Third Space

Third Quadrant Design, UBC

Land Acknowledgement

Located on the University of British Columbia (UBC) campus, we acknowledge that our team operates on the traditional, ancestral and unceded territory of the xməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and Sel̓íl̓witulh (Tsleil-Waututh) Nations. We honor with gratitude the land itself and the people who have stewarded it throughout the generations.

Third Quadrant Design

Adam Rysanek
Faculty Lead

Blair Satterfield
Faculty Advisor

Sheryl Staub-French
Faculty Advisor

Milan Jaan
Design Manager

- Student Team Lead

Katie Theall
Architecture Design Lead

- Architecture
  Maverick Chan
  7 members
- Building Science
  Juliette Mollard-Thibault
  5 members

Agustina Flores-Pitton
Engineering Design Lead

- Structural
  Stephen Oord & Alvin Tran
  5 members
- Civil/Geological
  Cameron Shepherd
  6 members

Alicia Hobmaier
Engineering Design Lead

- Mechanical
  Kyle Gerrard
  5 members
- Energy
  Harishankar Krishnan
  4 members
- Electrical
  Nestor Brito
  5 members
- Measured Contest Officer

Peter Ehrlich
Construction Lead

- Construction
  Dom Oum & Bagas Linanda
  8 members
- Construction Officer
- Health and Safety Officer

Ben Rener
Outreach Lead

- Finance
  2 members
- Marketing
  Reuben Mistas & Paige Doig
  2 members
- Community Outreach Officer

Partners

build partner

structural engineer

mechanical & electrical engineer

architect

building envelope engineer

prime contractor

Third Space - Concept

Single family home with a live-work typology, constructed at the University of British Columbia – Vancouver campus.

Carbon Minimalism
Low-carbon materials and on-site carbon sequestration

Circularity
Prioritizing re-usability, recycle-ability, and locality

Flexibility
Configurable to a variety of occupant needs and desires

Living Lab
Monitoring and experimenting with green building systems

Resilience
Adaptable to changing conditions and redundant in the face of disaster

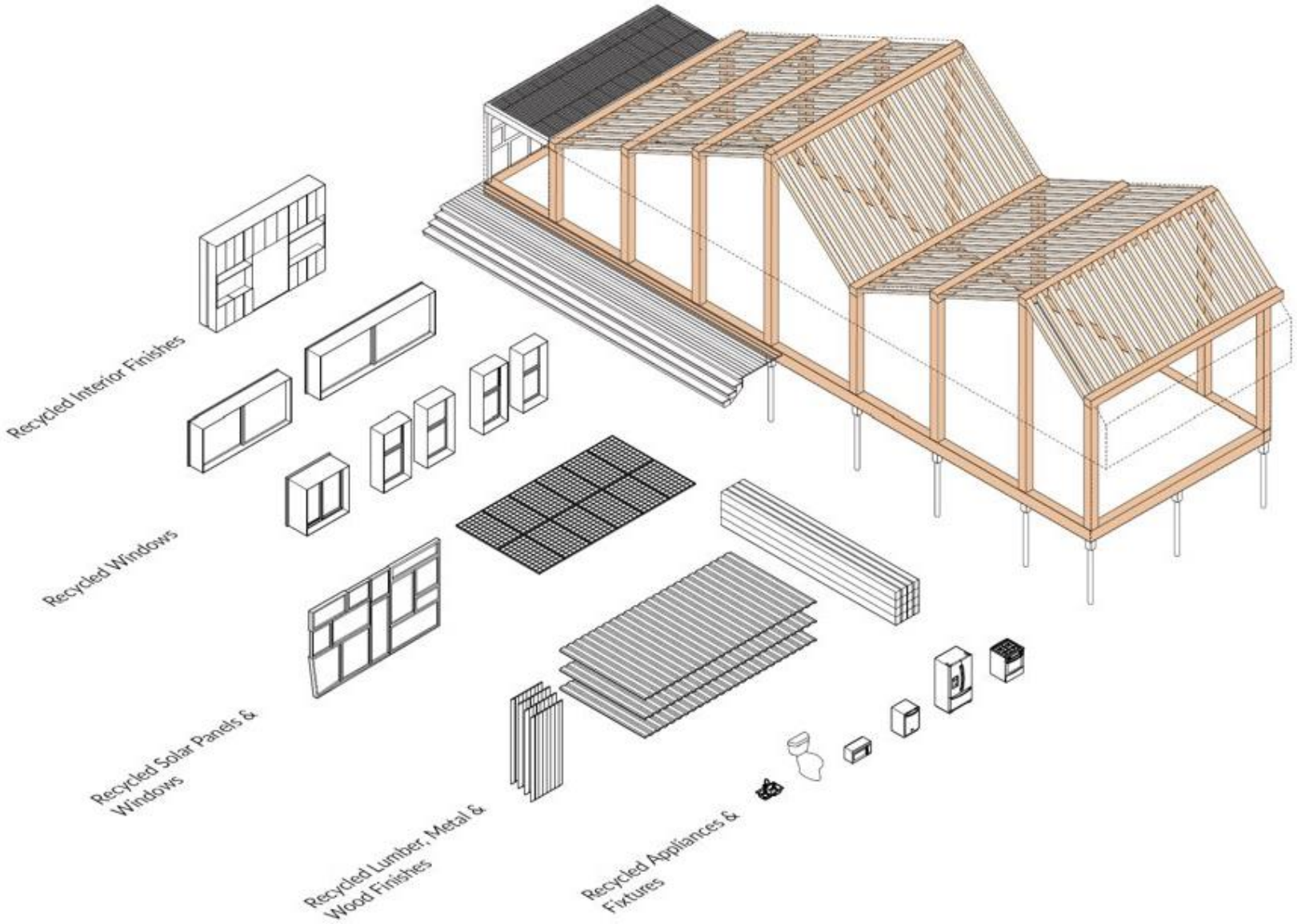
Third Space's Story

Three lives

First Life

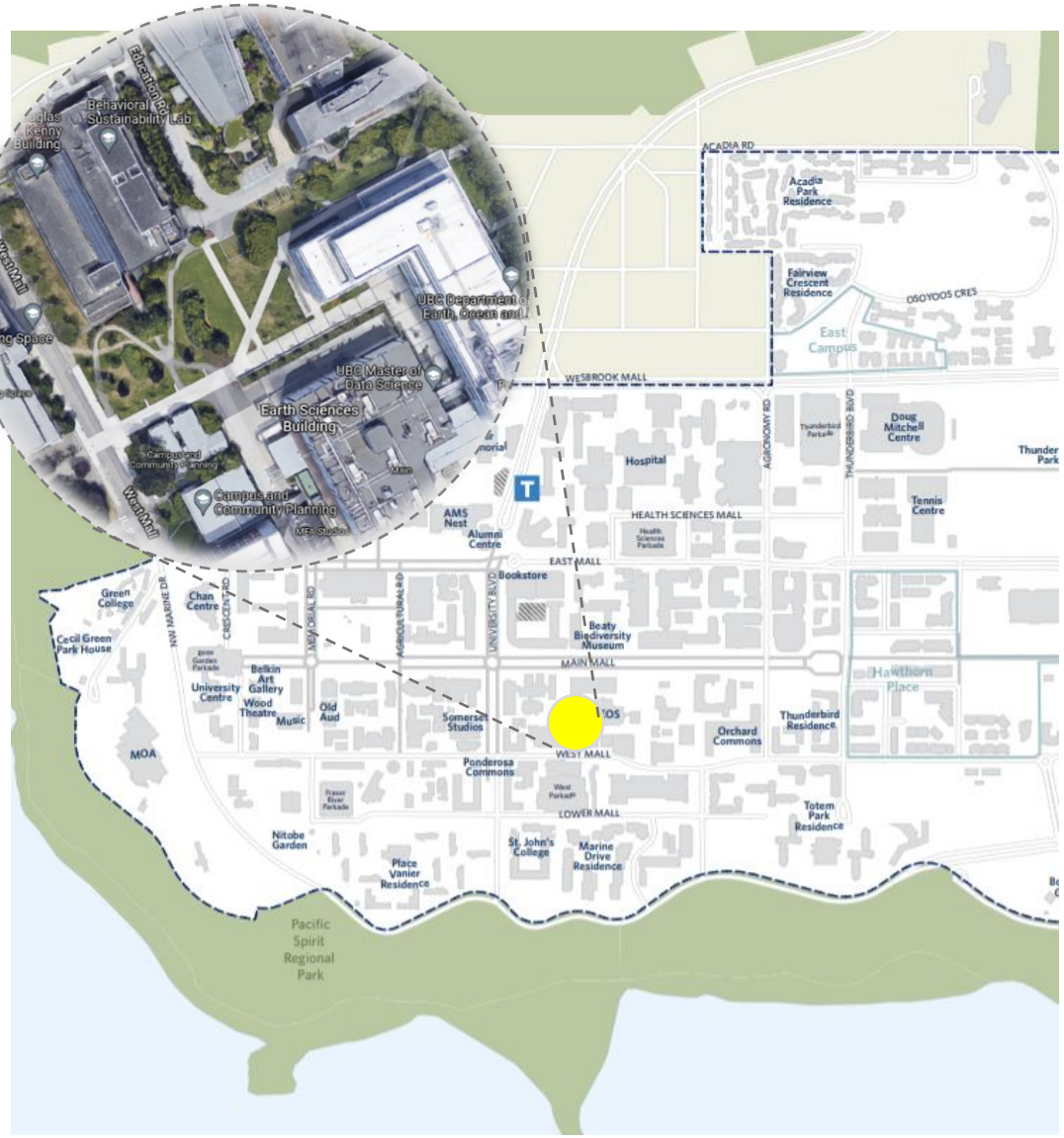
Existing single-family home slated for demolition

Adaptive Reuse

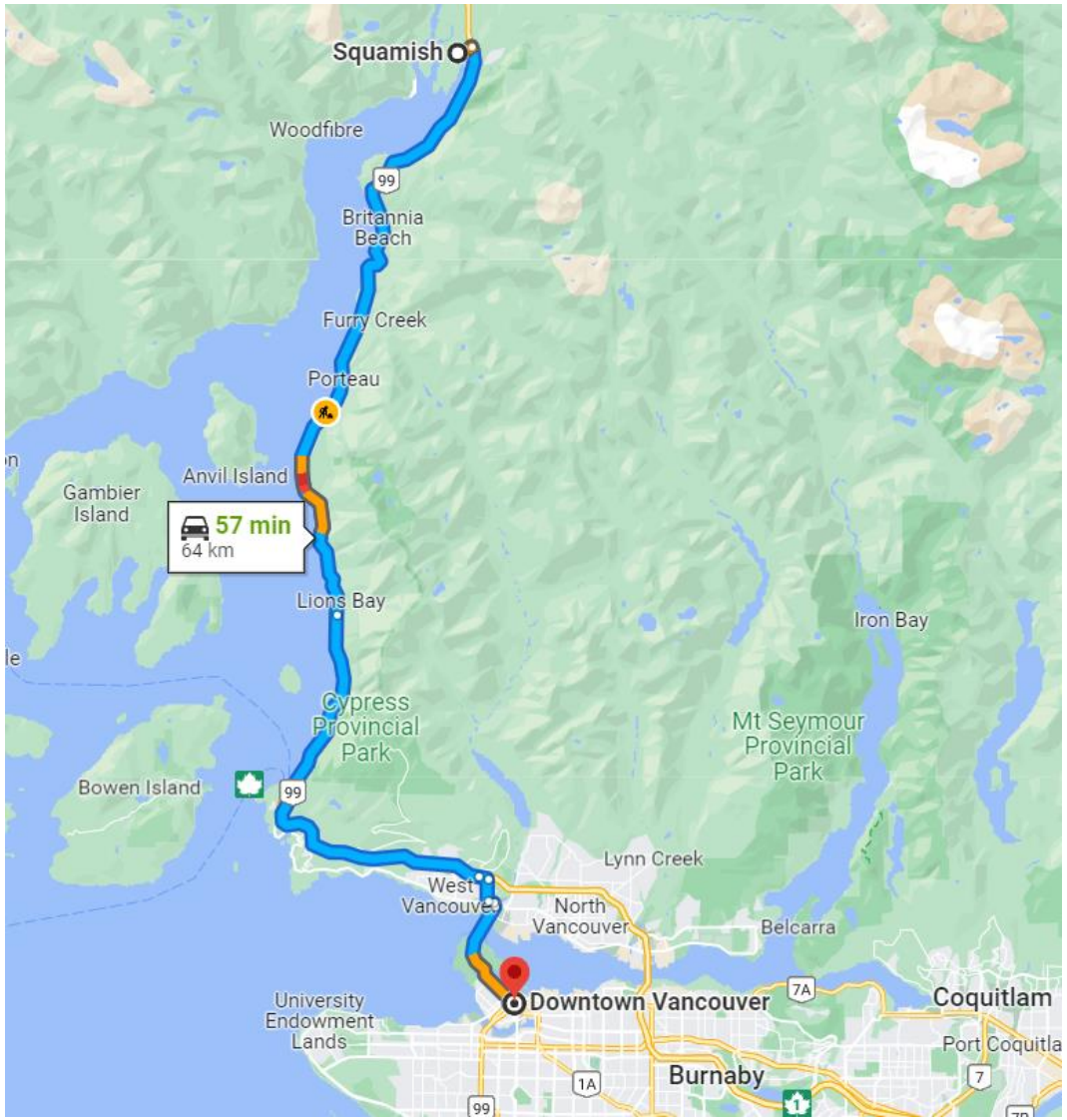


Second Life

Net-zero energy, net-zero carbon single-family home

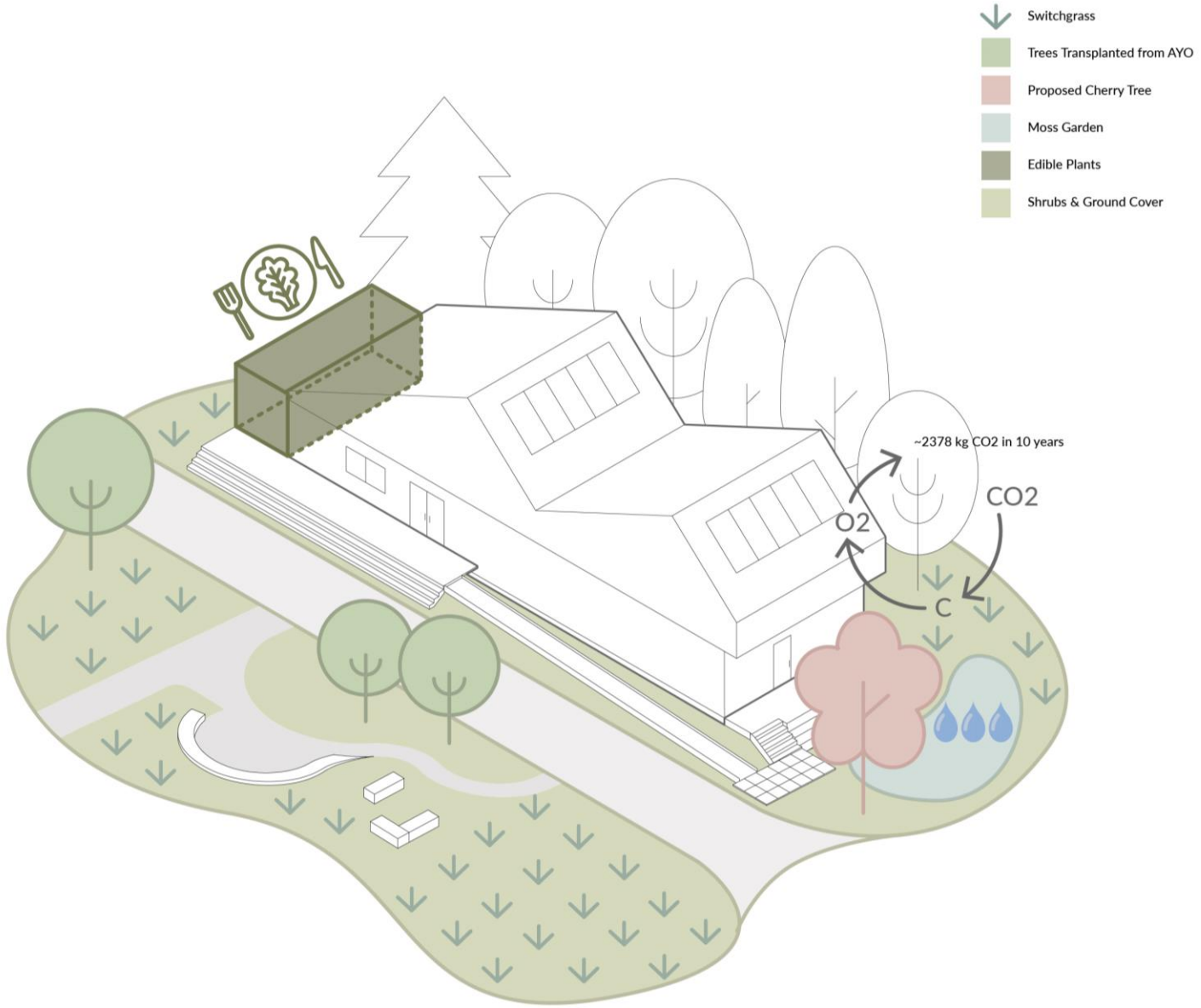


UBC Site



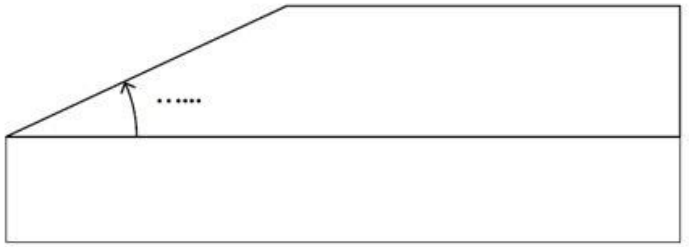
Squamish, BC

Landscape

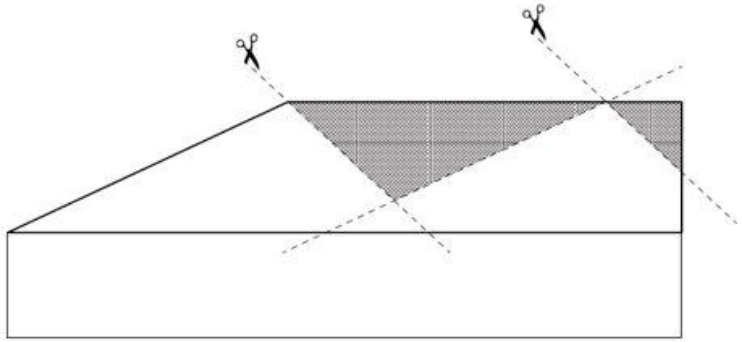


Architectural Form

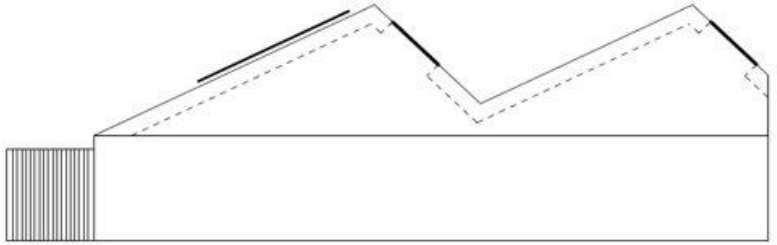
1. start with simple tight massing



2. rotate south roof face to maximize solar exposure

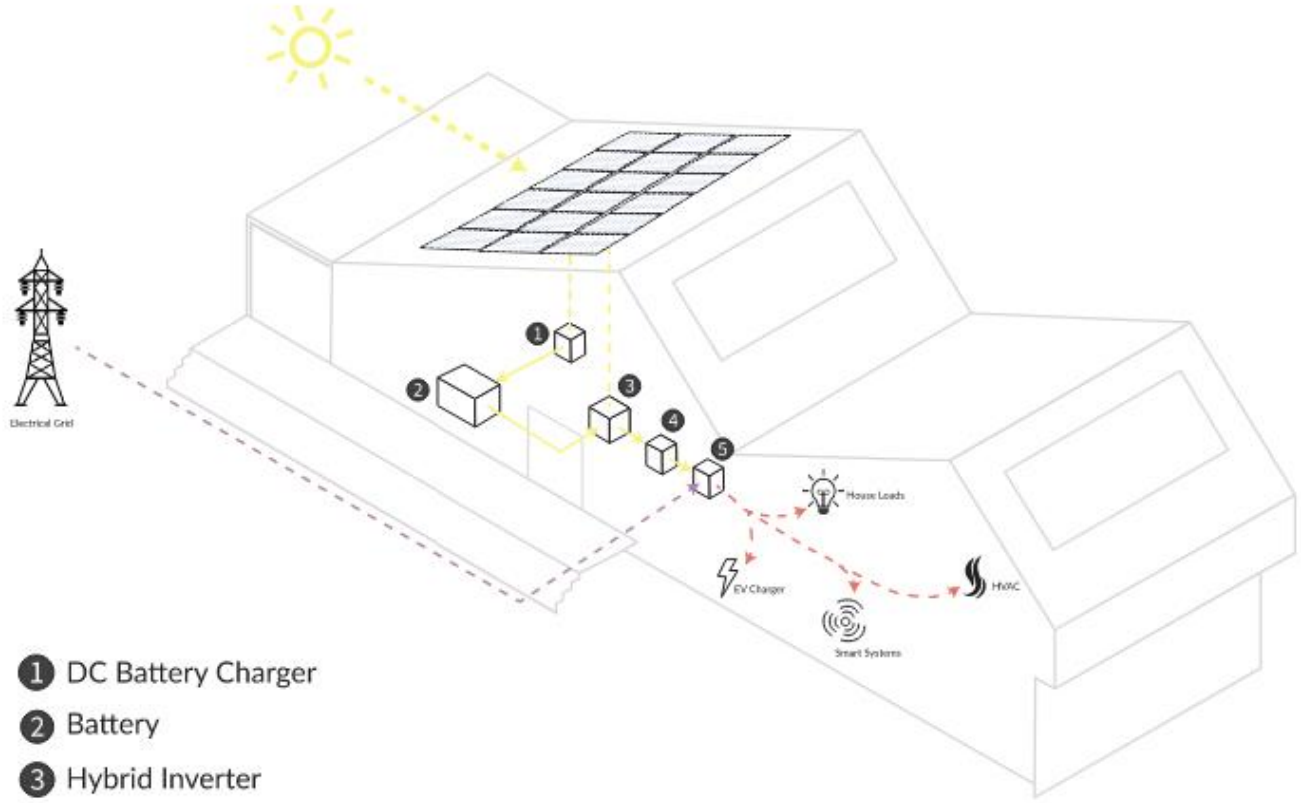


3. cut roof volume

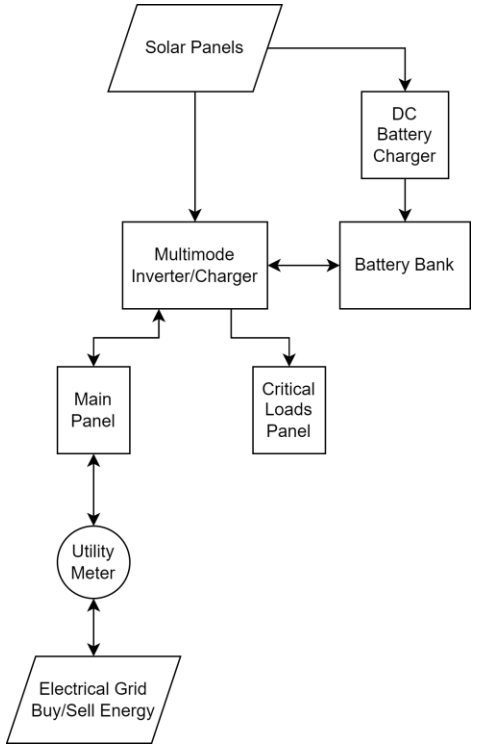


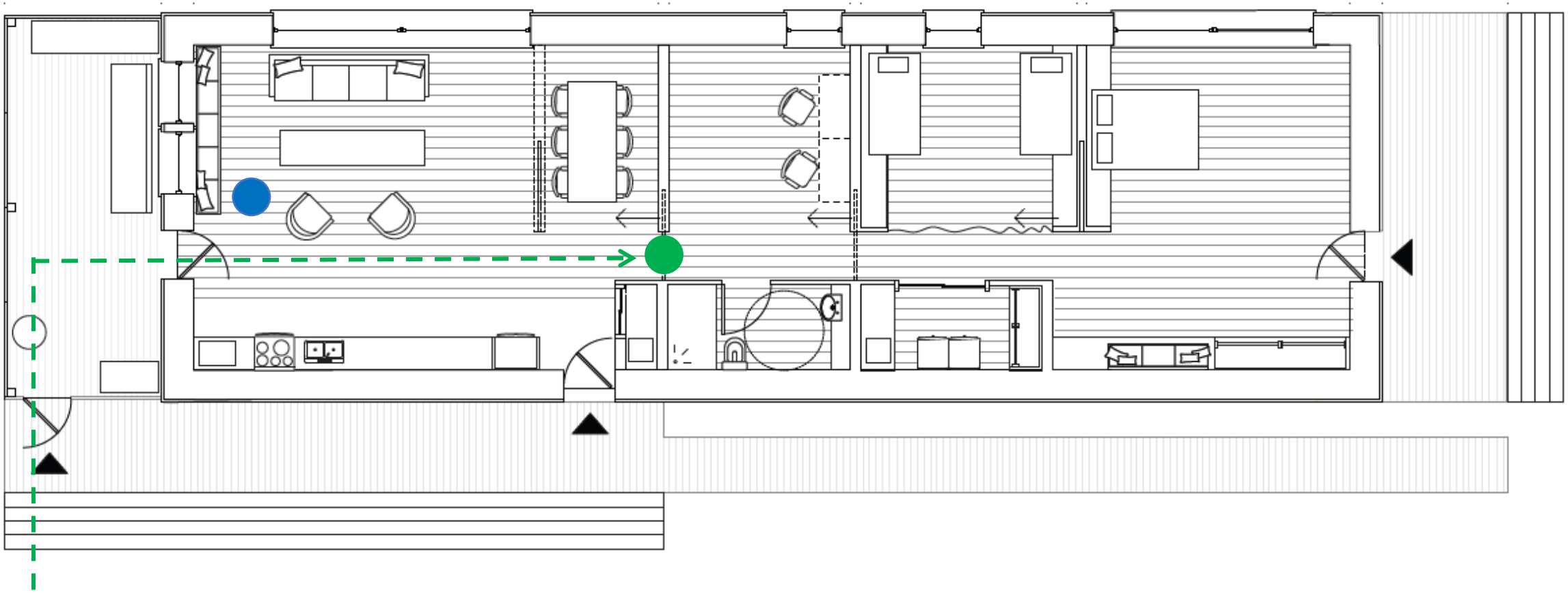
4. capture diffuse natural day light

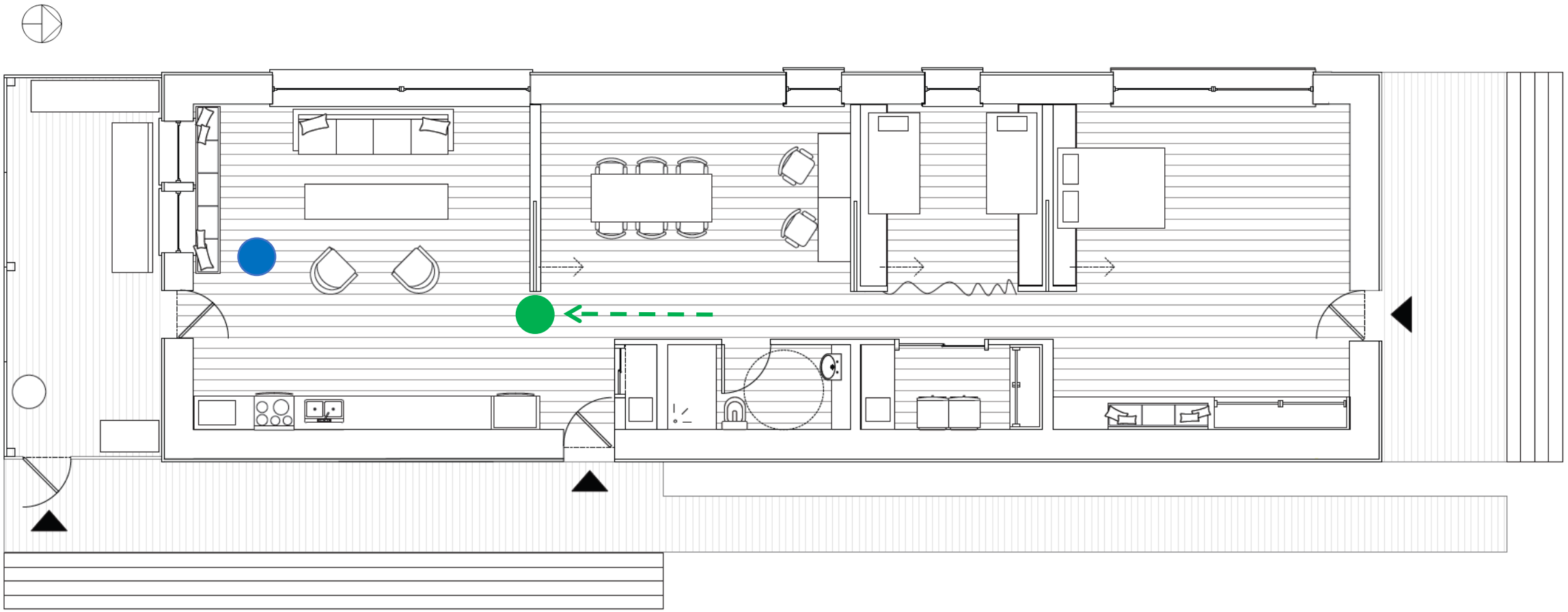
Energy Generation System



1. DC Battery Charger
2. Battery
3. Hybrid Inverter
4. Panel Board Critical Load
5. Panel Board Service Entrance/House Loads

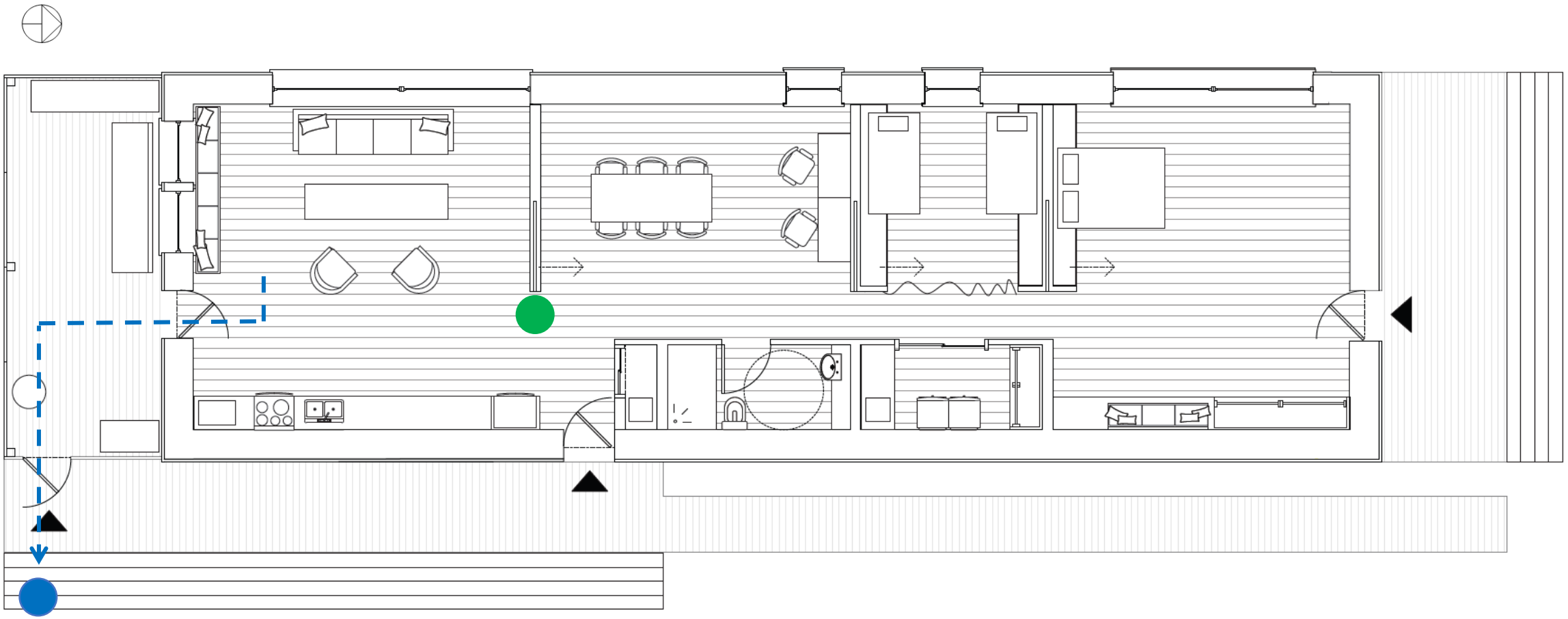






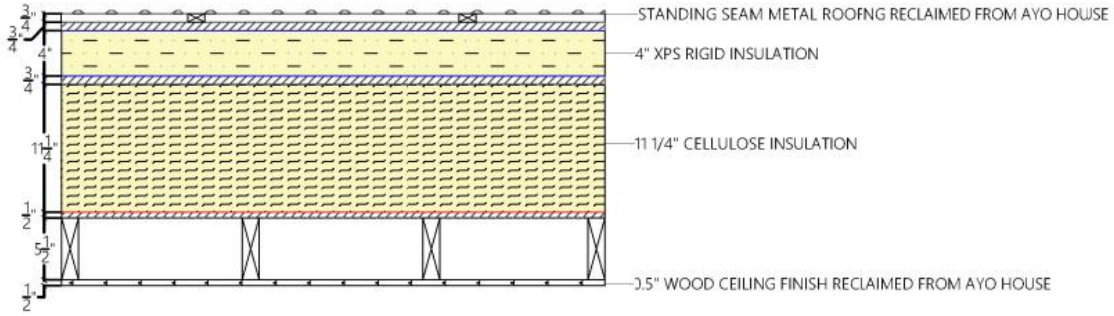
Target Market: Live-Work

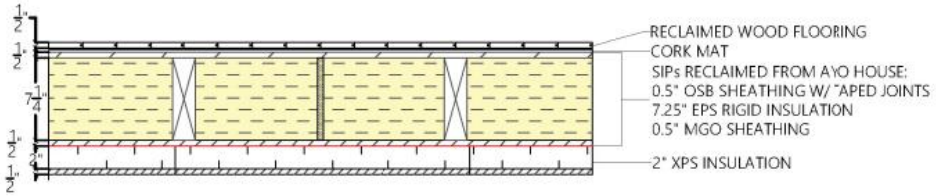
Flexible layout



Building Envelope

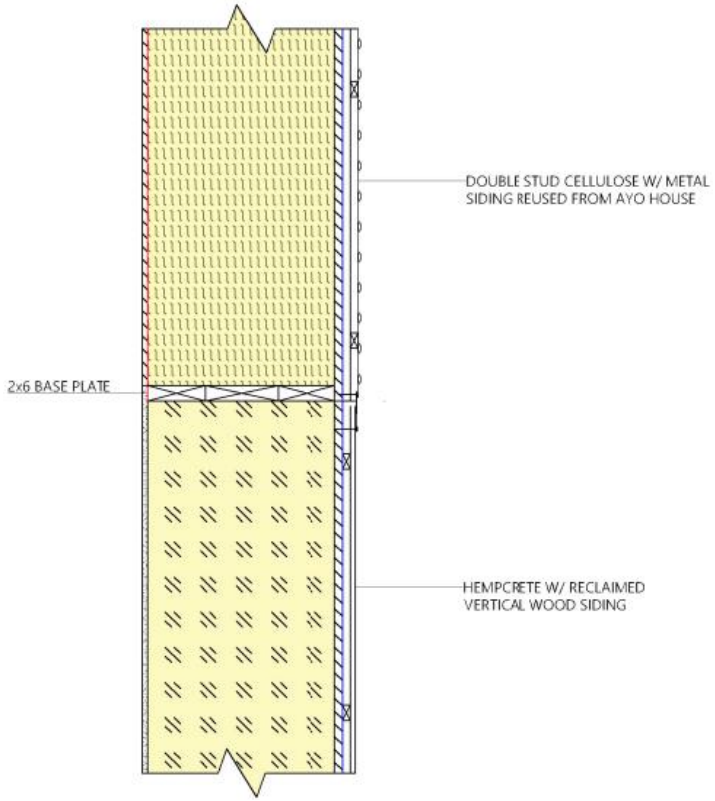
R-55 Roof





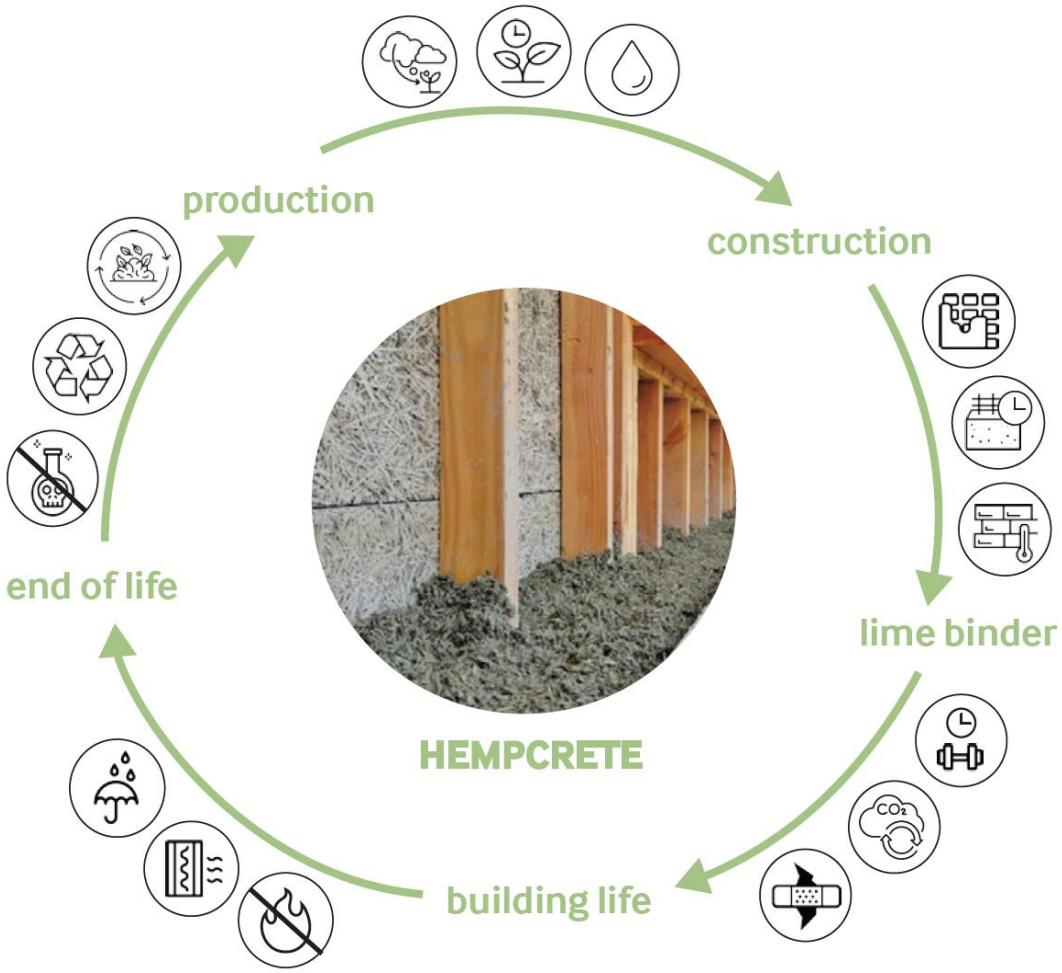
R-35 Floor

R-60 Upper Wall



R-50 Lower Wall

Hempcrete



- recycleable
- fireproof
- excellent insullator
- doesn't emit VOCs
- humidity regulating
- grows stronger over time
- requires less water
- biodegradeable
- self-healing
- structural & insulating
- shorter setting time
- cold process
- continuously sequesters CO_2
- sequesters CO_2
- fast growing

