

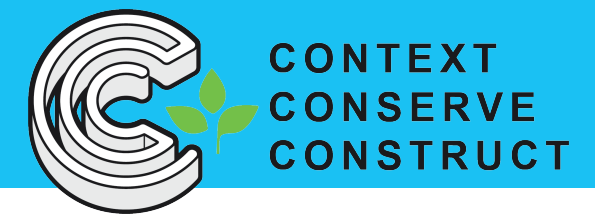
# Ball State University - Urban Single Family



CONTEXT  
CONSERVE  
CONSTRUCT



# Context Conserve Construct



## CONTEXT

Any new construction that takes place in the Emily Kimbrough Historic District should be compatible with existing structures in terms of its:

- style
- configuration
- scale
- materials
- setback
- roof pitch and shape
- and facade pattern.

**GOAL:** Create a beautiful building that will inspire new construction in an old neighborhood.

## CONSERVE

All DOE Zero Energy Ready Homes must meet ENERGY STAR requirements in their:

- envelope
- duct system
- water efficiency
- lighting and appliances
- indoor air quality
- renewable readiness

**GOAL:** Create a house that will act as a catalyst for net-zero design practices in a city that is in the midst of a major revitalization.

## CONSTRUCT

- The living space provided should not exceed 1,230 square feet for a four-bedroom house
- Four-bedroom houses can have 2 full bathrooms
- Houses should be ADA accessible on first floor
- Houses should be able to be constructed with a volunteer force (comprised roughly of 50-60 year-olds in Muncie, Indiana)

**GOAL:** Establish a prototype of a two-story construction practice for a non-profit volunteer force.

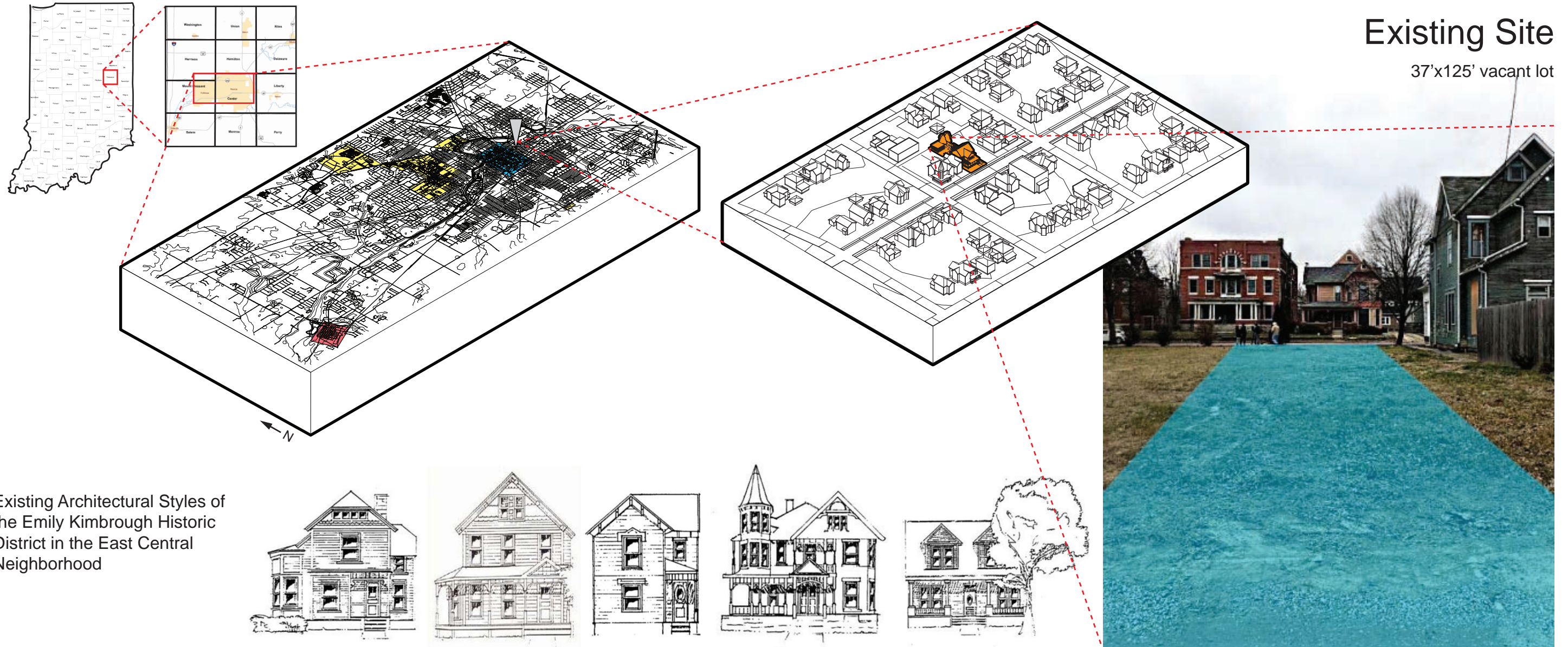
## CCC

Although it may seem challenging to design within the regulations of three separate organizations, we at "CCC" embrace the guidelines of our community partners to create a beautiful building that will inspire new construction in an old neighborhood, act as a catalyst for net-zero design practices in a city that is in the midst of a major revitalization, and establish a prototype of a two-story construction practice for a non-profit volunteer force.



# Introduction

717 E. Main Street, Muncie, Indiana, 47303 | Climate Zone 5A - cool, humid climate - wide range of seasonal changes



CONTEXT

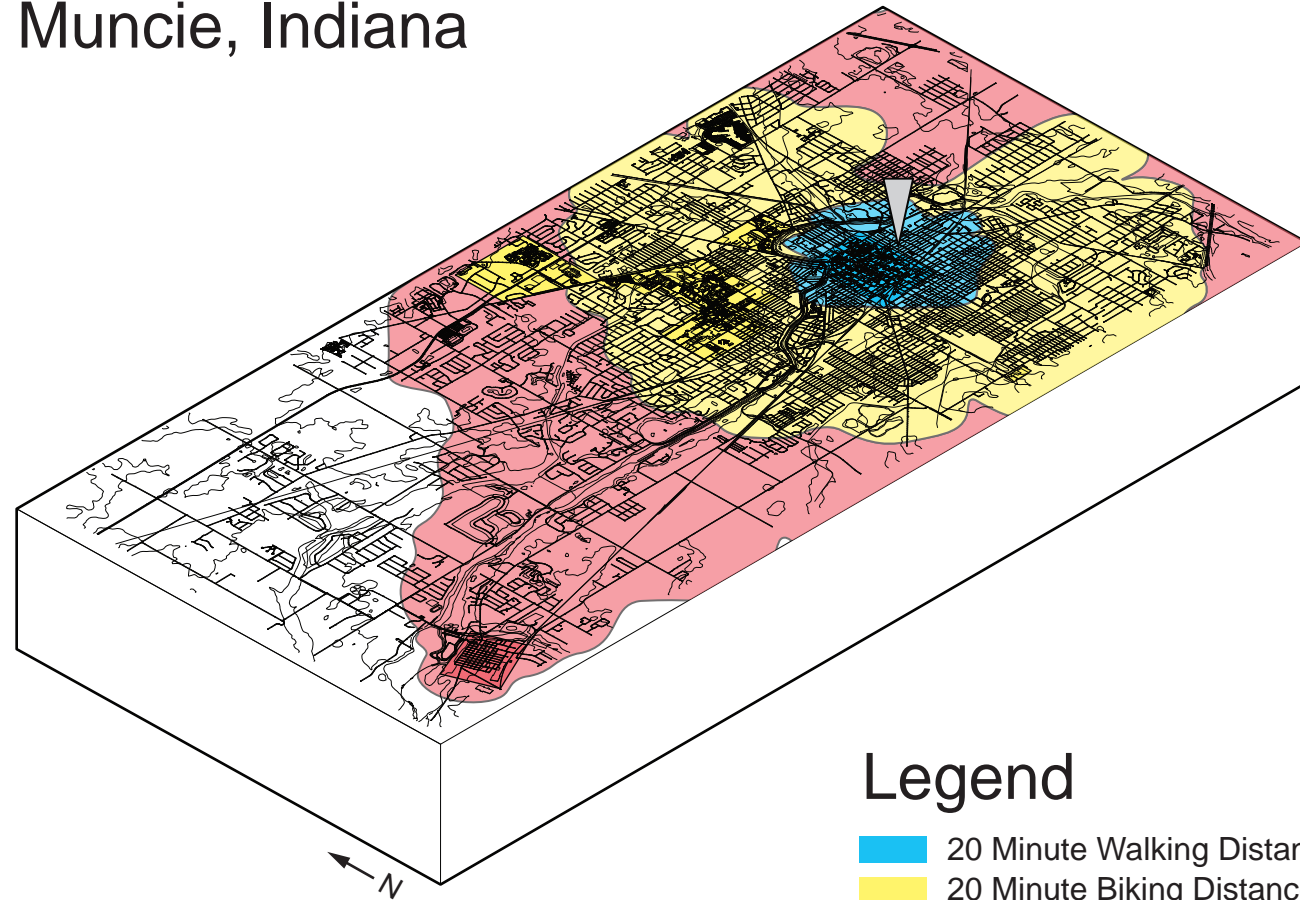
CONSERVE

CONSTRUCT



# Market Potential

## Muncie, Indiana



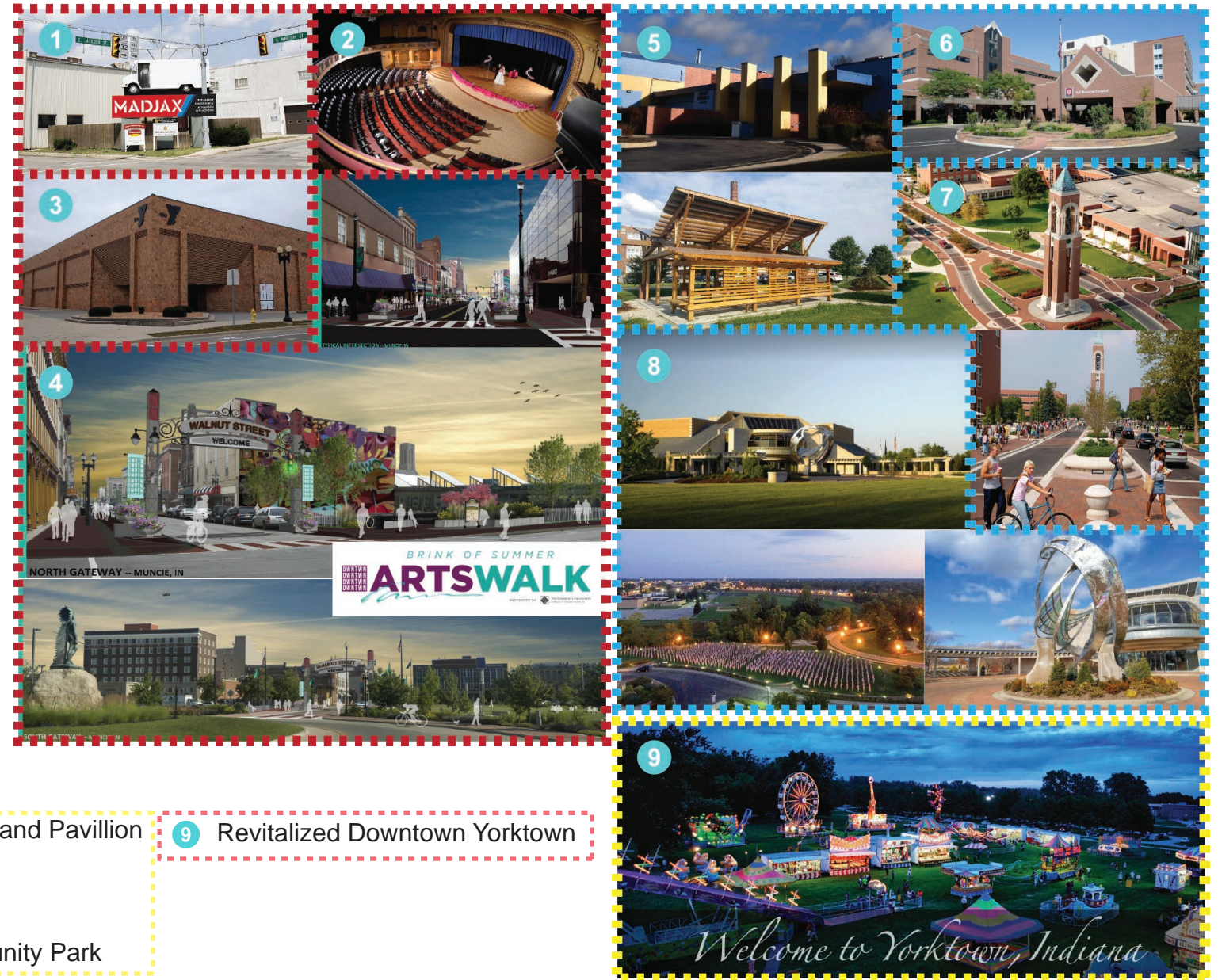
### Legend

- 20 Minute Walking Distance
- 20 Minute Biking Distance
- 20 Minute Driving Distance

- 1 MadJax - Community Makerspace
- 2 Cornerstone - Arts Center
- 3 YMCA of Muncie
- 4 Revitalized Downtown Muncie

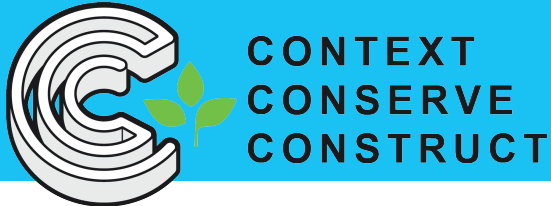
- 5 Maring-Hunt Library and Pavillion
- 6 Ball Hospital
- 7 Ball State University
- 8 Minnetrista - Community Park

