing Expenses (33%) **\$25,000 /yr**

Harvest Home **\$24,597 /yr**

Critical Components Replaced **\$403 Net Annual Cash Flow**
Twice in 30 years

RATING SYSTEMS



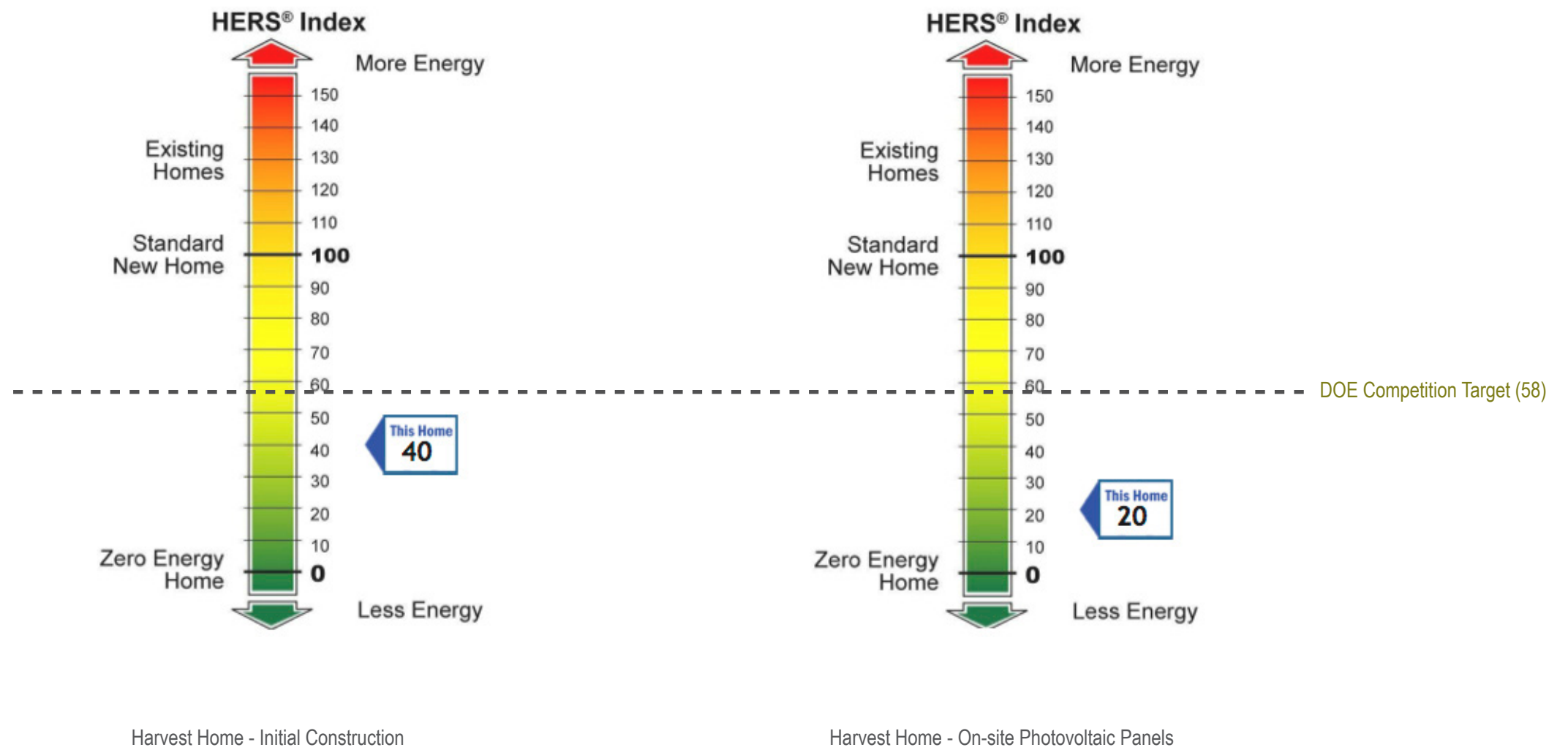
Passive House Institute US



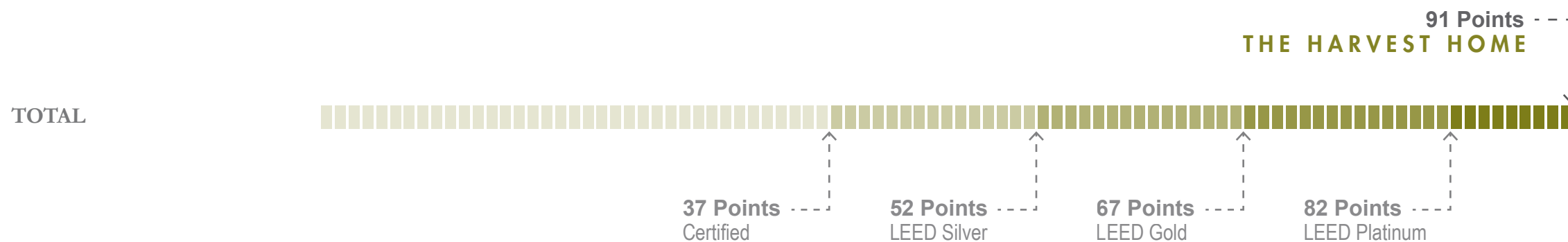
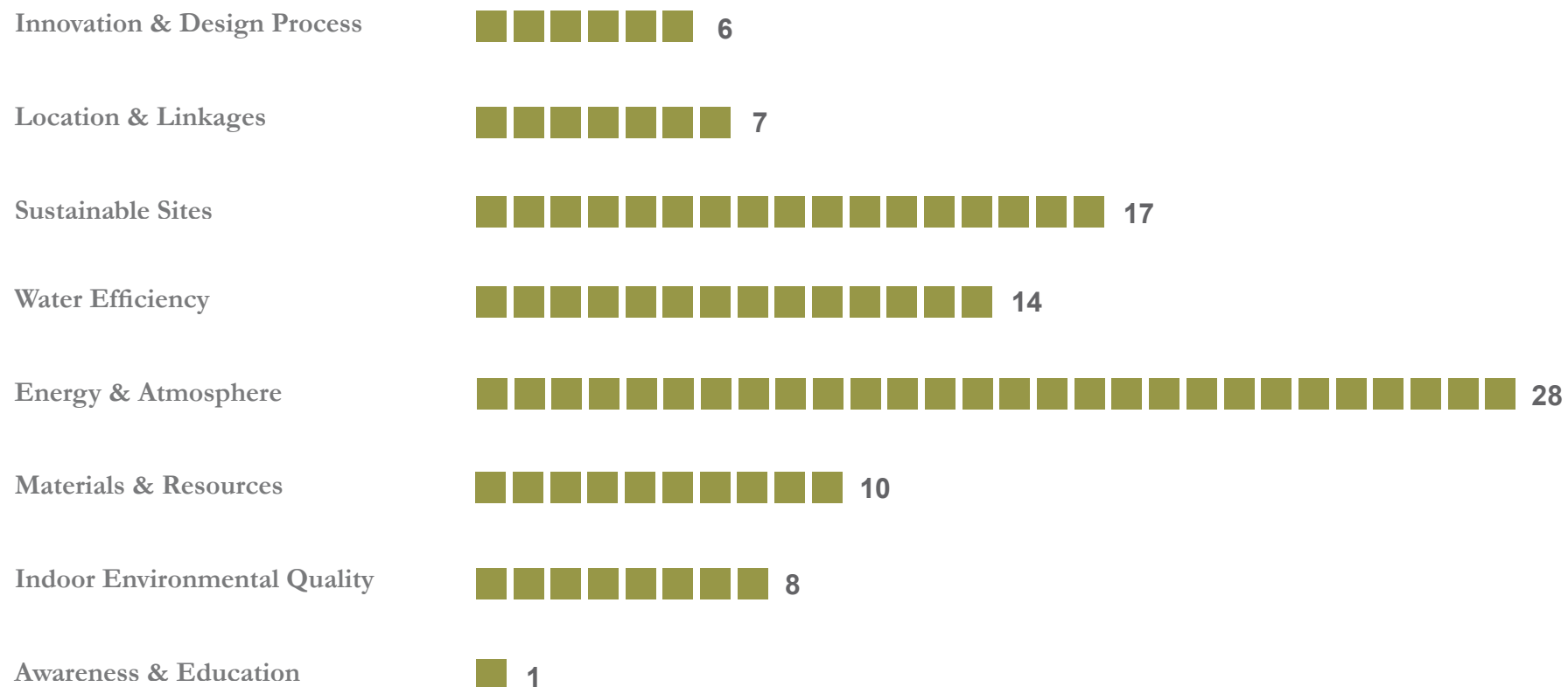
THE PASSIVE HOUSE STANDARD

	Heat Demand kBTU/ft ² - yr	Cooling Demand kBTU/ft ² - yr	Primary Energy Demand kBTU/ft ² - yr
Passive House Standard	4.75	4.75	38
Harvest Home	2.4	1.74	37.82

HERS RATING - REM/RATE SOFTWARE



LEED FOR HOMES



	AVERAGE COLORADO RESIDENCE	THE HARVEST HOME
HERS Rating	100	40
Passive House U.S.	N/A	Certified
LEED Certification	N/A	Platinum - 91 pts
Annual Energy Consumption	102,000 kBTU/yr	23,600 kBTU/yr
Annual Heating + Cooling Cost	\$1,551 /yr	\$632 /yr
Gross Area	2,082 sf	1,175 sf
Construction Cost / ft ²	\$120 - \$300 /sf	\$146 /sf





Third Level South Terrace

THE HARVEST HOME

RYERSON UNIVERSITY | TORONTO, CANADA