Our hempcrete walls will sequester 14 400 kg CO2 eq over 10 years

Architecture

Engineering

Market Analysis

Durability and Resilience

Embodied Environmental Impact

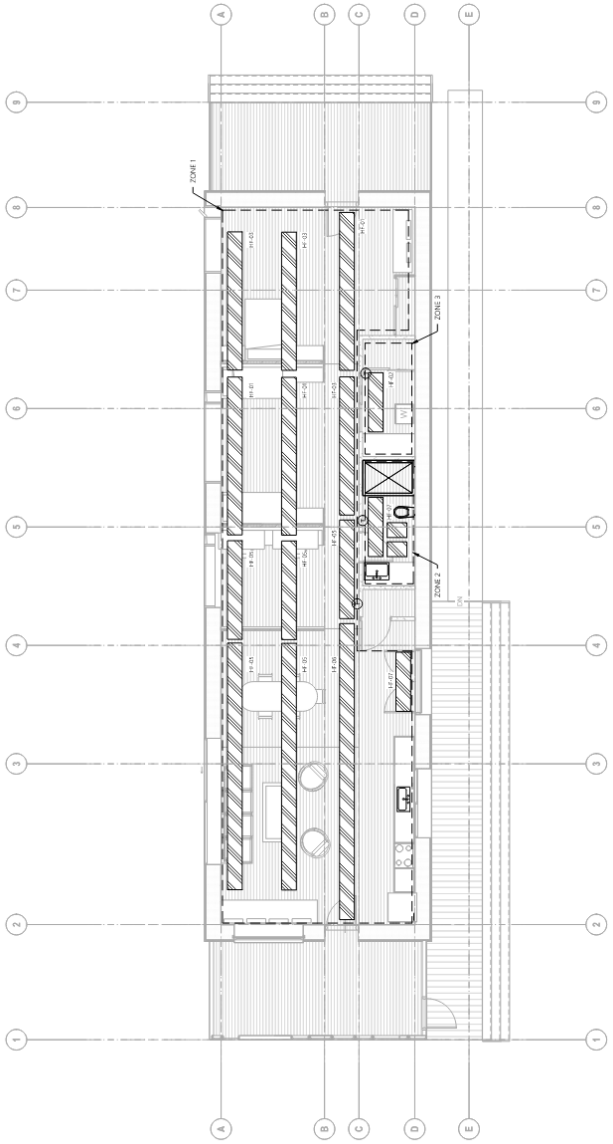
Integrated Performance

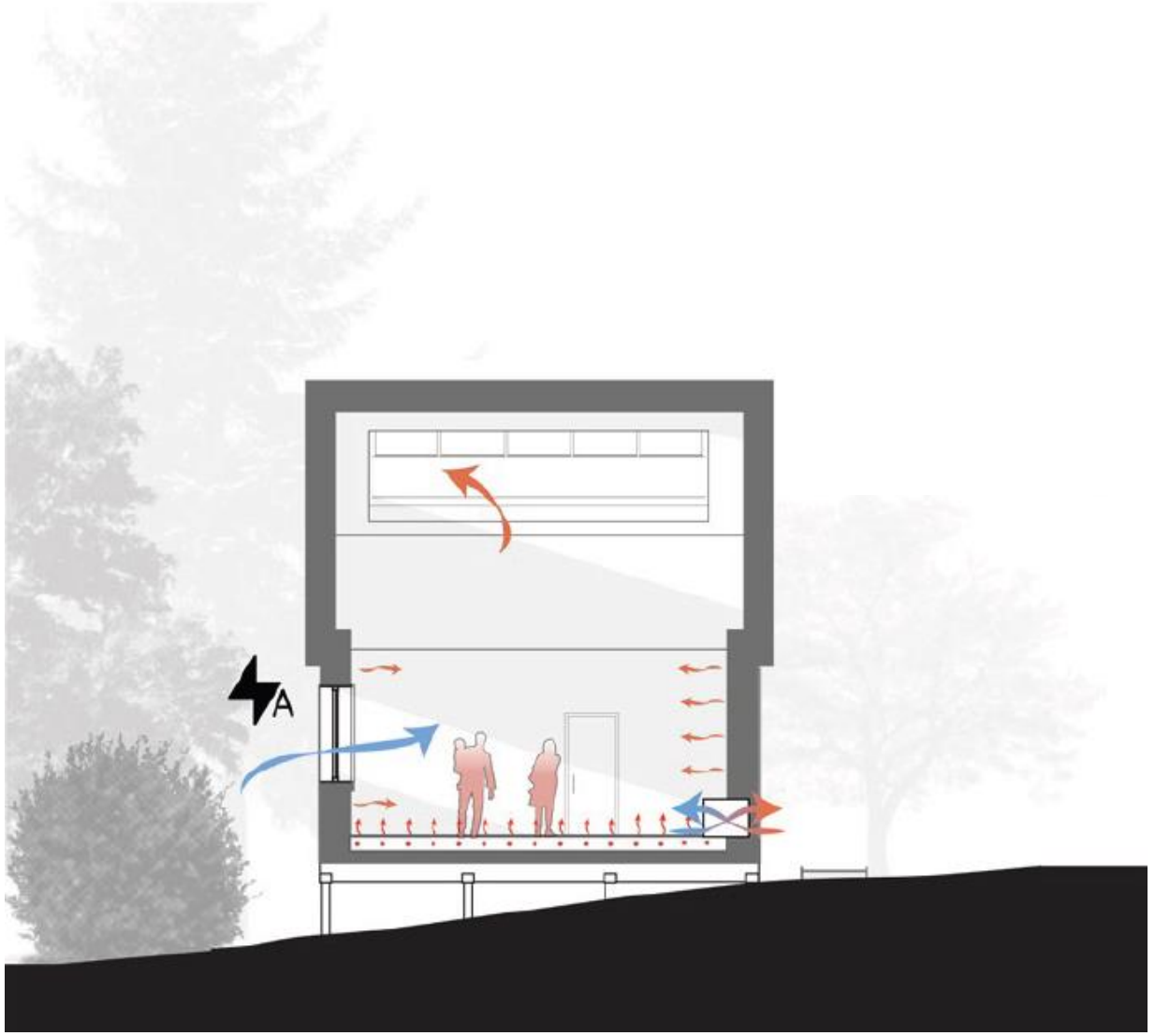
Occupant Experience

Comfort and Environmental Quality

Energy Performance

Electric Radiant Heating





Architecture

Engineering

Market Analysis

Durability and Resilience

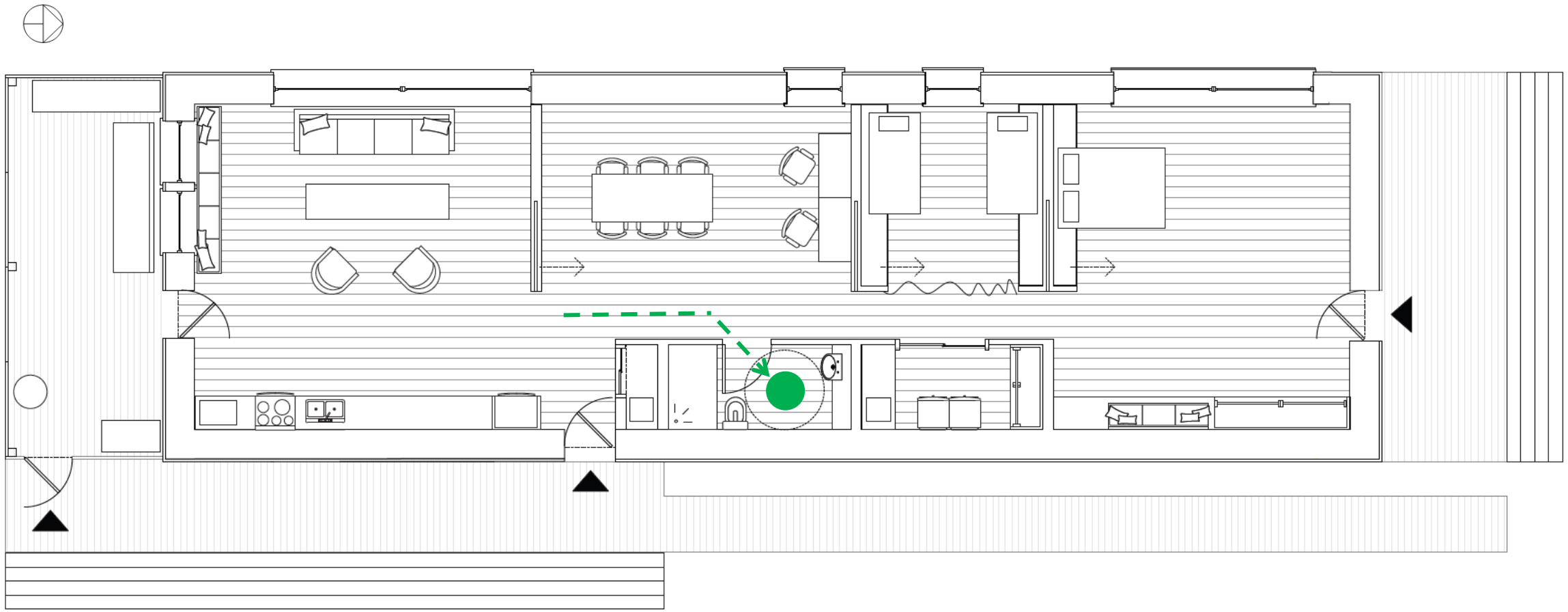
Embodied Environmental Impact

Integrated Performance

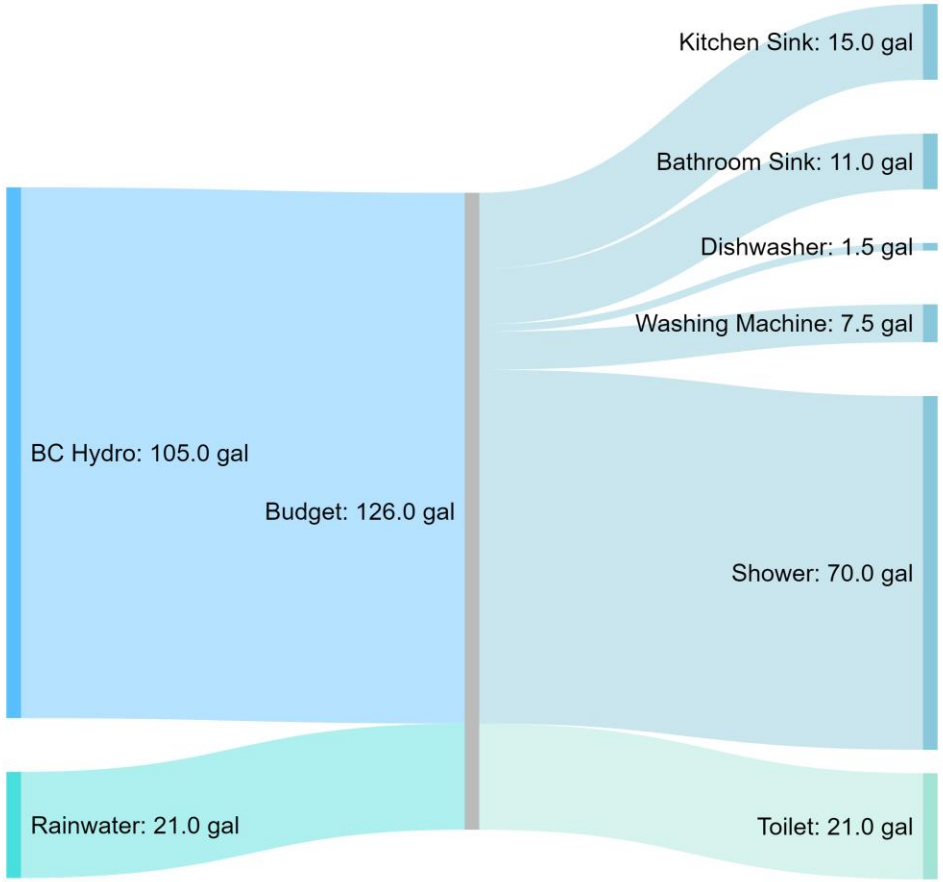
Occupant Experience

Comfort and Environmental Quality

Energy Performance



Low-Flow Fixtures and Low-Energy Appliances



Daily Water Usage, 4-person family

Dishwasher
Whirlpool WDF540PADM1

Compact Washer
LG WM1388HW

Dishwasher
Whirlpool WDF540PADM1

Fridge/Freezer
Whirlpool WRB119WFBM00

Range/Oven
Whirlpool YWEE730H0DS0

Architecture

Engineering

Market Analysis

Durability and Resilience

Embodied Environmental Impact

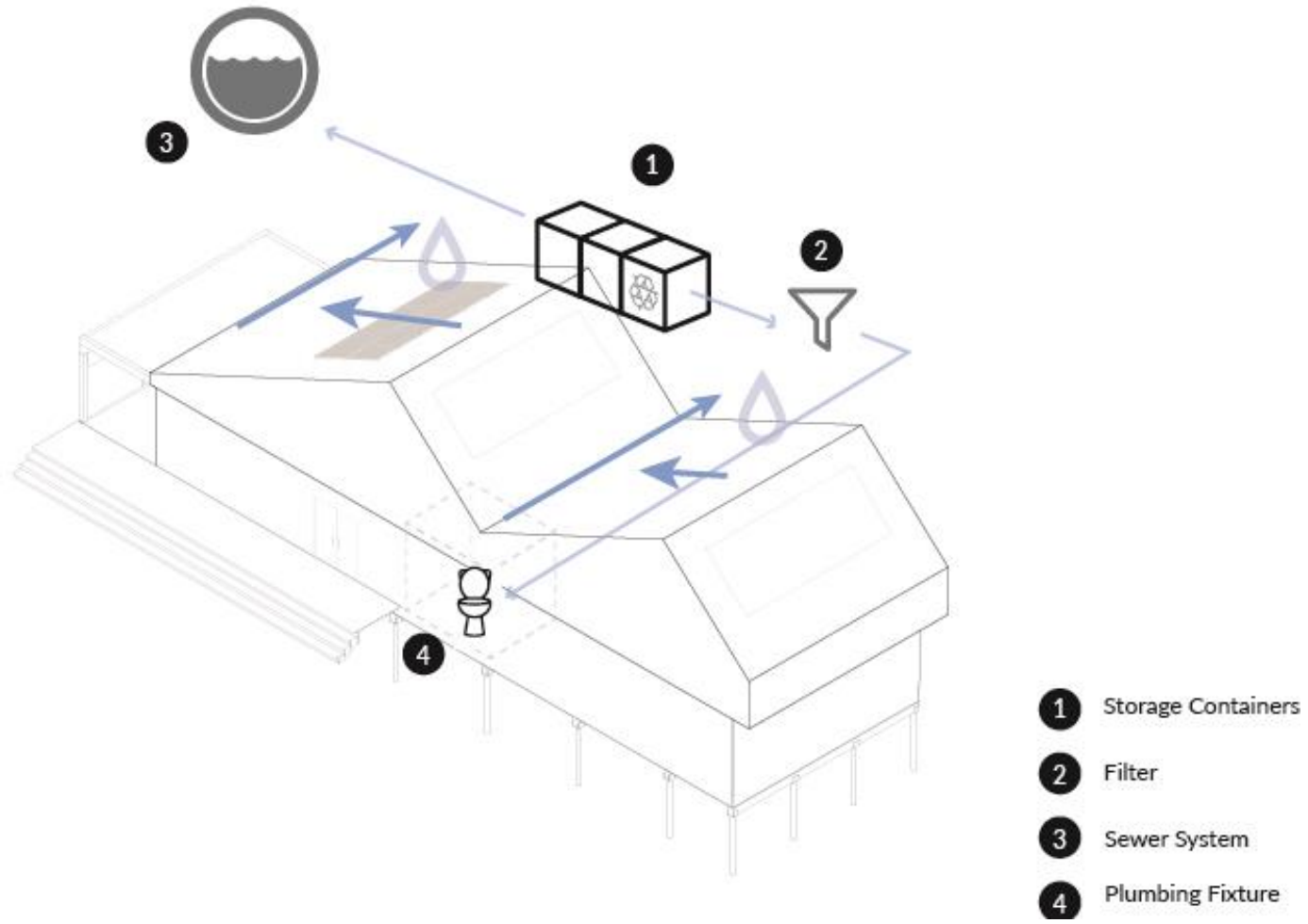
Integrated Performance

Occupant Experience

Comfort and Environmental Quality

Energy Performance

Rainwater Harvesting System



Architecture

Engineering

Market Analysis

Durability and Resilience

Embodied Environmental Impact

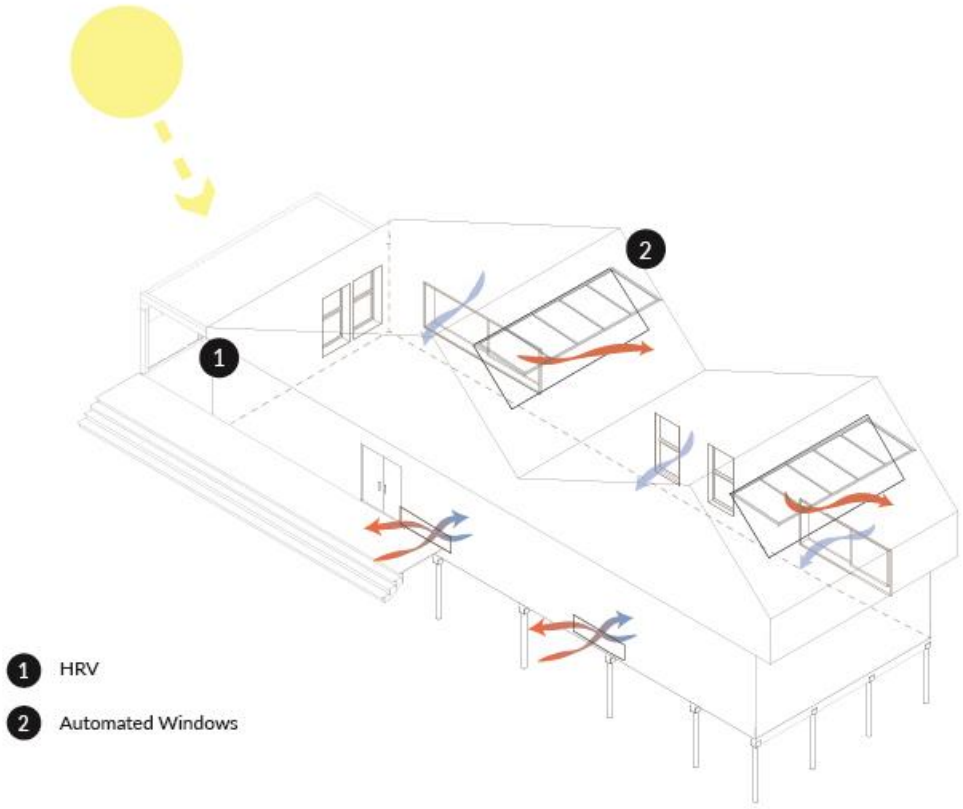
Integrated Performance

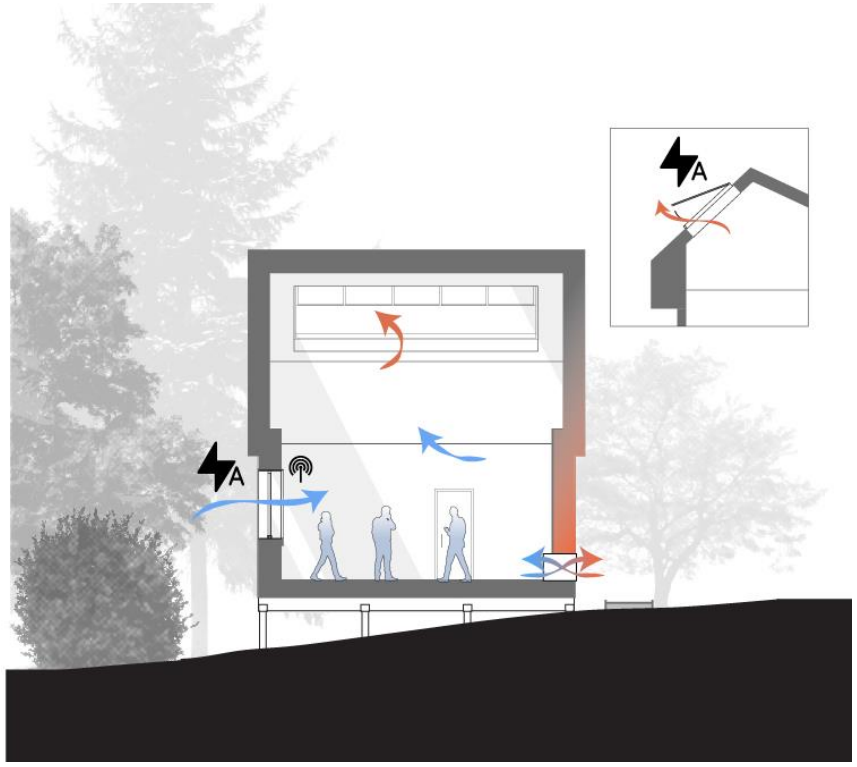
Occupant Experience

Comfort and Environmental Quality

Energy Performance

Natural Ventilation and Passive Cooling





Architecture

Engineering

Market Analysis

Durability and Resilience

Embodied Environmental Impact

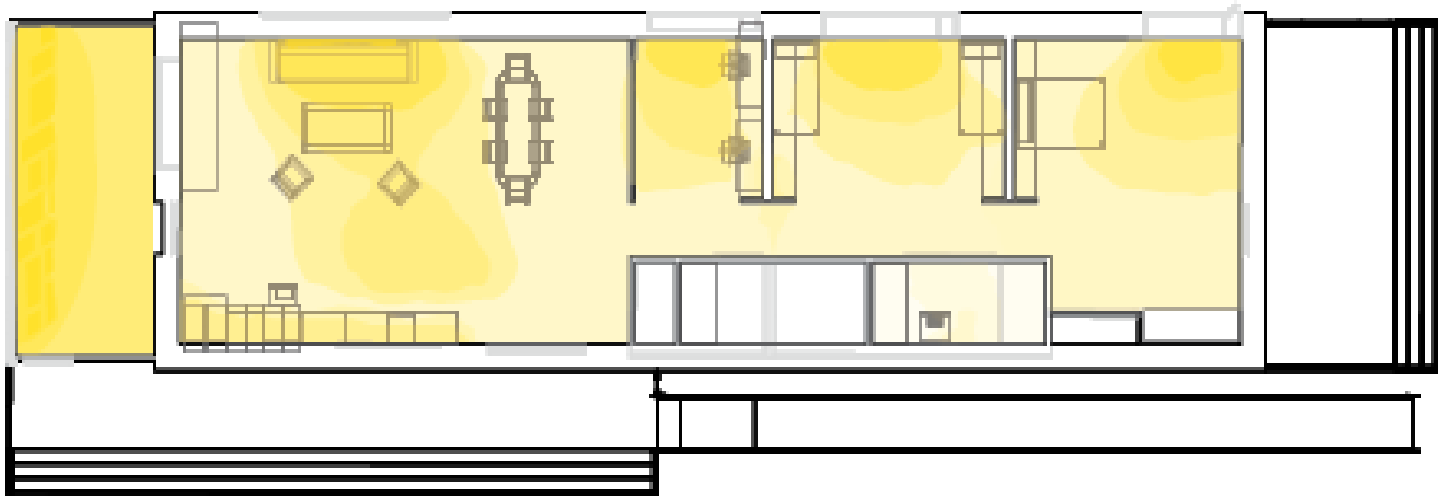
Integrated Performance

Occupant Experience

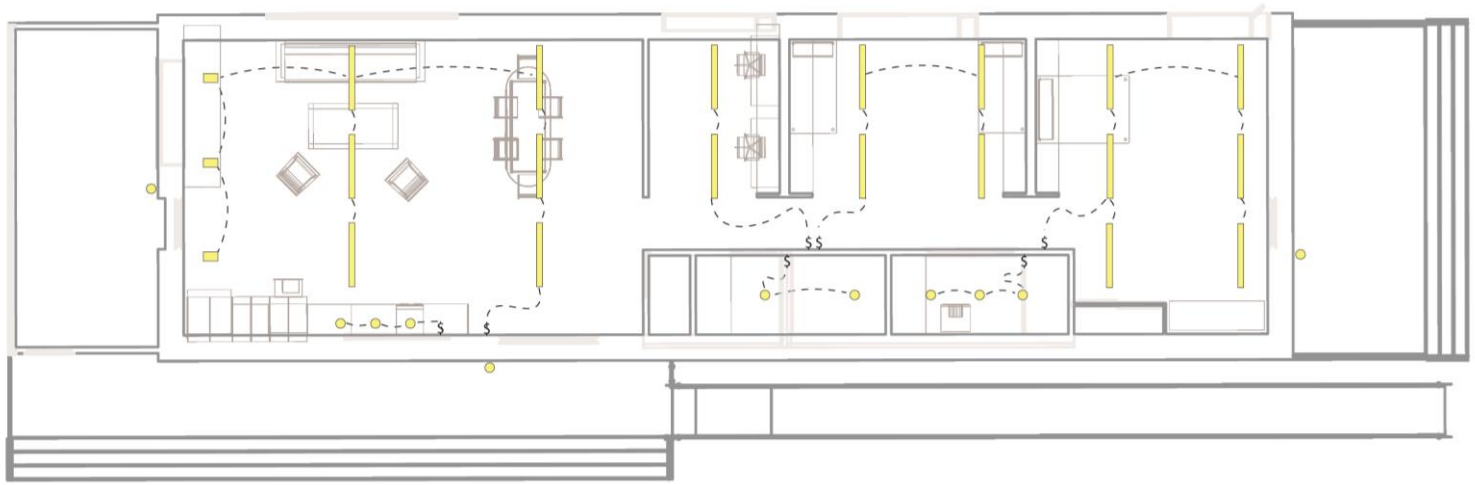
Comfort and Environmental Quality

Energy Performance