- 9 Revitalized Downtown Yorktown

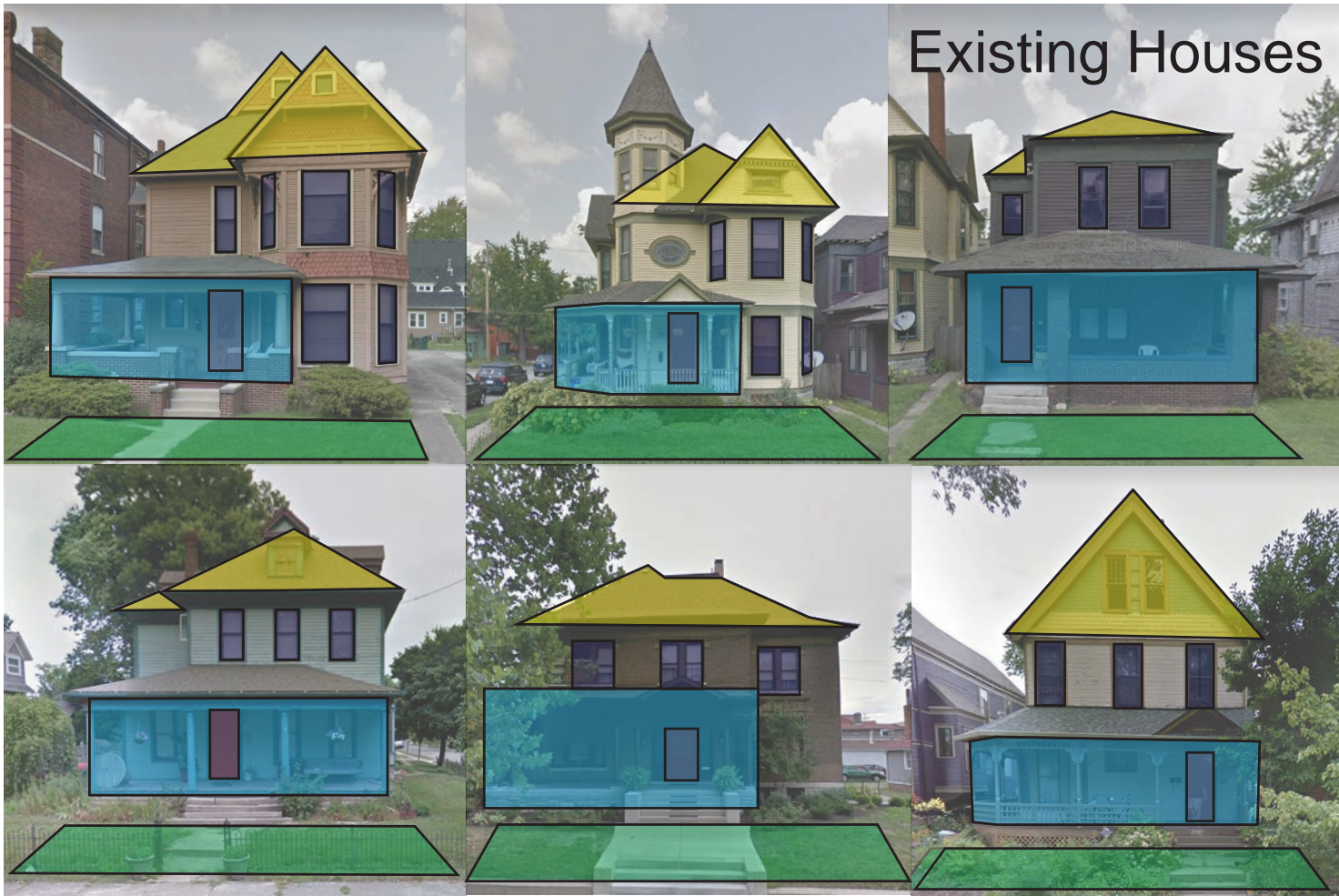




# Emily Kimbrough Historic District



Existing Houses



## Legend

- |                                                                                                                                                |                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|  Roof Pitch (typically 9"/12" slope, but can vary)           |  Front Porch (1/2 or fully wrapped) |
|  Windows (varies in size, but typically in groups of 2 or 3) |  Recessed Entrance                  |
|                                                                                                                                                |  Street Stepback (5-10 ft)          |

Proposal



CONTEXT



CONSERVE

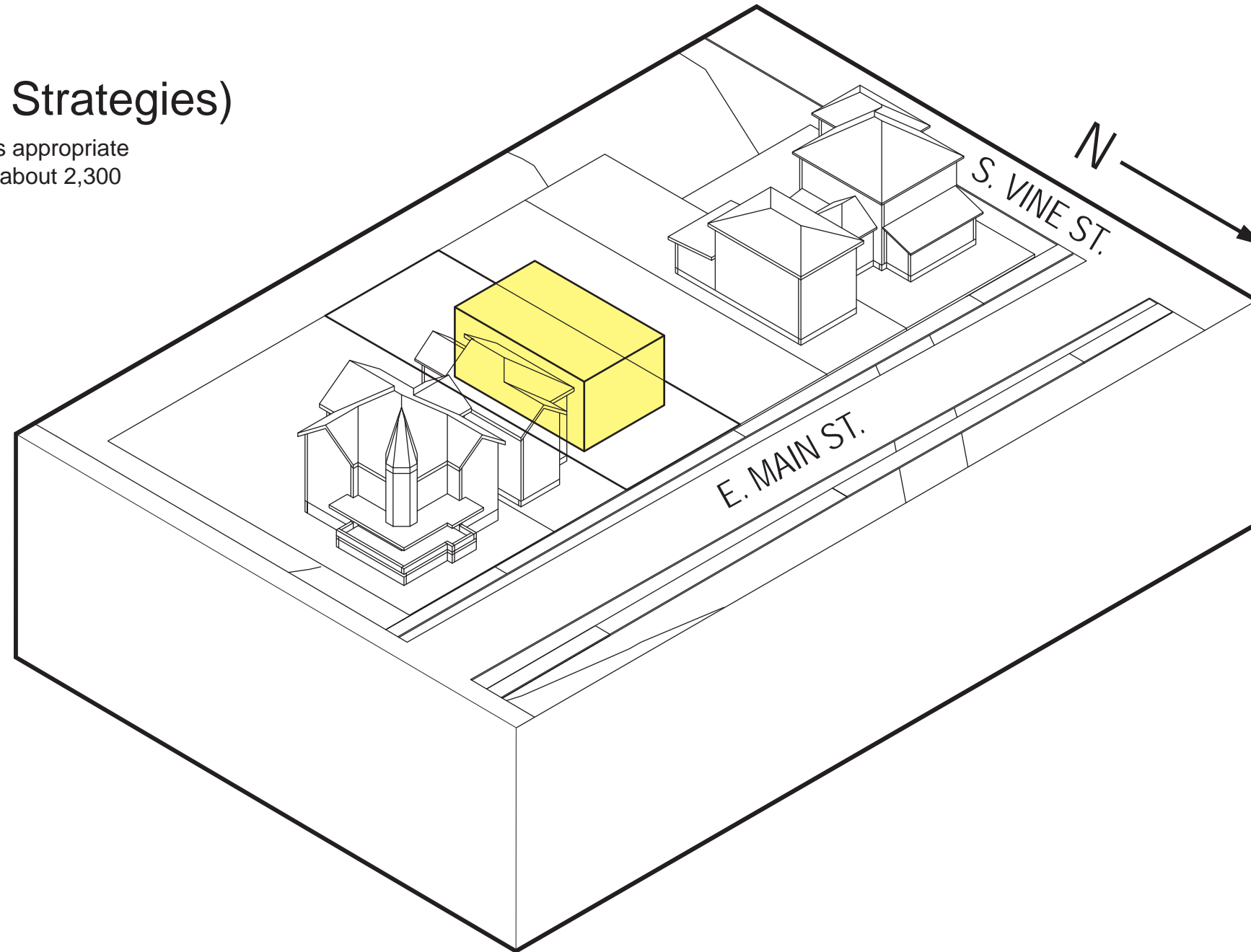


CONSTRUCT



## PHASE A (Massing Strategies)

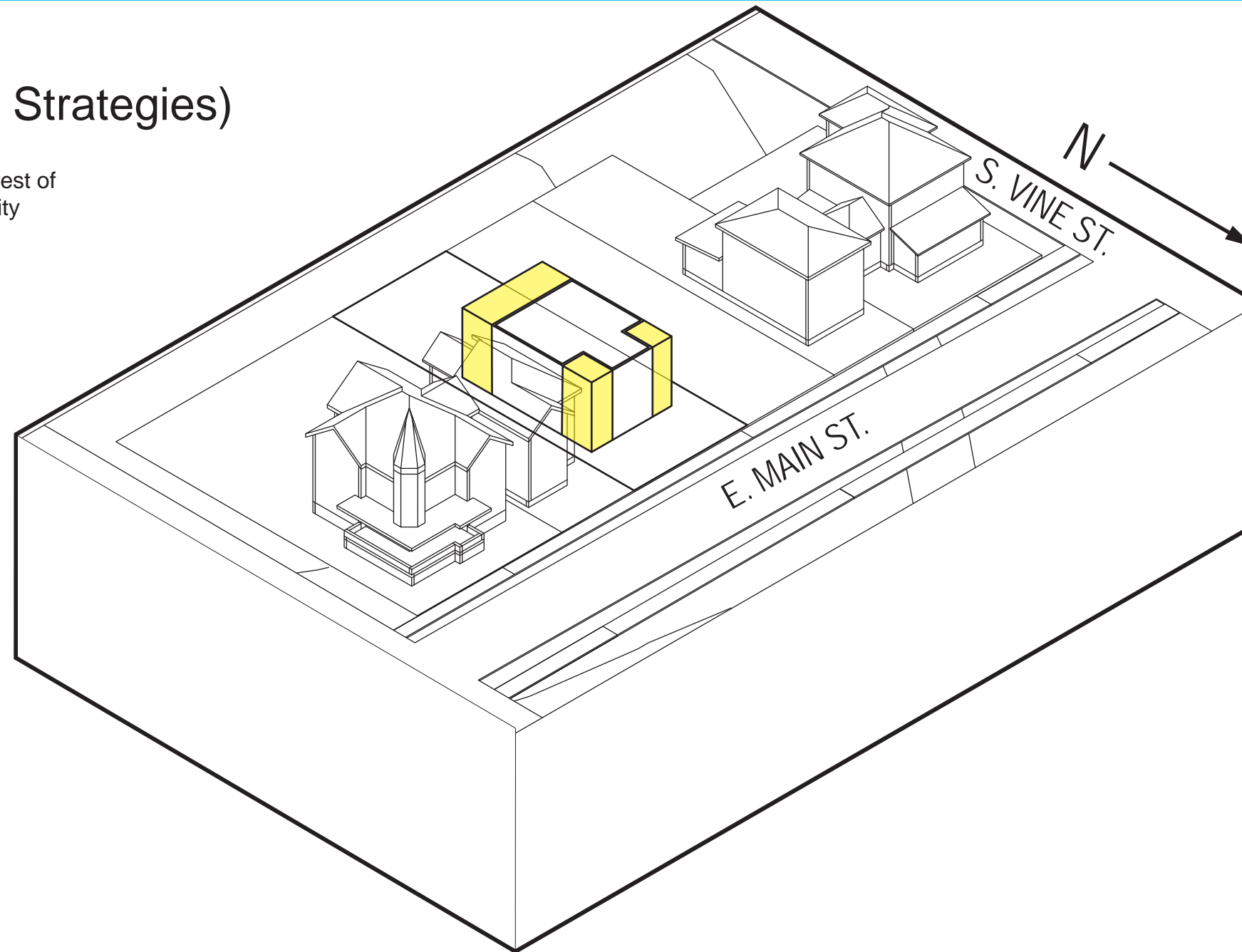
- 1 Begin with a square footage that is appropriate to the Solar Decathlon program (about 2,300 square feet).





## PHASE A (Massing Strategies)

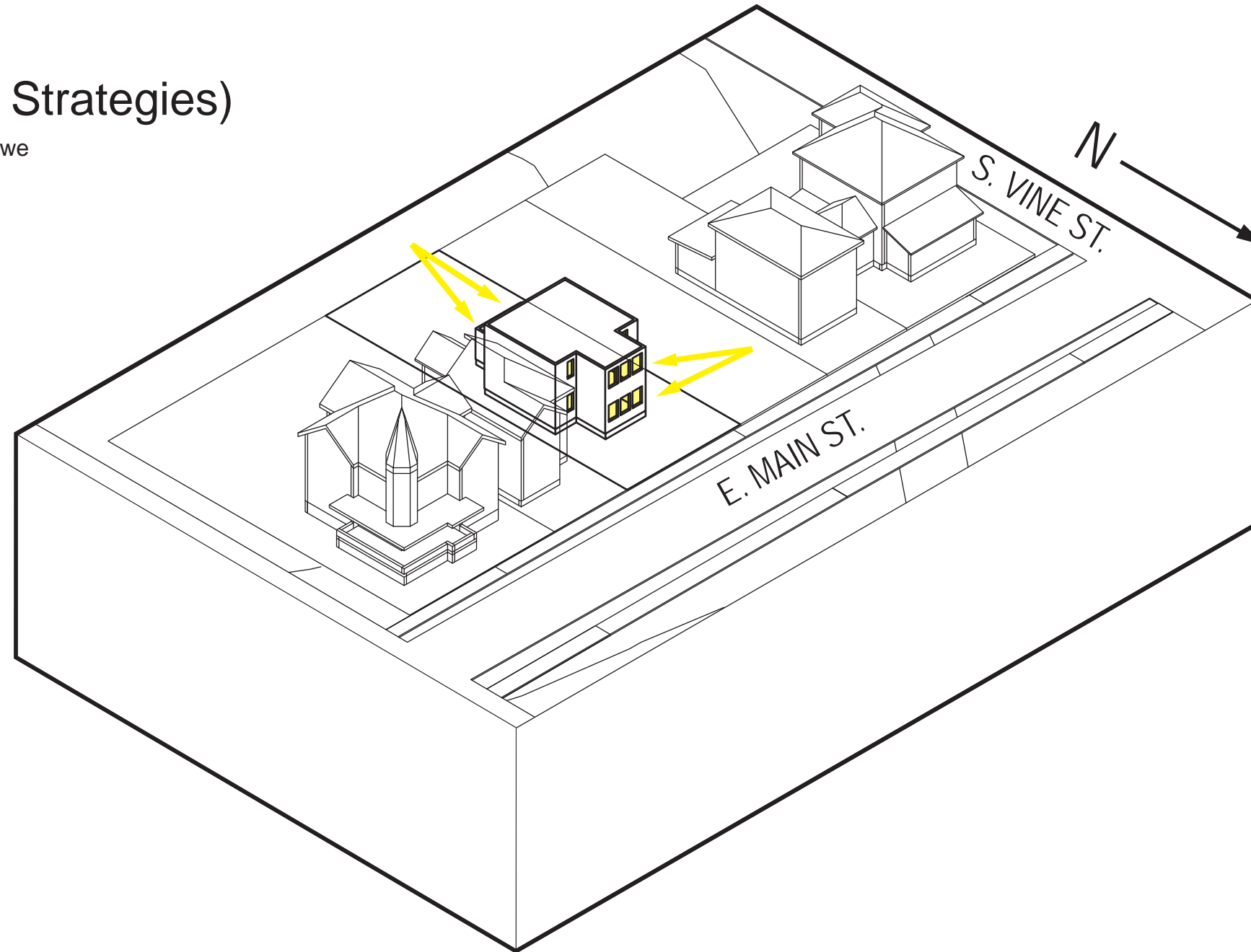
- 2 Subtract from the original form to adhere to the proportions of the rest of the houses in the historic district, per city regulations.





## PHASE A (Massing Strategies)

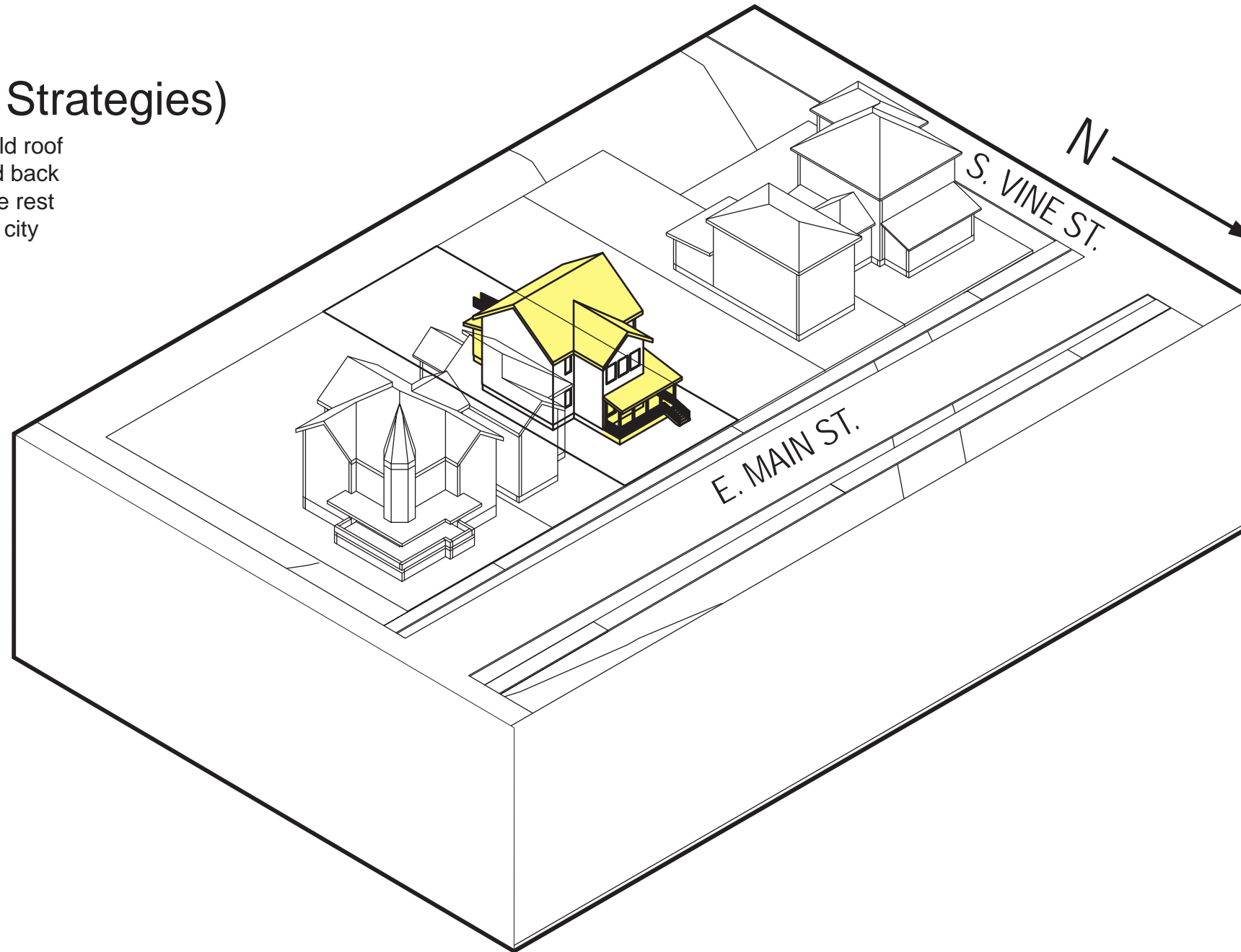
3 Since our site is a very narrow lot, we will use these subtractions to let natural daylight into the middle of the house from the North and South.