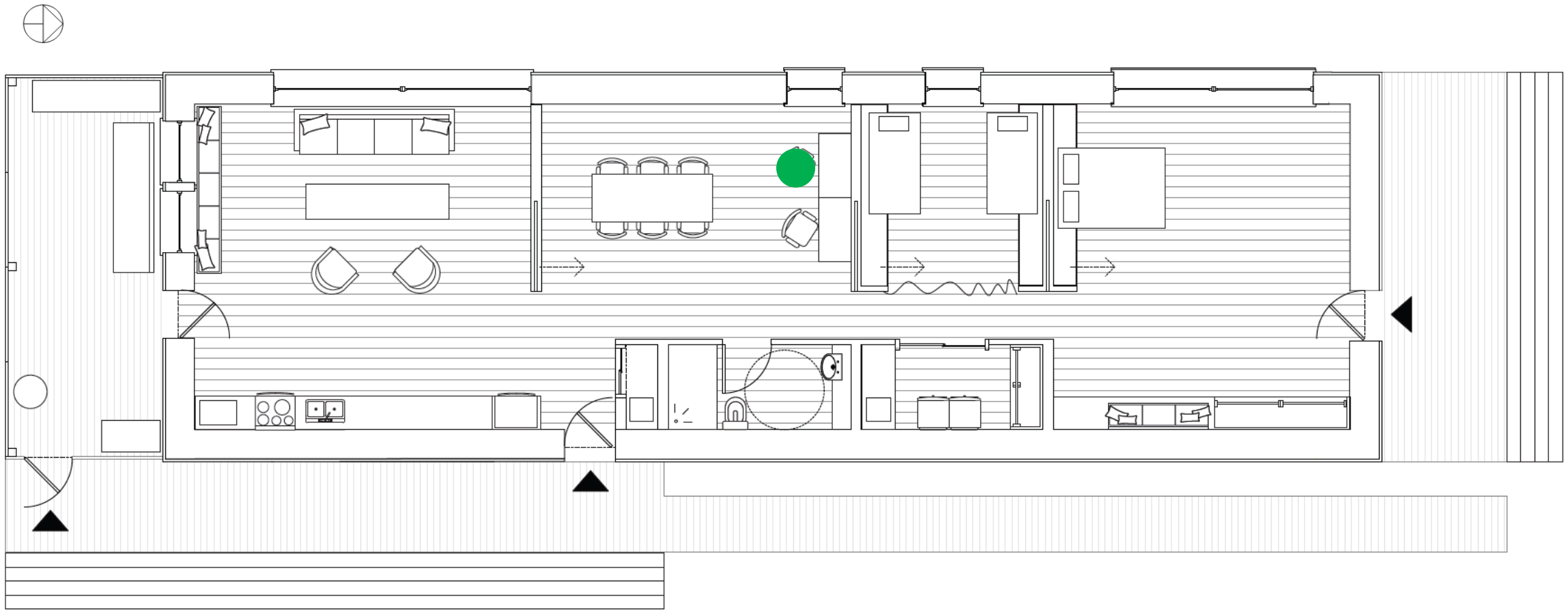
Lighting



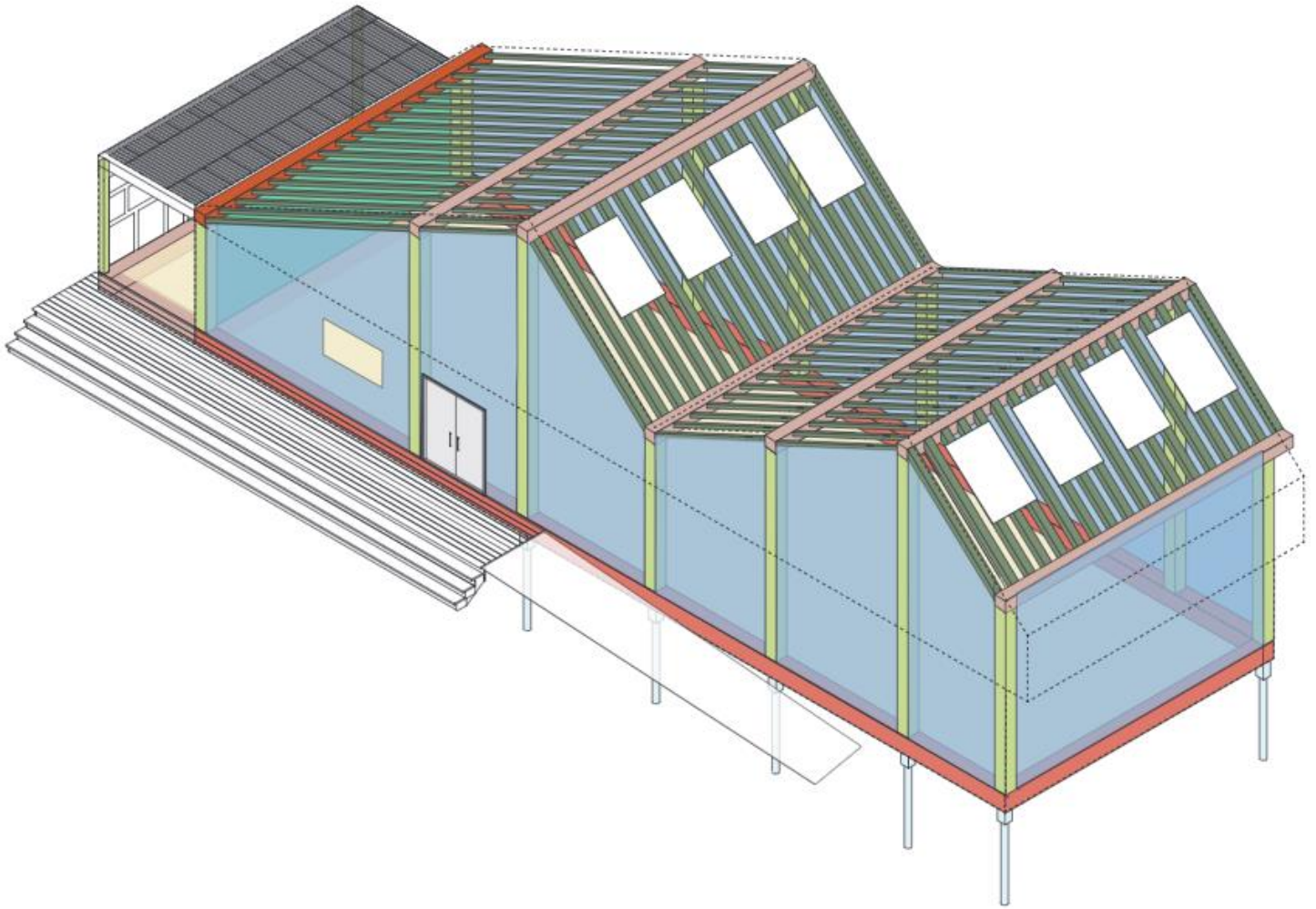
Natural Lighting



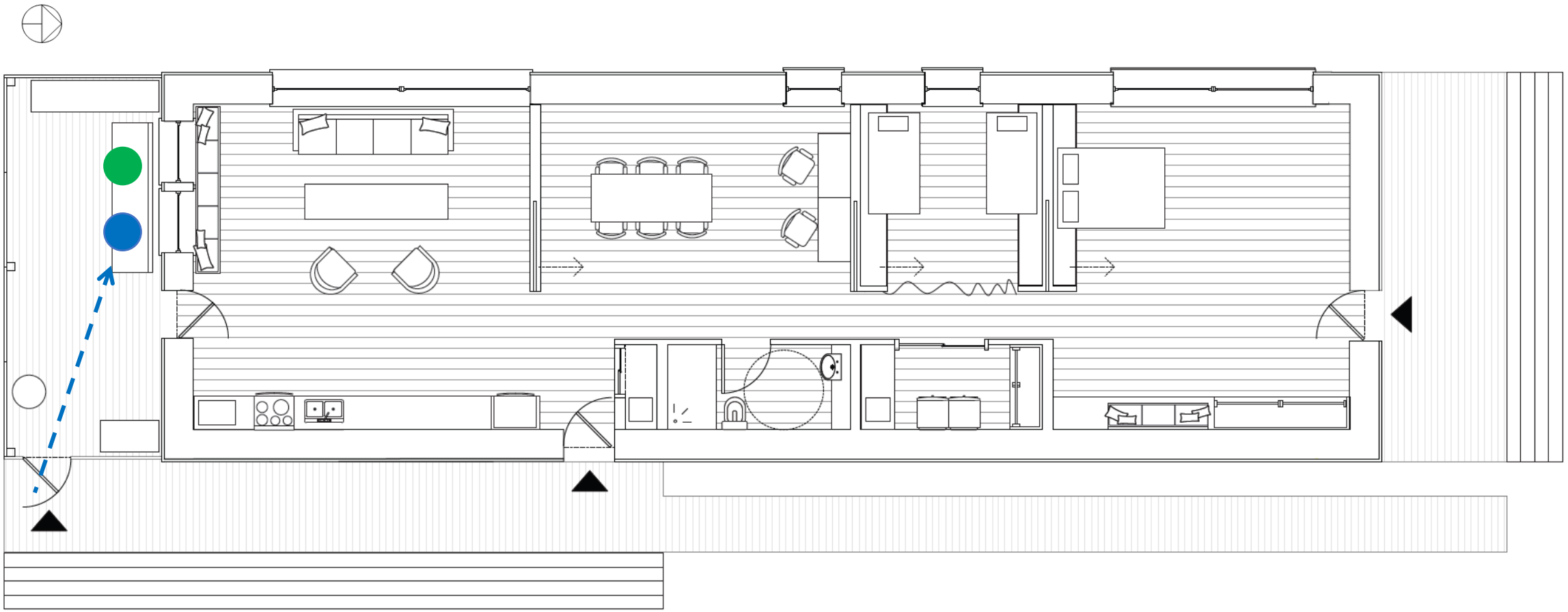
Active Lighting

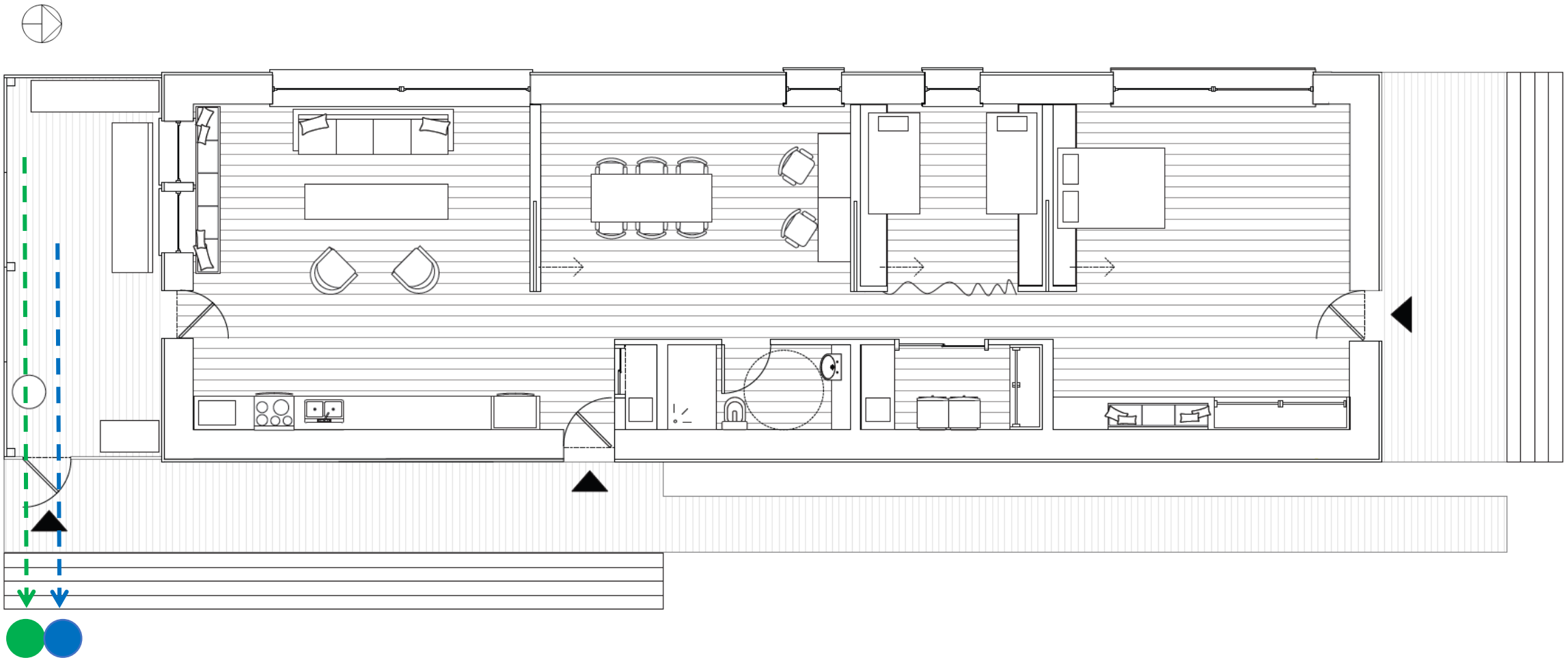


Structural System



- SHEAR WALLS
- COLUMNS
- BEAMS
- JOISTS
- PERIMETER BEAM
- HELICAL PILES
- FLOORING
- STUD WALL
- DOUBLE TOP PLATE



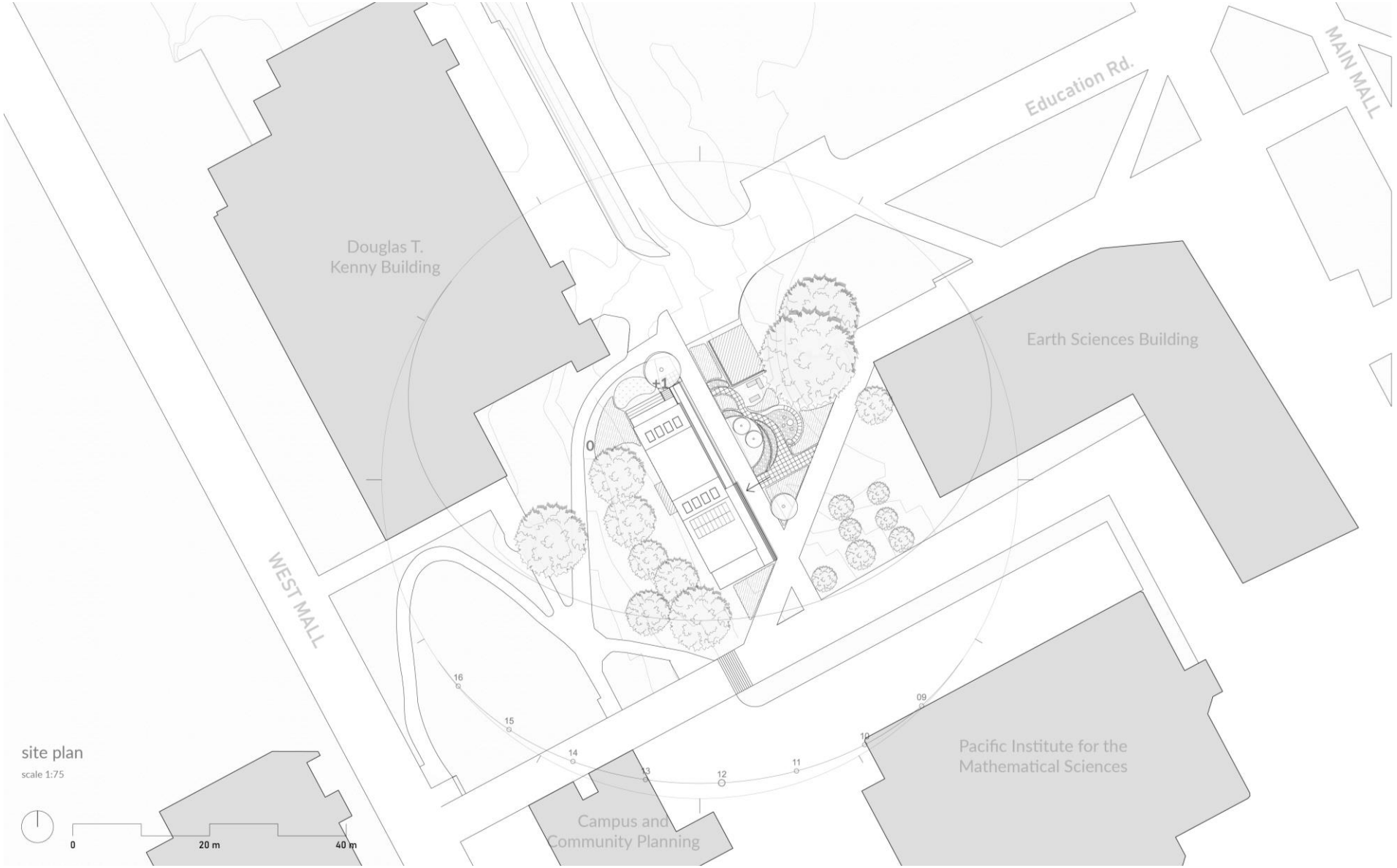


Third Life

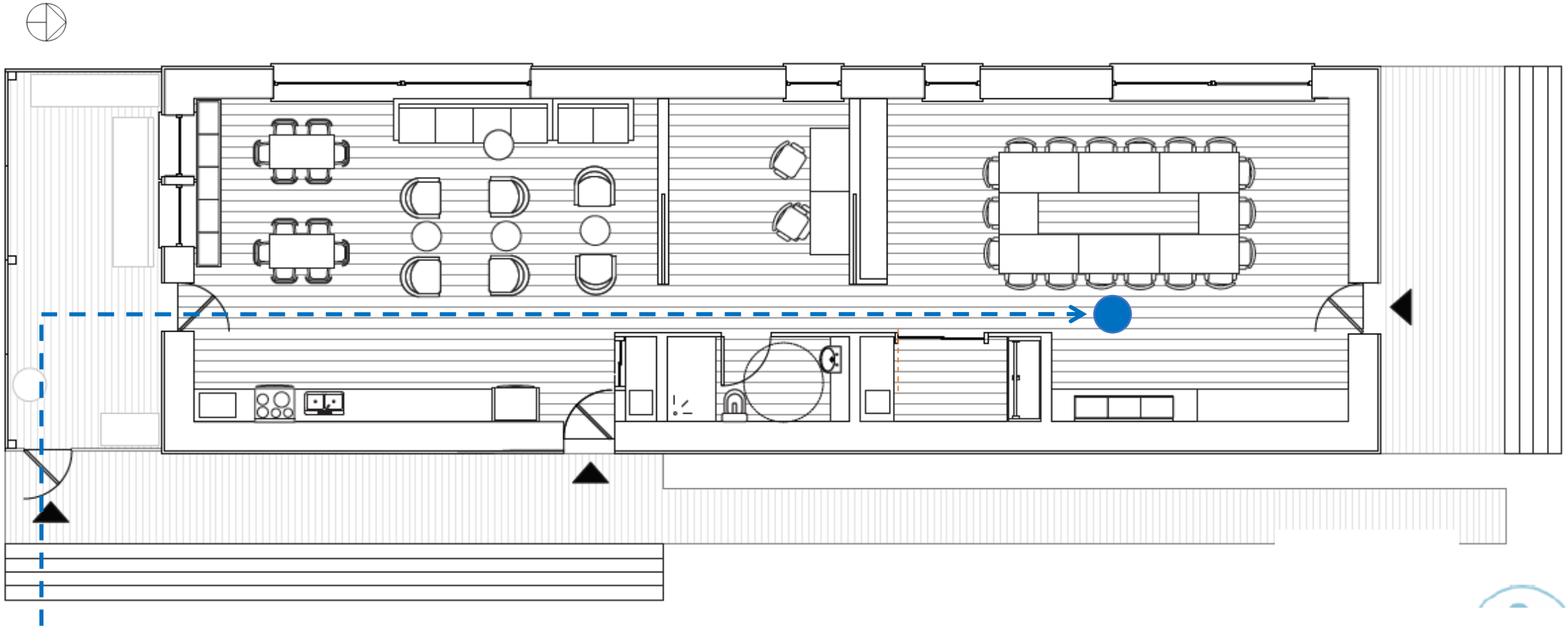
Student collaboration space and living lab

Sustainability Corridor

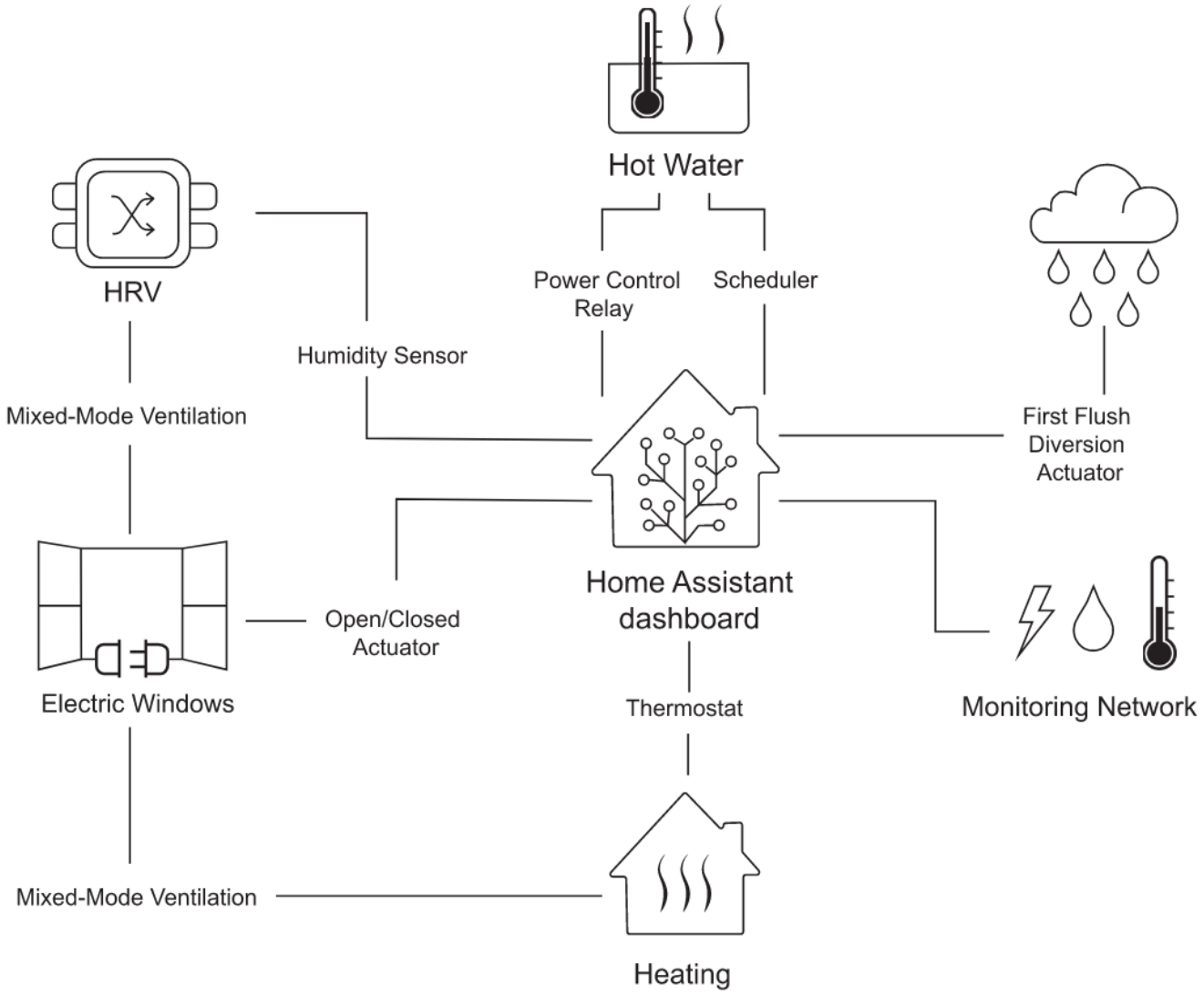
Site Context



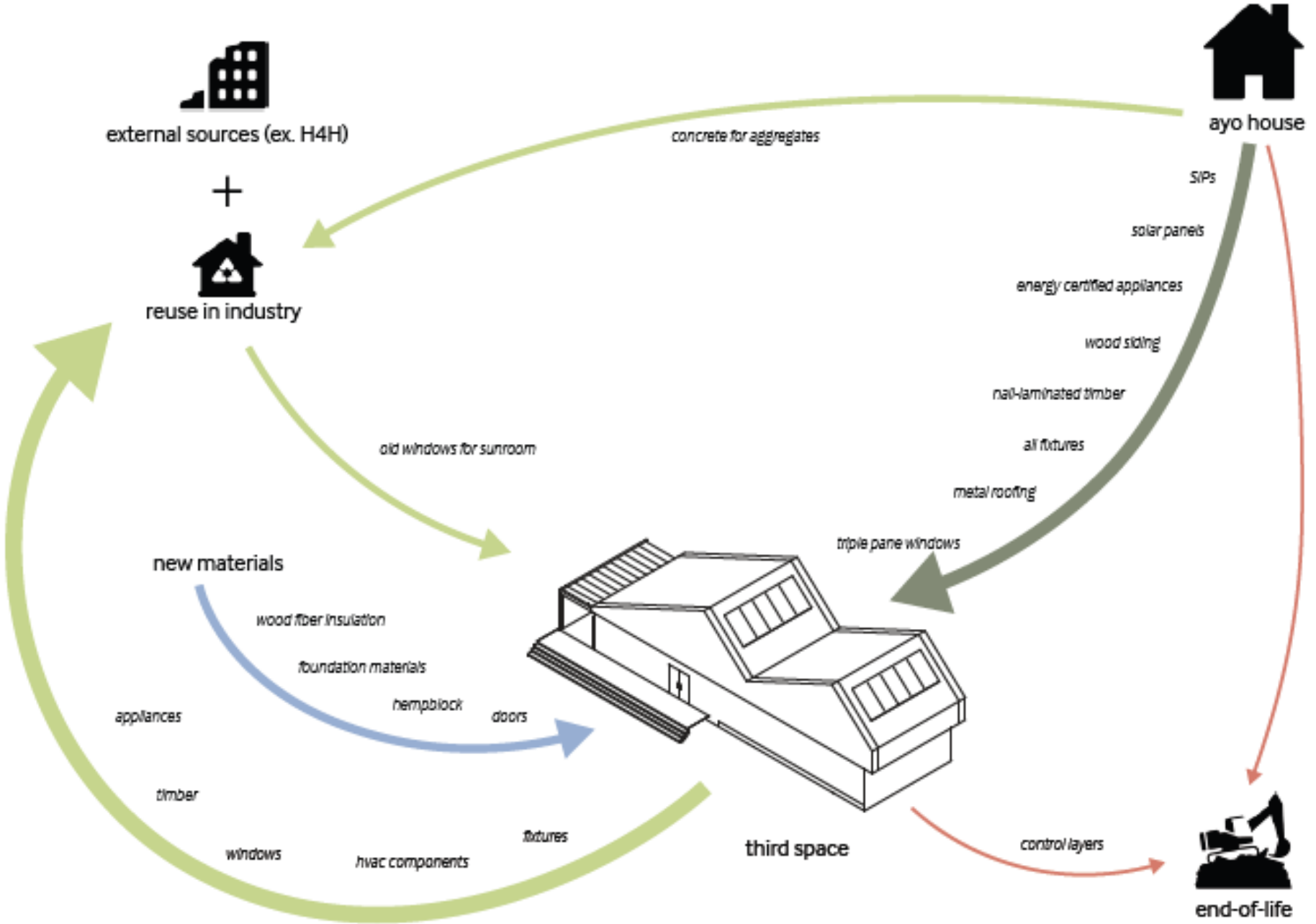
Student Collaboration Space



Smart Controls



Third Space's Cycle



Thank you!

Appendix

Drawings, renders, calculations - for reference

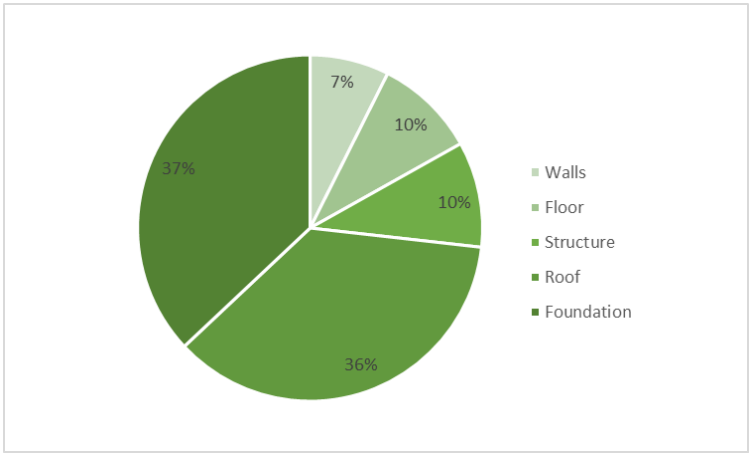
Third Space Embodied Carbon

Global Warming Potential Intensity: 194 kg CO2 eq / sf

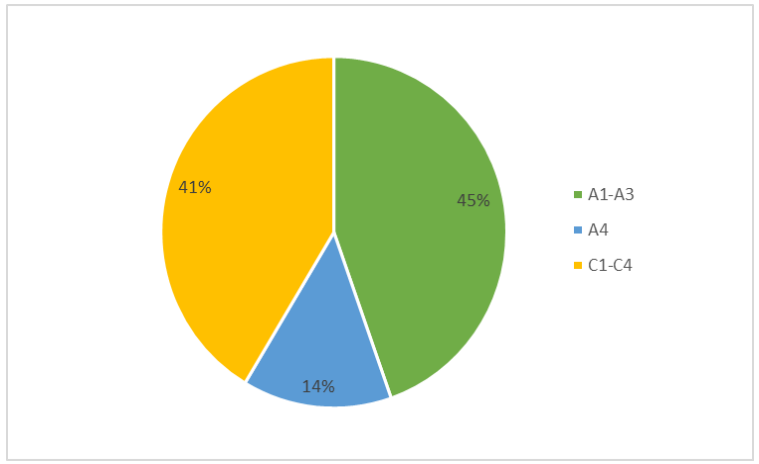
Carbon Sequestered by Hempcrete: 14 400 kg CO2 eq over 10 years

Carbon Sequestered by Landscaping: 2400 kg CO2 eq over 10 years

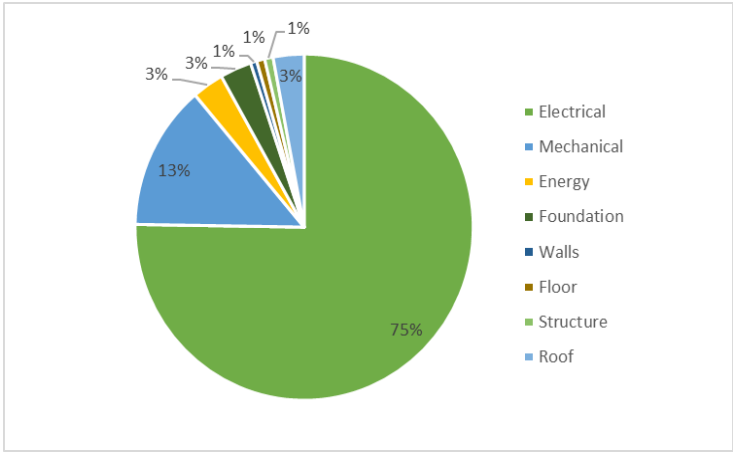
Typical Components including Envelope, Structure, and Foundation



Impacts by Lifecycle Phase



All Components, including Mechanical, Electrical and Energy Components



Embodied Carbon Comparison

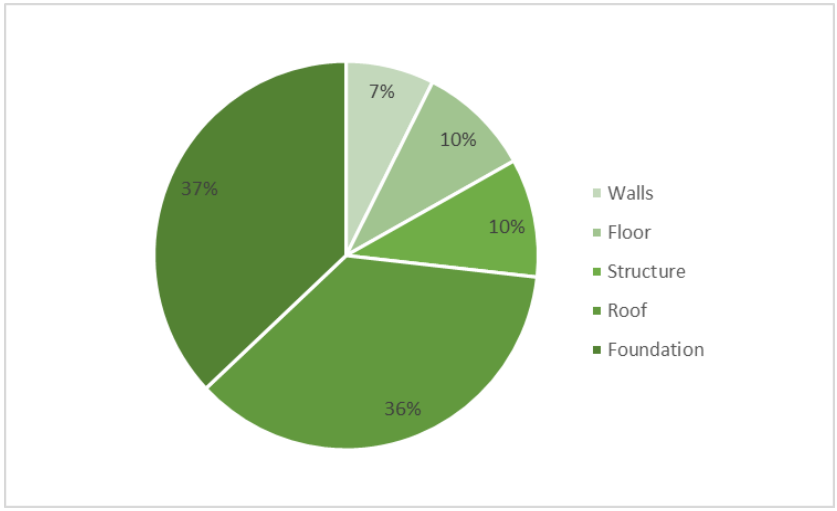
Third Space building:
-hempcrete & cellulose walls
-softwood lumber only
-minimal rigid insulation
-re-used windows, appliances, finishes, SIPs

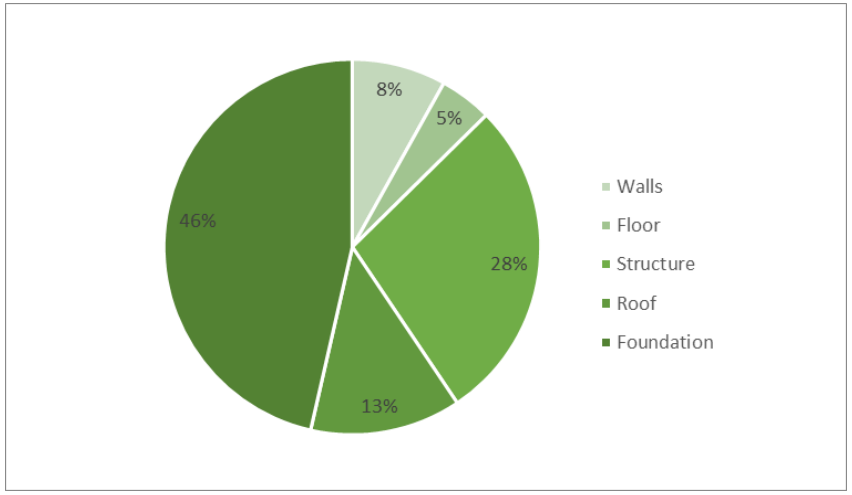
194 kg CO2 eq / sf

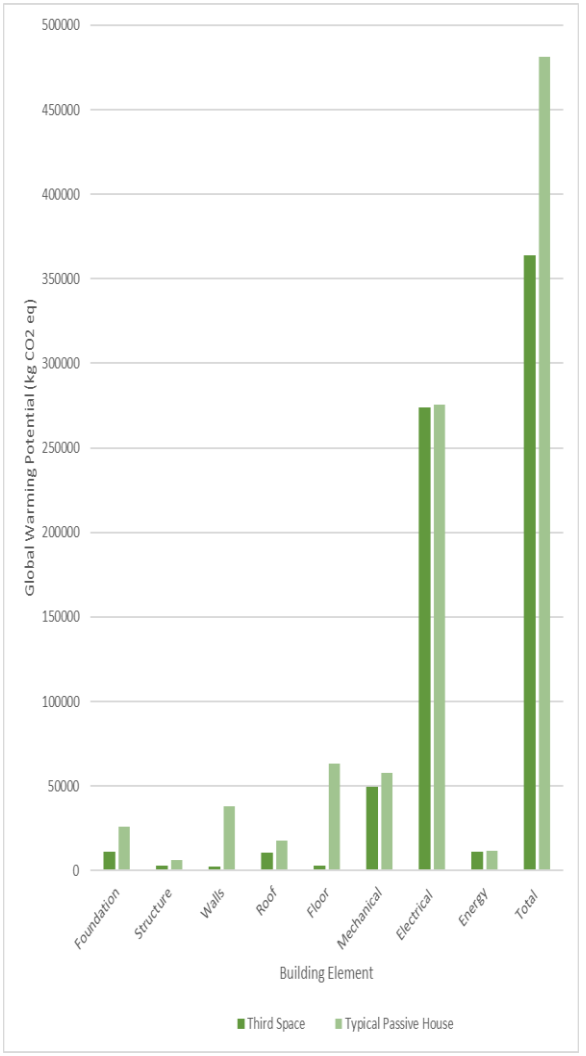
vs

234 kg CO2 eq / sf

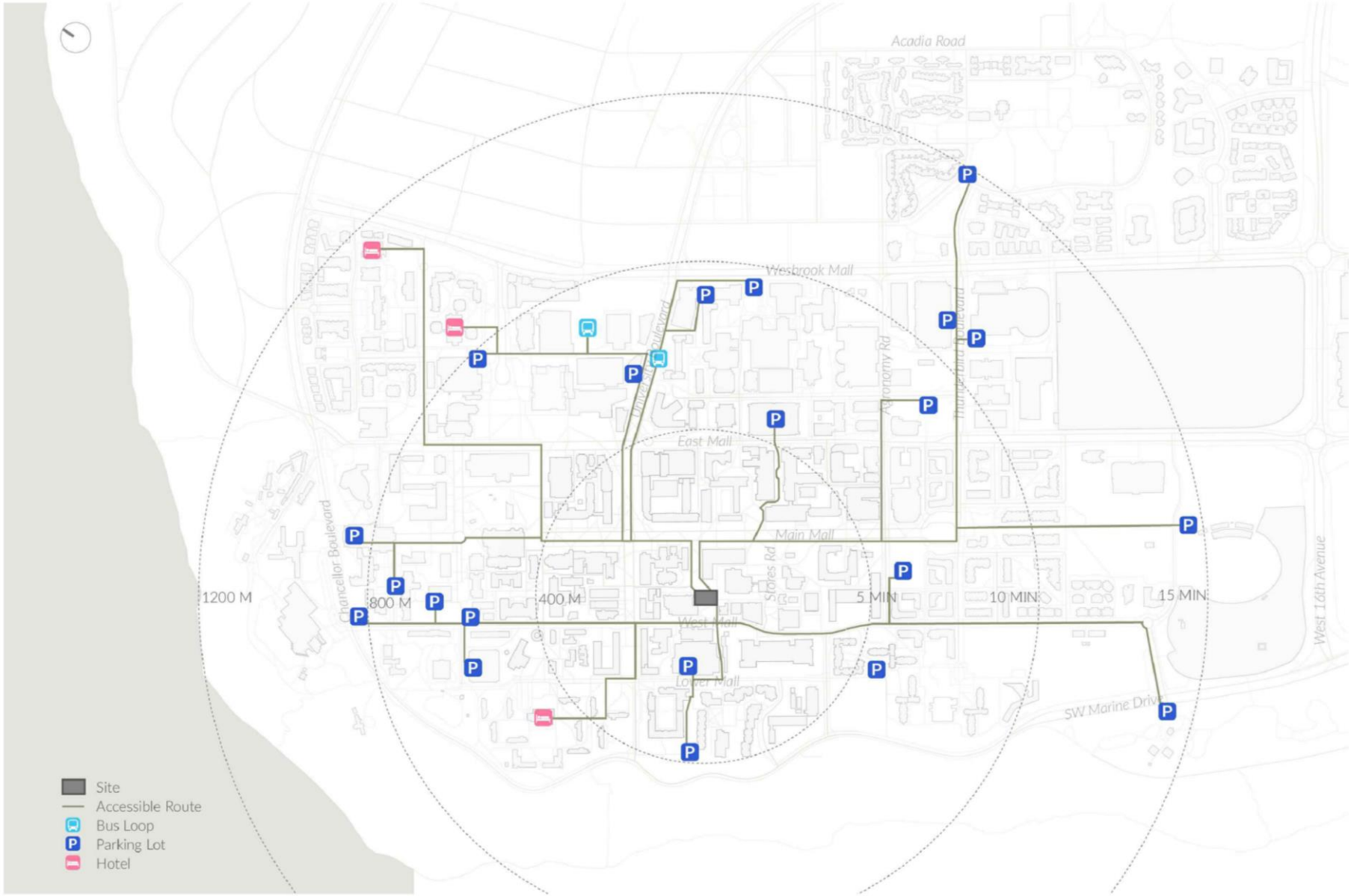
Typical Passive House building:
-mineral wool batt & polyiso walls
-XPS insulation in roof & floor
-engineered lumber
-no material re-use



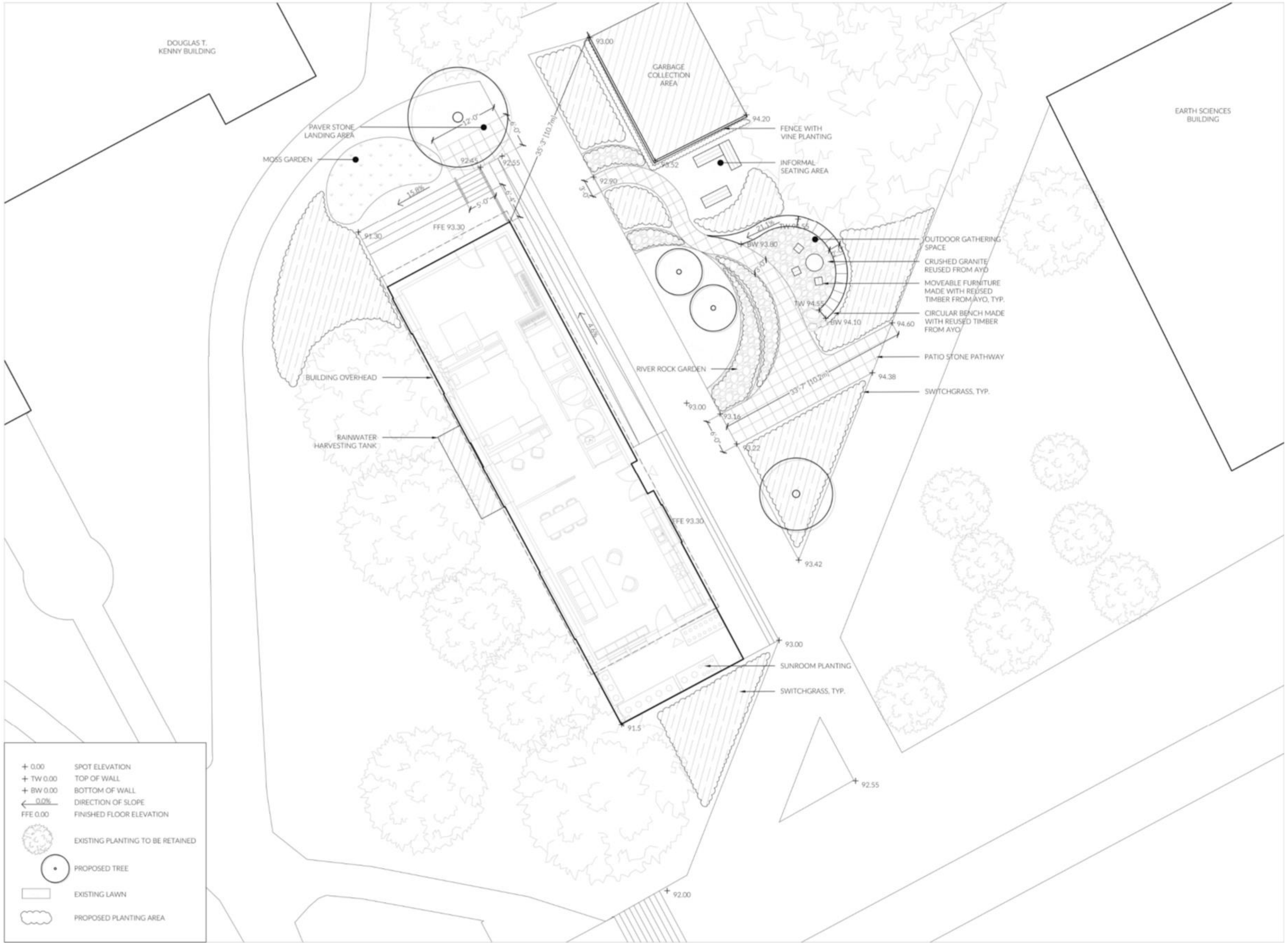




Site Access and Parking



Site Plan


DOUGLAS T. KENNY BUILDING
EARTH SCIENCES BUILDING
GARBAGE COLLECTION AREA
FENCE WITH VINE PLANTING
INFORMAL SEATING AREA
PAVER STONE LANDING AREA
MOSS GARDEN
OUTDOOR GATHERING SPACE
CRUSHED GRANITE REUSED FROM AYO
MOVEABLE FURNITURE MADE WITH REUSED TIMBER FROM AYO, TYP.
CIRCULAR BENCH MADE WITH REUSED TIMBER FROM AYO
PATIO STONE PATHWAY
SWITCHGRASS, TYP.
RIVER ROCK GARDEN
BUILDING OVERHEAD
RAINWATER HARVESTING TANK
SUNROOM PLANTING
SWITCHGRASS, TYP.
FFE 93.30
SPOT ELEVATION
TOP OF WALL
BOTTOM OF WALL
DIRECTION OF SLOPE
FINISHED FLOOR ELEVATION
EXISTING PLANTING TO BE RETAINED
PROPOSED TREE
EXISTING LAWN
PROPOSED PLANTING AREA

Planting Plan

PLANT SCHEDULE - EXTERIOR

TREES	CODE	QTY	BOTANICAL / COMMON NAME	SPACING
	PA	1	PRUNUS × YEDOENSIS AKEBONO CHERRY	AS SHOWN
SHRUBS	**CODE**	**QTY**	**BOTANICAL / COMMON NAME**	**SPACING**
	Pv	197	PANICUM VIRGATUM / SWITCHGRASS	36" O.C.
	Pm	2	PINUS MUGO / MUGO PINE	42" O.C.
	Sj	3	SPIRAEA JAPONICA / JAPANESE SPIRAEA	42" O.C.
	Po	4	POLYSTICHUM MUNITUM / WESTERN SWORD FERN	36" O.C.
	Fg	29	FESTUCA GLAUCA / BLUE FESCUE	12" O.C.
	Sa	9	SEDUM × 'AUTUMN JOY' / AUTUMN JOY SEDUM	18" O.C.
	La	6	LAVANDULA ANGUSTIFOLIA / ENGLISH LAVENDER	24" O.C.
	Am	10	ACHILLEA MILLEFOLIUM / COMMON YARROW	18" O.C.
	Pt	28	PARTHENOCISSUS TRICUSPIDATA / BOSTON IVY	18" O.C.
	Tr	183 sf	TORTULA RURALIS/ STAR MOSS	AS SHOWN

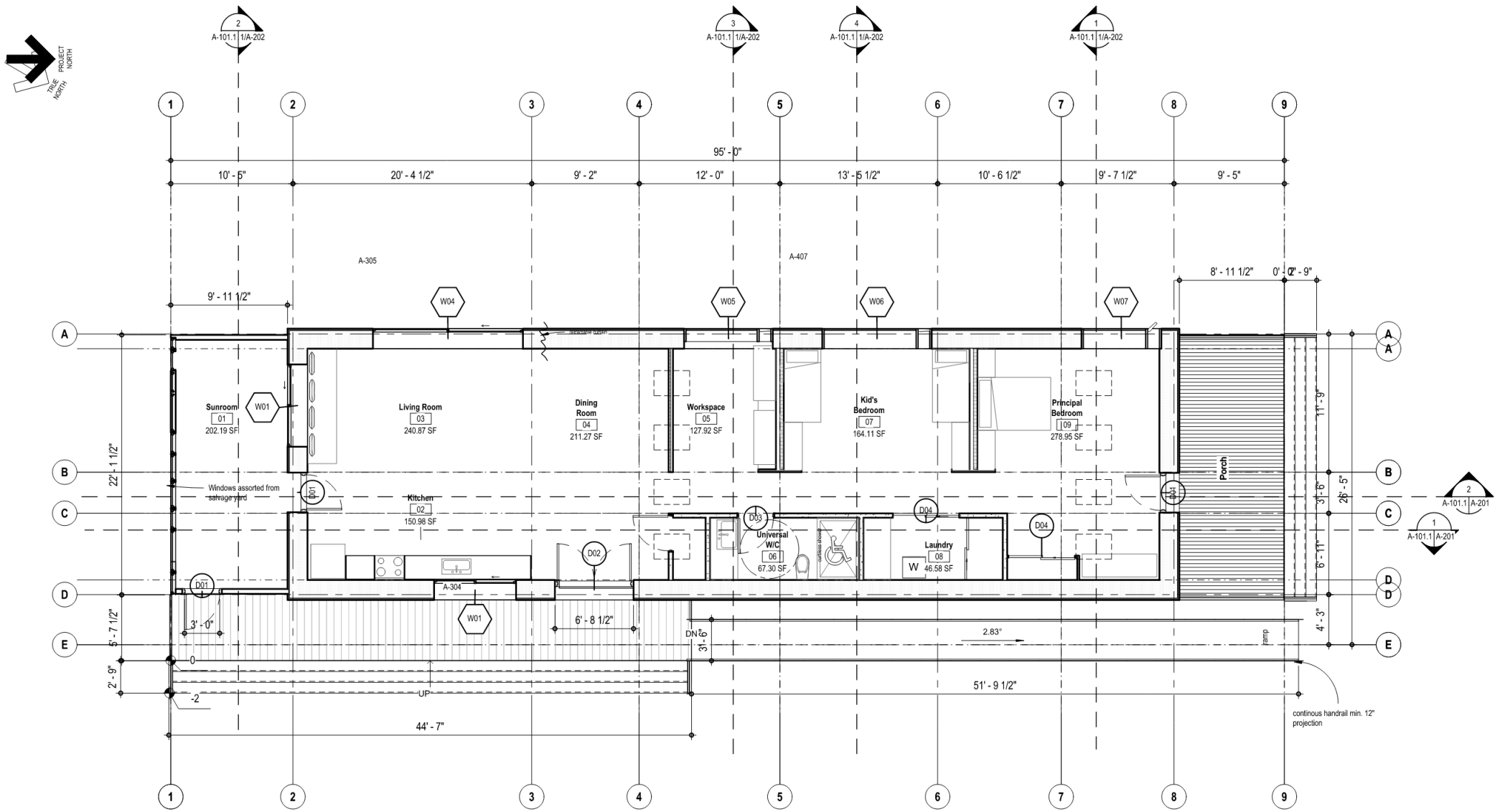
PLANT SCHEDULE - EXTERIOR PLANTING TRANSPLANTED FROM AYO

TREES	CODE	QTY	BOTANICAL / COMMON NAME	SPACING
	MD	2	MALUS DOMESTICA / APPLE	AS SHOWN
	?	1	?	AS SHOWN
SHRUBS	**CODE**	**QTY**	**BOTANICAL / COMMON NAME**	**SPACING**
	Ed	7	ERICA × DARLEYENSIS / DARLEY DALE HEATH	24" O.C.

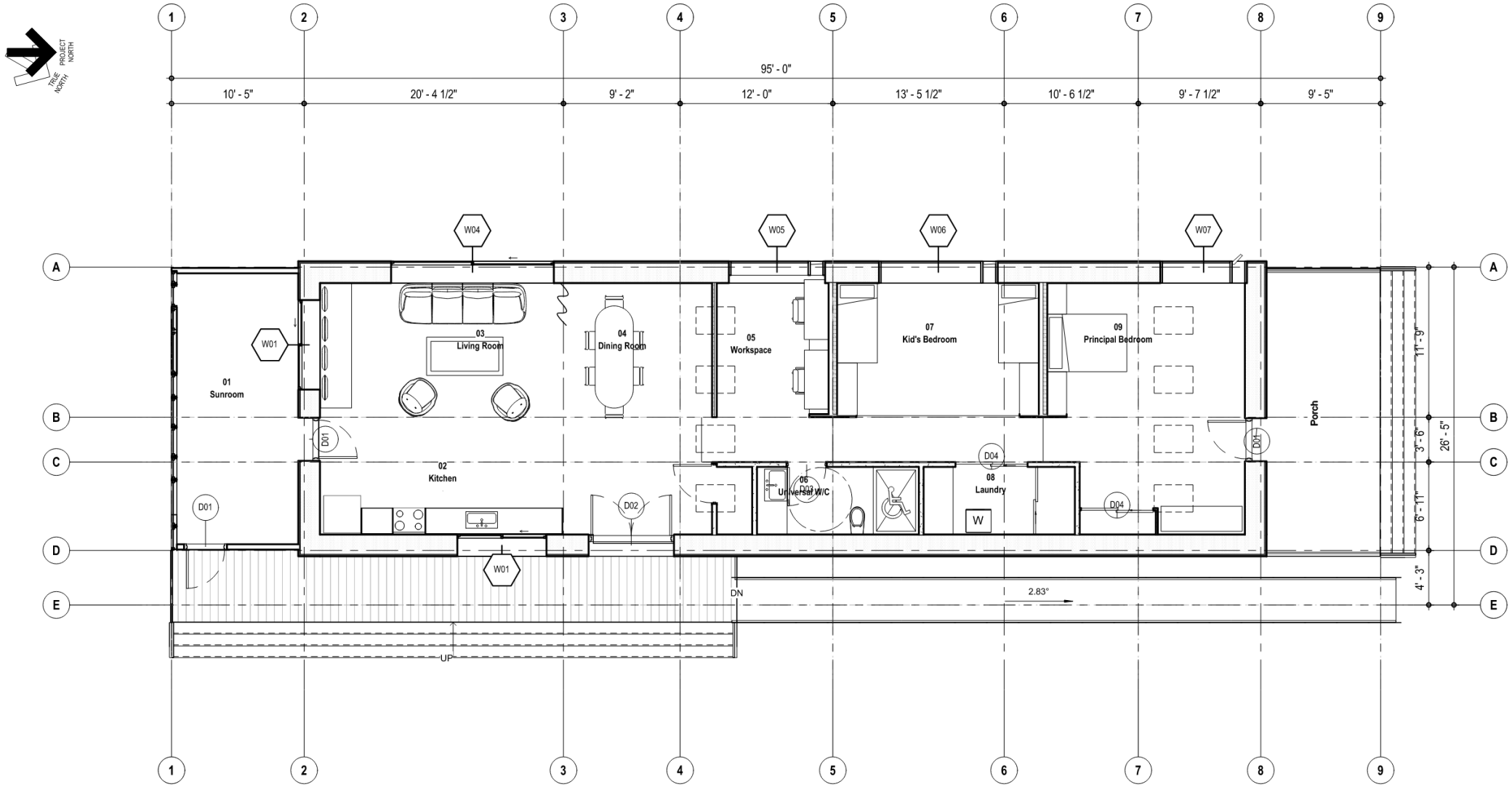
PLANT SCHEDULE - INTERIOR

SHRUBS	CODE	QTY	BOTANICAL / COMMON NAME
	Pc	1	PETROSELINUM CRISPUM / DARK GREEN ITALIAN PARSLEY
	Cs	1	CORIANDRUM SATIVUM / CALYPSO CILANTRO
	Ms	1	MENTHA SPICATA / SPEARMINT
	Ov	1	ORIGANUM VULGARE SSP. HIRTUM / GREEK OREGANO
	Sr	1	SALVIA ROSMARINUS / ROSEMARY
	Tv	1	THYMUS VULGARIS / ENGLISH THYME
	Rs	8	RAPHANUS SATIVUS / EASTER EGG II RADISH
	So	8	SPINACIA OLERACEA / MONSTRUEUX DE VIROFLAY SPINACH
	Sl	2	SOLANUM LYCOPERSICUM / SUN GOLD TOMATO
	St	3	SOLANUM TUBEROSUM / SIEGLINDE POTATO
	Ib	2	IPOMOEA BATATAS / GEORGIA JET SWEET POTATO
	Bo	3	BRASSICA OLERACEA VAR. ACEPHALA / VATES BLUE CURLED SCOTCH KALE

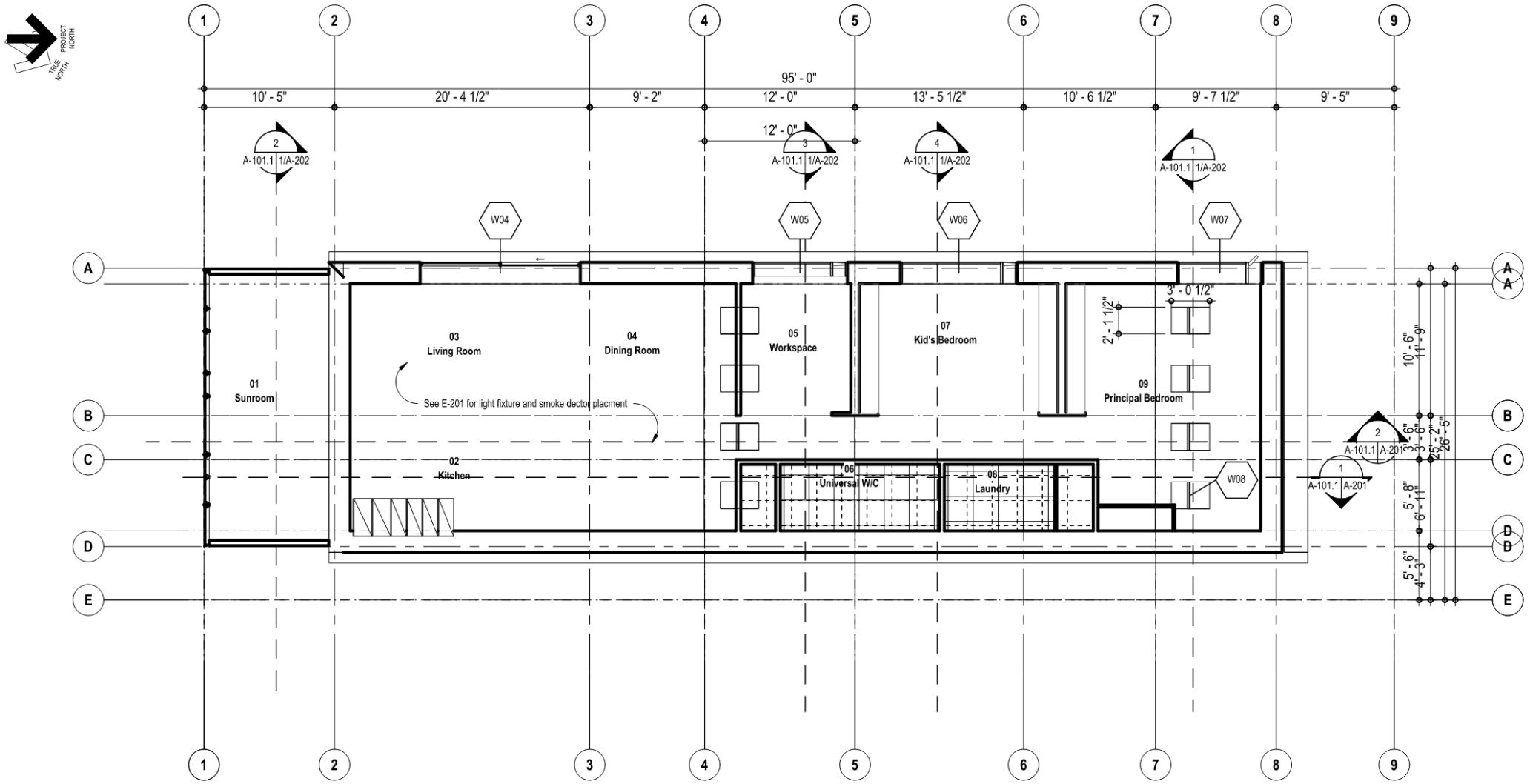
Technical Floor Plan



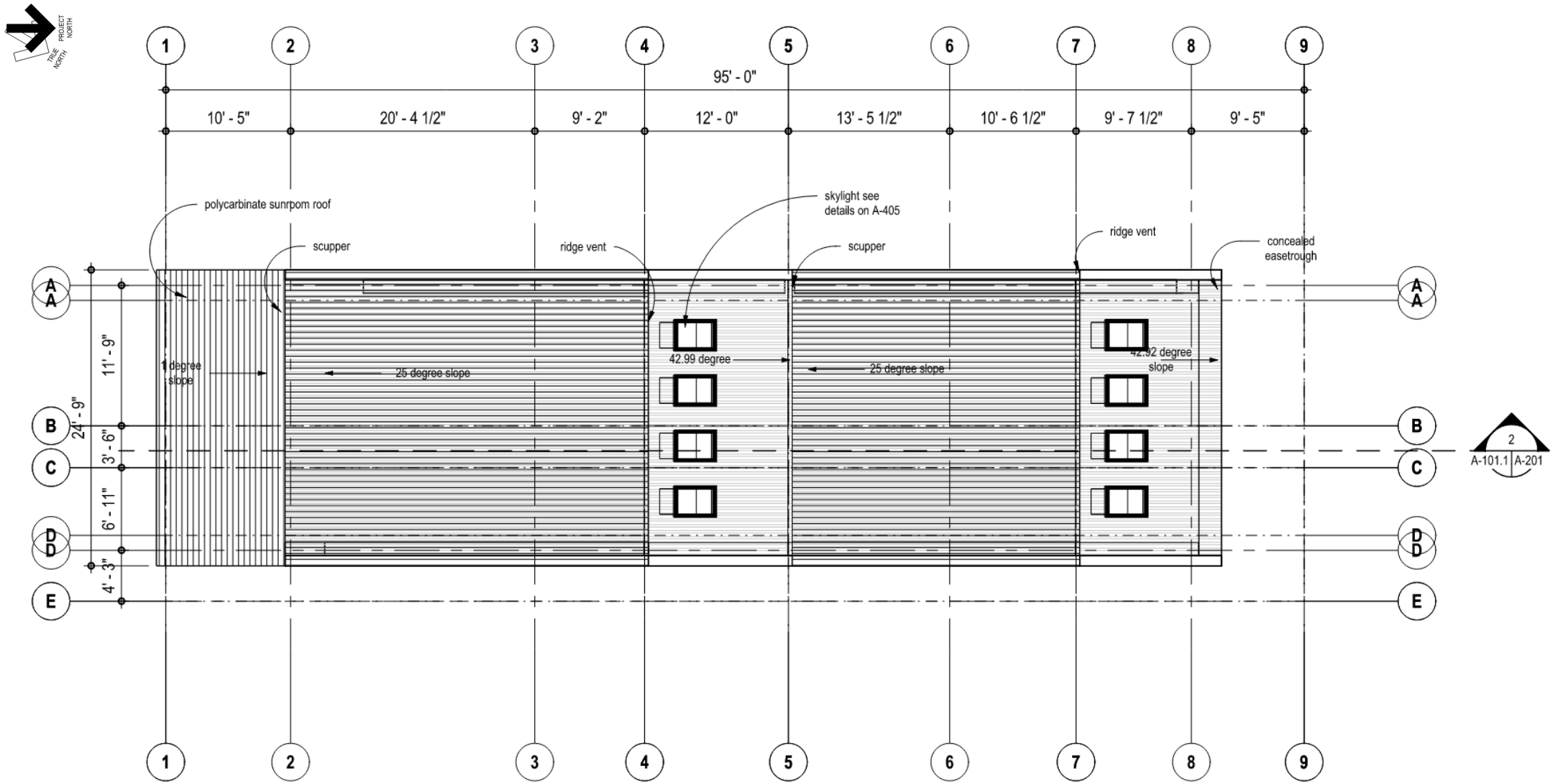
Furniture Plan



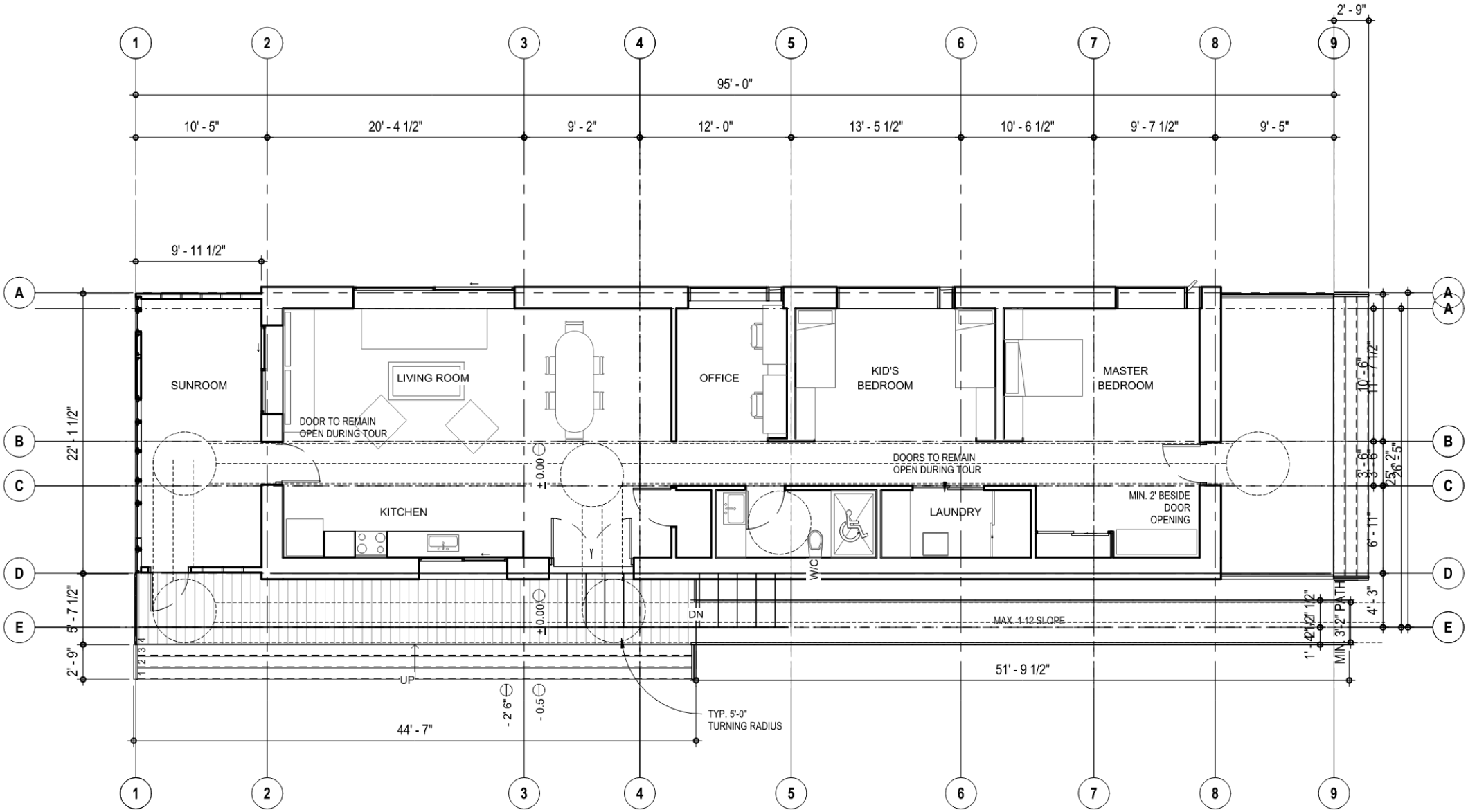
Reflected Ceiling Plan



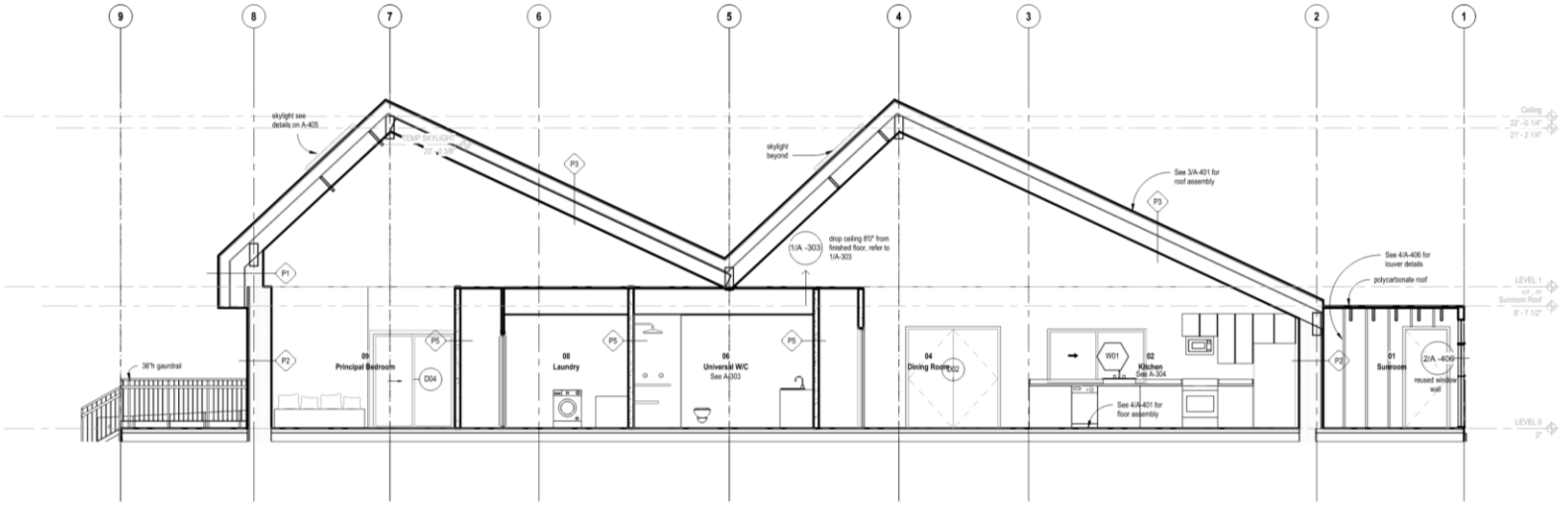
Roof Plan


PROJECT NORTH
TRUE NORTH
1
2
3
4
5
6
7
8
9
95' - 0"
10' - 5"
20' - 4 1/2"
9' - 2"
12' - 0"
13' - 5 1/2"
10' - 6 1/2"
9' - 7 1/2"
9' - 5"
polycarbinate sunrpom roof
scupper
ridge vent
skylight see details on A-405
scupper
ridge vent
concealed easetrough
A
B
C
D
E
24' - 9"
11' - 9"
3' - 6"
6' - 11"
4' - 3"
1 degree slope
25 degree slope
42.99 degree
25 degree slope
42.92 degree slope
2
A-101.1
A-201