## PHASE A (Massing Strategies)

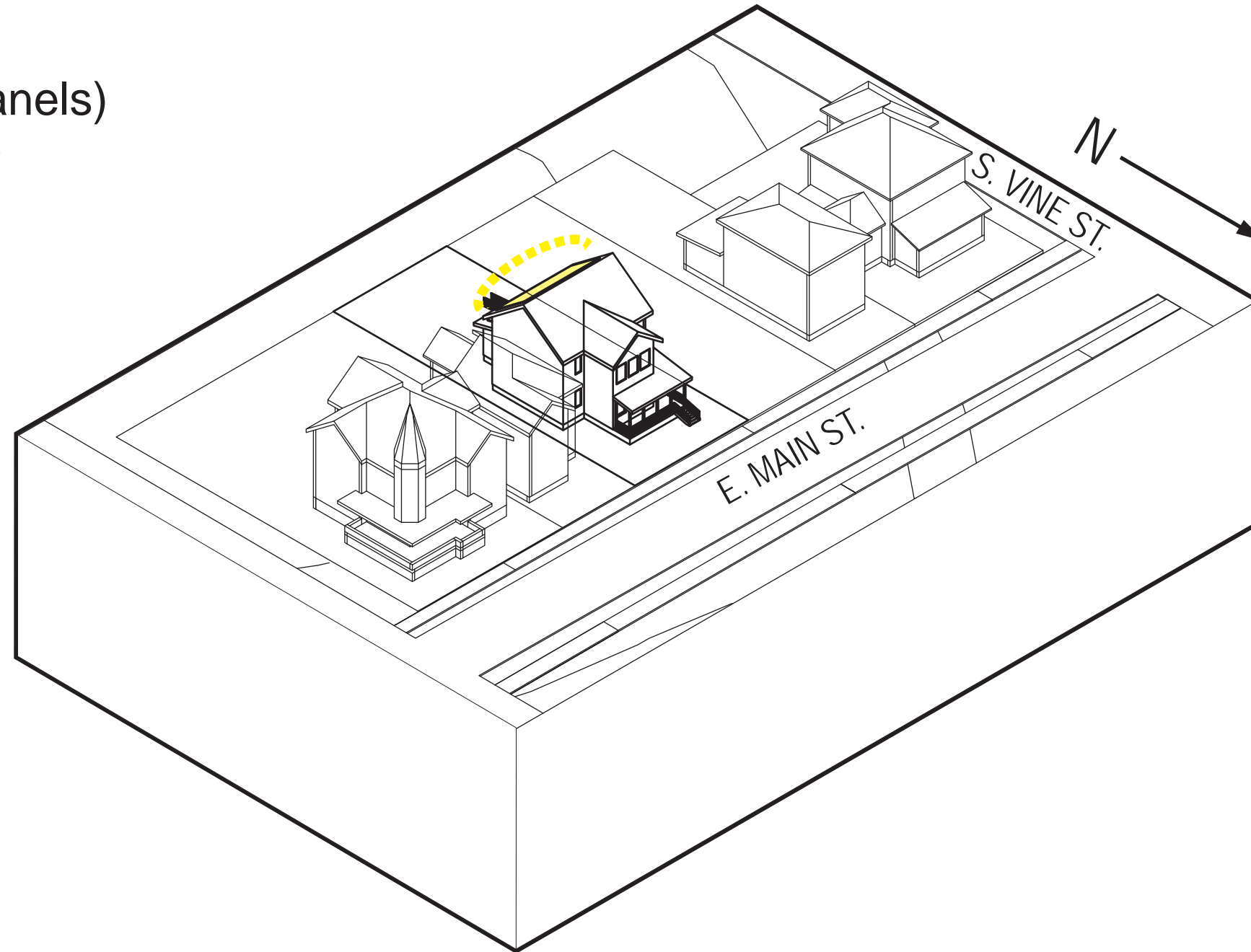
- 4 Add on an appropriately pitched cold roof with attic insulation, and a front and back porch to adhere to the proportions of the rest of the houses in the historic district, per city regulations.





## PHASE B (Solar Panels)

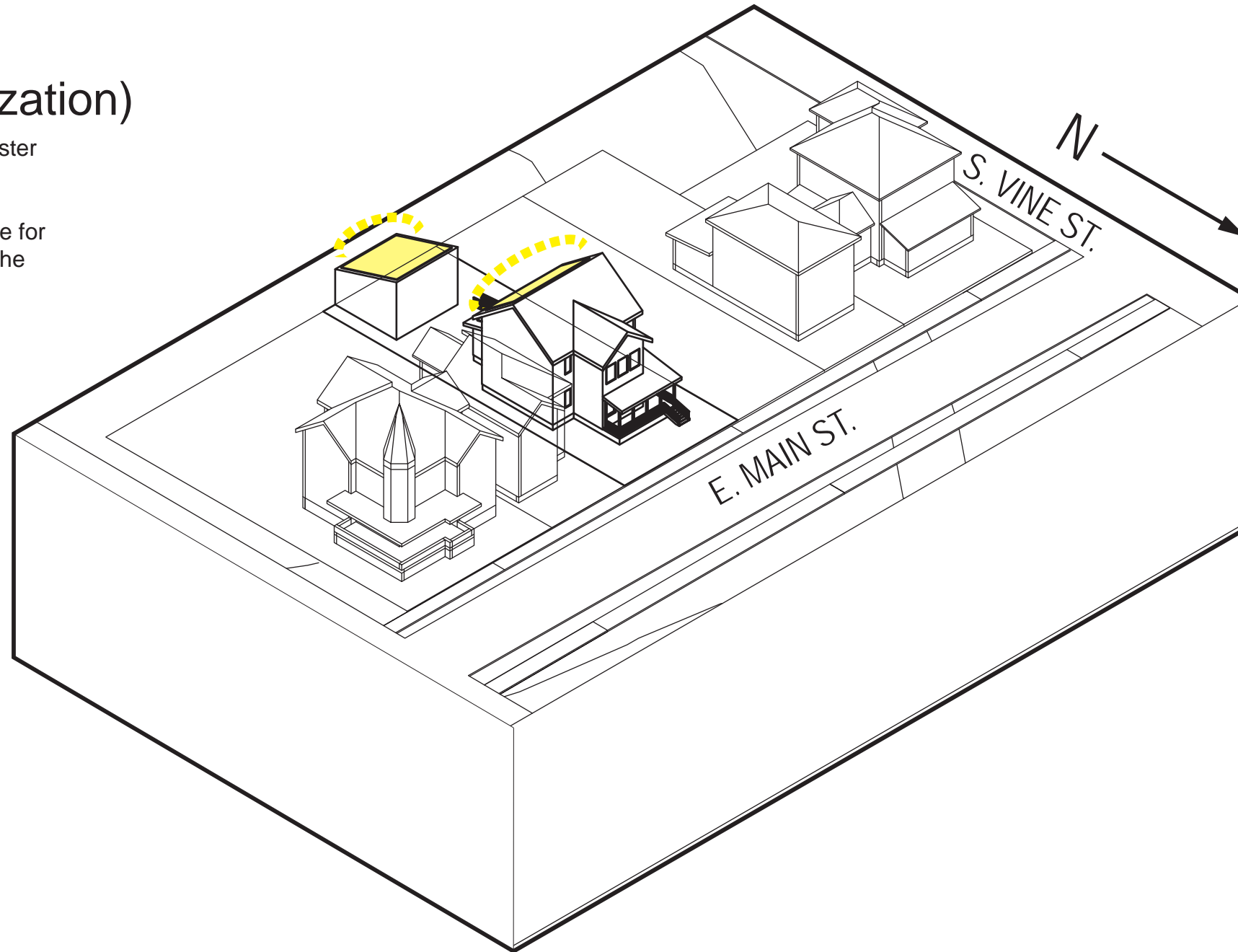
- 5 Add additional photovoltaic panels that may be outside of Habitat for Humanity's budget to create a net-zero energy house.





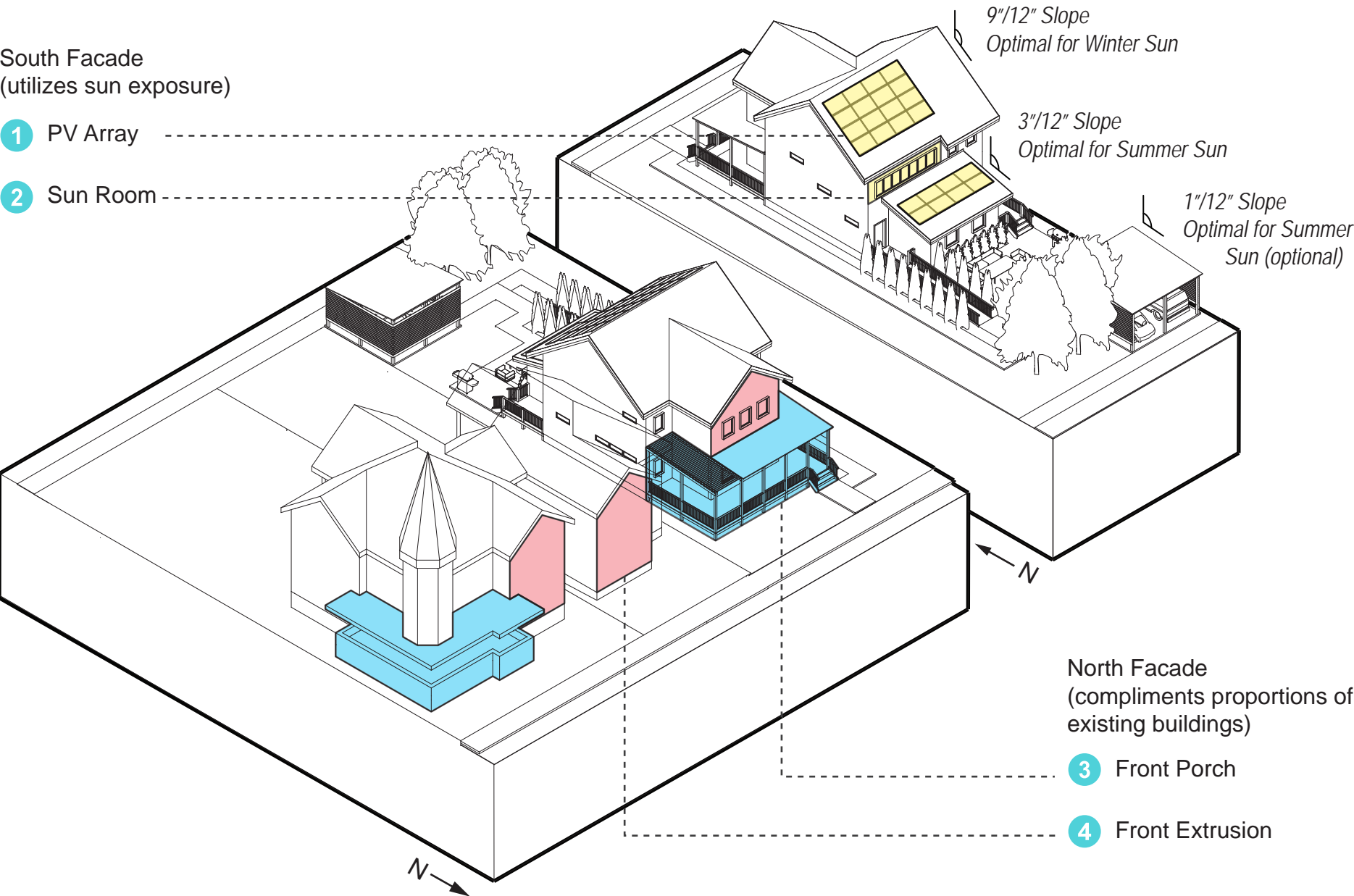
## PHASE C (Customization)

- 6 Provide different iterations of a master plan for the homeowners that will encourage expansion on the property (garage/shelter) and provide more space for additional photovoltaic panels to make the house net-positive



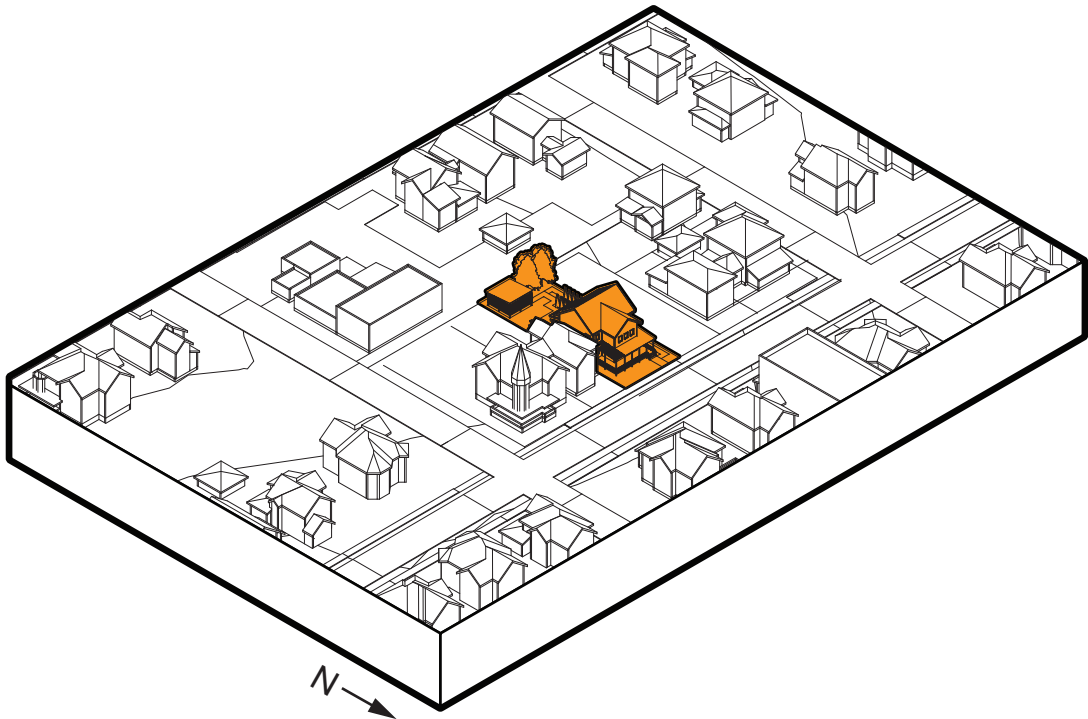


# Design Proposal



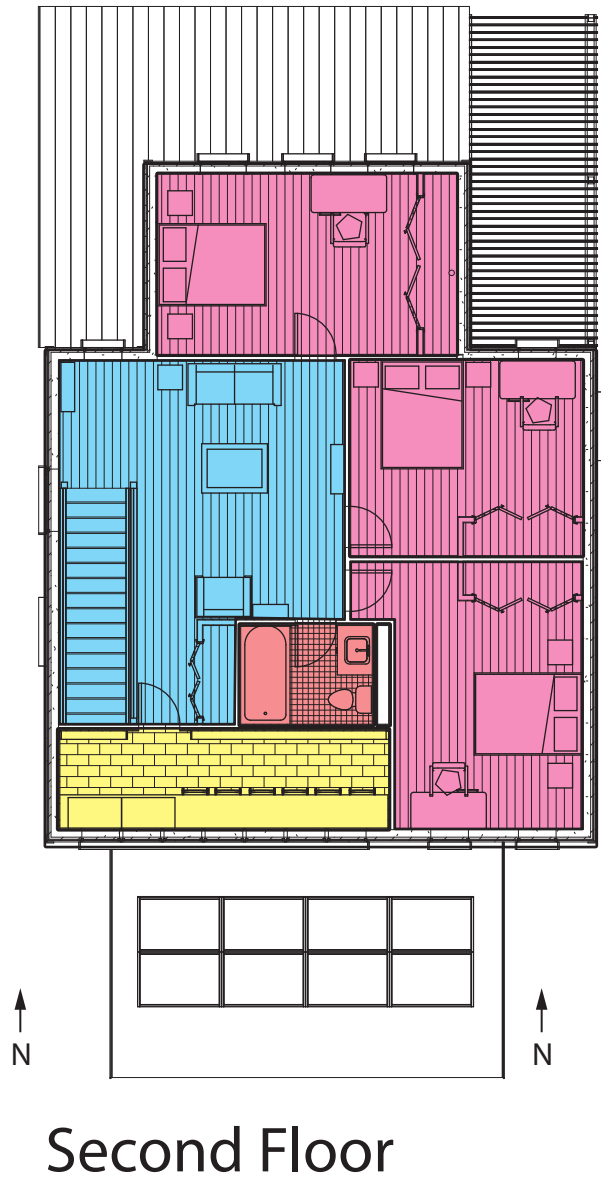
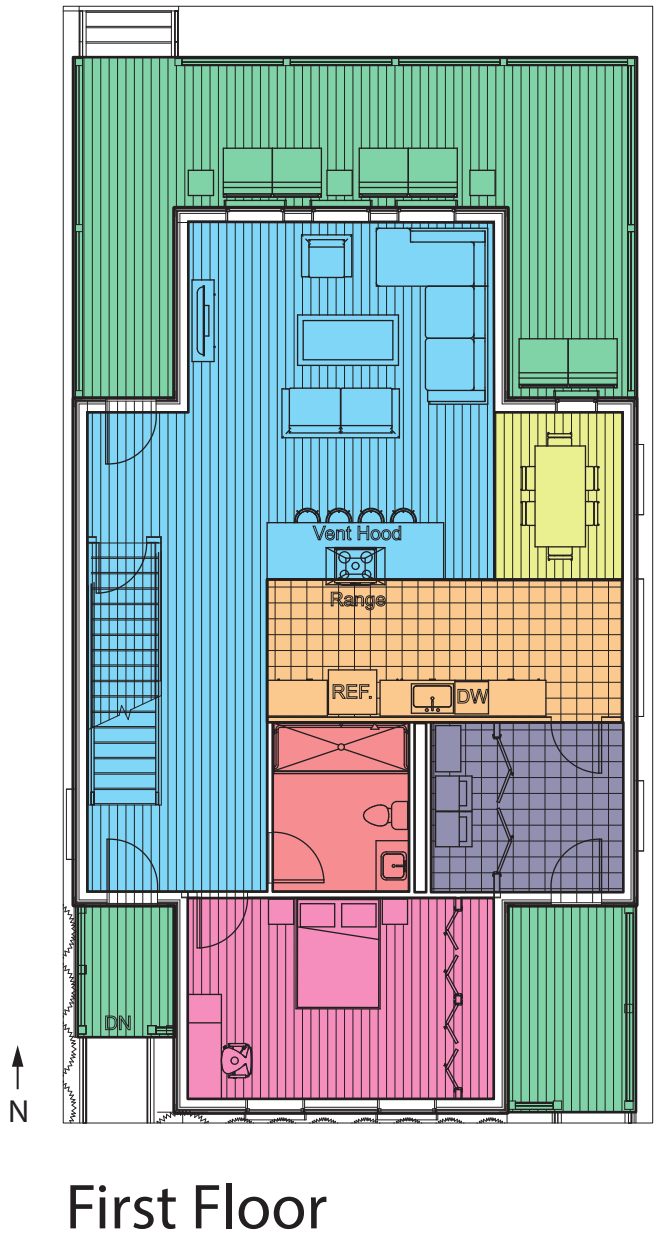
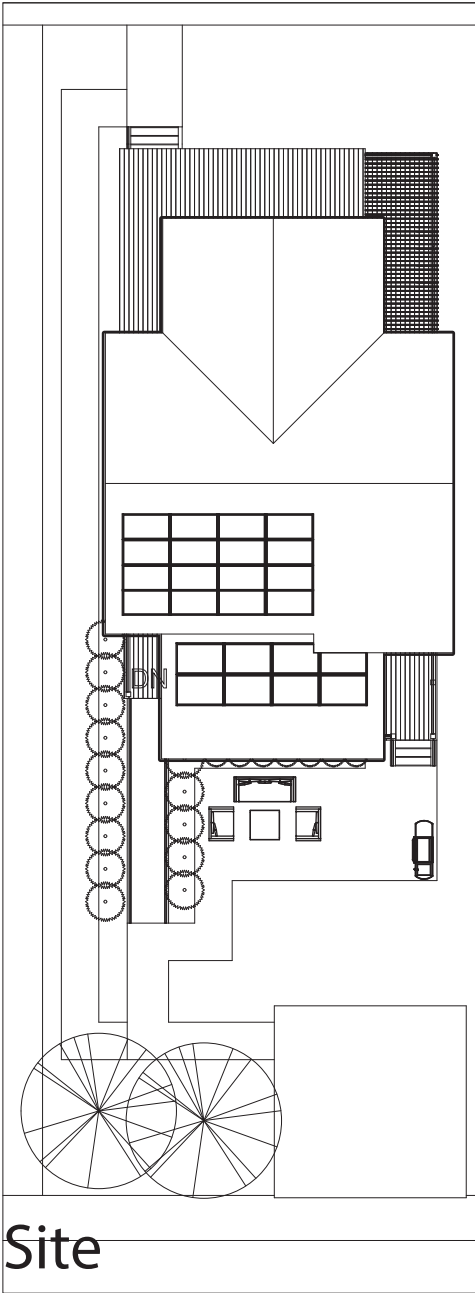


# Floor Plans

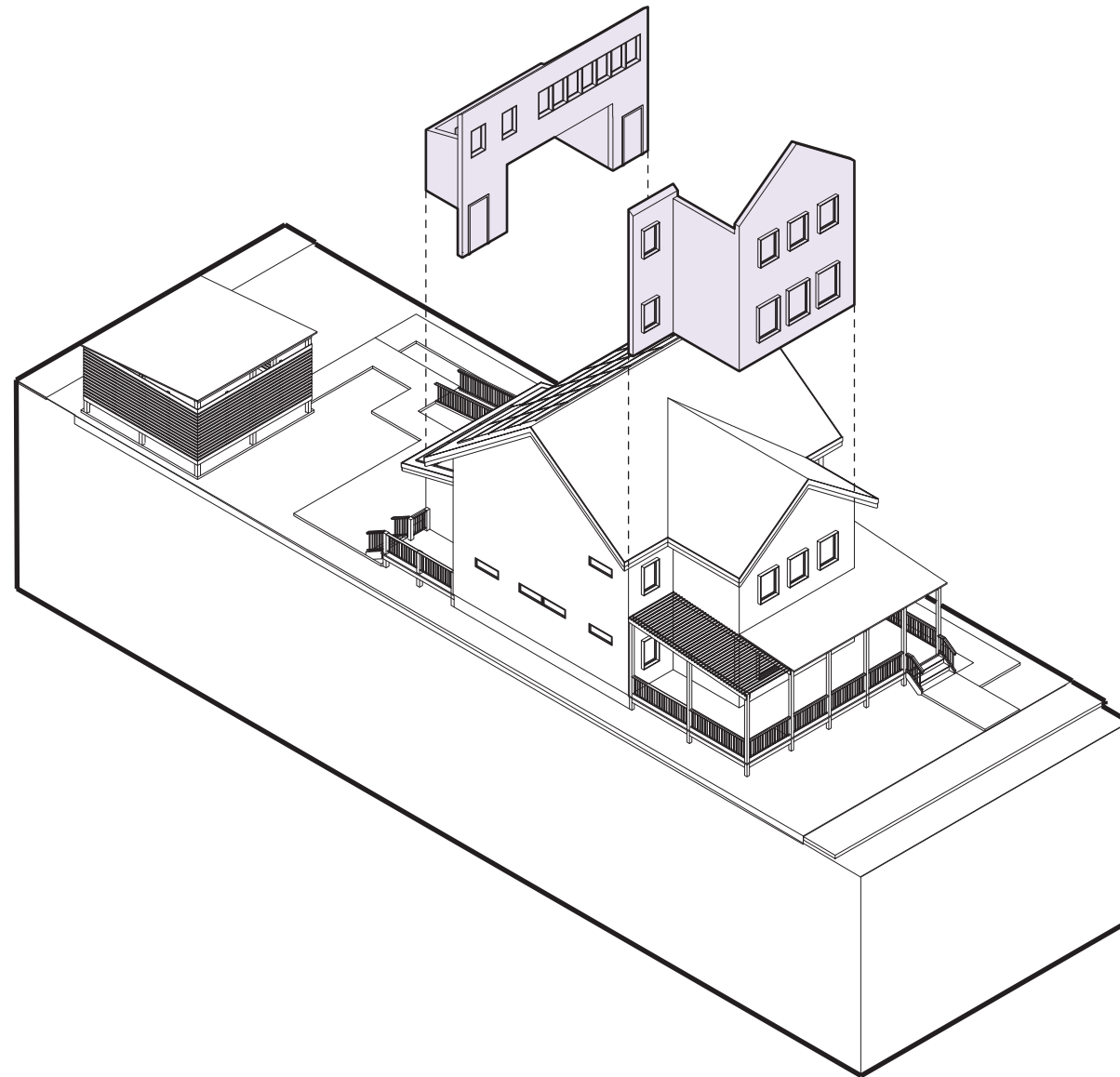


## Legend

- Living Room
- Kitchen
- Dining Room
- Porch
- Bathroom
- Bedroom
- Mechanical Room
- Sun Room



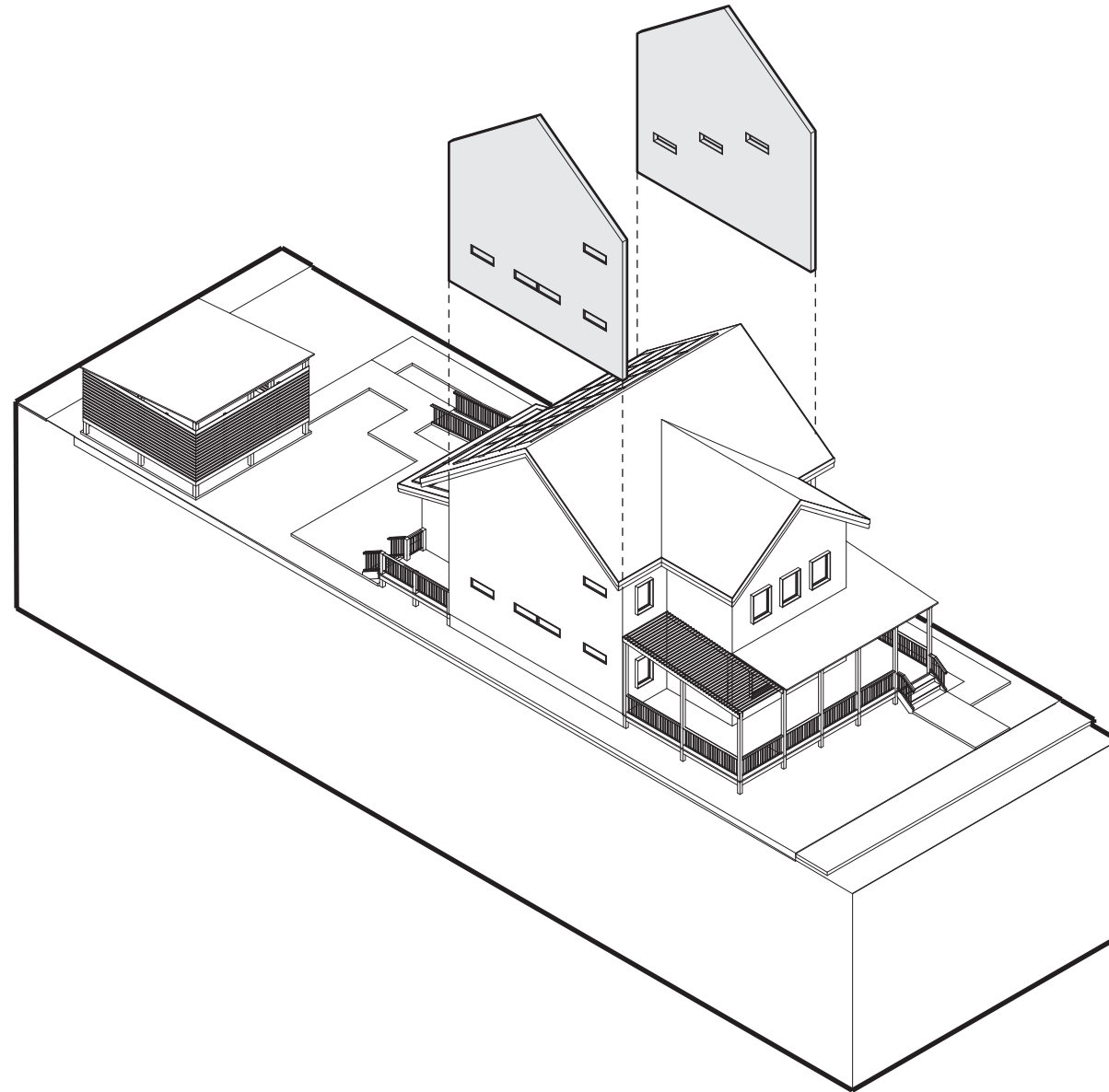




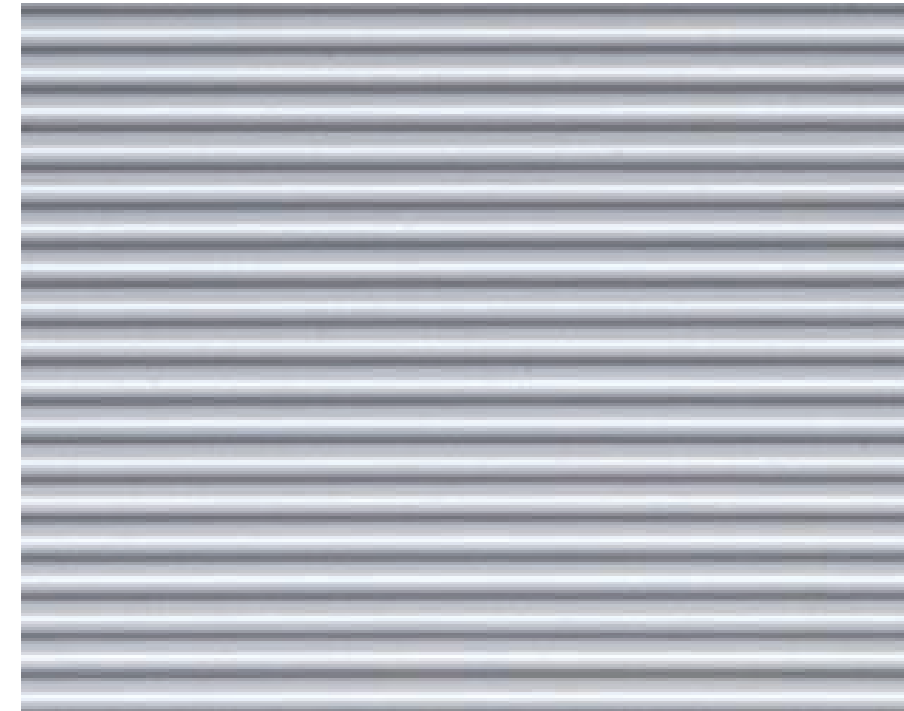
## FIBER CEMENT BOARD



Fiber cement board siding will also compliment the horizontal siding of most of the houses in this district and, since Habitat for Humanity receives free donations of fiber cement board, it will provide a cost efficient alternative to the traditional wooden siding most of the houses in this area use.