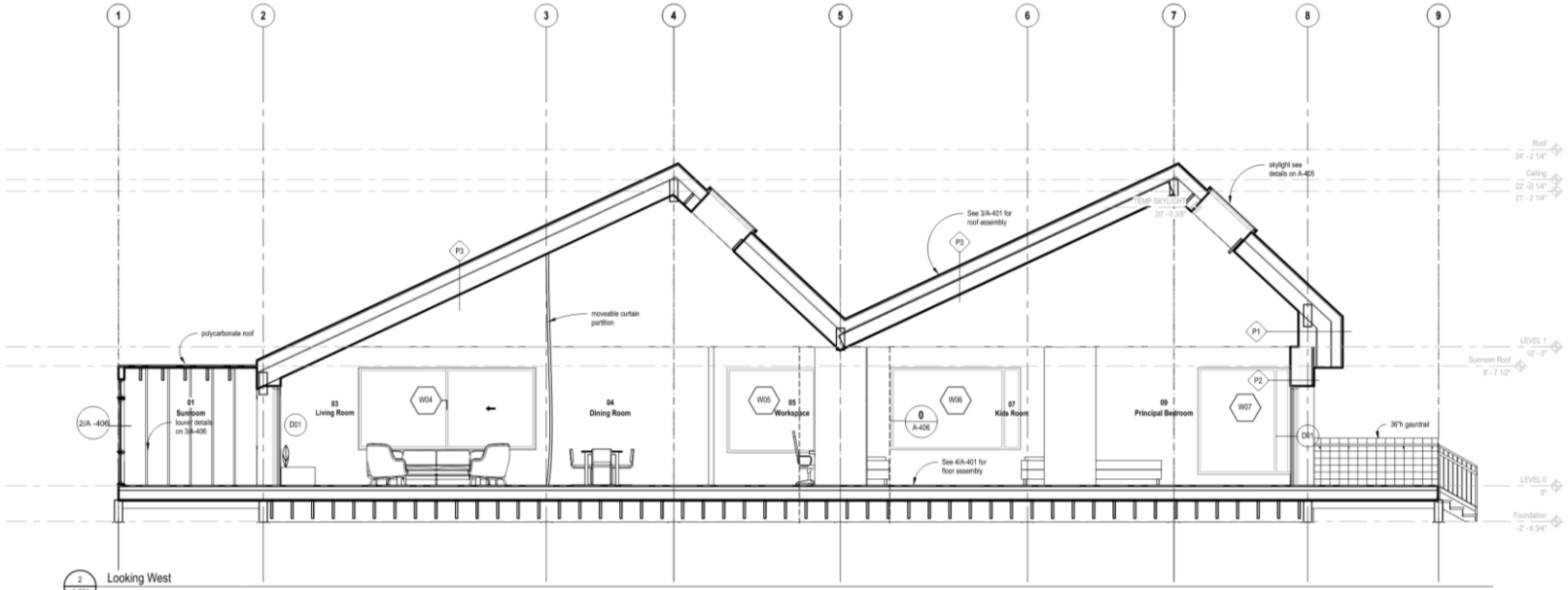
Accessibility and Bathroom Plan



East and West Sections

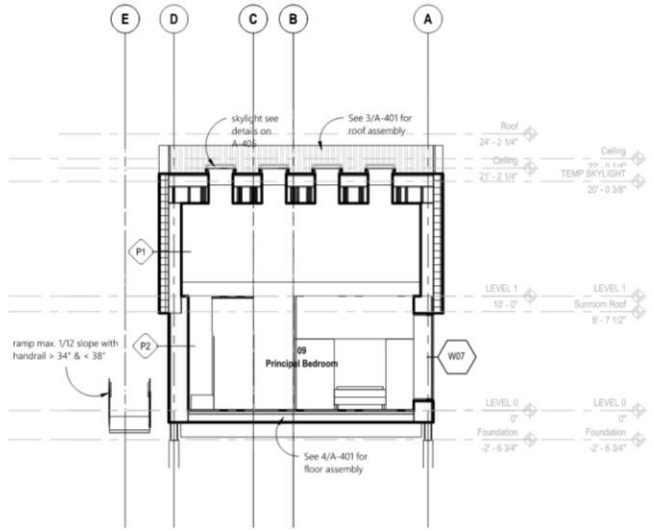


1 A-201 Looking East
SCALE: 1 : 50

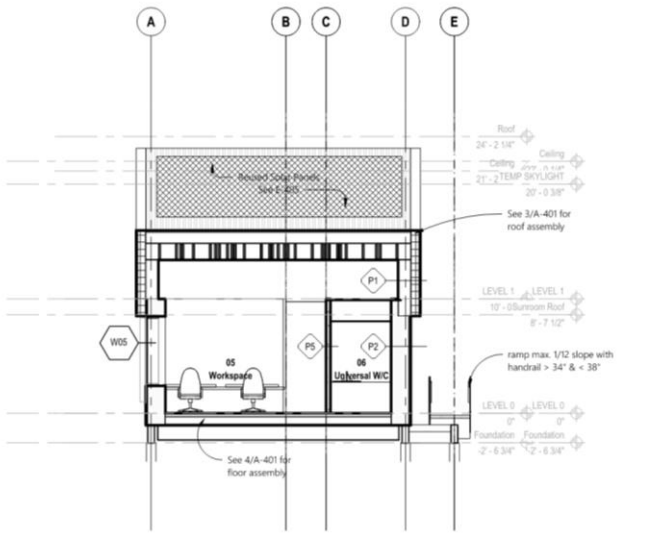


2 A-201 Looking West
SCALE: 1 : 50

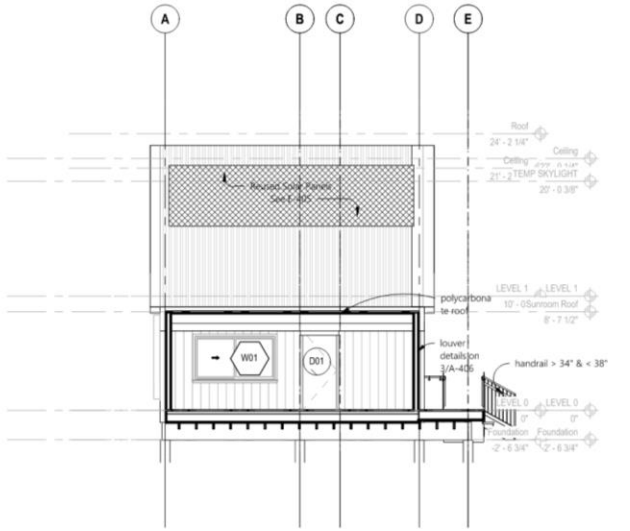
Workspace, Master and Sunroom Sections



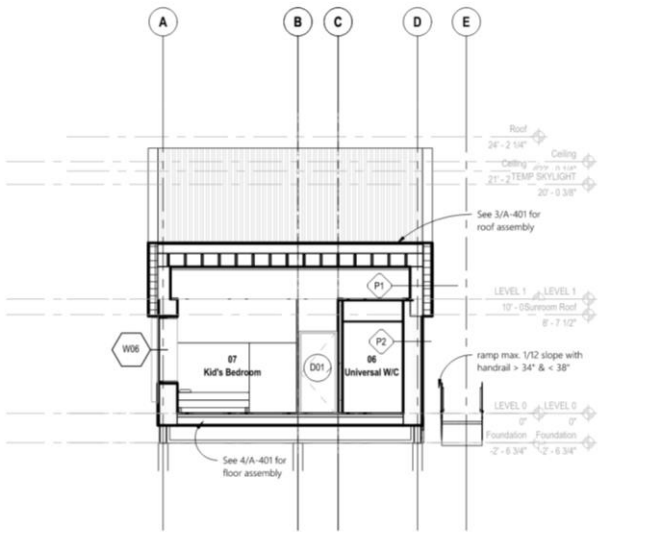
1 A-202 Principal Bedroom
SCALE: 1 : 75



3 A-202 Workspace
SCALE: 1 : 75

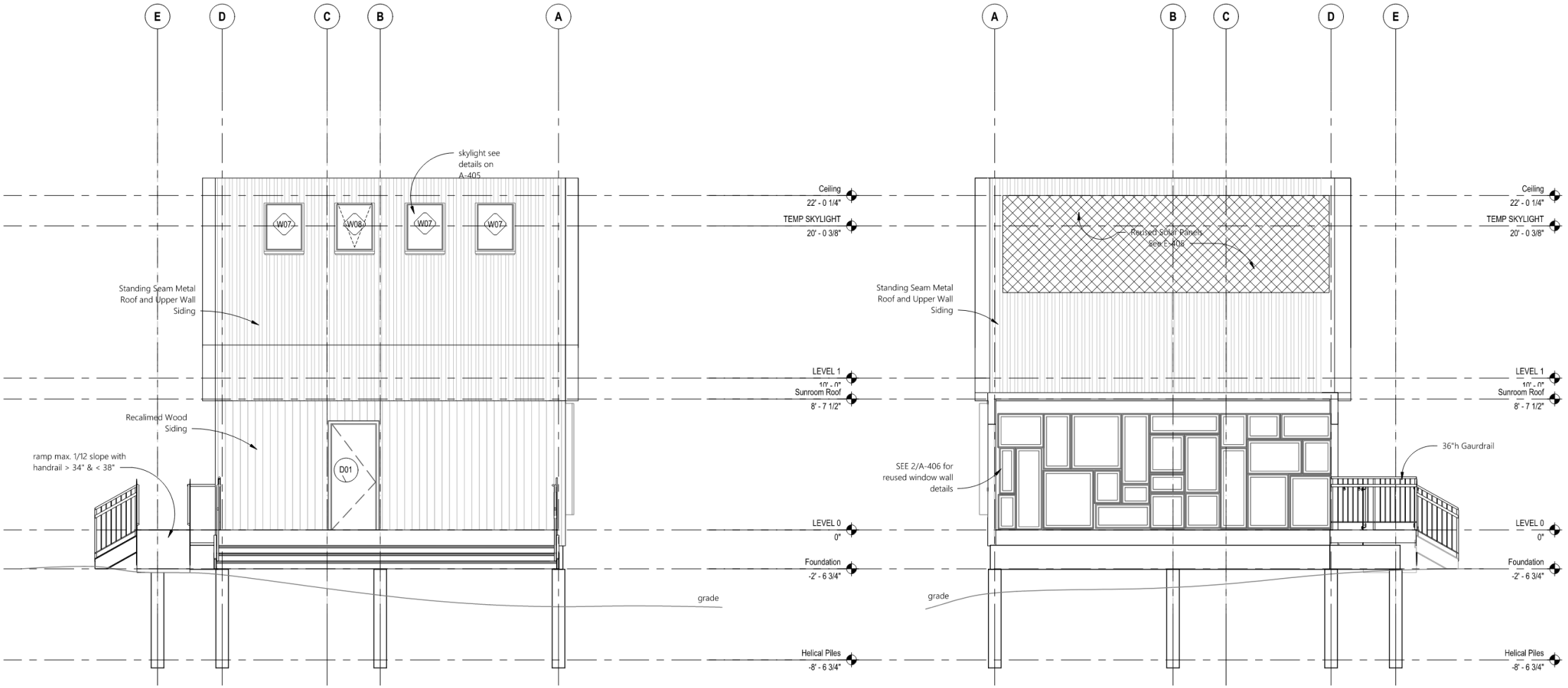


2 A-202 Sunroom
SCALE: 1 : 75



4 A-202 Children Bedroom
SCALE: 1 : 75

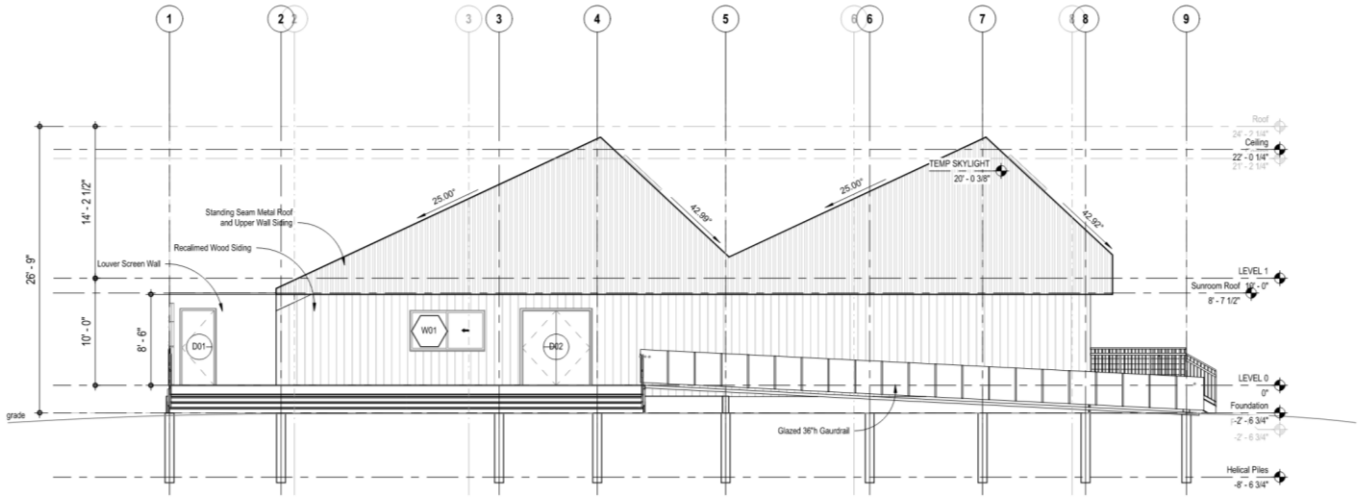
North and South Elevations



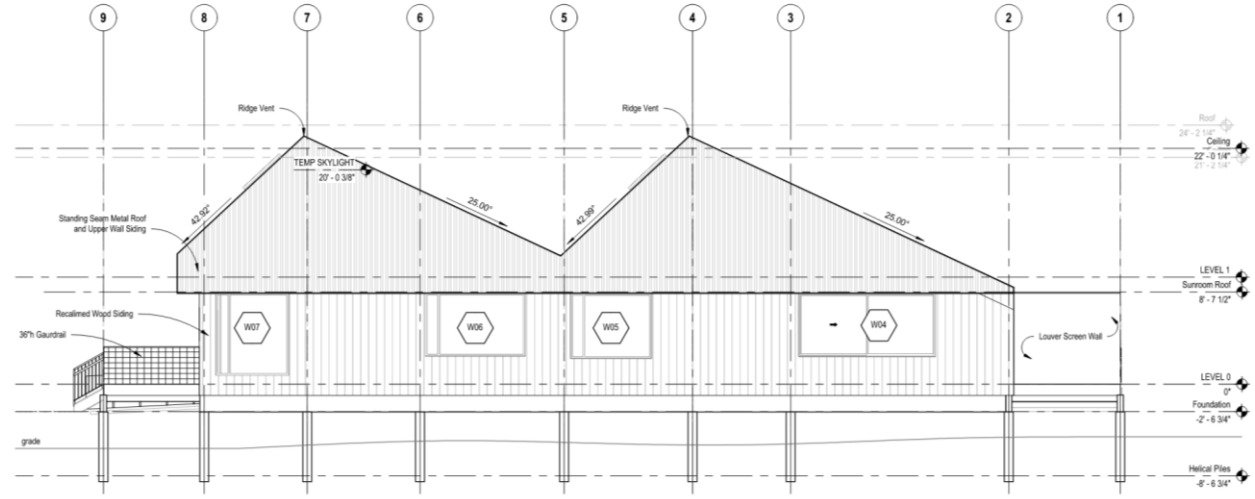
1 / A-301 NORTH ELEVATION
SCALE: 1 : 50

2 / A-301 SOUTH ELEVATION
SCALE: 1 : 50

East and West Elevations

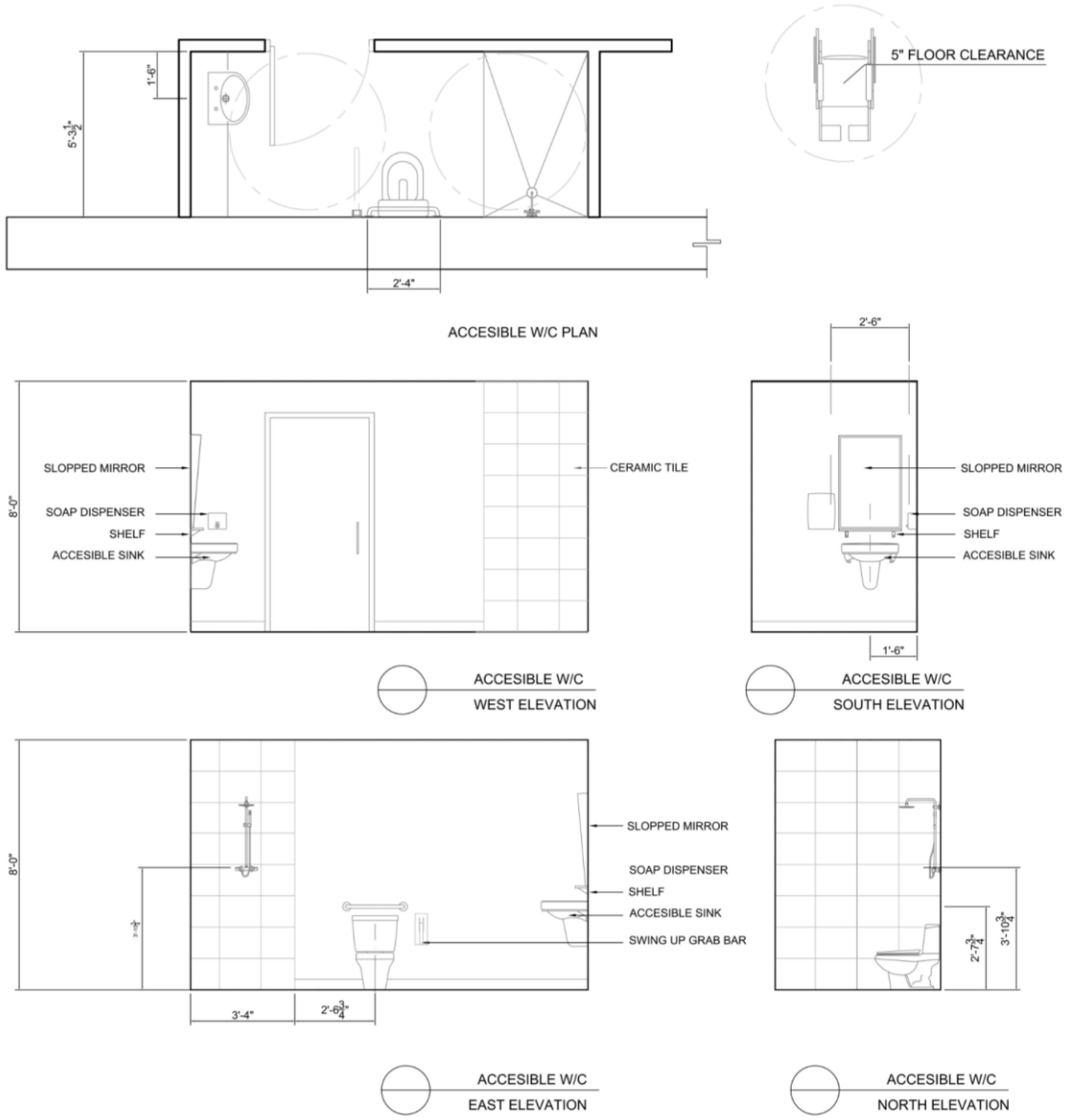


1 A-302 EAST ELEVATION
SCALE: 1 : 75



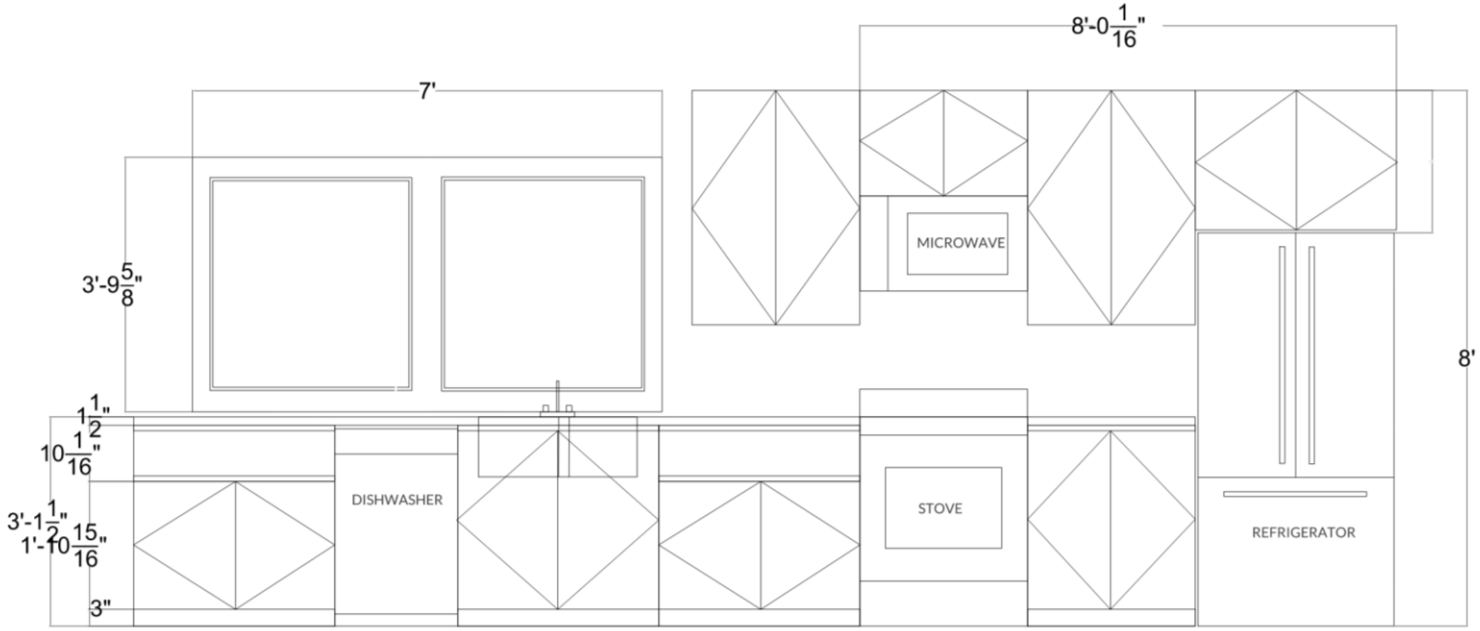
2 A-302 WEST ELEVATION
SCALE: 1 : 75

Bathroom Elevations

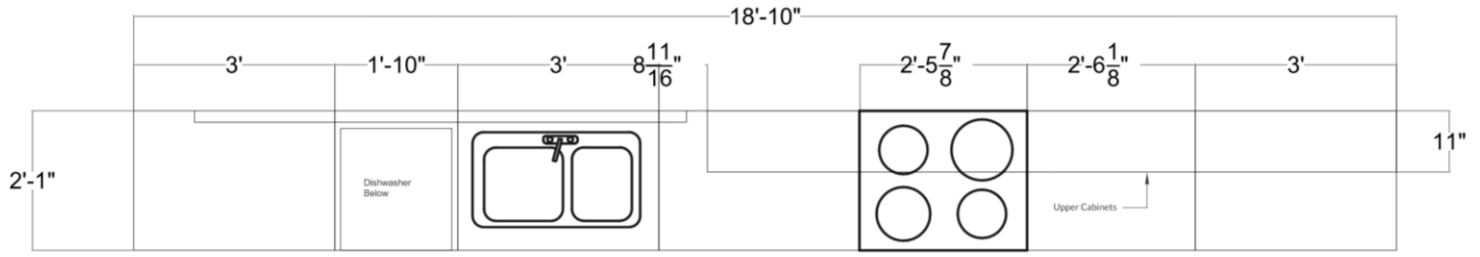


1 A-303 Kitchen Elevation
SCALE: N.T.S

Kitchen Elevations

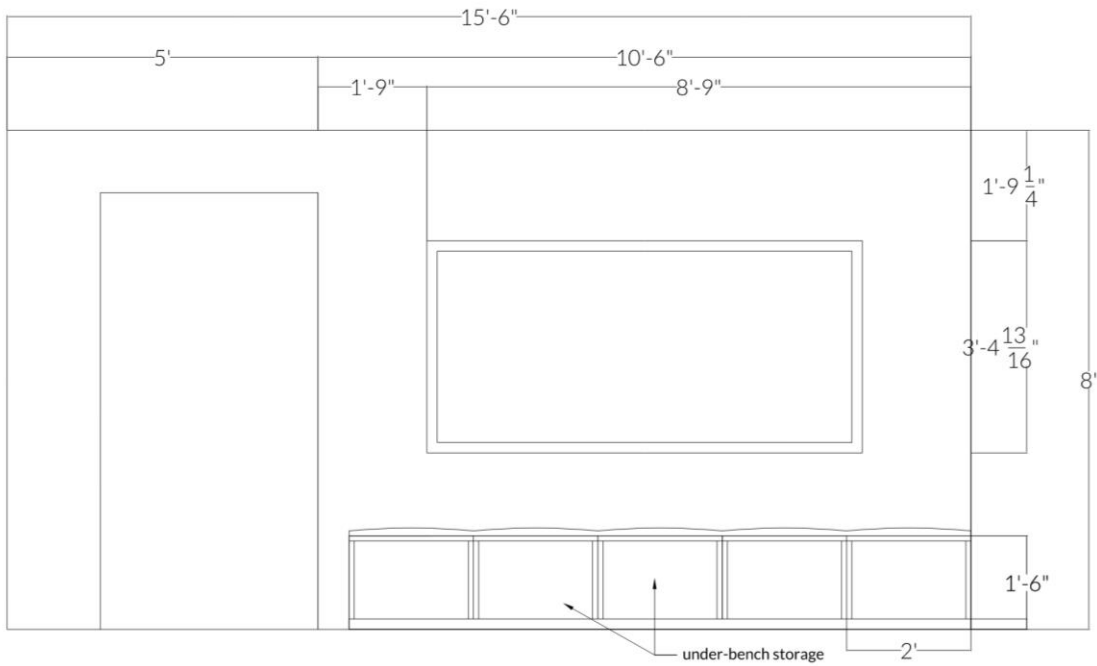


ELEVATION A

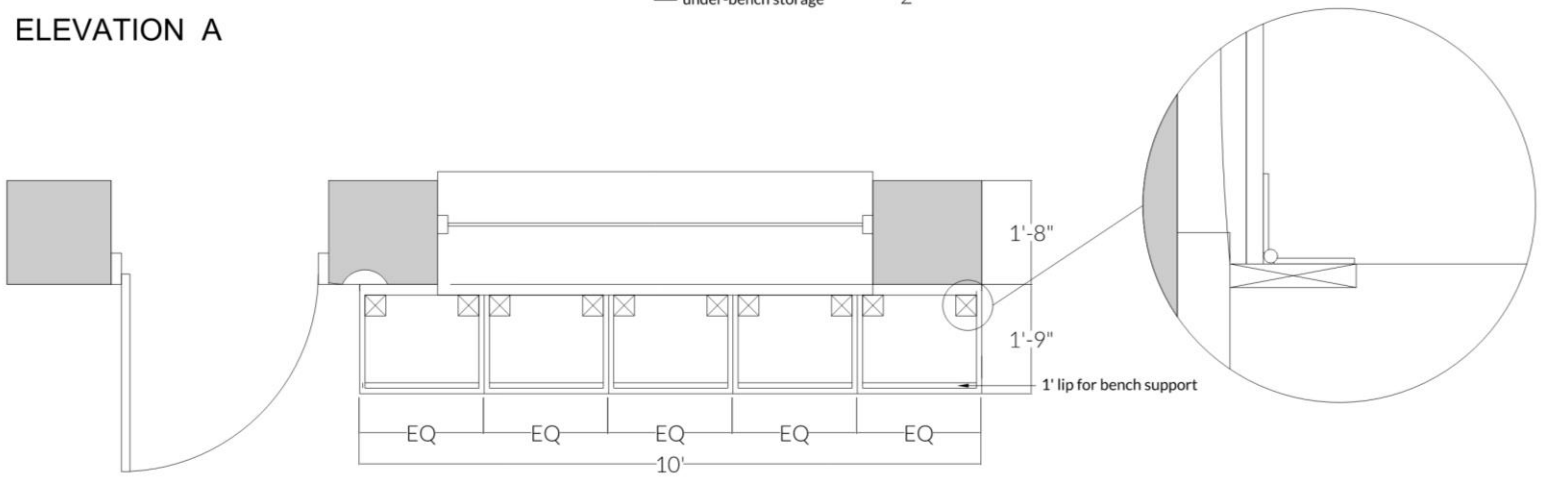


1 A-304 Kitchen Elevations
SCALE: 1" = 1'-0"

Built-In Bench Elevation

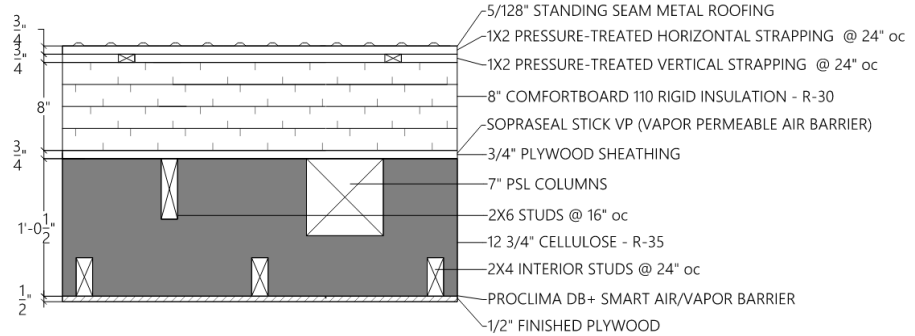


ELEVATION A



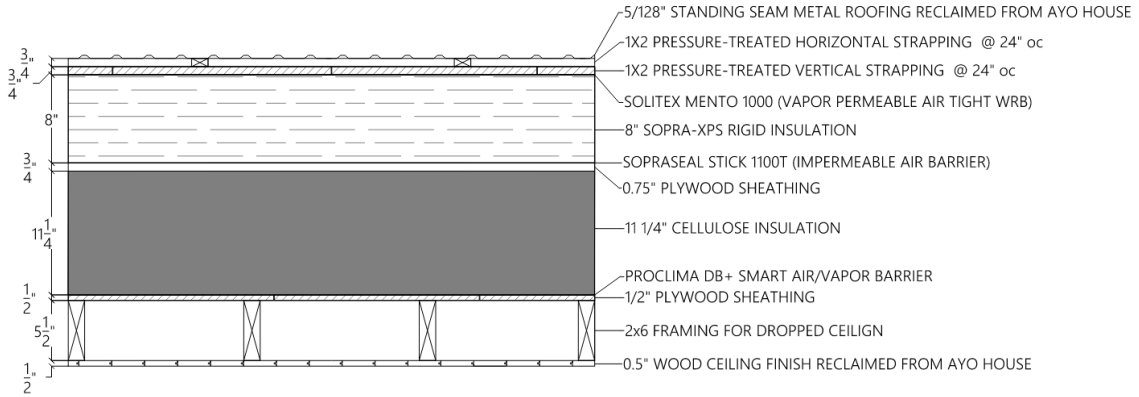
1 A-305 Built-In Bench Elevations
SCALE: 1" = 1'-0"

Assembly Details



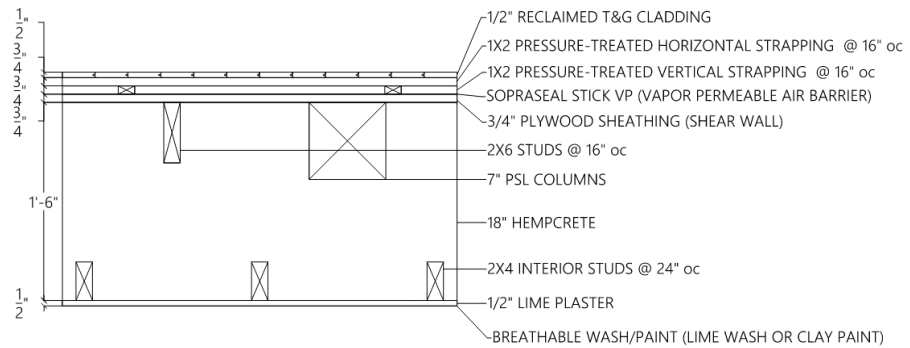
1 A-401 UPPER WALL ASSEMBLY DETAIL

SCALE: 1 1/2" = 1'-0"



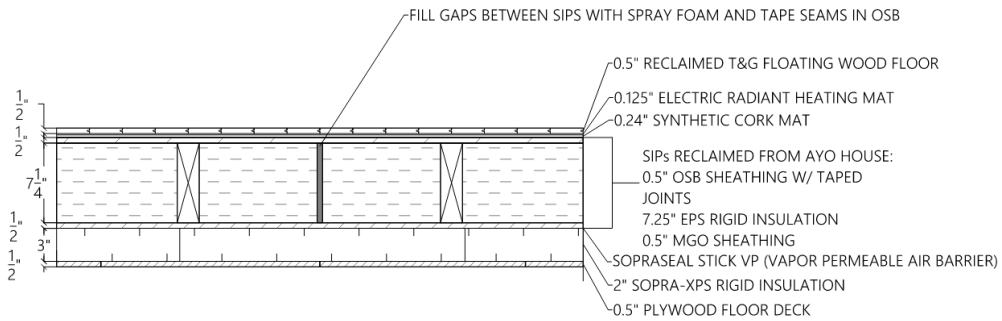
3 A-401 ROOF ASSEMBLY DETAIL

SCALE: 1 1/2" = 1'-0"



2 A-401 UPPER WALL ASSEMBLY DETAIL

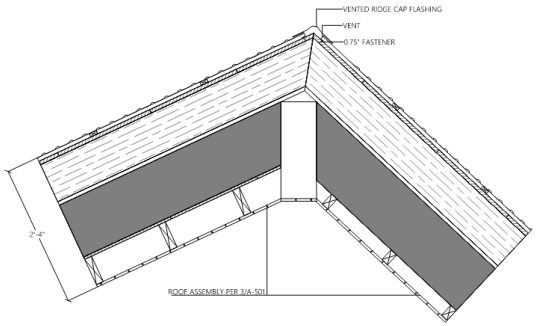
SCALE: 1 1/2" = 1'-0"



4 A-401 FLOOR ASSEMBLY DETAIL

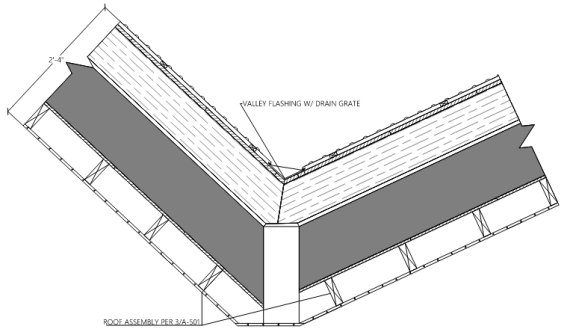
SCALE: 1 1/2" = 1'-0"

Roof Details



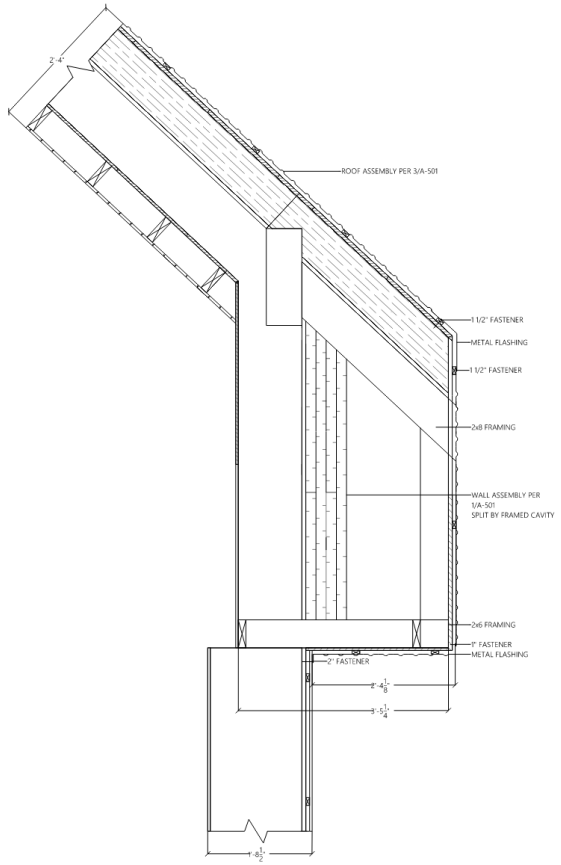
1/A-502 ROOF RIDGE DETAIL

1 A-402 ROOF RIDGE DETAIL
SCALE: 3/4" = 1'-0"



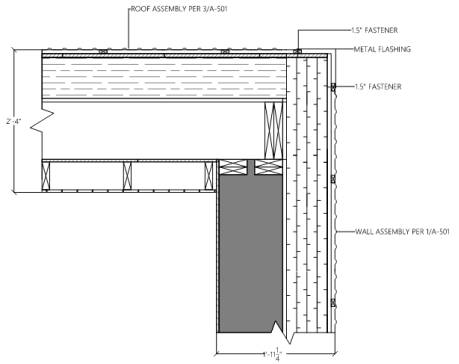
2/A-502 ROOF VALLEY DETAIL

2 A-402 ROOF VALLEY DETAIL
SCALE: N.T.S

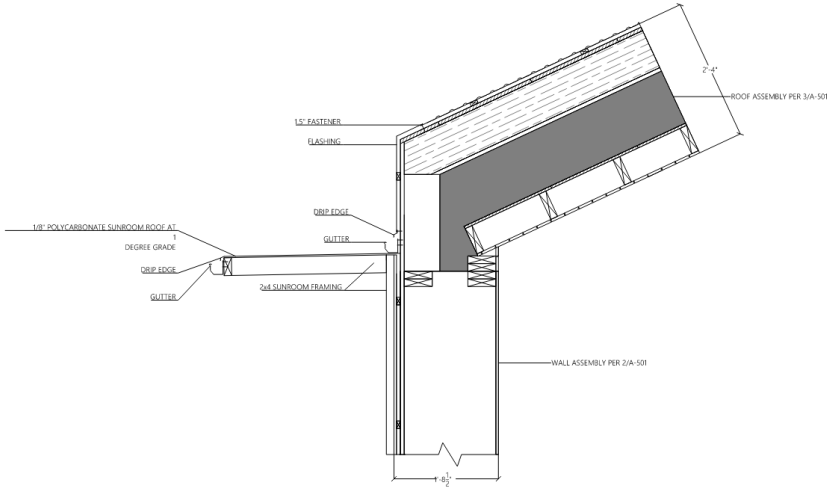


NORTH OVERHANG DETAIL

5 A-402 NORTH OVERHANG DETAIL
SCALE: 3/4" = 1'-0"

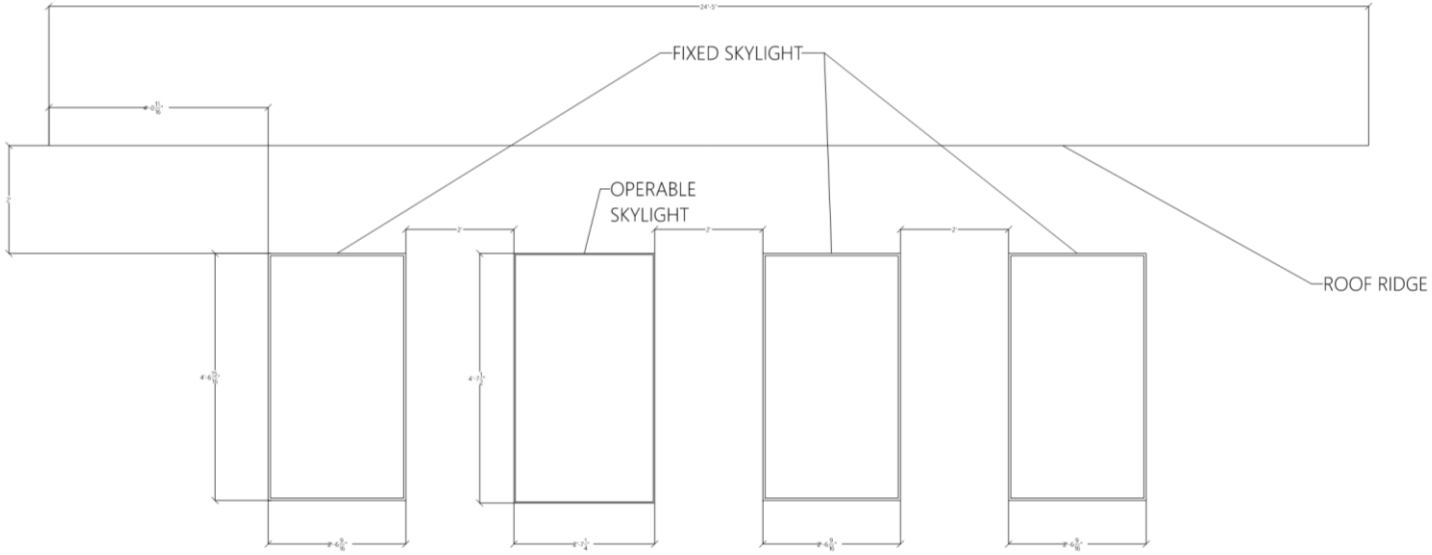


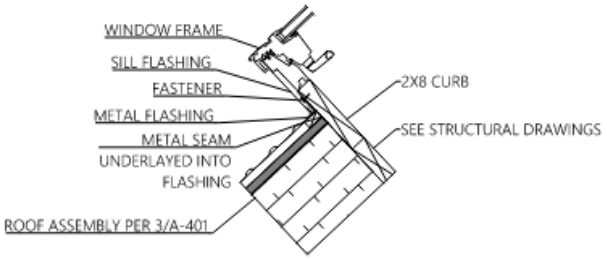
3 A-402 ROOF TO WALL DETAIL
SCALE: 3/4" = 1'-0"

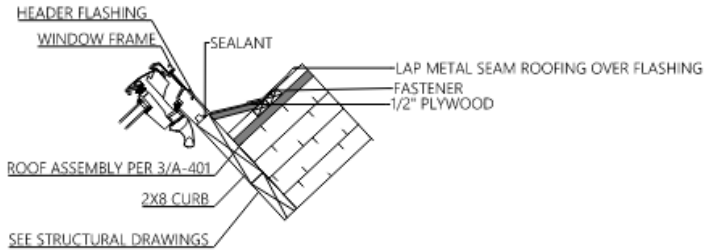


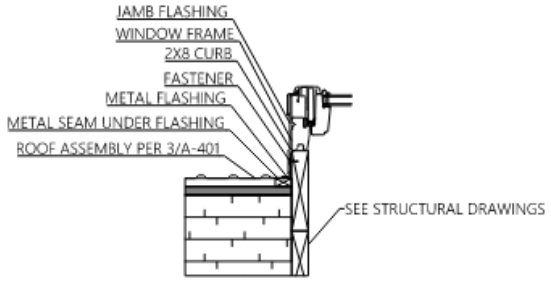
4 A-402 ROOF TO SUNROOM TRANSITION DETAIL
SCALE: 3/4" = 1'-0"

Skylight Details

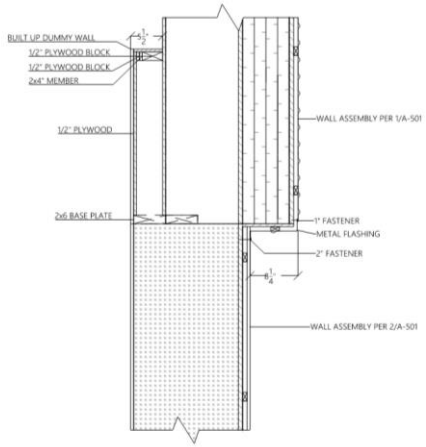




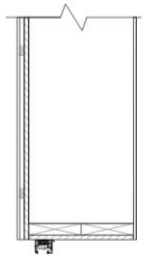


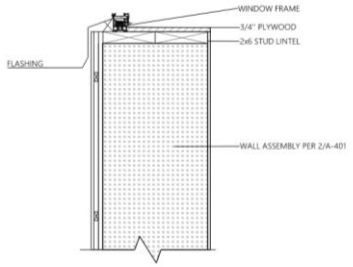


Wall and Glazing Details

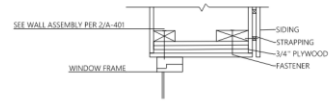


1 A-404 UPPER TO LOWER WALL DETAIL
SCALE: 1" = 1'-0"

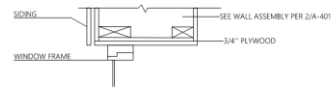




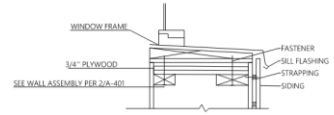
2 A-404 WINDOW DETAIL
SCALE: 1" = 1'-0"



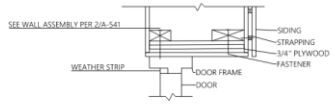
3 A-404 WINDOW HEADER DETAIL
SCALE: 1" = 1'-0"



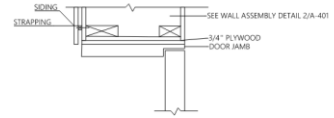
4 A-404 WINDOW JAMB DETAIL
SCALE: 1" = 1'-0"



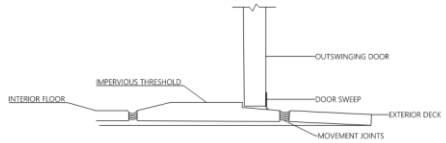
5 A-404 WINDOW SILL DETAIL
SCALE: 1" = 1'-0"



6 A-404 DOOR HEADER DETAIL
SCALE: 1" = 1'-0"

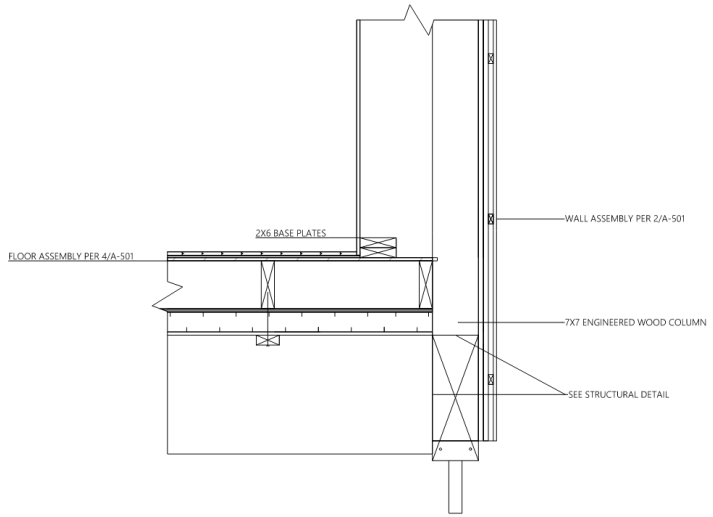


7 A-404 DOOR JAM DETAIL
SCALE: 1" = 1'-0"

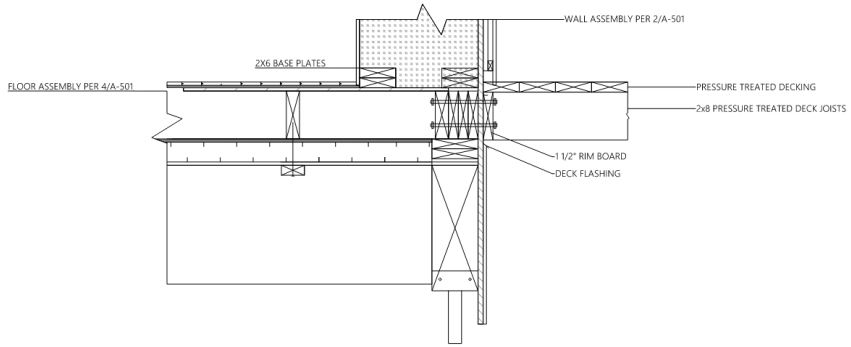


8 A-404 DOOR SILL DETAIL
SCALE: 1" = 1'-0"

Floor Details

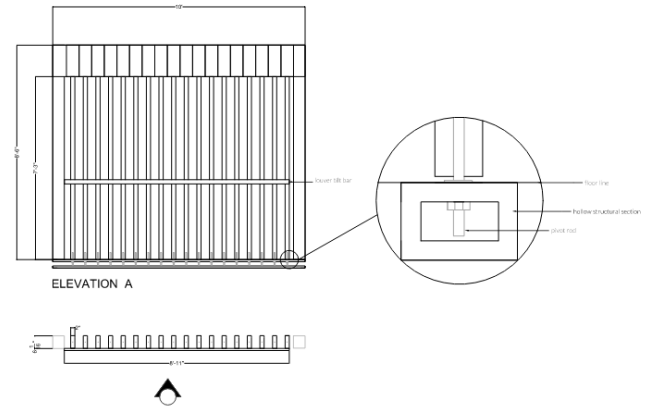


8 A-405 WALL TO FLOOR DETAIL
SCALE: 1" = 1'-0"



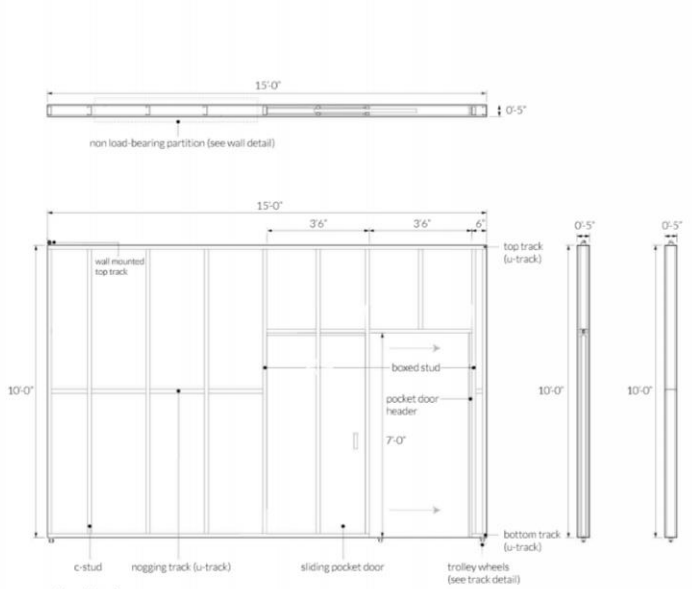
2/A-404 DECK LEDGER DETAIL

1 A-405 WALL TO FLOOR DETAIL
SCALE: 1" = 1'-0"

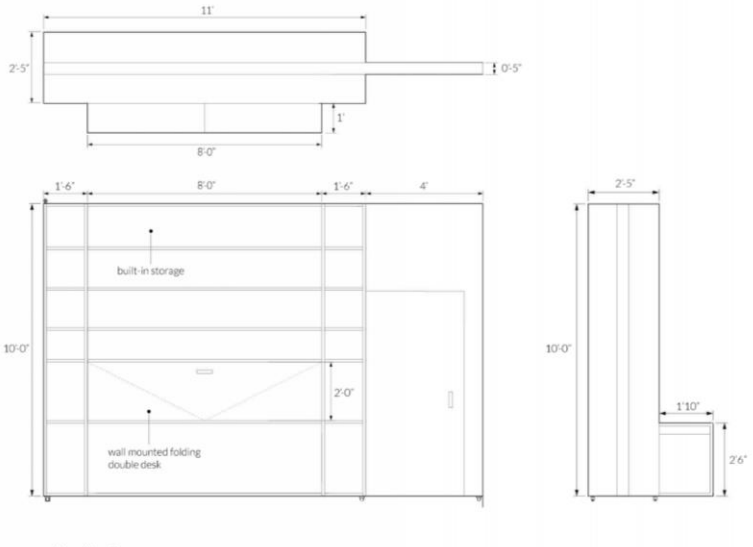


5 A-405 SUNROOM LOUVRE DETAIL
SCALE: 1/4" = 1'-0"

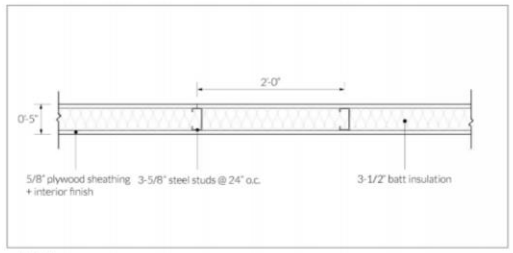
Movable Partition



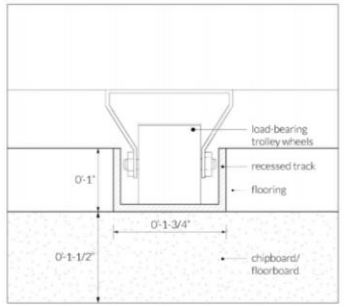
movable wall typ. 1
1:100



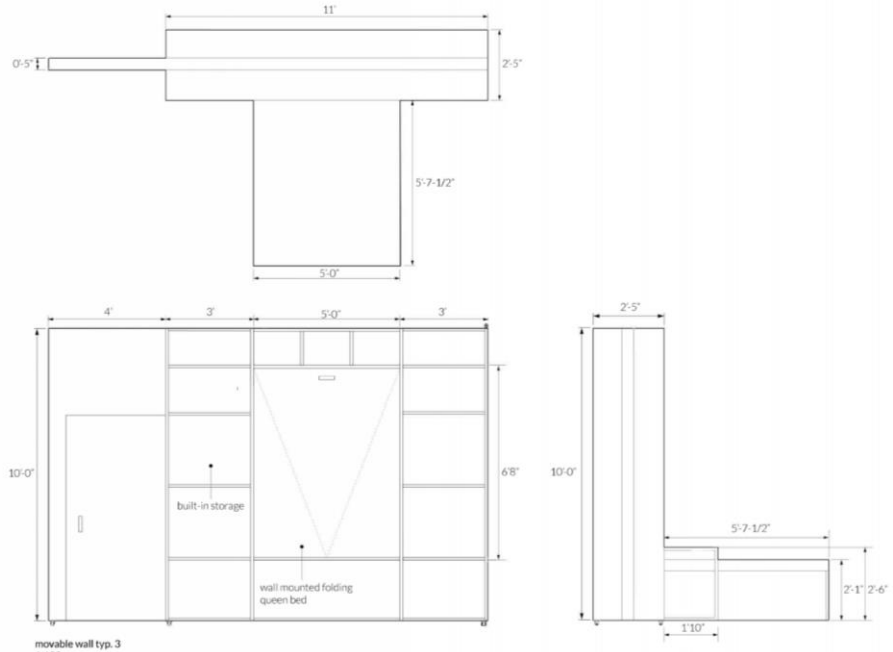
movable wall typ. 2
1:100



wall detail
1:10

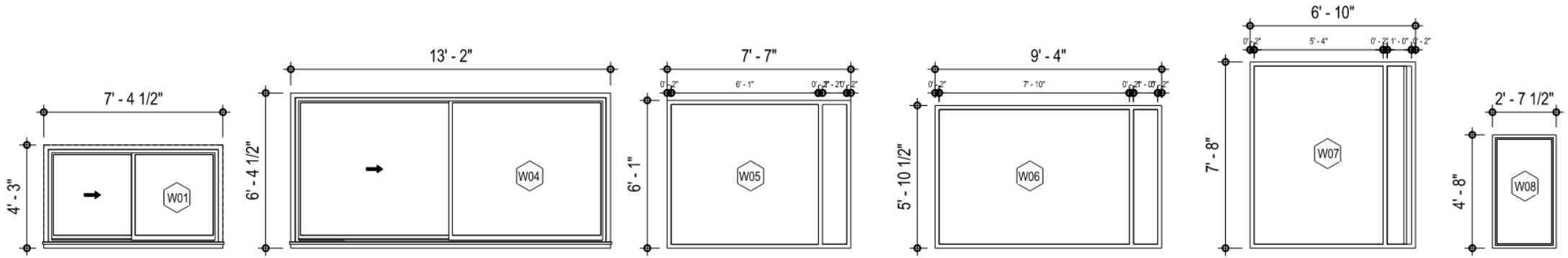


track detail
1:10



movable wall typ. 3
1:100

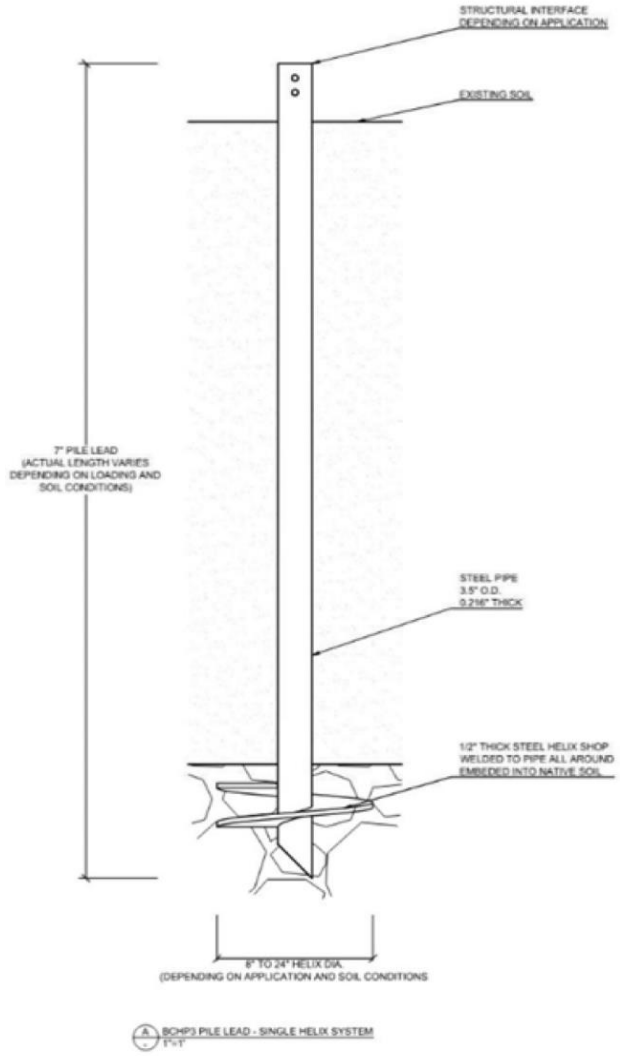
Window Dimensions



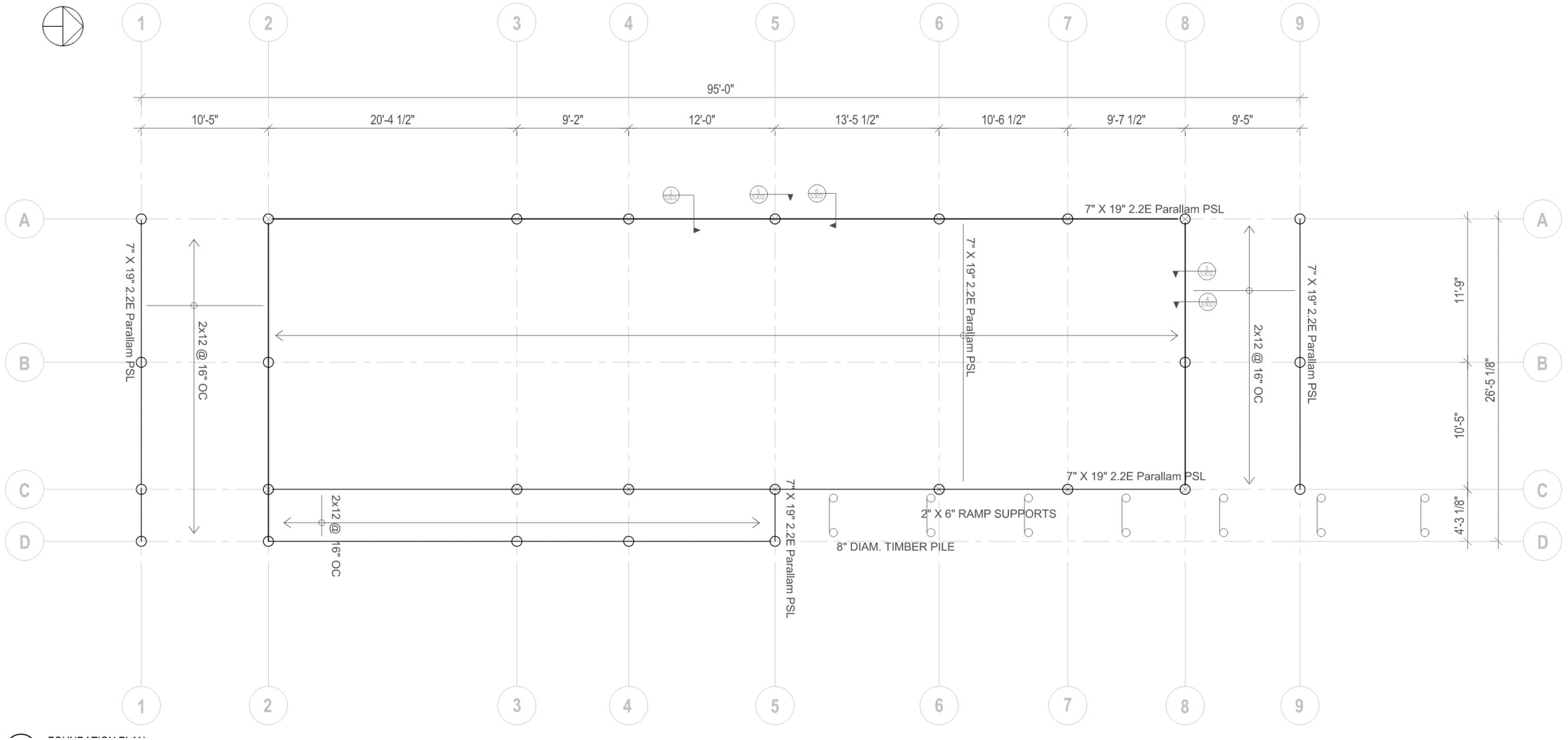
Window Legend

SCALE: N.T.S

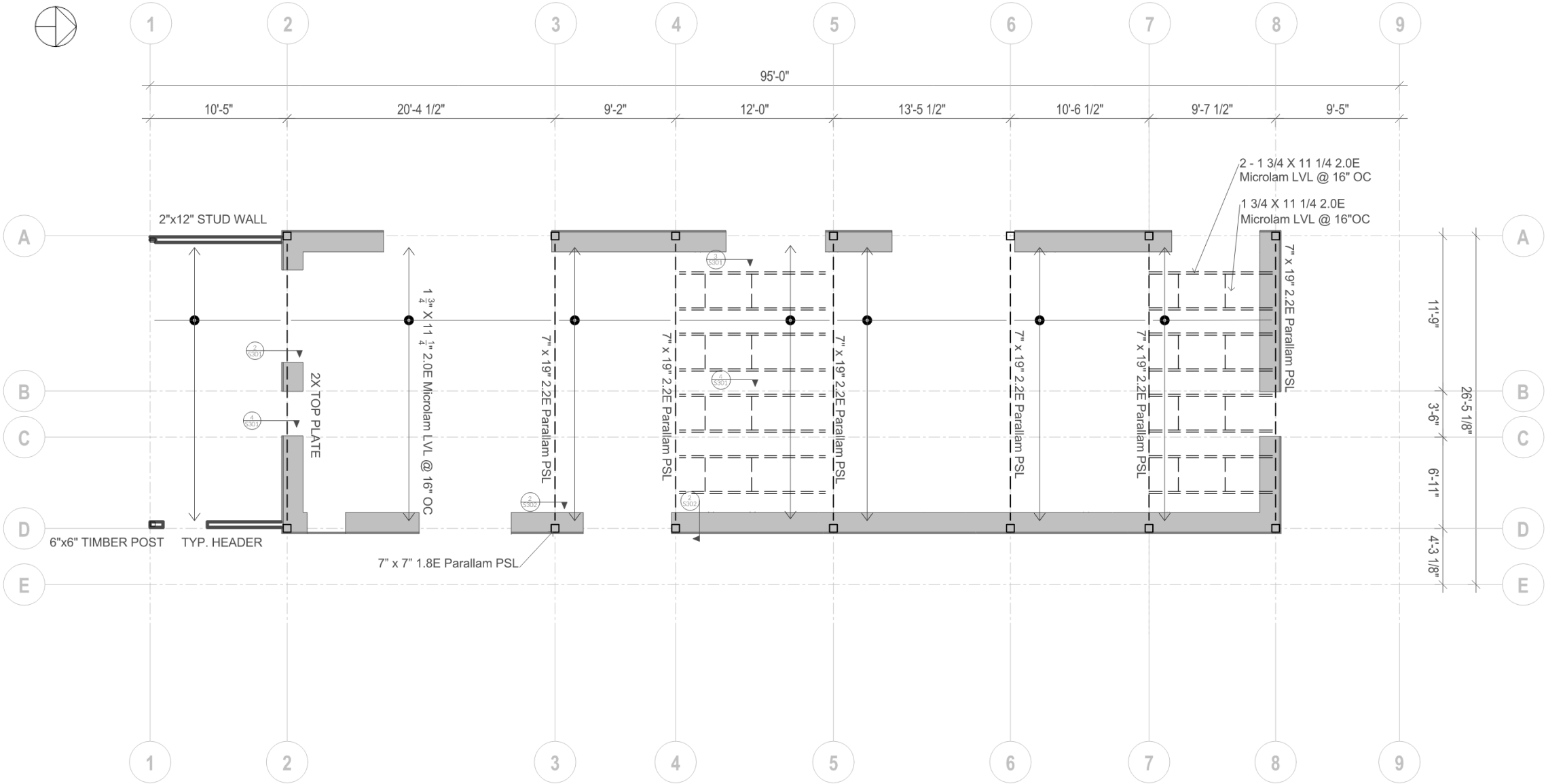
Helical Pile



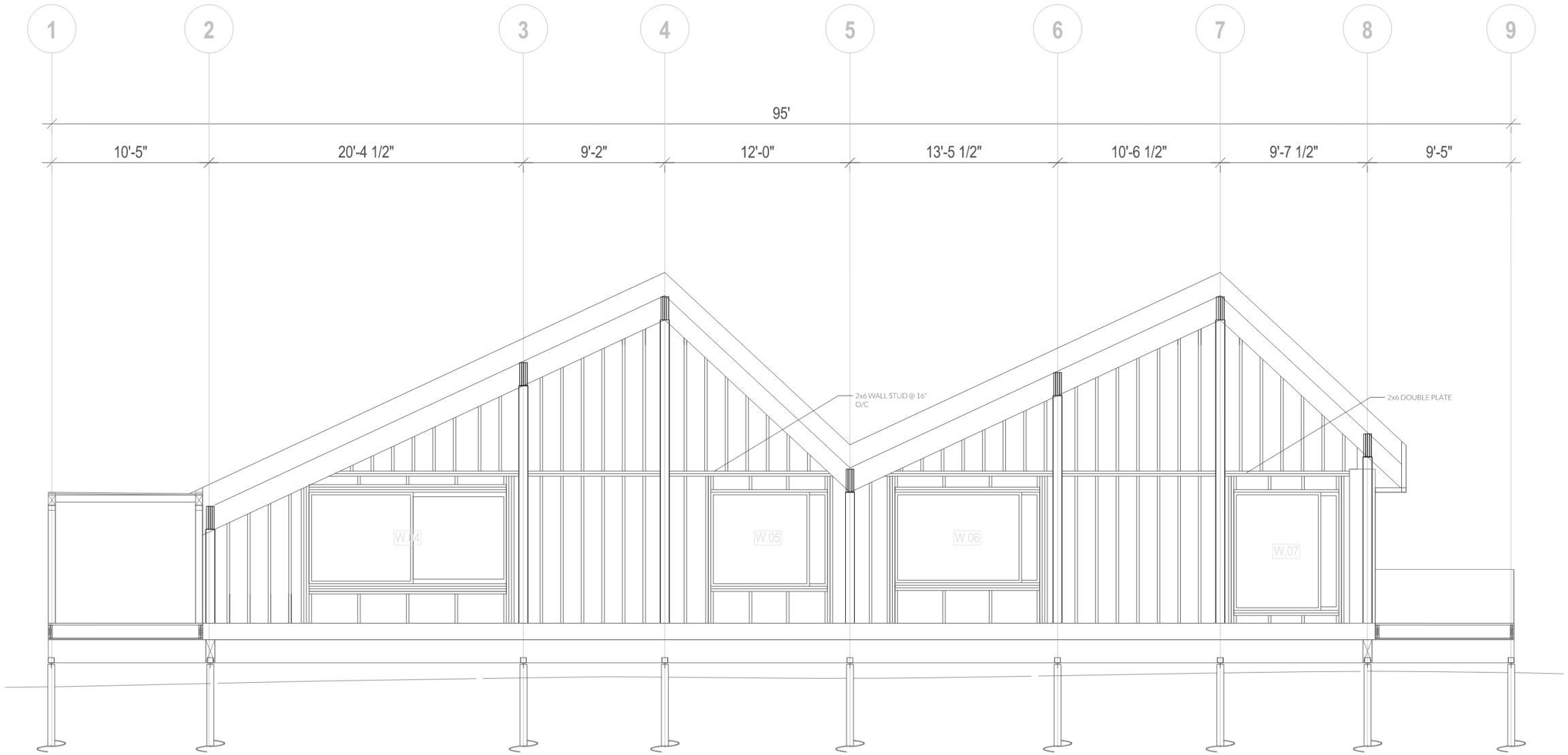
Foundation Plan



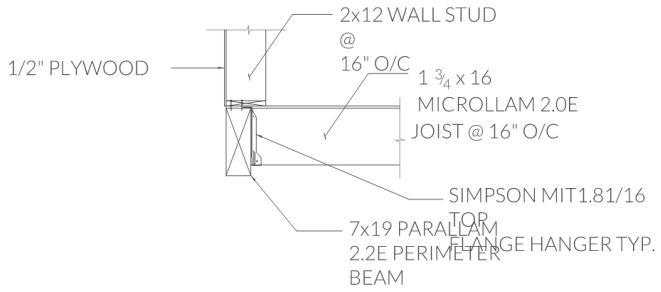
Framing Plan



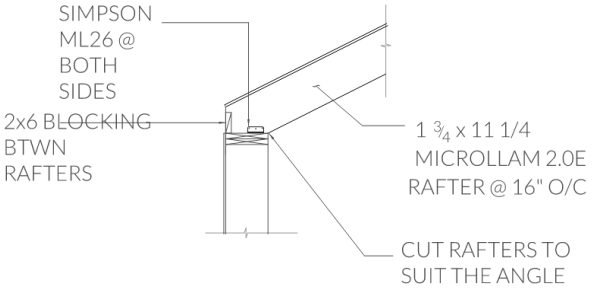
Structural Elevation



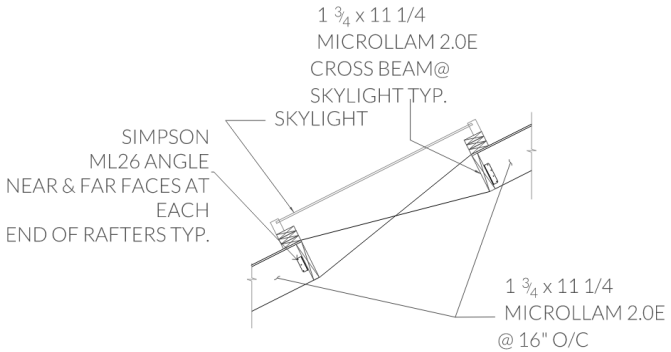
Structural Connections 1



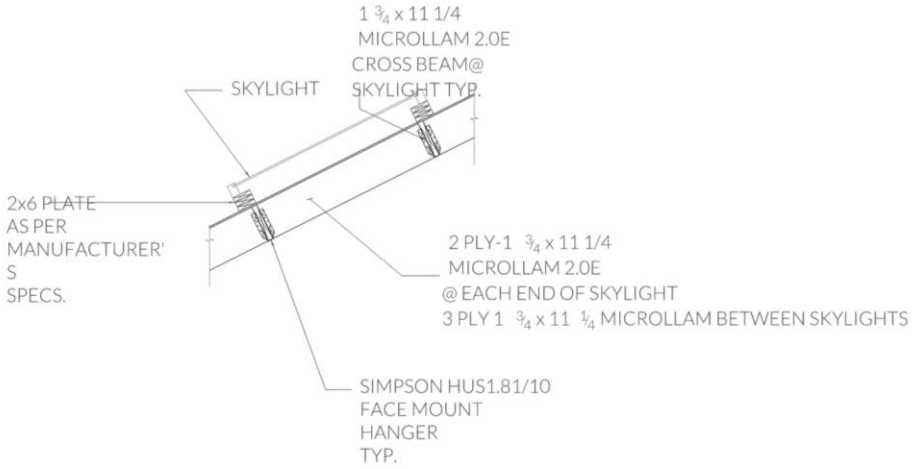
1 S301 FLOOR JOIST TO PERIMETER BEAM CONECTION

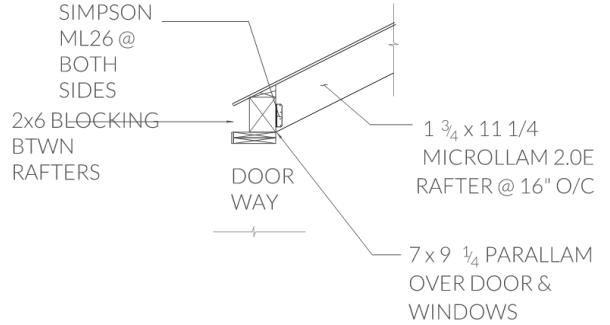


2 S301 DOUBLE TOP PLATE TO CEILING JOISTS



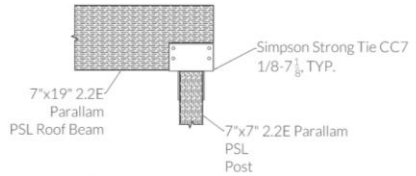
3 S301 SKYLIGHT CONNECTION



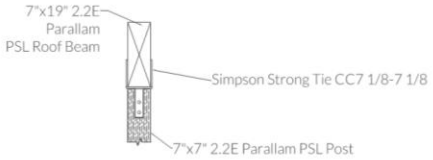


4 S301 CEILING JOISTS TO DOUBLE TOP PLATE OVER OPENINGS

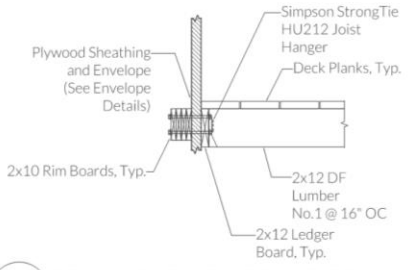
Structural Connections 2



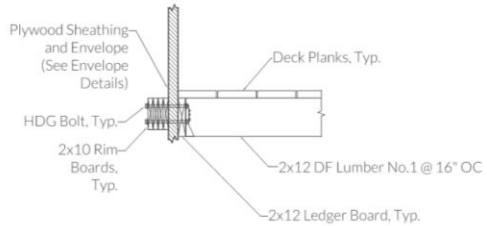
1 S302 ROOF BEAM TO POST CONNECTION



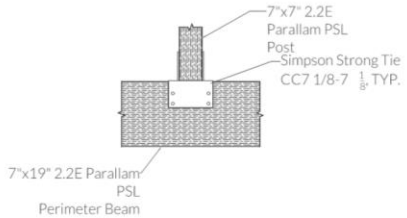
2 S302 ROOF BEAM TO POST CONNECTION



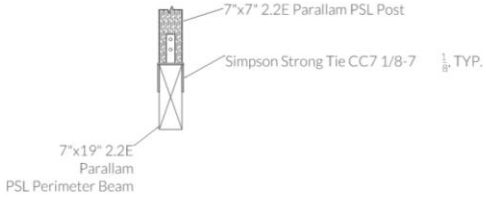
3 S302 DECK JOIST LEDGER BOARD CONNECTION (IN BETWEEN DECK JOISTS)