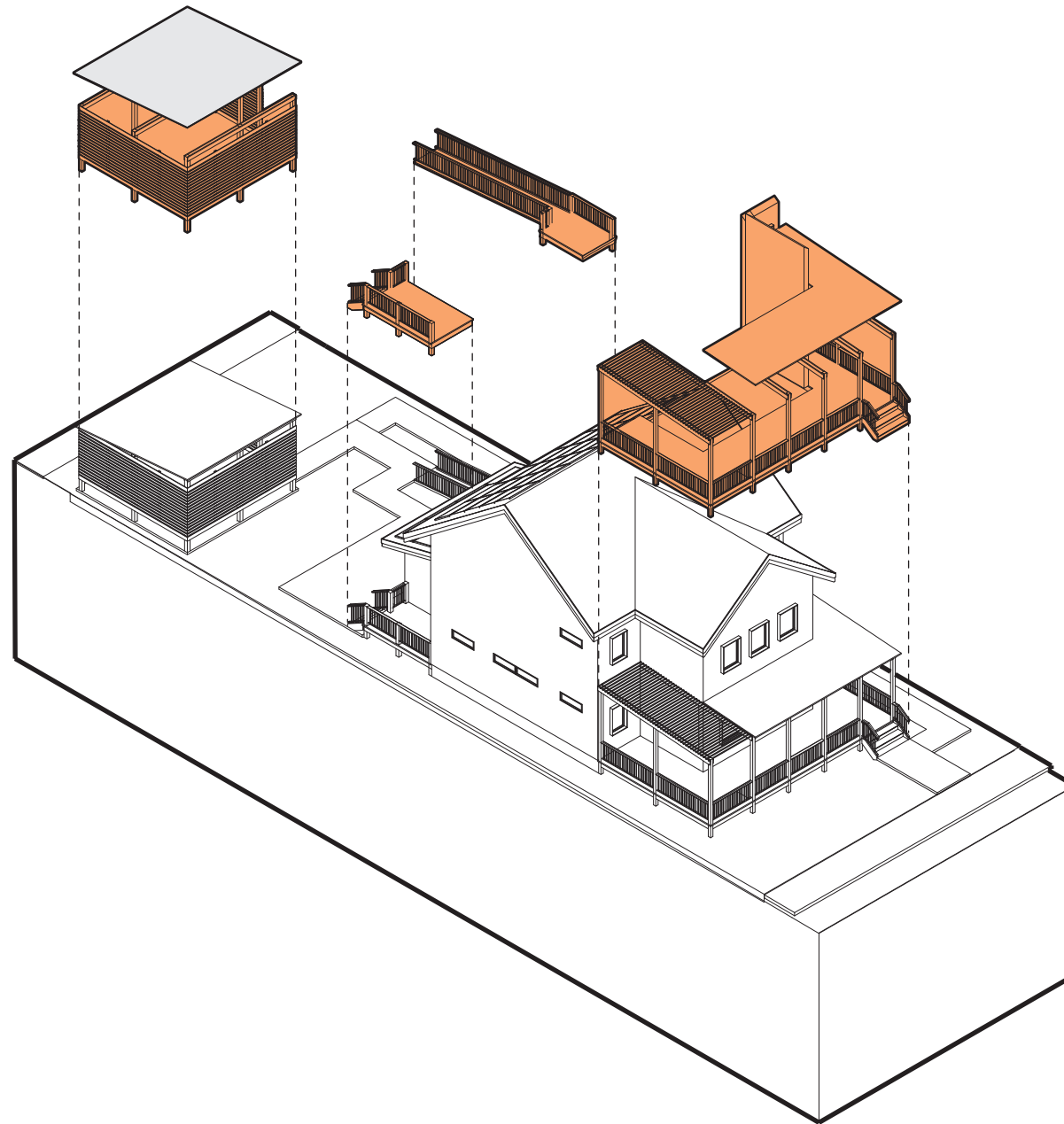


## CORRUGATED METAL



Corrugated metal siding will be used only on the East and West facade where our house comes within 2-5 feet of an adjacent historic house. This metal will be able to last with very little maintenance, which could prove to be difficult in such a tight space. Since the houses in this neighborhood are so close together, the corrugated metal will be out of sight from the street.



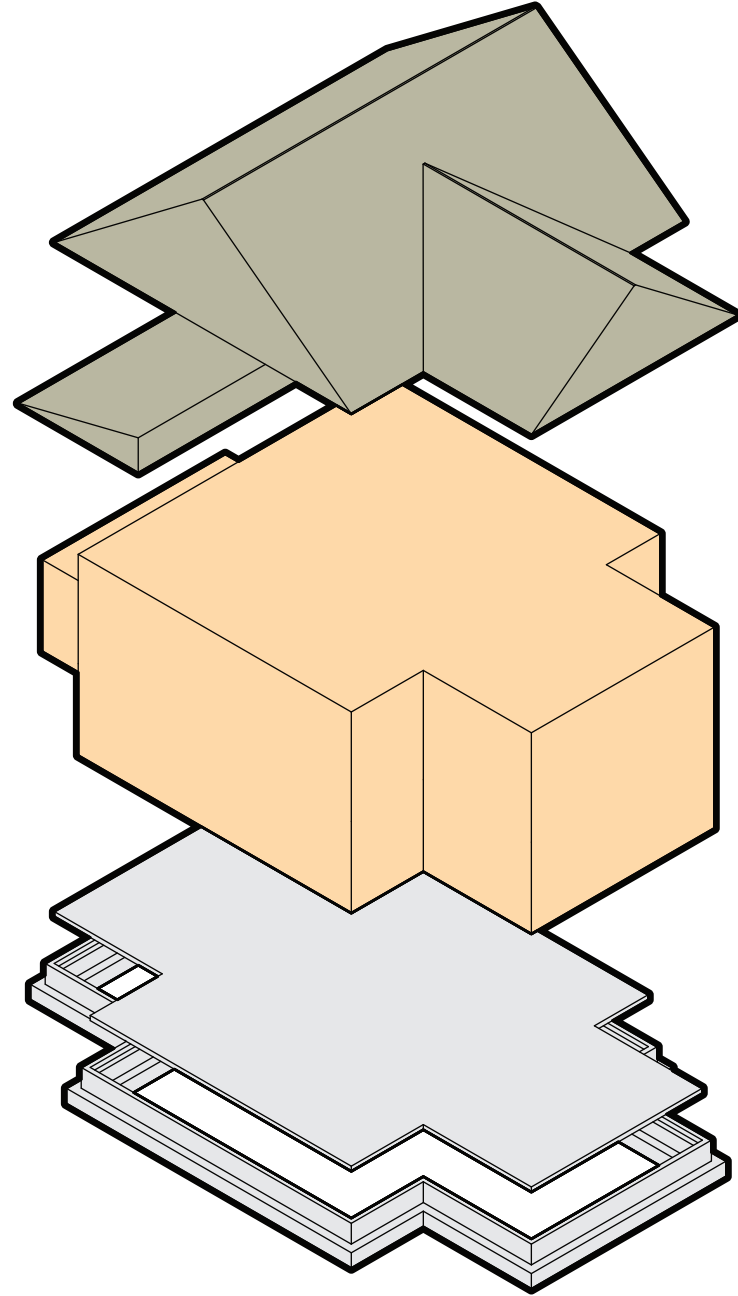


## RED CEDAR

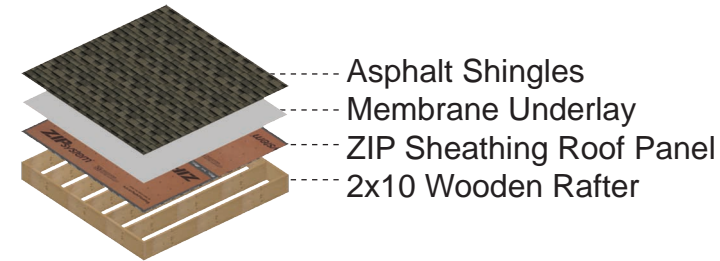


Red Cedar siding will compliment the wooden siding and trim of the neighborhood while introducing a more contemporary highlight to our front entrance, front porch, back porch, and carport. Once treated and installed, red cedar will need minimal upkeep to maintain its natural aesthetic.

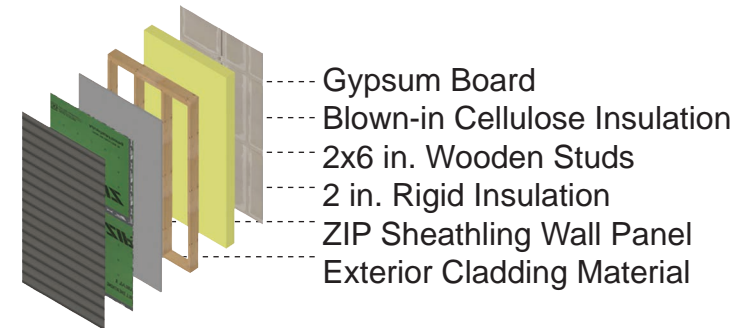
# Assembly R-Values



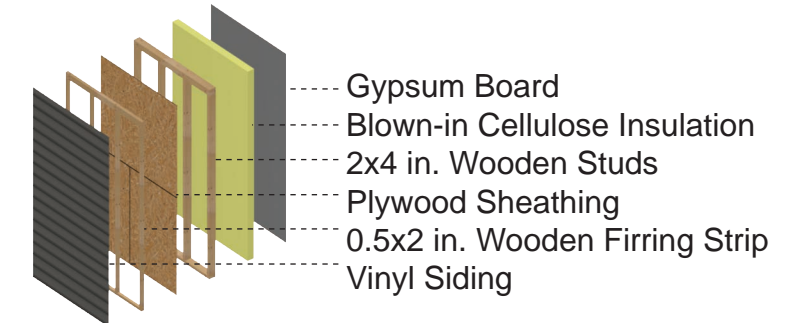
## 1 Roof Assembly (R-49)



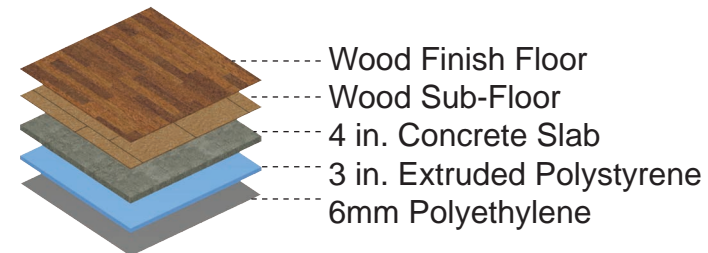
## 2 Typical Wall Assembly (R-31)



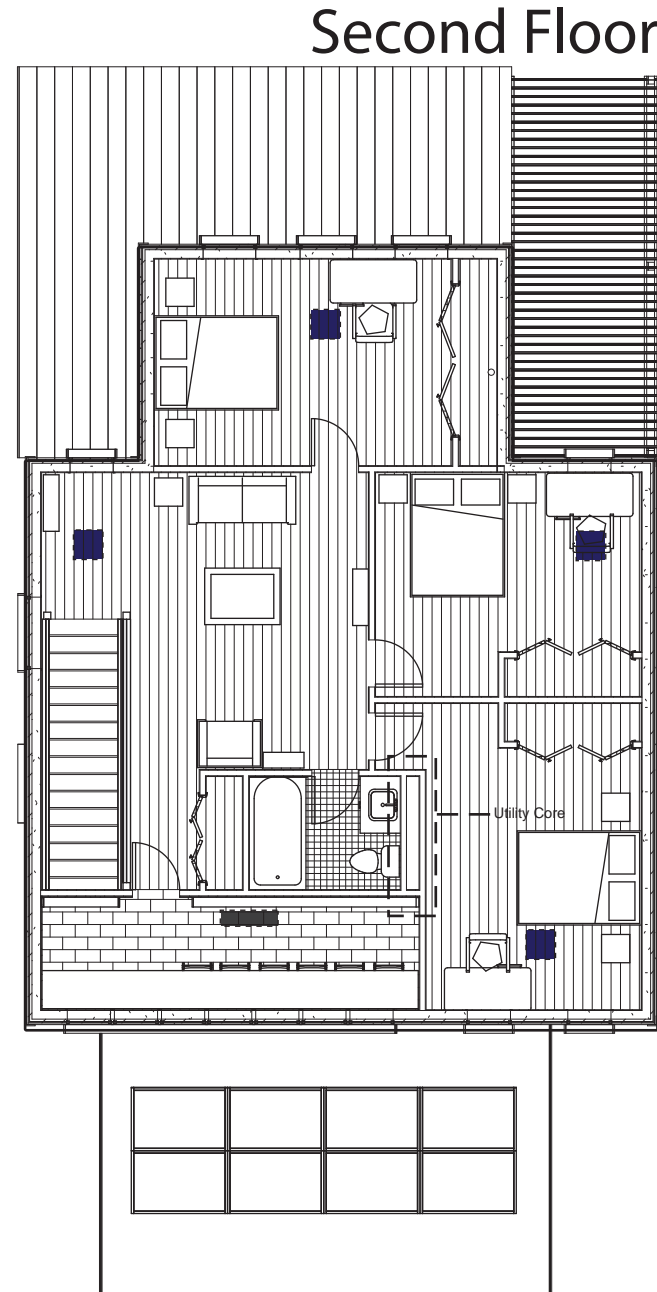
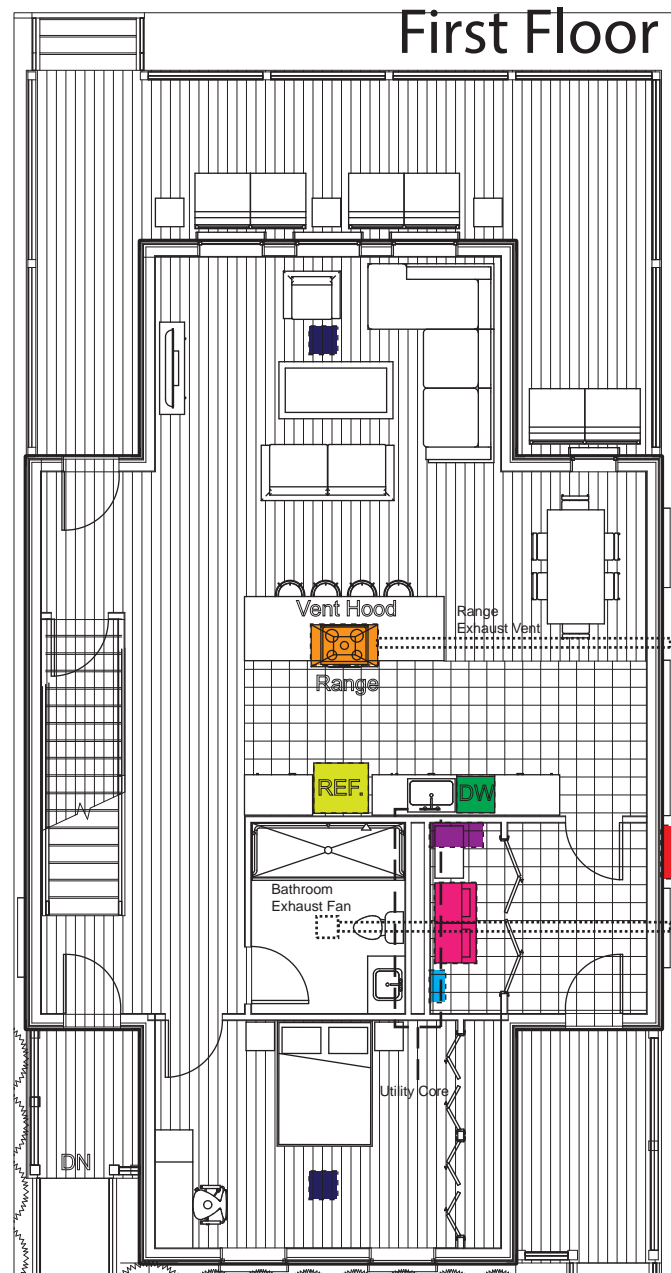
## Typical Habitat Wall Assembly (R-20)