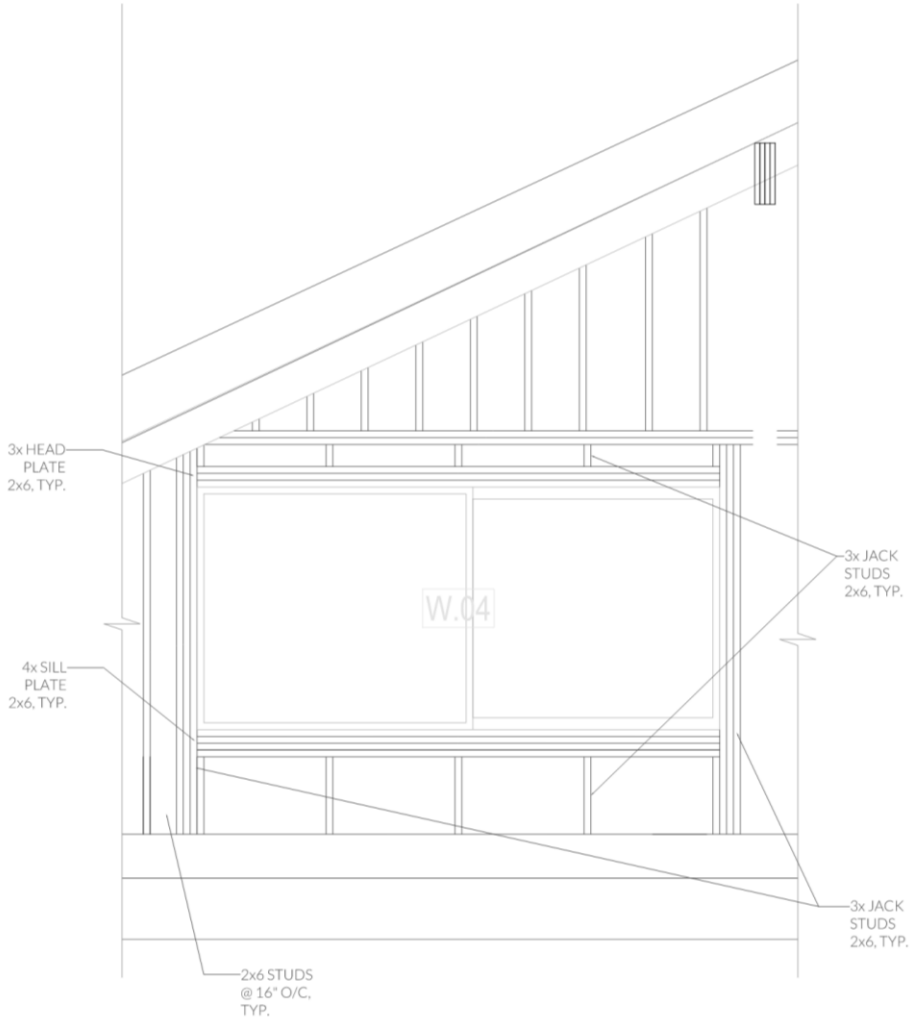
4 S302 DECK JOIST LEDGER BOARD CONNECTION (AT DECK JOIST)



5 S302 POST TO PERIMETER BEAM CONNECTION

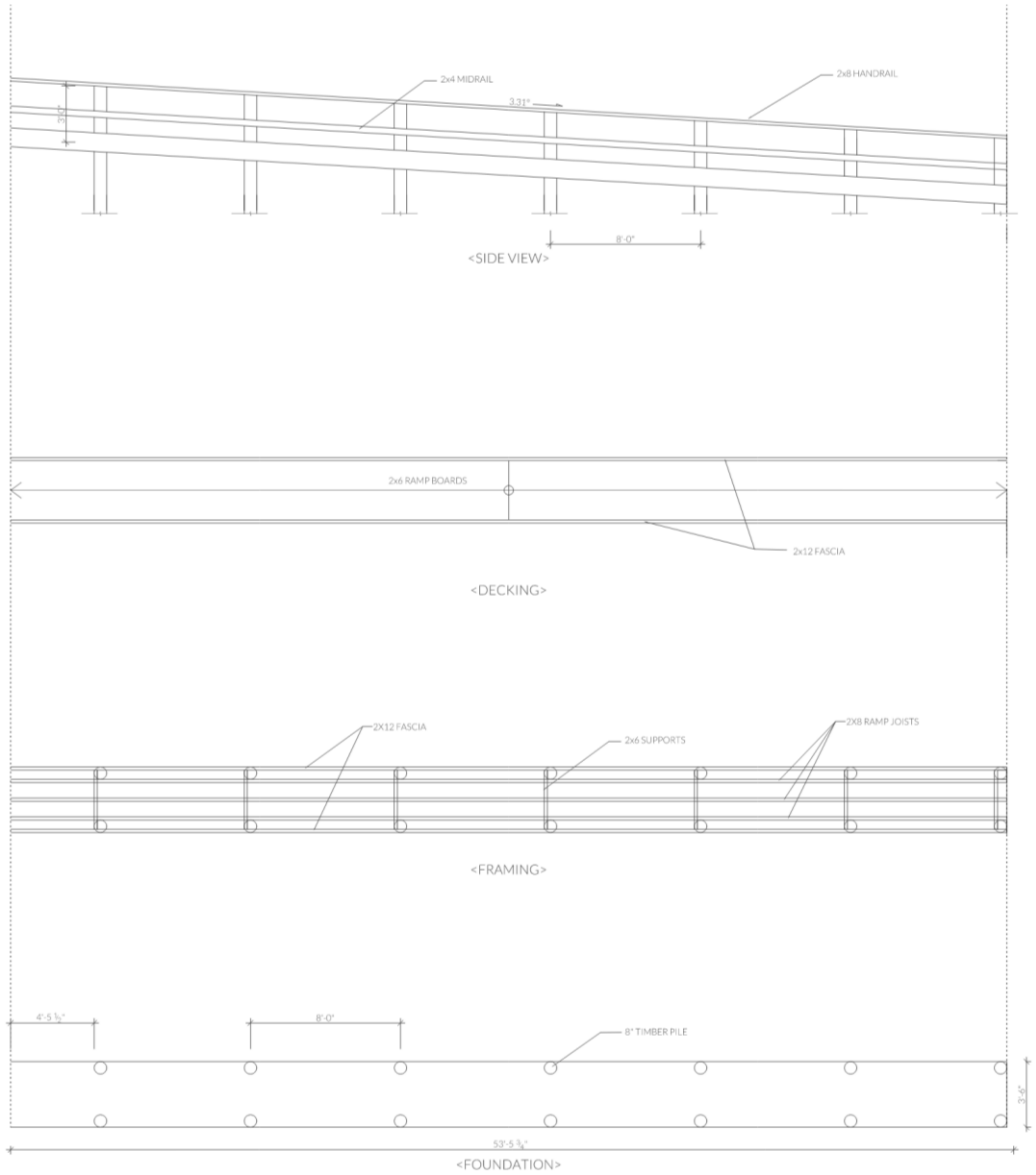


6 S302 POST TO PERIMETER BEAM CONNECTION



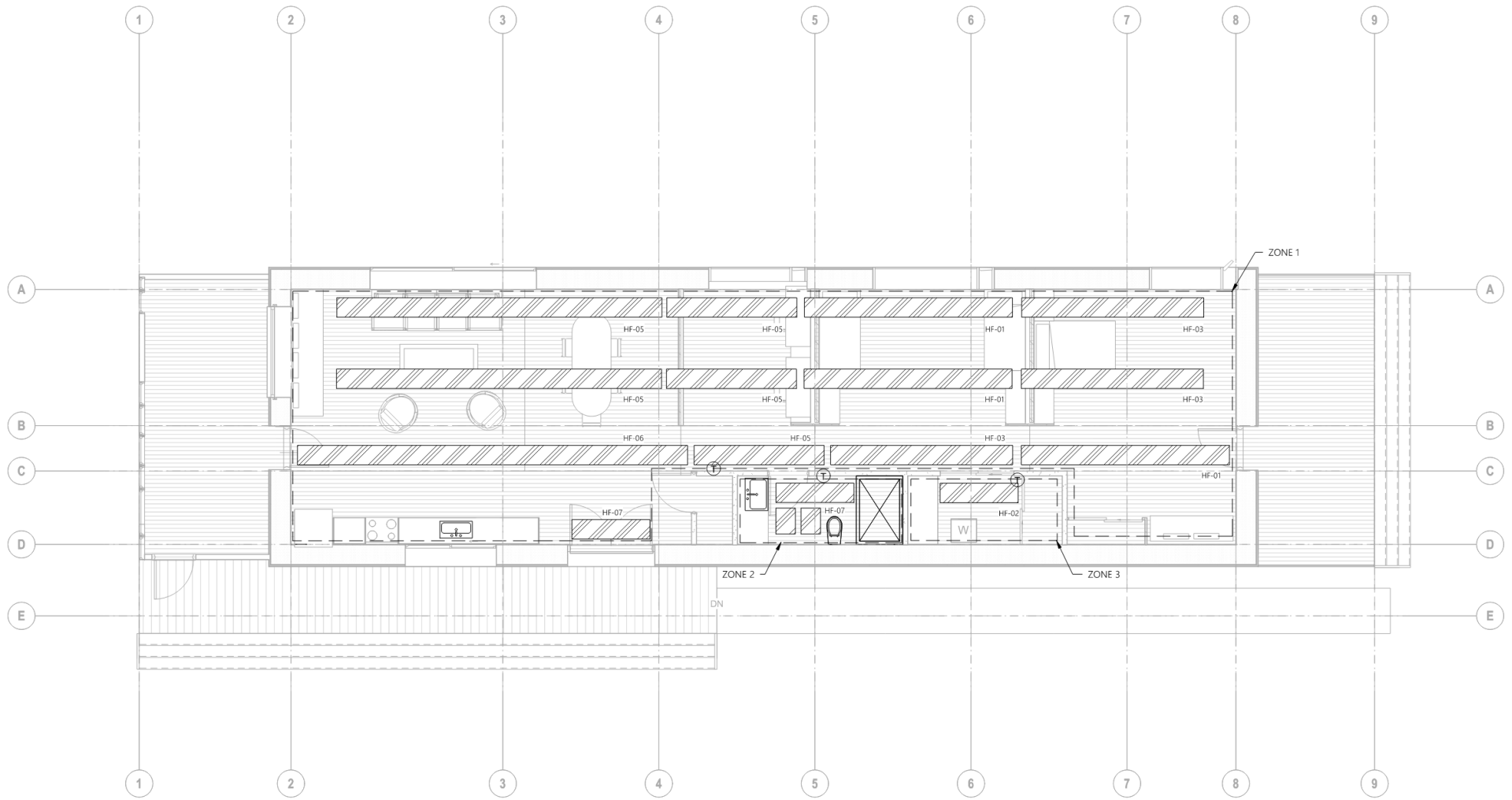
7 S302 EXTERIOR WINDOW OPENING, TYP.

Deck Details



1 S-401 DECK DETAILS
SCALE: N.T.S

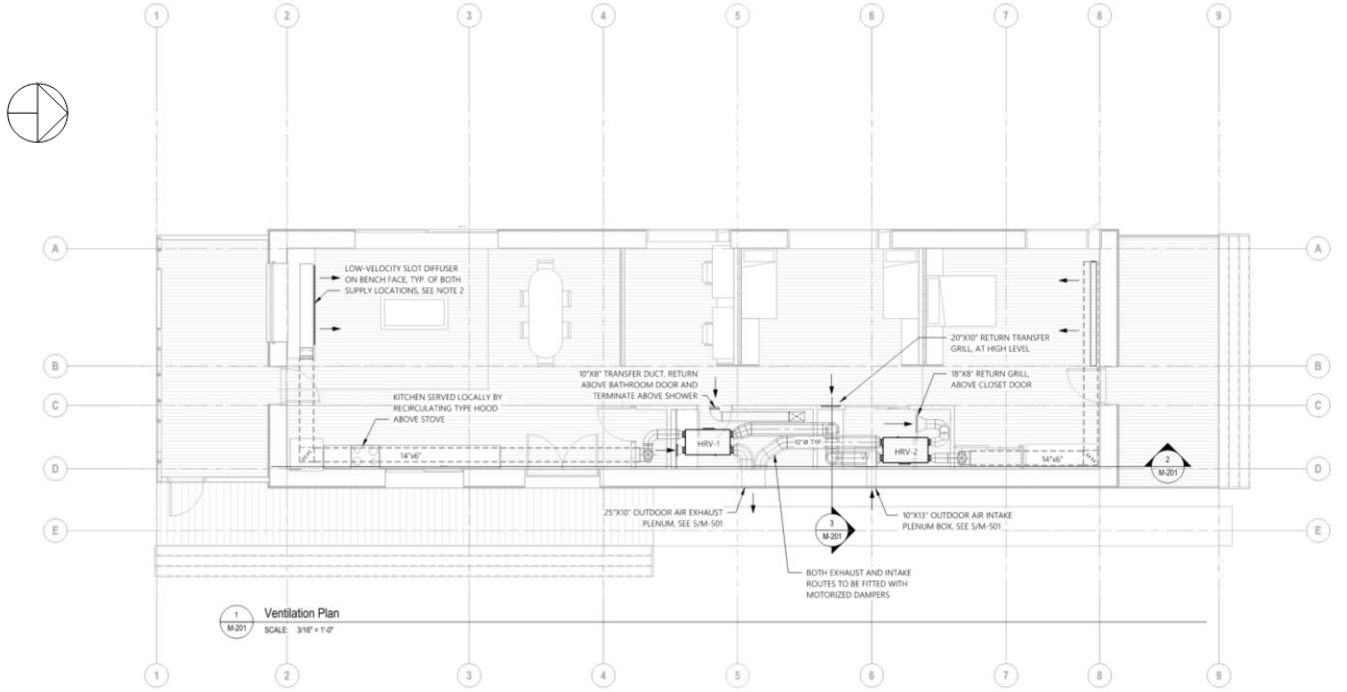
Heating Plan

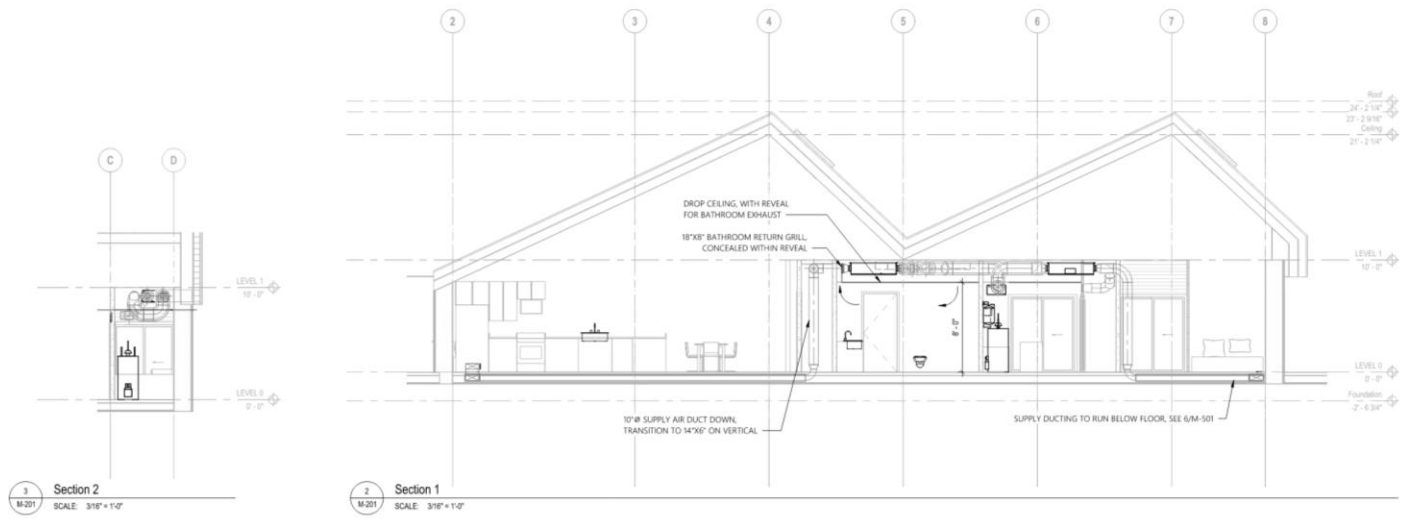


1 M-101 Heating Plan

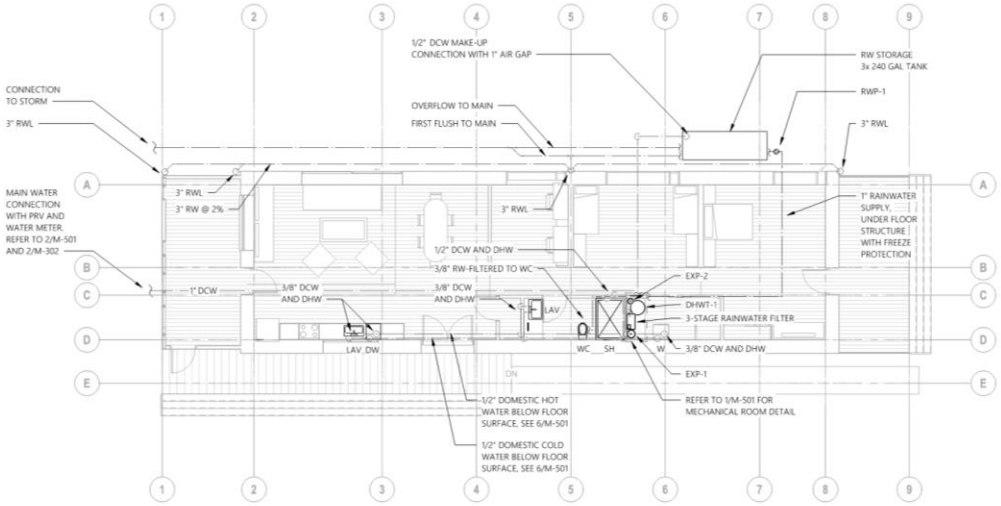
SCALE: 3/16" = 1'-0"

Ventilation Plan

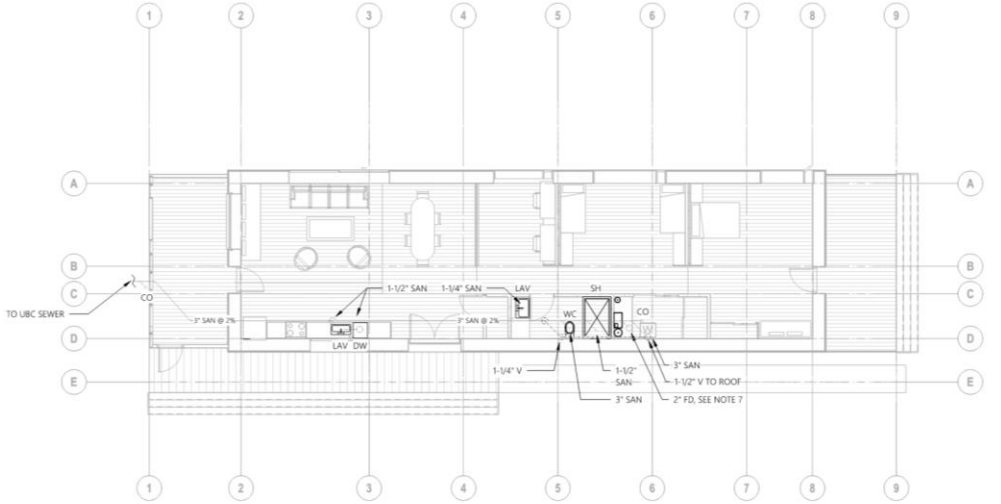




Plumbing Plan

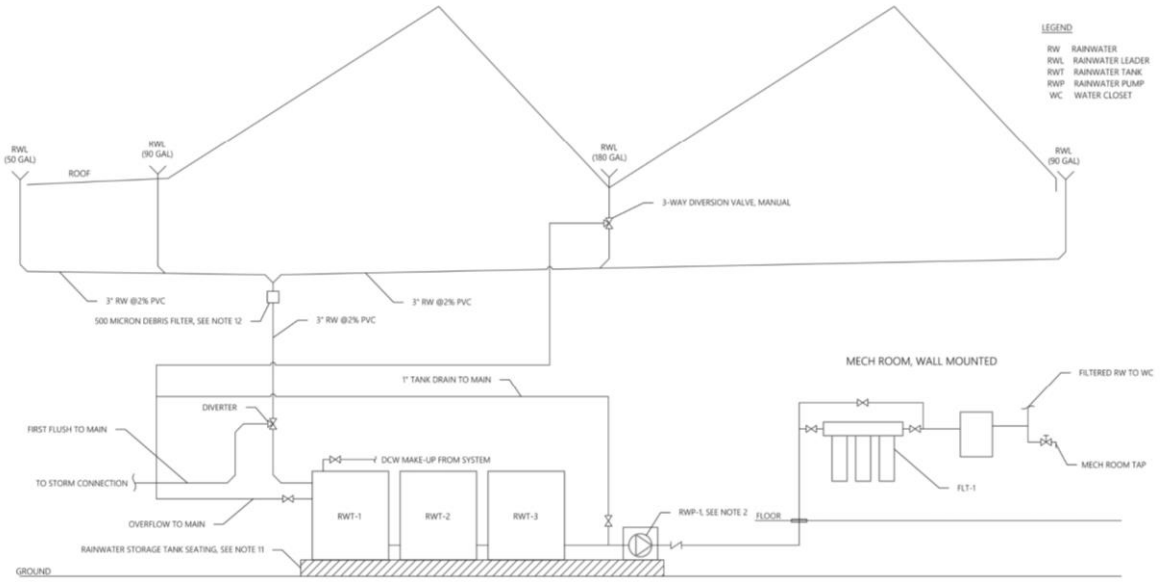


1 M-301 Domestic Water Supply/Rainwater
SCALE: 1/8" = 1'-0"

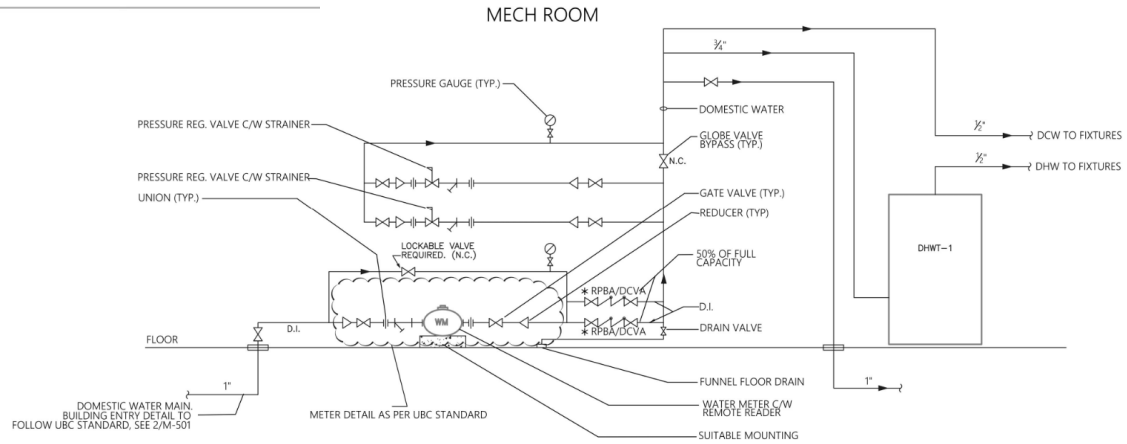


2 M-301 Sanitary Drainage
SCALE: 1/8" = 1'-0"

Water System Diagram



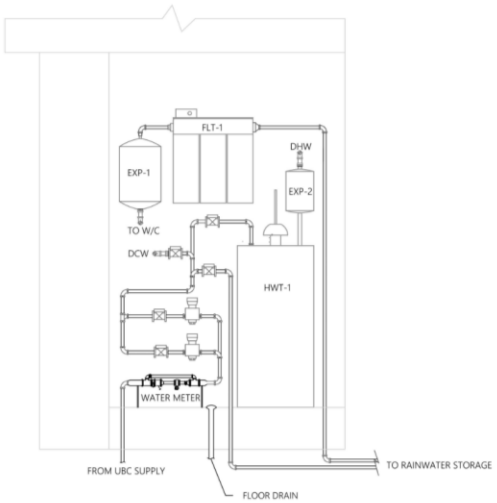
1 M-302 RAINWATER SYSTEM DIAGRAM
SCALE: N.T.S



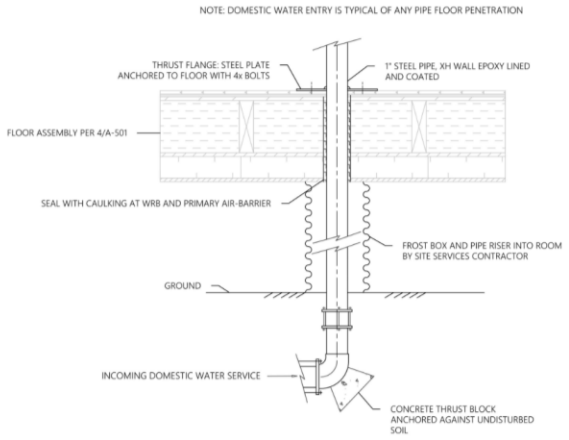
2 M-302 DOMESTIC SYSTEM DIAGRAM
SCALE: N.T.S

Site Servicing and Irrigation Plan

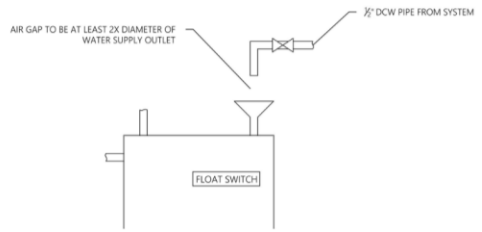
Mechanical Details



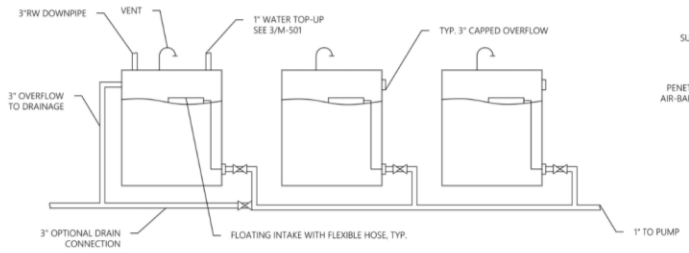
1 M-501 MECH ROOM SECTION DETAIL
SCALE: 12" = 1'-0"



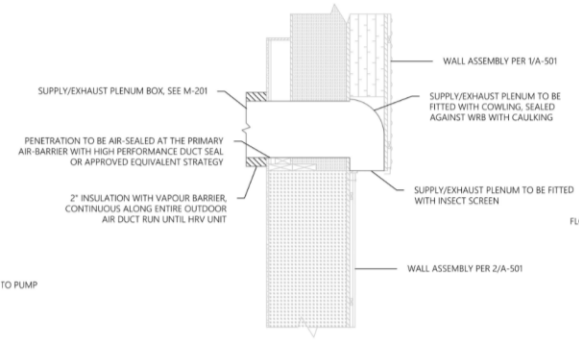
2 M-501 DOMESTIC WATER ENTRY DETAIL
SCALE: 12" = 1'-0"



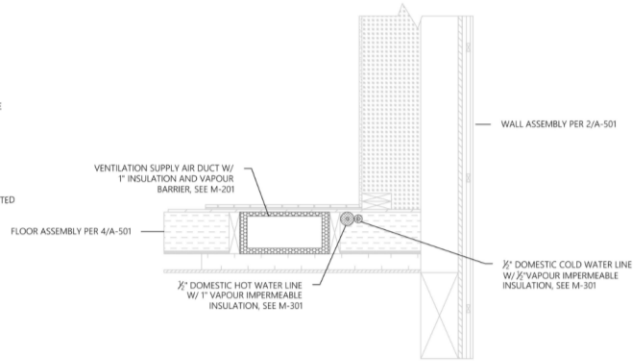
3 M-501 PORTAL WATER TOP-UP DETAIL
SCALE: 12" = 1'-0"



4 M-501 RAINWATER STORAGE TANK CONNECTION DETAIL
SCALE: 12" = 1'-0"



5 M-501 CONCEALED VENTILATION INTAKE/EXHAUST DETAIL
SCALE: 12" = 1'-0"

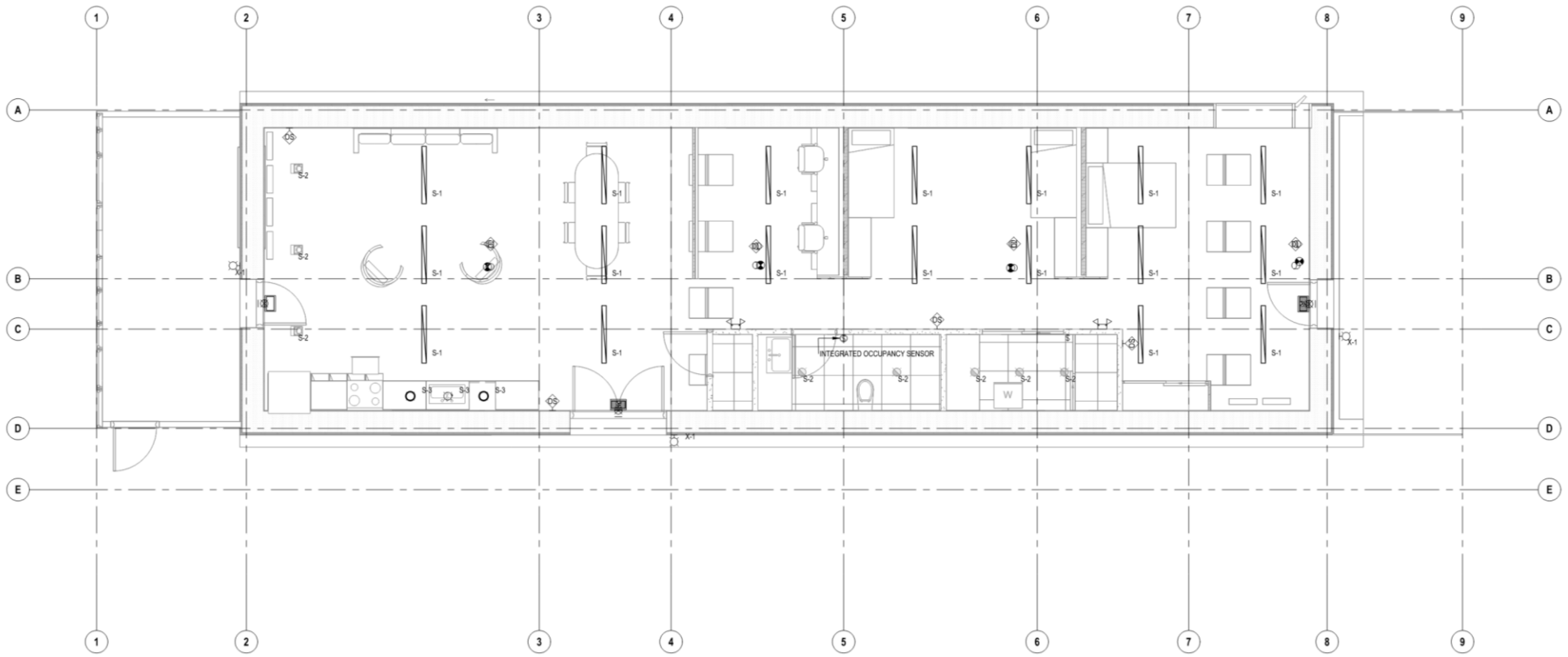


6 M-501 SUPPLY DUCT + WATER LINE DETAIL
SCALE: 12" = 1'-0"

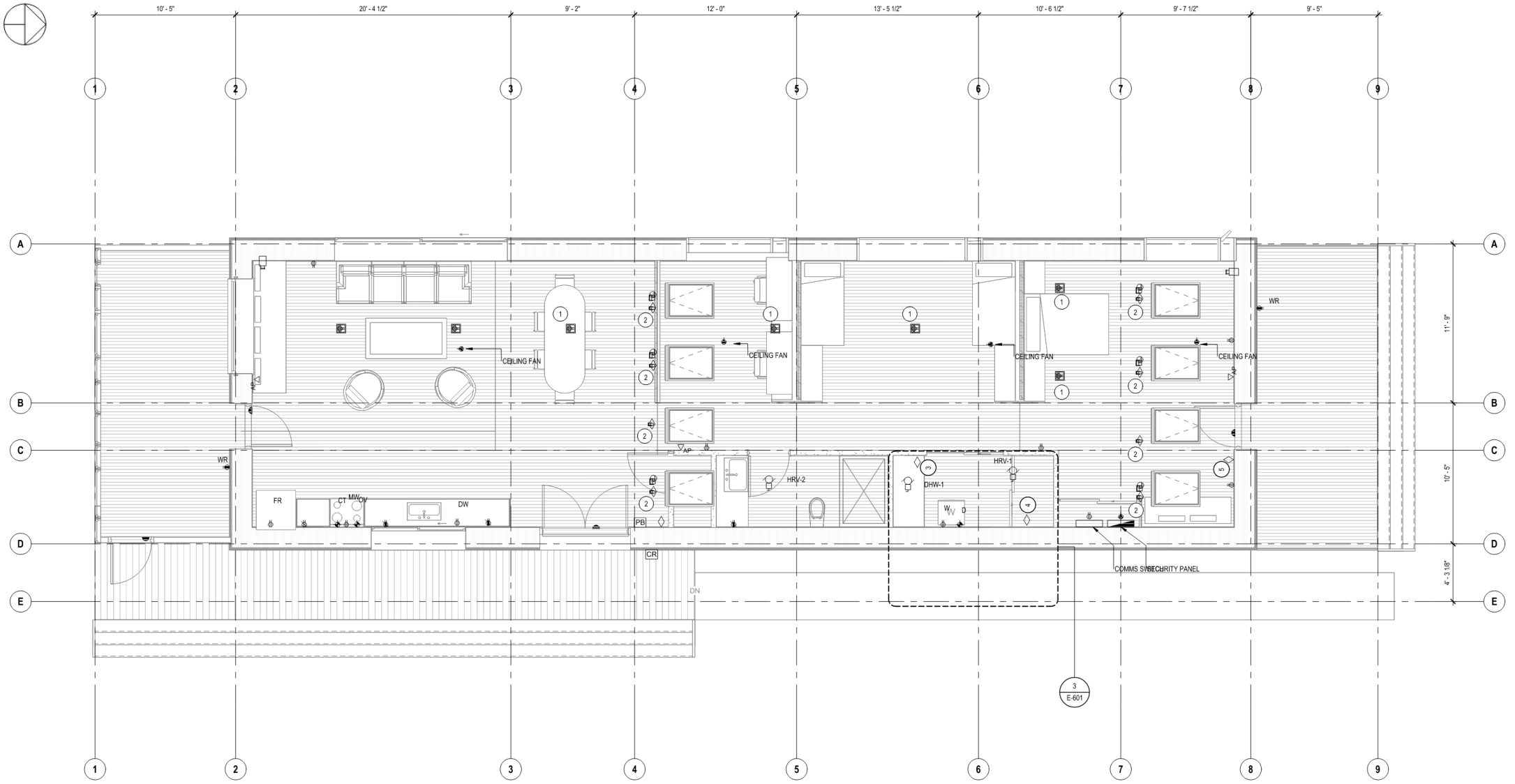
Lighting and Life Safety Plan

GENERAL NOTES:

A. ALL SMOKE DETECTORS SHALL BE HARDWIRED TO LOCAL LIGHTING CIRCUIT.
B. WHERE A ROUGH-IN IS SPECIFIED FOR A CEILING FAN, THE BOX SHALL BE LISTED FOR THE APPLICATION AND WEIGHT OF THE FAN IT SUPPORTS.
C. CEILING FAN BLADES SHALL NOT OBSTRUCT SMOKE/CO DETECTION BY THE ALARM.
D. ALL LIGHTING LEVELS AND CONTROLS SHALL MEET THE UBC LIGHTING GUIDELINES LISTED IN THE VANCOUVER CAMPUS PLAN PART 3 SEC. 2.5.2.
E. ALL EQUIPMENT INSTALLATIONS AND MATERIAL SELECTION TO BE IN ACCORDANCE WITH UBC TECHNICAL GUIDELINES DIVISION 26 ELECTRCIAL.