## 3 Floor Slab Assembly (R-20)







Whirlpool  
36" Convertible Wall  
Mounted Range Hood



Samsung  
5.8 cu ft Electric Range  
- 1.2 kW-3.0kW Ceramic  
Cooktop  
- 1,250-3,000W Oven



Samsung  
18 cu ft Refrigerator  
- 364 kW/yr



Samsung  
44 dBA Dishwasher  
- 239kW/yr



Samsung  
DVM S Eco  
- heating capacity=  
54,000 BTU/hr  
- cooling capacity=  
48,000 BTU/hr



Samsung  
2.2 cu ft Washer  
- 85 kW/yr  
Samsung  
Ventless Electric  
4 cu ft Dryer  
-148 kW/yr



Rheem  
RTEX-27  
- 27 kW model flow  
rate (up to 6.6 GPM)  
- 99.8% energy  
efficient



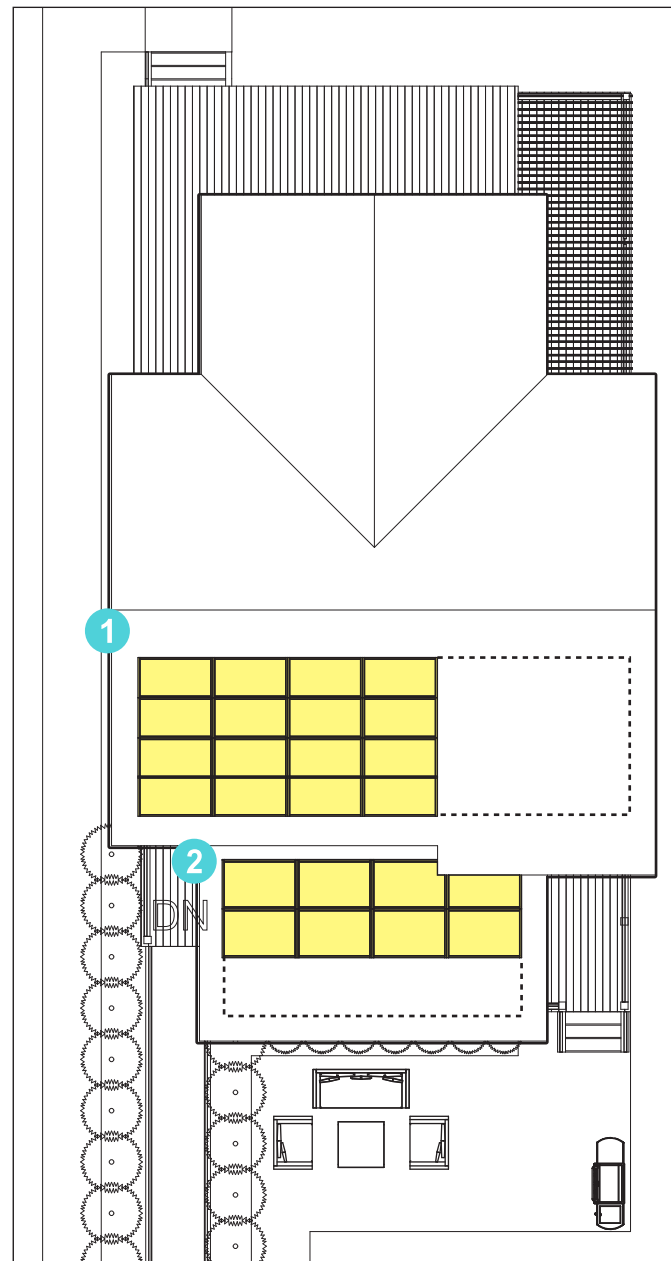
Samsung  
Wind-Free 4 Way  
Cassette  
- heating capacity=  
10,000 BTU/hr  
- cooling capacity=  
9,000 BTU/hr



Samsung AR 5000  
- heating capacity=  
5,800 BTU/hr  
- cooling capacity=  
5,000 BTU/hr



Panasonic FV-10VEC1  
- ASHRAE 62.2, LEED  
& Energy Star Compliant  
- 100 CFM



SunPower  
E-Series Residential Solar Panel  
SPR-E20-327  
- nominal power = 327W  
- temperature = -40°F to 185°F  
- 96 monocrystalline Moxeon Gen II Solar Cell

## 1 Main Roof PV Array



### ACTUAL

- 16 panels
- 5 kW array
- 37° tilt towards South
- YIELD: 7,154 kWh/yr

### POTENTIAL

- 30 panels
- 9.3 kW array
- 37° tilt towards South
- YIELD: 13,307 kWh/yr

## 2 Shed Roof PV Array



### ACTUAL

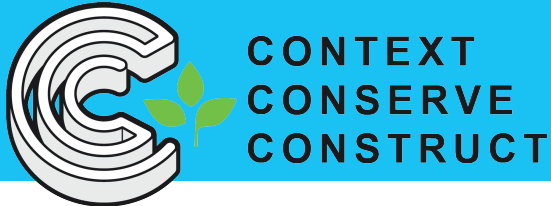
- 8 panels
- 2.5 kW array
- 14° tilt towards South
- YIELD: 3,410 kWh/yr

### POTENTIAL

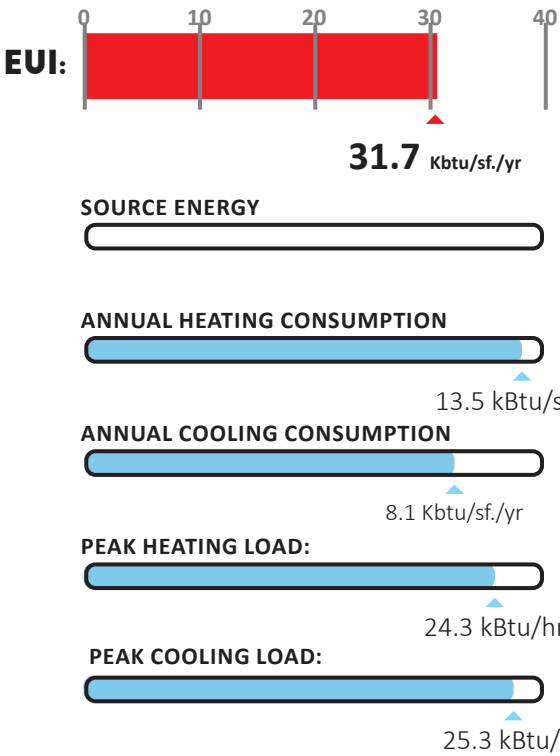
- 12 panels
- 3.75 kW array
- 14° tilt towards South
- YIELD: 5,074 kWh/yr



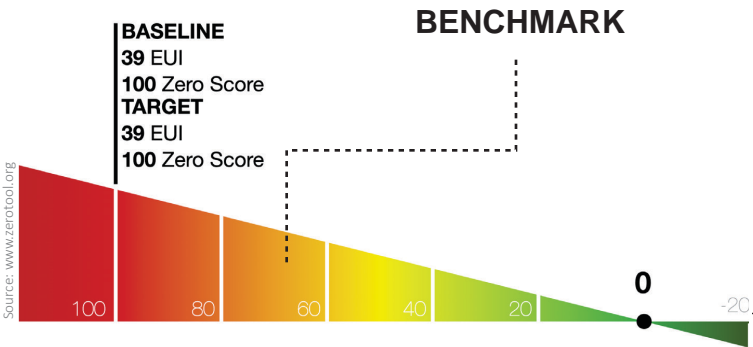
# Energy Performance



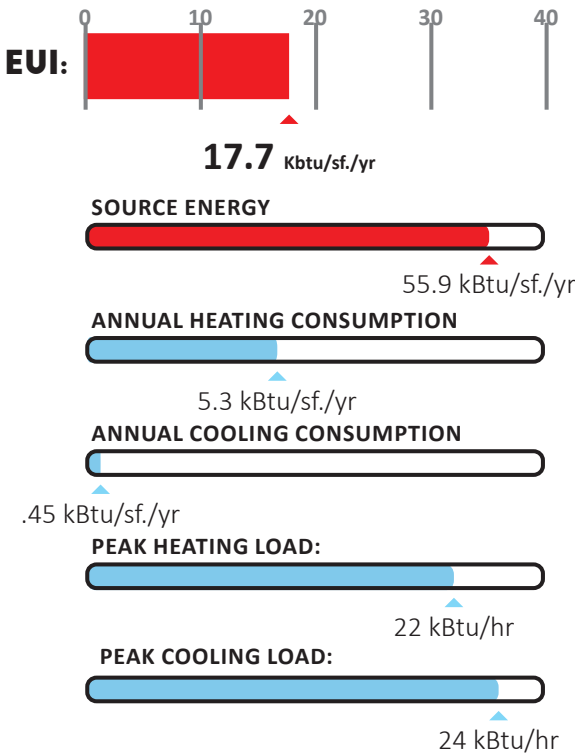
BENCHMARK



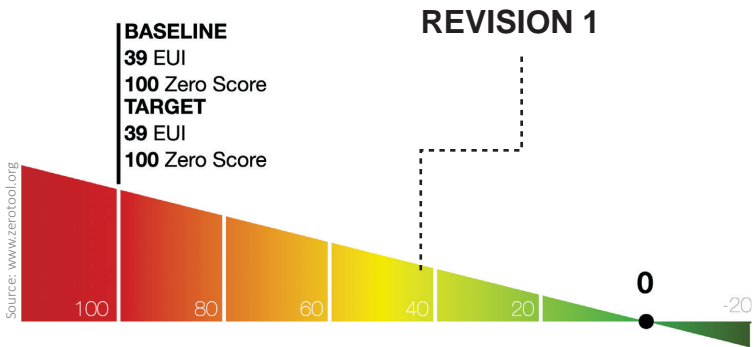
BUILDINGS VALUES		
R-VALUE:	WALLS	R-25
	ROOF/ATTIC	R-49
	FLOOR	R-10
WINDOWS:	U-VALUE	.29
	SHGC	.4
AIR LEAKAGE:		
1 ACH@50PA		
HVAC:	HEATING	94 AFUE 32 K
	COOLING	13 SEER 1.5 TON
LIGHTING:		
100% LED		
SOLAR:		
N/A		
HOT WATER:		
GAS (50 GAL)		



REVISION 1

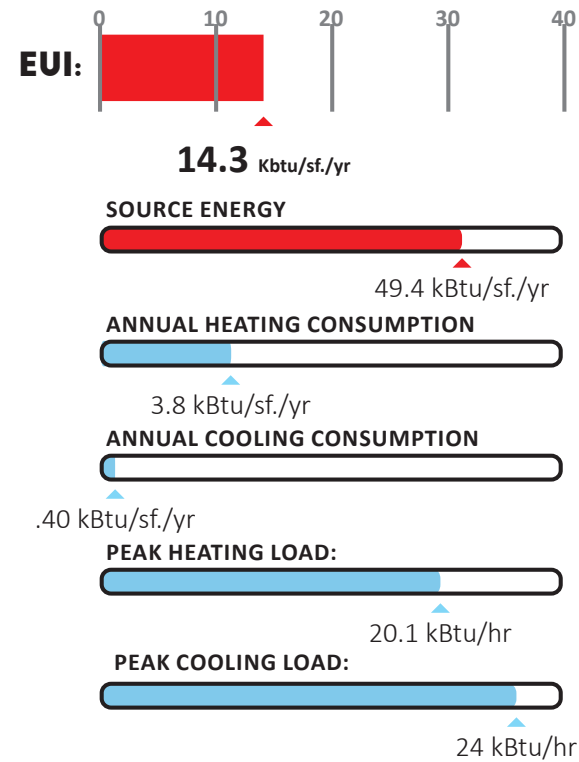


BUILDINGS VALUES		
R-VALUE:	WALLS	R-31
	ROOF/ATTIC	R-49
	FLOOR	R-10
WINDOWS:	U-VALUE	.27
	SHGC	.4
AIR LEAKAGE:		
1 ACH@50PA		
HVAC:	HEATING	94 AFUE 32 K
	COOLING	13 SEER 1.5 TON
LIGHTING:		
100% LED		
SOLAR:		
N/A		
HOT WATER:		
GAS (50 GAL)		





## REVISION 2



BUILDINGS VALUES

R-VALUE:

WALLS

R-31

ROOF/ATTIC

R-49

FLOOR

R-20

WINDOWS:

U-VALUE

.27

SHGC

.4

AIR LEAKAGE:

1 ACH@50PA

HVAC:

AIR SOURCE HP

SEER 22, HSPF 10 VAR. SP

LIGHTING:

100% LED

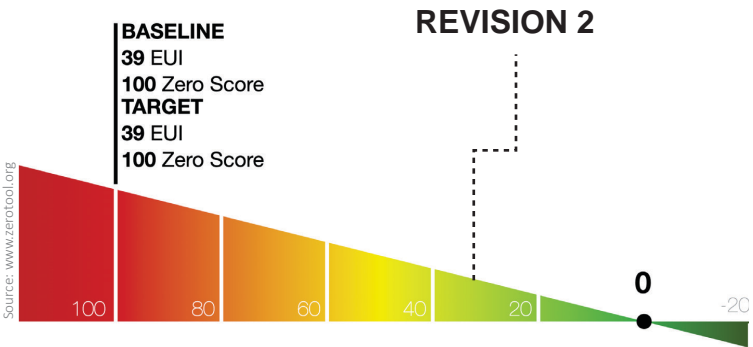
SOLAR:

N/A

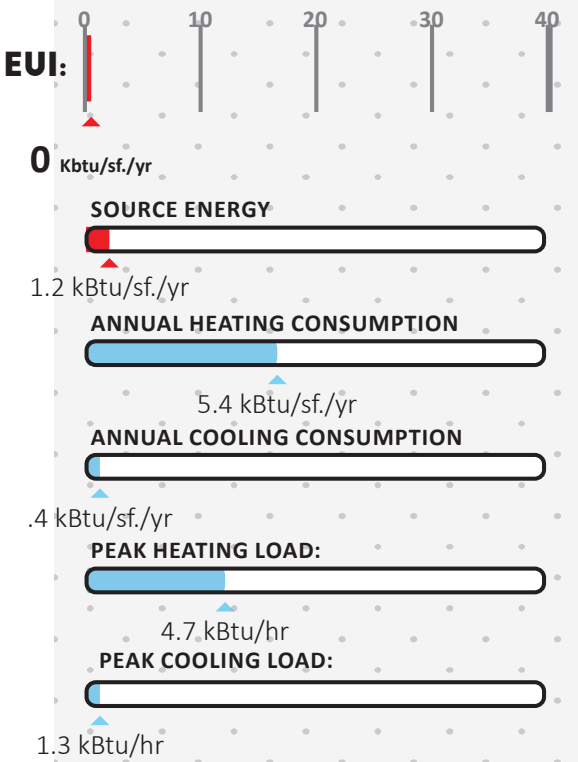
HOT WATER:

HPWH ELECTRIC

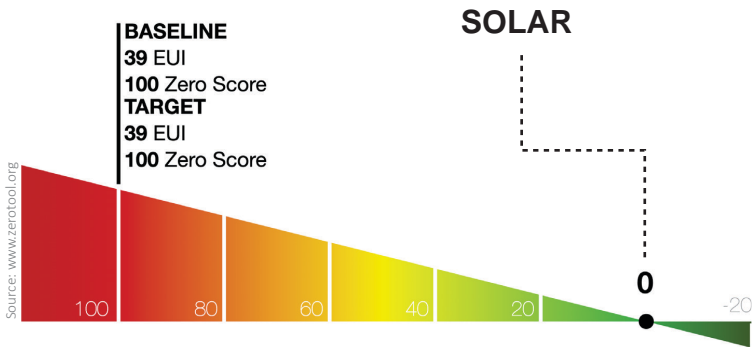
(50 GAL)



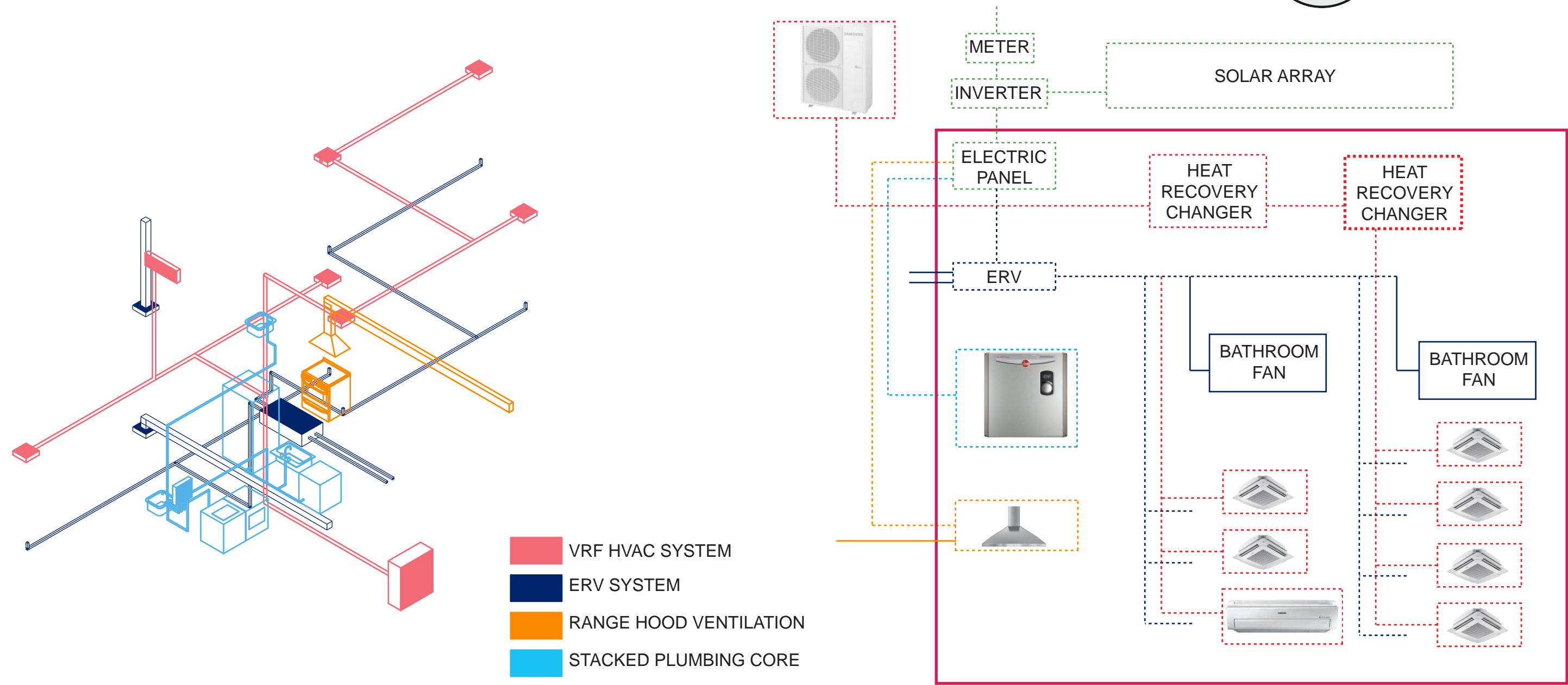
## SOLAR



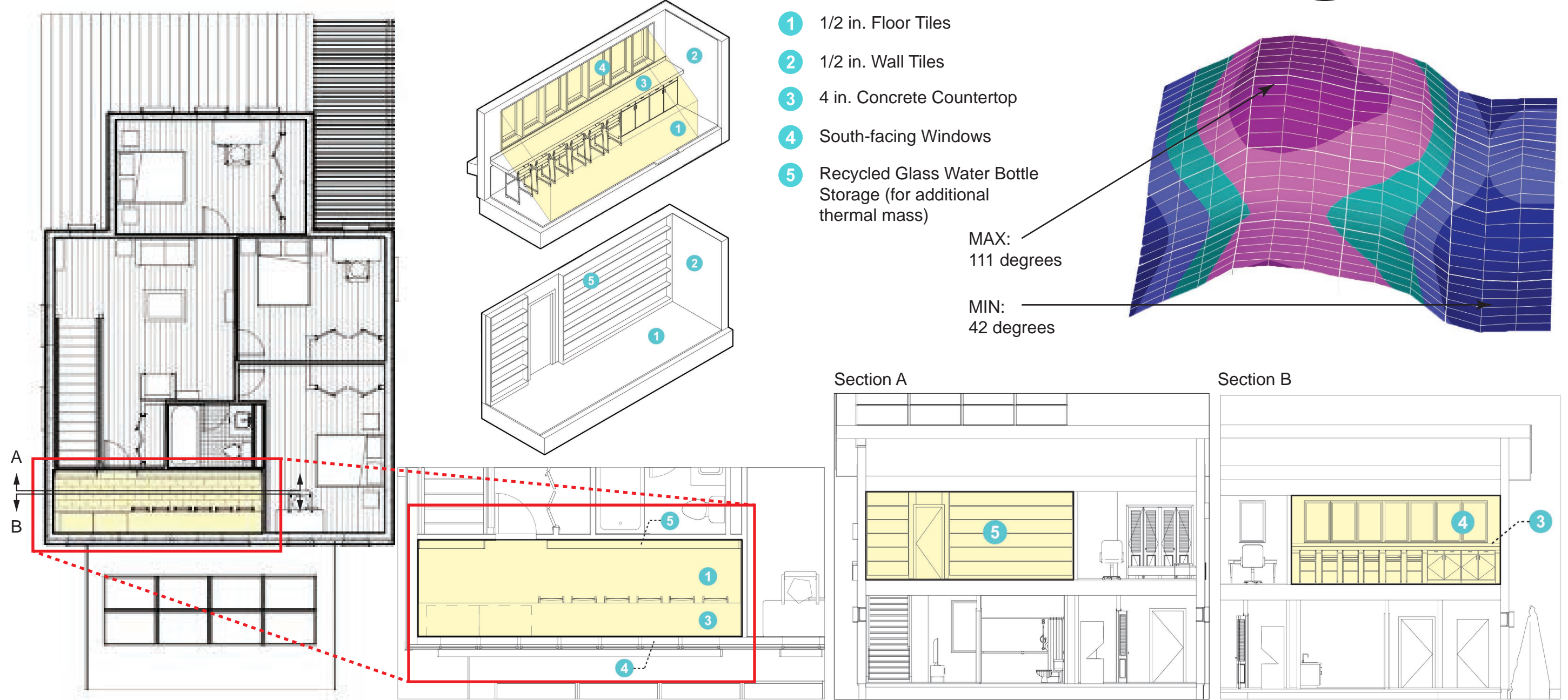
BUILDINGS VALUES		
R-VALUE:	WALLS	R-25
	ROOF/ATTIC	R-49
	FLOOR	R-10
WINDOWS:	U-VALUE	.27
	SHGC	.4
AIR LEAKAGE:		
		1ACH@50PA
HVAC:	HEATING	94 AFUE 32 K
	COOLING	13 SEER 1.5 TON
LIGHTING:		
		100% LED
SOLAR:		8.5 Kw
HOT WATER:		GAS (50 GAL







# Sun Room

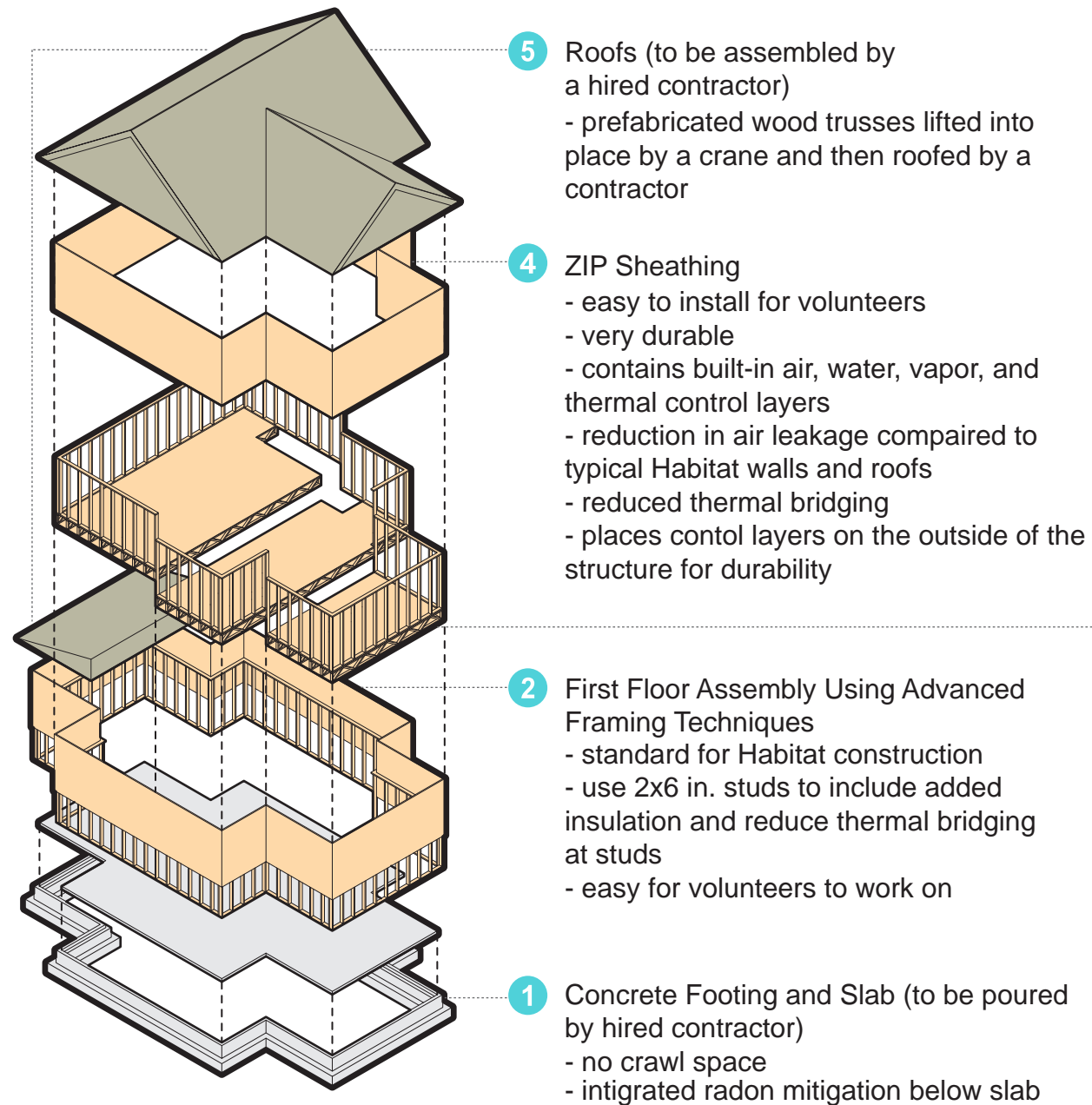




# Comfort and Environmental Quality

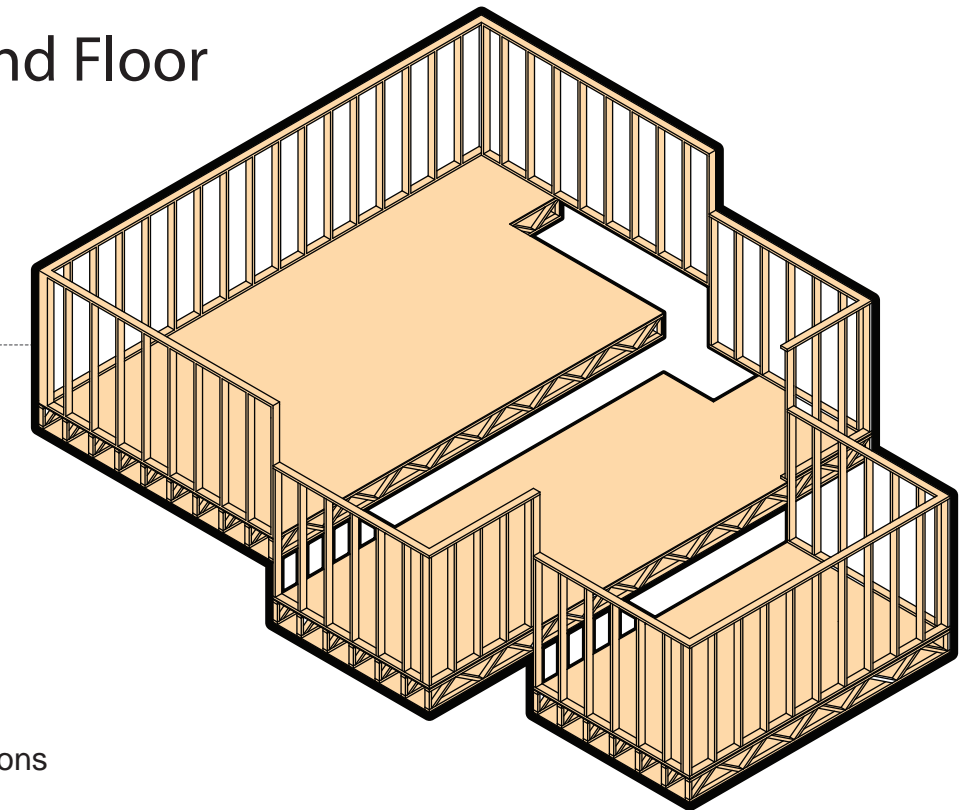


# Construction Diagram

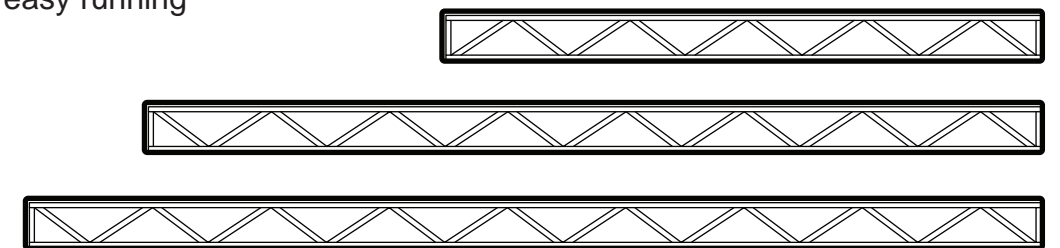


## Prefabricated Second Floor

- 3** Prefabricated Second Floor
- assembled into 3 separate sections
  - lifted onto first floor frame
  - wouldn't need to pay a contractor to frame second floor
  - reduced liability with having volunteers frame a second floor
  - wood floor joists allow for easy running of HVAC and ductwork