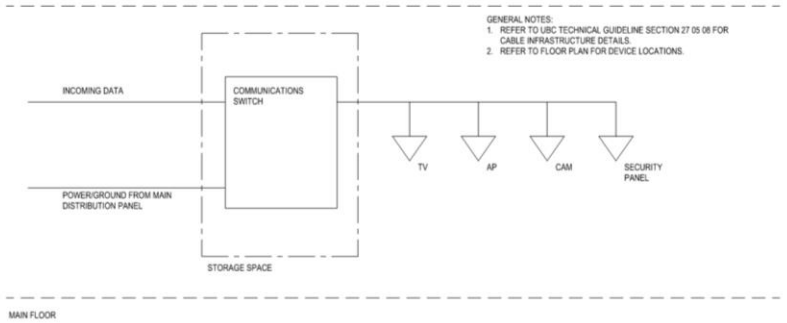
Power and Low Tension Plan



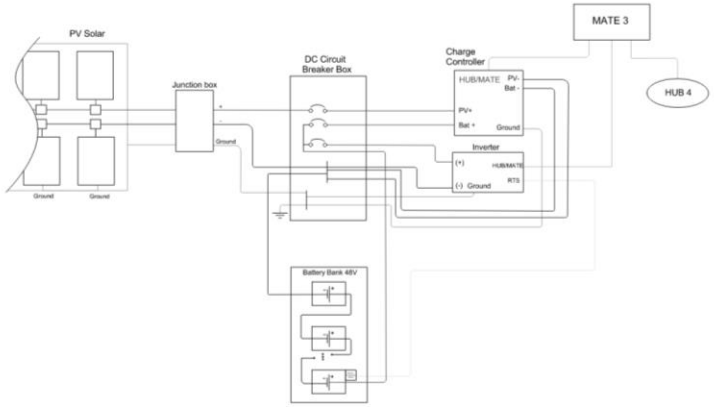
1 E-211 LEVEL 0 - POWER, COMMS, & SECURITY

SCALE: 1/4" = 1'-0"

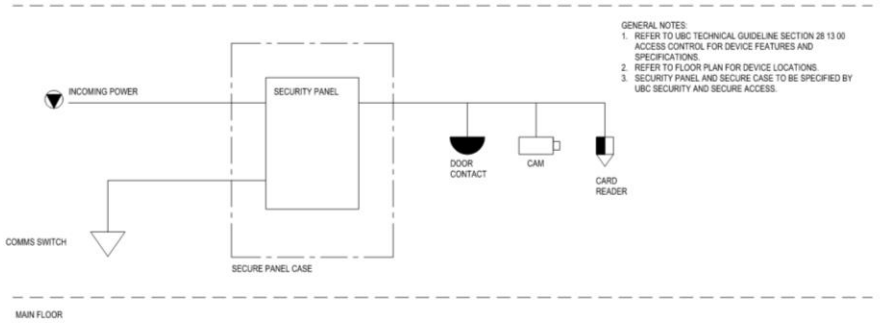
Electrical Single-Line Diagrams



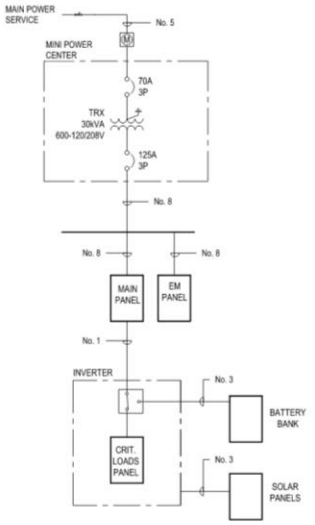
1 E-401 COMMUNICATIONS DIAGRAM
SCALE: N.T.S



4 E-401 SOLAR THREE LINE DIAGRAM
SCALE: N.T.S



2 E-401 SECURITY DIAGRAM
SCALE: N.T.S



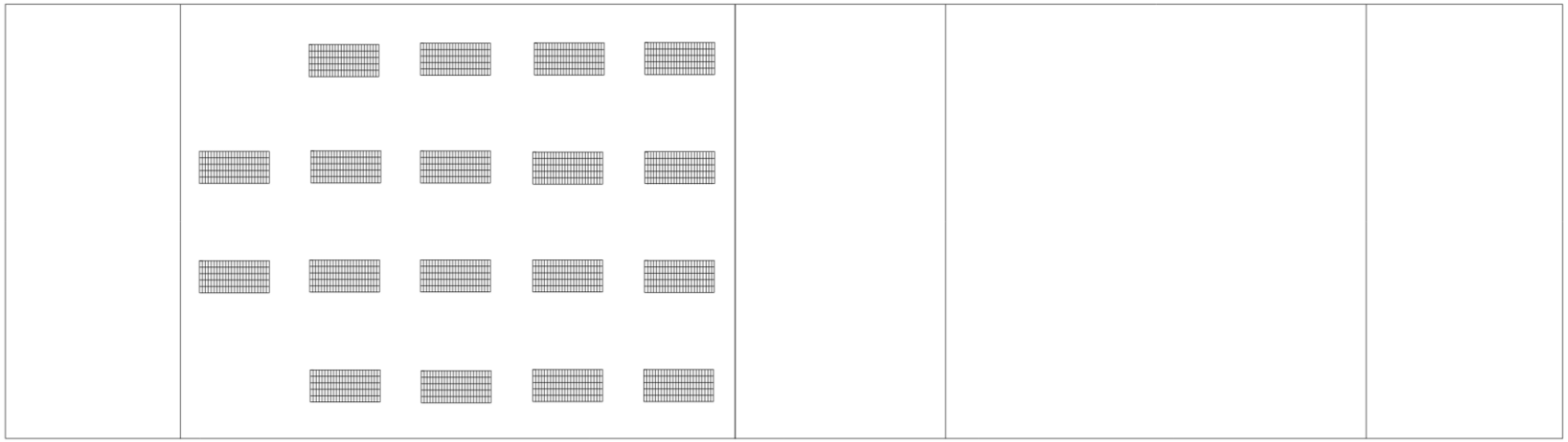
FEEDER SCHEDULE

FEEDER AMPS.	FEEDER NO.	SIZE/TYPE	FEEDER NO.	SIZE/TYPE
20	1	4 #12, 21mmC	1A	3 #12, 21mmC
30	2	4 #10, 21mmC	2A	3 #10, 21mmC
50	3	4 #8, 27mmC	3A	3 #8, 21mmC
65	4	4 #6, 35mmC	4A	3 #6, 27mmC
85	5	4 #4, 35mmC	5A	3 #4, 35mmC
100	6	4 #3, 35mmC	6A	3 #3, 35mmC
115	7	4 #2, 41mmC	7A	3 #2, 35mmC
130	8	4 #1, 53mmC	8A	3 #1, 41mmC
150	9	4 #1/0, 53mmC	9A	3 #1/0, 41mmC
175	10	4 #2/0, 53mmC	10A	3 #2/0, 53mmC
200	11	4 #3/0, 63mmC	11A	3 #3/0, 53mmC
230	12	4 #4/0, 63mmC	12A	3 #4/0, 63mmC
255	13	4 #250MCM, 78mmC	13A	3 #250MCM, 63mmC
285	14	4 #300MCM, 78mmC	14A	3 #300MCM, 78mmC
310	15	4 #350MCM, 78mmC	15A	3 #350MCM, 78mmC
335	16	4 #400MCM, 91mmC	16A	3 #400MCM, 78mmC
380	17	4 #500MCM, 103mmC	17A	3 #500MCM, 91mmC
420	18	4 #600MCM, 103mmC	18A	3 #600MCM, 103mmC

NOTES:
1. PROVIDE GROUNDING WIRE IN ALL CONDUITS, SIZE AS PER CANADIAN ELECTRICAL CODE.
2. ALL SIZES ARE BASED ON COPPER CONDUCTORS.

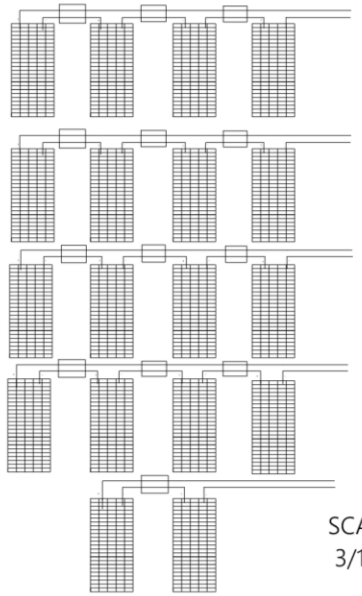
3 E-401 POWER SINGLE LINE DIAGRAM
SCALE: N.T.S

PV and Mounting Details



SCALE
3/125'' = 1''

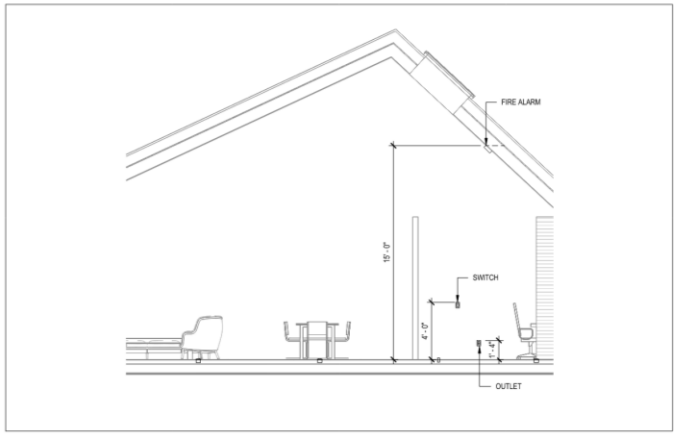
PHOTOVOLTAIC PANELS	
MODEL	GP-PV-100M
LOCATION	ROOF
RATED POWER	100 W
CELL TYPE	MONOCRYSTALLINE
EFFICIENCY	15.34%
DIMENSIONS	47.2 X 21.6 X 1.4
MAX POWER VOLTAGE	12.0 V
MAX POWER CURRENT	5.43 A



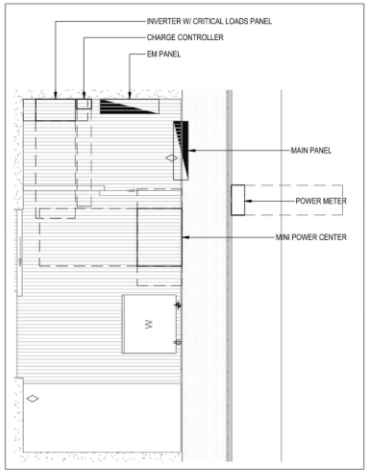
SCALE
3/100'' = 1''

1 E-404 PV AND MOUNTING DETAILS
SCALE: N.T.S

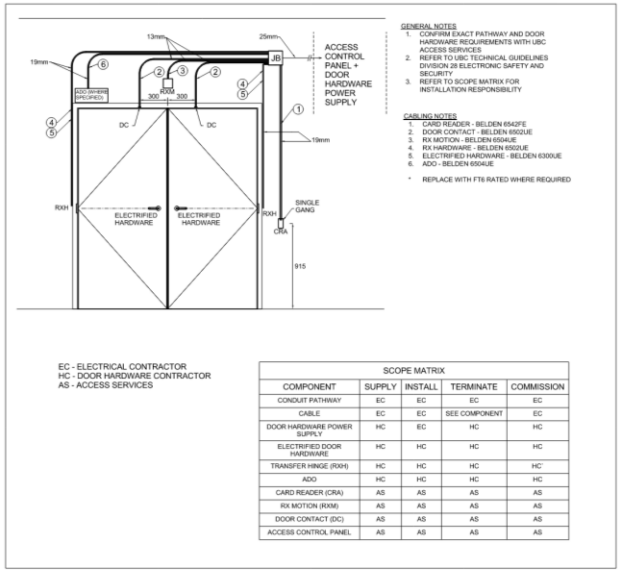
Electrical Details 1



1 E-601 TYPICAL MOUNTING HEIGHTS
SCALE: N.T.S



3 E-601 ELECTRICAL ROOM LAYOUT
SCALE: 1/2" = 1'-0"



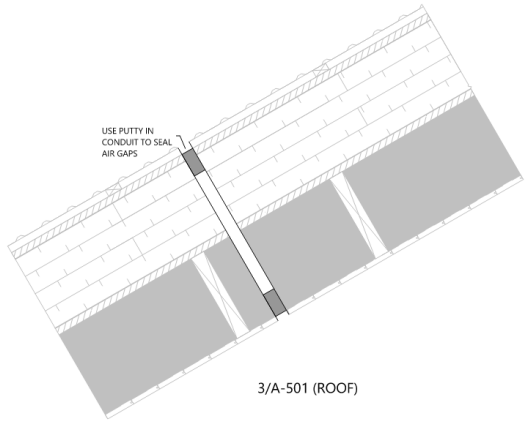
EC - ELECTRICAL CONTRACTOR
HC - DOOR HARDWARE CONTRACTOR
AS - ACCESS SERVICES

SCOPE MATRIX

COMPONENT	SUPPLY	INSTALL	TERMINATE	COMMISSION
CONDUIT PATHWAY	EC	EC	EC	EC
CABLE	EC	EC	SEE COMPONENT	EC
DOOR HARDWARE POWER SUPPLY	HC	EC	HC	HC
ELECTRIFIED DOOR HARDWARE	HC	HC	HC	HC
TRANSFER HINGE (RXH)	HC	HC	HC	HC
ADO	HC	HC	HC	HC
CARD READER (CRA)	AS	AS	AS	AS
RX MOTION (RXM)	AS	AS	AS	AS
DOOR CONTACT (DC)	AS	AS	AS	AS
ACCESS CONTROL PANEL	AS	AS	AS	AS

2 E-601 TYPICAL DOOR HARDWARE
SCALE: N.T.S

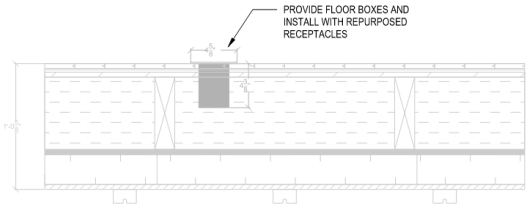
Electrical Details 2



3/A-501 (ROOF)

1 E-602 ROOF PENETRATION DETAIL

SCALE: N.T.S



4/A-501 (FLOOR)

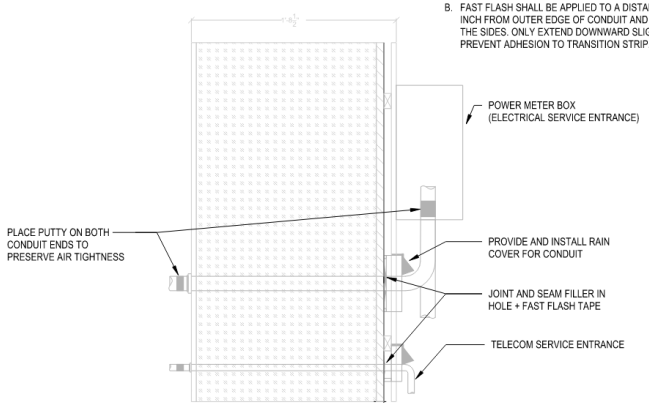
2 E-602 FLOOR RECEPTACLE PENETRATION DETAIL

SCALE: N.T.S

NOTE:

A. CUT HOLE ON DUCT AS CLOSE AS POSSIBLE. SPACE BETWEEN DUCT AND WALL SHEATING SHALL BE 1/4 INCH OR LESS.

B. FAST FLASH SHALL BE APPLIED TO A DISTANCE OF 9 INCH FROM OUTER EDGE OF CONDUIT AND 2 INCH UP THE SIDES. ONLY EXTEND DOWNWARD SLIGHTLY TO PREVENT ADHESION TO TRANSITION STRIP.

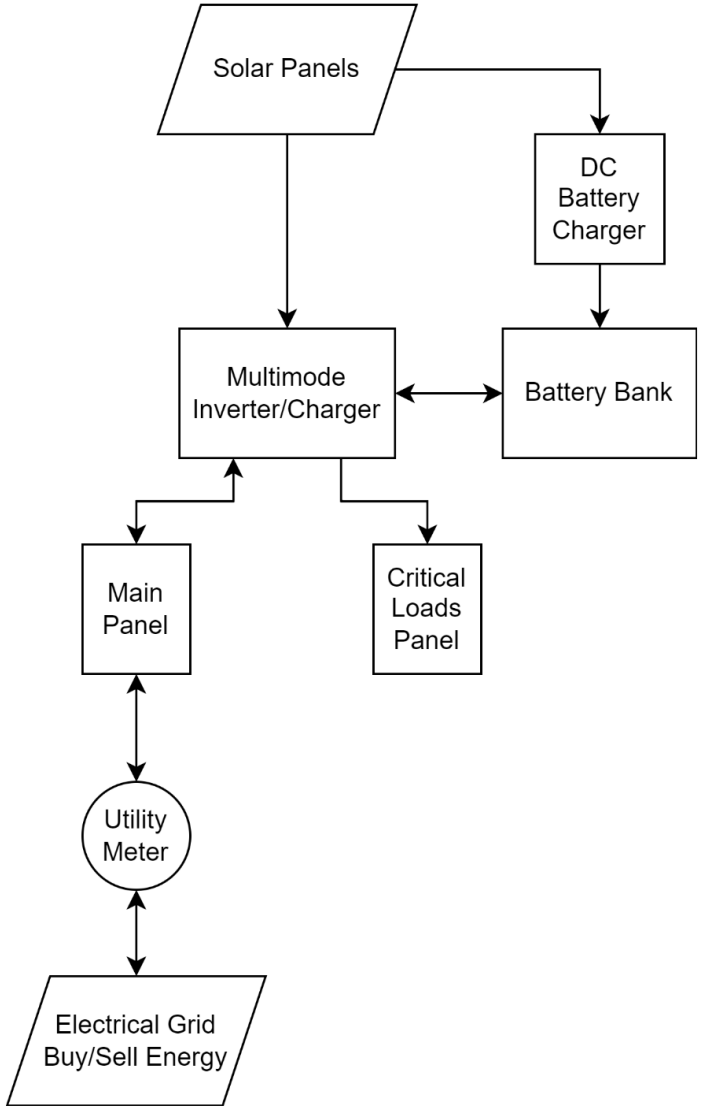


2/A-501 (LOWER WALL)

3 E-602 WALL PENETRATION DETAIL

SCALE: N.T.S

Energy System Diagram



Preliminary Energy Analysis and Modelling

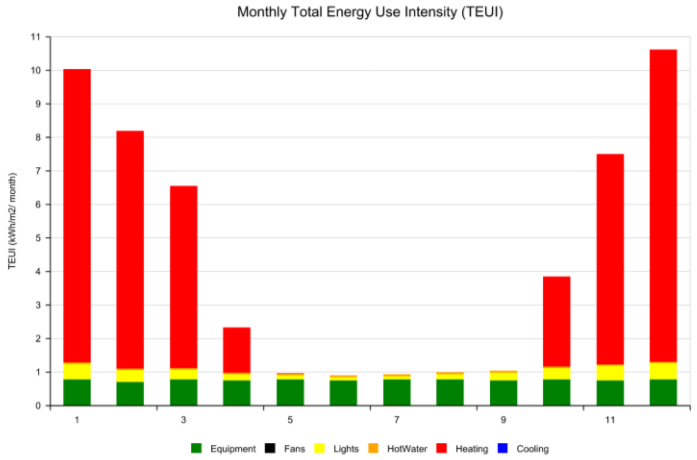


Figure 1: Site Energy Breakdown by Month

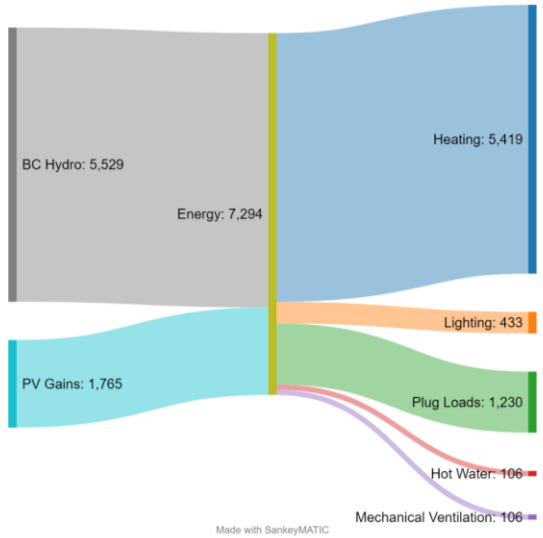


Figure 2: Site Energy Breakdown by End Use

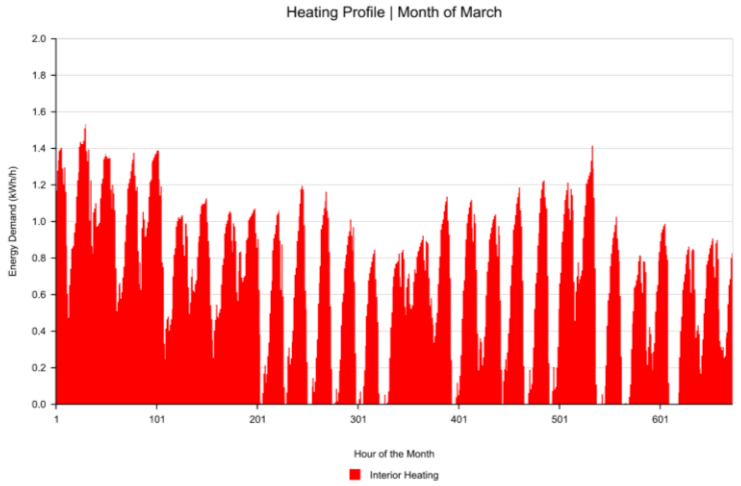


Figure 3: Building Heating Profiles in February

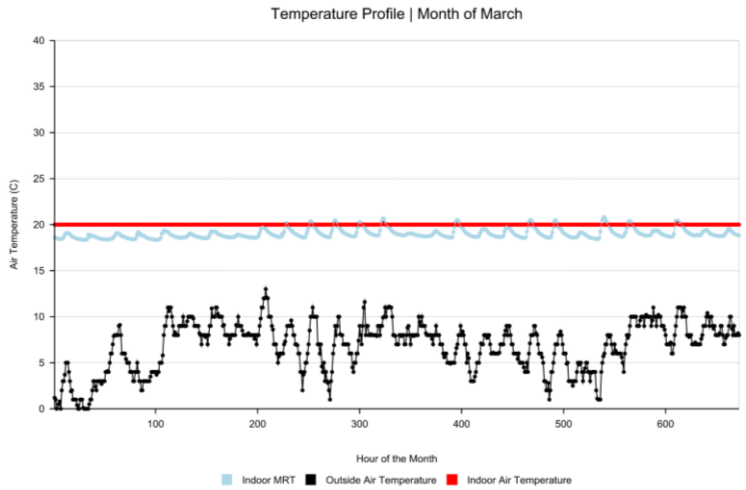


Figure 4: Temperature profile comparing conditioned and unconditioned spaces

Inputs	Value
People Density	0.0023 people/ft^2 (0.025 people / m^2)
Lighting Power Density	0.51 BTU/hft^2 (1.6 W/m^2)
Equipment Power Density	0.63 BTU/hft^2 (2.0 W/m^2)
Heating Set Point	68F (20°C)

Table 1: Energy Model Inputs

Structural Loads

Roof Loads

Dead with PV Solar Panels : 24 *psf*

Dead without PV Solar Panels: 20 *psf*

Live: 21*psf*

Snow: 34.25 *psf*

Max Snow at Valley: 60.6 *psf*

Wind: 20 *psf*

Floor Loads

Dead: 20 *psf*

Live: 100.25 *psf*

Wall Loads

$$Dead: \frac{320lbs}{ft}$$

Load Combinations		
Case	**Principal Loads**	**Companion Loads**
1	1.4D	
2	(1.25D or 0.9D) + 1.5L	1.0S or 0.4W
3	(1.25D or 0.9D) + 1.5S	1.0L or 0.4W
4	(1.25D or 0.9D) + 1.4W	0.5L or 0.5S
5	1.0D + 1.0E	0.5L + 0.25S

Electrical

Table 1 Summary of Input Modes

Mode	Summary	Benefits	Cautions	Intended	Charger
Generator	Accepts power from an irregular or low-quality AC source	• Can use AC that may be unusable in other modes • Can charge even with poor generator or low-quality AC source	• Will pass irregular or low-quality power to the output; could damage sensitive loads • Offset unavailable	**Source:** Generator **Loads:** Non-sensitive devices	Performs three-stage charge and goes silent as specified by settings.
Support	Adds battery power to augment an AC source that has limited output	• Can use battery power in conjunction with AC source • Offset operation sends excess DC to loads	• Drains batteries during support; intended for intermittent use only • May not function with low-quality AC source	**Source:** Grid or Generator **Loads:** Can be larger than AC source	Performs three-stage charge and goes silent as specified by user settings.
Grid Tied	Inverter sells excess power (renewable) to utility	• Bidirectional input • Can reduce utility bills and still provide backup • **Offset** operation sends excess DC to loads • Any additional **Offset** excess is sold to the grid	• Requires utility approval • Other approvals may be required depending on electrical codes • Has exact requirements for accepting AC input • Requires renewable energy source	**Source:** Grid **Loads:** Any type	Performs three-stage charge and goes silent as specified by user settings.
UPS	In grid failure, unit switches to batteries with fastest possible response time	Quick backup for sensitive devices during grid outage	• Uses higher idle power than other modes • **Search** function unavailable • Offset unavailable	**Source:** Grid **Loads:** PC, audio, video, etc.	Performs three-stage charge and goes silent as specified by user settings.
Backup	In grid failure, unit switches batteries to support loads	• Simple use compared to other modes; often used with generators for this reason • Less idle power than ***UPS*** • Does not drain battery as in ***Support***	Has none of the special functions described in other modes	**Source:** Grid or Generator **Loads:** Any type	Performs three-stage charge and goes silent as specified by user settings.
Mini Grid	Stays off grid most of the time; only uses grid when batteries low	• Can minimize/eliminate dependence on grid • Offset operation sends excess DC to loads (but only when on grid)	• Will not work properly unless renewable source is above a certain size • Conflicts with related modes in system display	**Source:** Grid **Loads:** Any type	Performs three-stage charge on reconnect; if charger is disabled, inverter emulates charge cycle from external source and reacts accordingly
Grid Zero	On-grid but actual grid use is "zeroed out" with battery and renewable power; does not sell or charge	• Can minimize/eliminate dependence on grid • Offset operation sends excess DC to loads at adjustable rate • Remains on-grid to avoid transfer problems	• Discharges batteries while remaining on grid • Will not work properly unless renewable source is above a certain size • Battery charger inoperative	**Source:** Grid **Loads:** Any type	Charger inoperative; batteries must be charged using an external (renewable) energy source

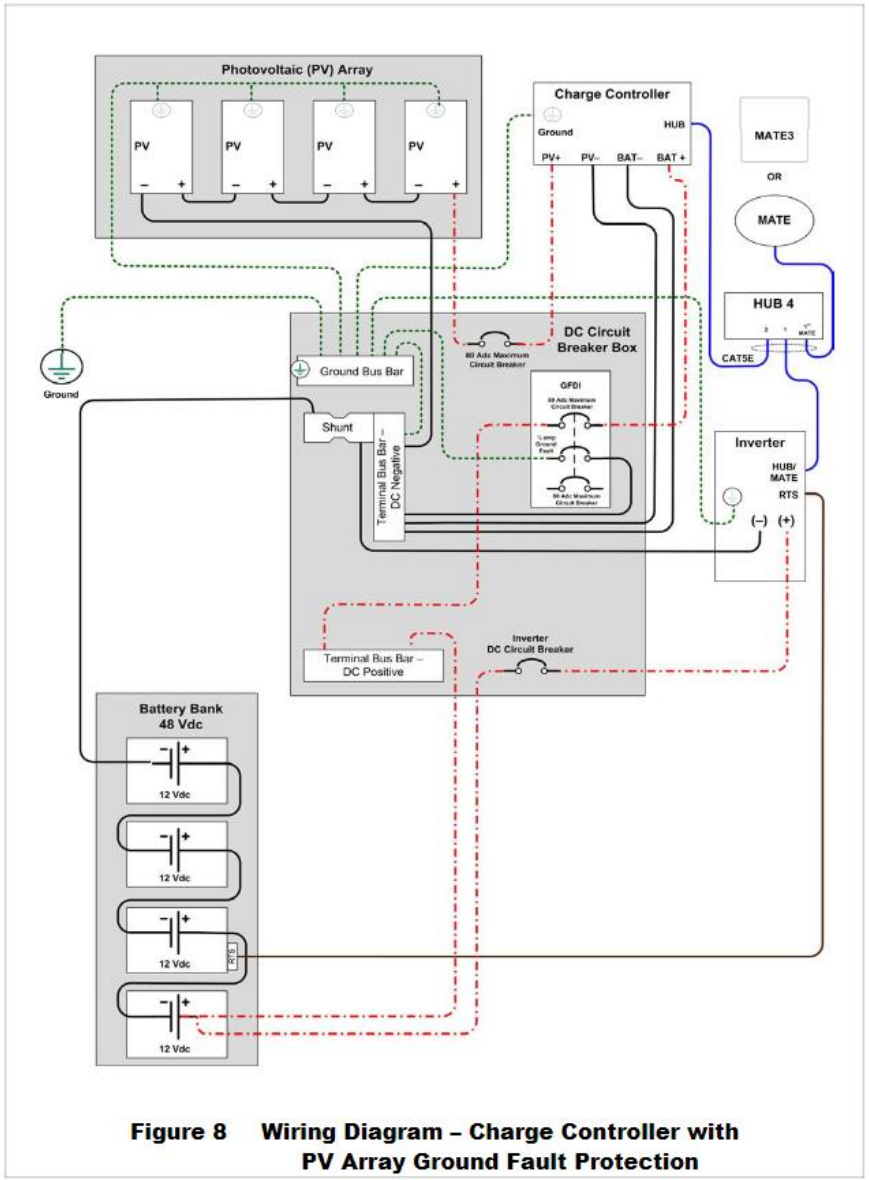
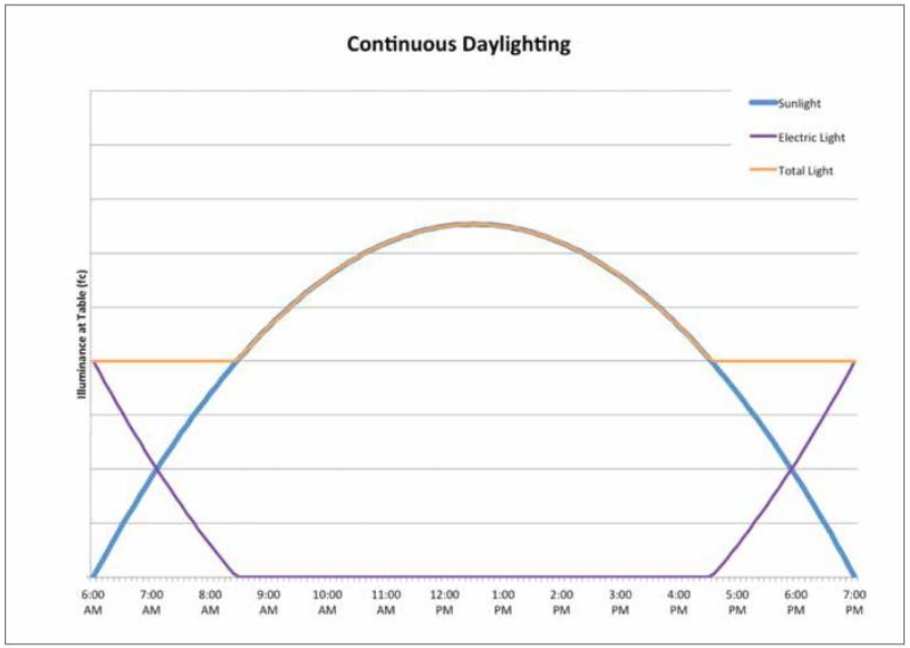


Figure 8 Wiring Diagram – Charge Controller with PV Array Ground Fault Protection

Electrical

Continuous daylighting

Continuous daylighting involves smooth, continuous dimming from low end to high end in order to maintain the desired light level. Continuous daylighting adjusts lights based on the amount of daylight that's always in the space, ensuring that the minimum light level is achieved without over-lighting the space (as in switched and bi-level daylighting).

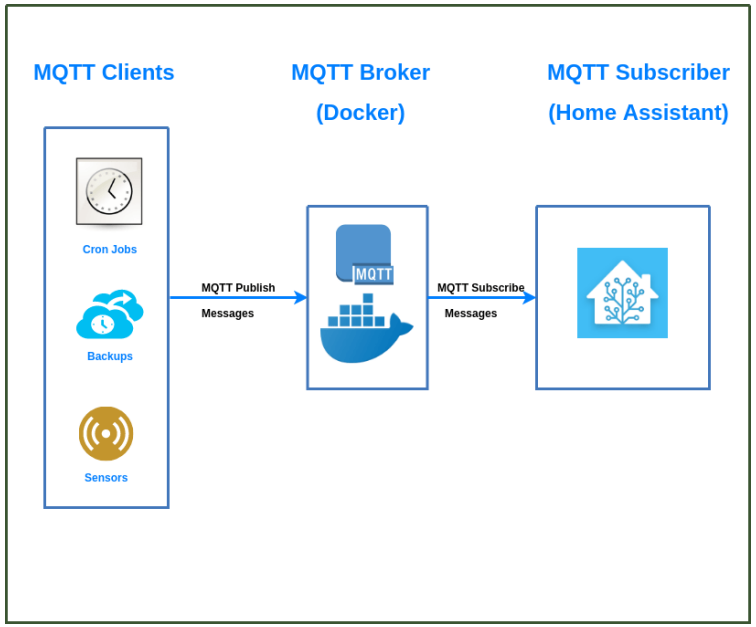


Lutron Radio Power Saver
Daylight Sensor

Automatic Window Opener

Electrical

Home Assistant Dashboard




```
# Discover some devices automatically
discovery:


mqtt:
    broker: 192.168.1.108

switch:
    - platform: mqtt
      name: "Example_Switch"
      command_topic: "room/light"
      payload_on: "on"
      payload_off: "off"

light:
    - platform: mqtt
      name: "Example_Light"
      command_topic: "room/light"
      state_topic: "room/light/state"
      payload_on: "on"
      payload_off: "off"
```