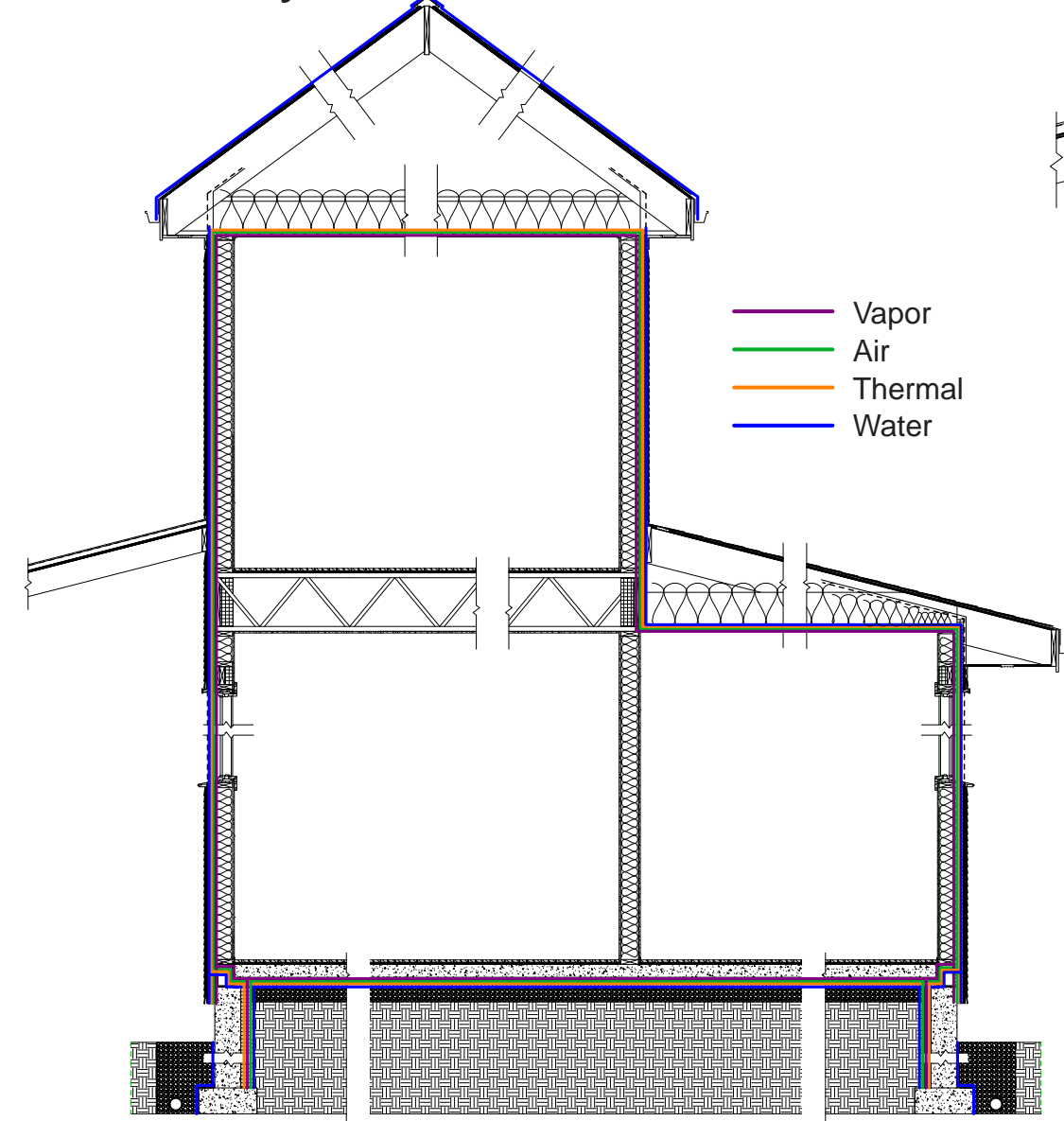


## Floor Joists

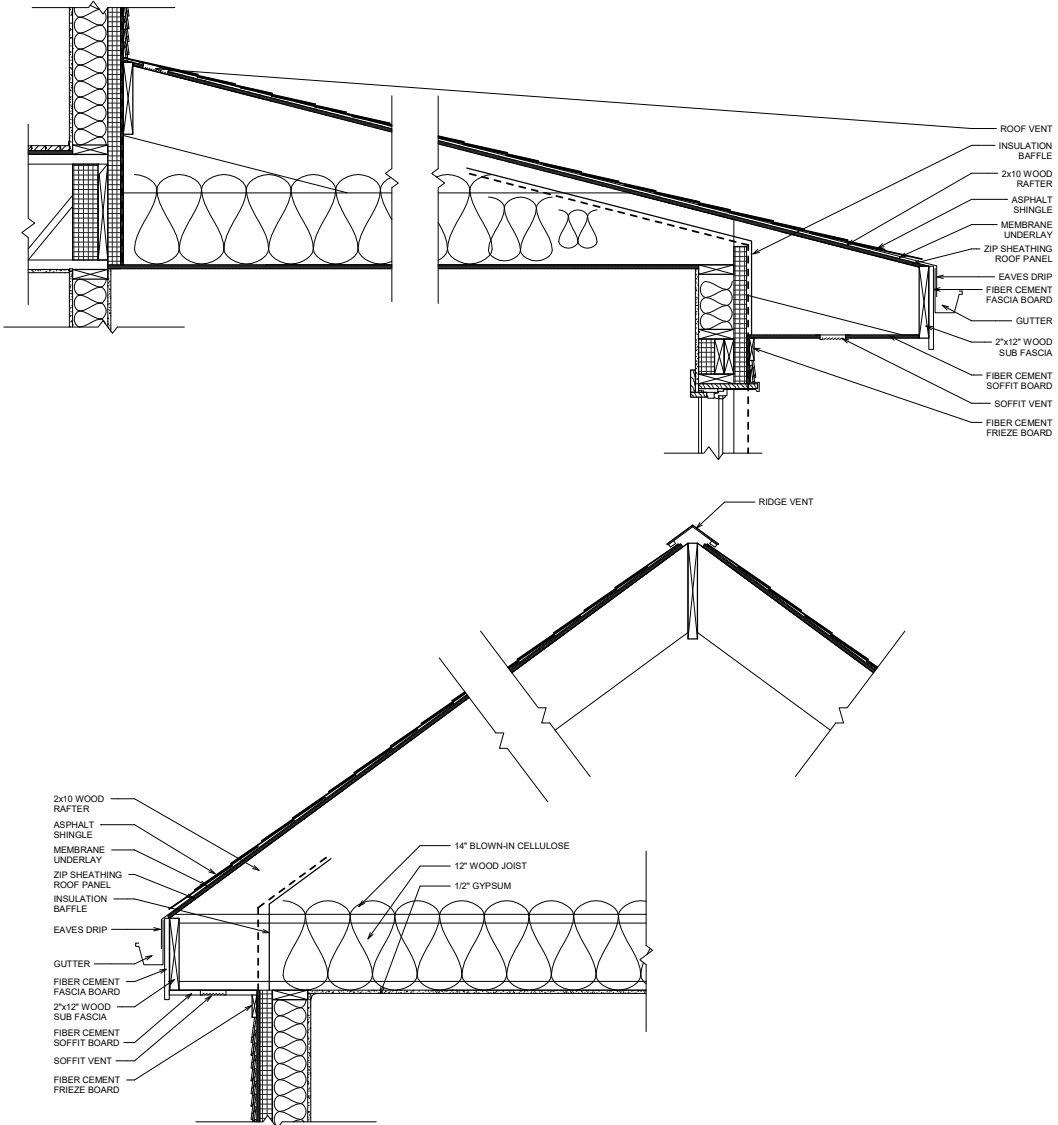
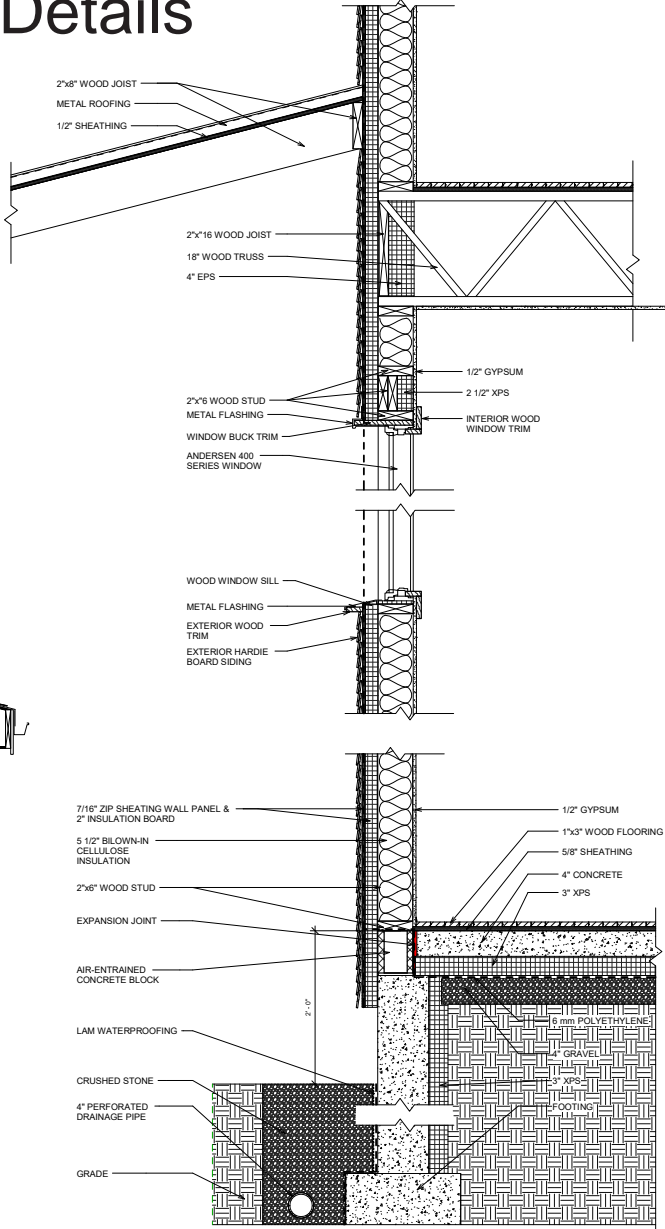




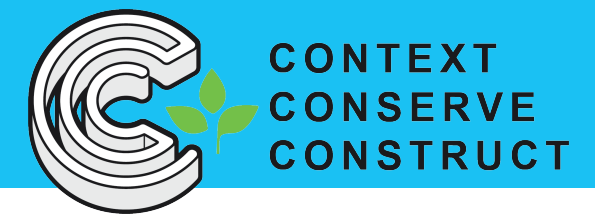
Control Layers



Details



# Financial Feasibility and Affordability



## Habitat for Humanity Muncie Partnerships

- Valspar (interior & exterior paints)
- DOW Chemical (rigid board, spray foam)
- Fiberglass blown-in insulation
- Hardie Board
- IKEA cabinets
- Square D (electrical panels & breakers)
- Appliances

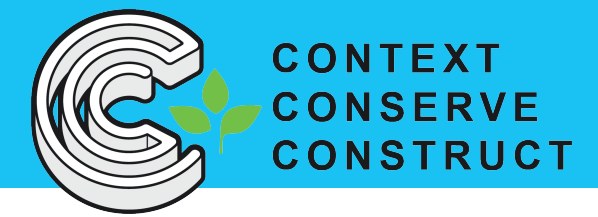
## Habitat for Humanity Muncie Family Application

- Need for adequate housing
  - housing is expensive or inadequate
  - can't obtain a conventional mortgage
- Have the ability to pay a Habitat Mortgage
  - steady home income within Habitat guidelines
  - no unpaid liens or judgements
- Willing to partner with Habitat
  - sweat equity
  - homeowner education classes
  - down payment
  - live where Habitat is working

Family Size	Minimum Income	Maximum Income
1	\$12,850	\$25,620
2	\$14,650	\$29,280
3	\$16,500	\$32,940
4	\$18,300	\$36,600
5	\$19,800	\$39,540
6	\$21,250	\$42,480
7	\$22,700	\$45,420
8	\$24,200	\$48,360



# Financial Feasibility and Affordability



## Unit Cost Estimate

### Typical Construction

Category	Category Type	Cost
A	sitework	\$ 23,254.54
B	foundation	\$ 23,273.94
C	framing	\$ 54,807.37
D	openings	\$ 13,385.13
E	finishes	\$ 8,433.07
F	appliances	\$ 8,880.00
G	Air, ventilation & HVAC	\$ 12,912.20
H	plumbing	\$ 14,448.60
I	electrical	\$ 12,574.00
J	solar array	\$ 20,100.00
K	landscaping	\$ 2,732.85
L	connections & other	\$ 25,000.00
	total cost	\$ 219,801.70

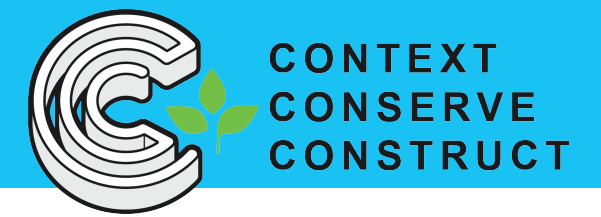
### Habitat Home

Category	Category Type	Cost
A	sitework	\$ 23,254.54
B	foundation	\$ 23,273.94
C	framing	\$ 40,364.12
D	openings	\$ 11,626.01
E	finishes	\$ 2,807.60
F	appliances	\$ -
G	Air, ventilation & HVAC	\$ 15,000.00
H	plumbing	\$ 14,448.60
I	electrical	\$ 11,574.00
J	solar array	\$ -
K	landscaping	\$ 2,732.85
L	connections & other	\$ 25,000.00
	total cost	\$ 170,081.66

Typical Single Floor Habitat Home

\$ 130,000-140,000

# Context Conserve Construct



## CONTEXT

Any new construction that takes place in the Emily Kimbrough Historic District should be compatible with existing structures in terms of its:

- style
- configuration
- scale
- materials
- setback
- roof pitch and shape
- and facade pattern.

**GOAL:** Create a beautiful building that will inspire new construction in an old neighborhood.

## CONSERVE

All DOE Zero Energy Ready Homes must meet ENERGY STAR requirements in their:

- envelope
- duct system
- water efficiency
- lighting and appliances
- indoor air quality
- renewable readiness

**GOAL:** Create a house that will act as a catalyst for net-zero design practices in a city that is in the midst of a major revitalization.

## CONSTRUCT

- The living space provided should not exceed 1,230 square feet for a four-bedroom house
- Four-bedroom houses can have 2 full bathrooms
- Houses should be ADA accessible on first floor
- Houses should be able to be constructed with a volunteer force (comprised roughly of 50-60 year-olds in Muncie, Indiana)

**GOAL:** Establish a prototype of a two-story construction practice for a non-profit volunteer force.

## CCC

Although it may seem challenging to design within the regulations of three separate organizations, we at "CCC" embrace the guidelines of our community partners to create a beautiful building that will inspire new construction in an old neighborhood, act as a catalyst for net-zero design practices in a city that is in the midst of a major revitalization, and establish a prototype of a two-story construction practice for a non-profit volunteer force.