The Catskill Project

Decarbonizing Single-Family Development at the Community Scale

EEBA Summit 2024

Greg Hale, Co-Founder & Principal
The Catskill Project

Learning Objectives

1. Learn TCP's simple formula for developing a carbon neutral community and understand the operational cost savings of high efficiency homes through utility bill analysis.

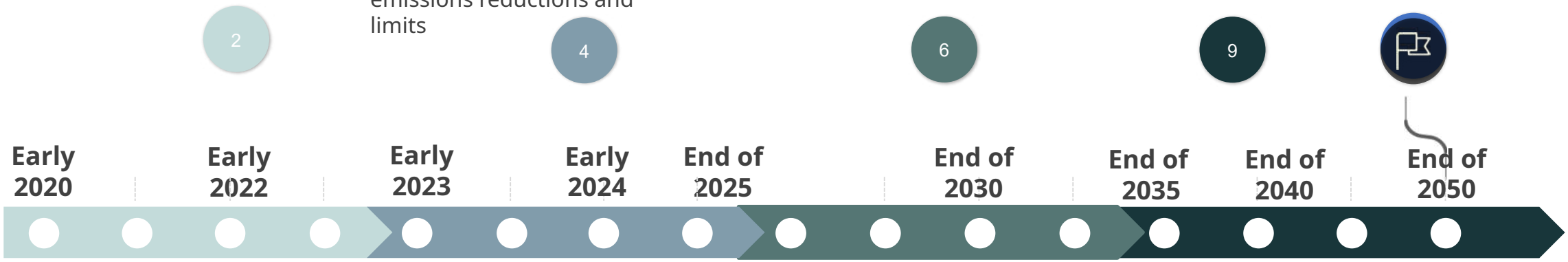
2. Learn different ways to cut embodied carbon through thoughtful product selection, and whole life carbon accounting.

3. Discuss the pros and cons of procuring resources on-site for reuse during construction, such as wood from the land used as finish materials in the houses.

4. Understand that building a SFR to Passive House standards with lower embodied carbon materials carries some inevitable cost premiums.

5. Review the evolution of our development's design – issues, pitfalls and solutions.

NYS & NYC Climate Goals:
Climate Leadership and Community Protection Act Timeline



1 — **CLCPA** comes into effect

2 — Climate Action Council **draft scoping plan** published for public comment

3 — The council must submit its **final scoping plan**

4 — Department of Environmental Conservation will create rules and regulations to ensure compliance with statewide emissions reductions and limits

5 — Develop 6,000 MW of **distributed solar** and a **reduction of 185 Btu of building energy usage** through energy efficiency

6 — **40% reduction in economy-wide emissions; 70% renewable grid;** 3,000 MW of **energy storage**

7 — **2 million homes** efficiently electrified or electrification ready

8 — Develop 9,000 MW of **offshore wind**

9 — **100% clean greenhouse gas emissions-free electrical grid** in New York State

85% reduction in statewide emissions, with 15% reduction from state-created offsets for **a net 100% reduction in emissions**

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New York Regulatory Drivers

nys: clcpa

Enacted legislation

- Emissions-free new construction (2026/2029)

In scoping plan, legislation pending

- Phase out of fossil heating appliances (2030/2035)
- Building performance standards (2030)
- Benchmarking / building labeling (ASAP)
- Cap and invest

nyc

Enacted legislation

- Local Law 97 building emissions caps (2024 – stepping down 2030, 2035, 2040…)
- Emissions-free new construction (2024/2027)

Governor's state of the state initiative

- 2-million climate friendly homes

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The Catskill Project – Mission & Principles

mission

Develop a model for carbon-neutral development at community scale; working prototype for the decarbonization of single-family housing in rural environments.

principles

Passive House
Regenerative design
Electrification
Renewable energy
Net zero operation
Embodied carbon tracking
Light-touch site development
Local materials and labor
Panelized construction

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Site Development

THE FALLS

phase 1

90.72 acres, 11 lots, 40+ acre conservation easement, community trails and pond

THE RIDGE

phase 2

31.75 acres, 6 existing lots and road, new trails to connect

THE MEADOWS

phase 3

35.14 acres, 8 existing lots and road, new trails to connect

Phase 1 The Falls

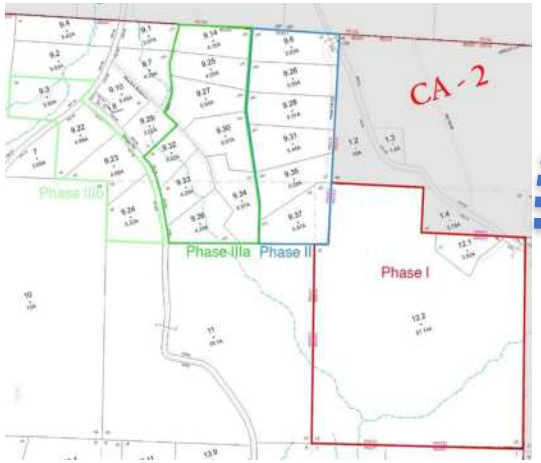
Zoning & Development

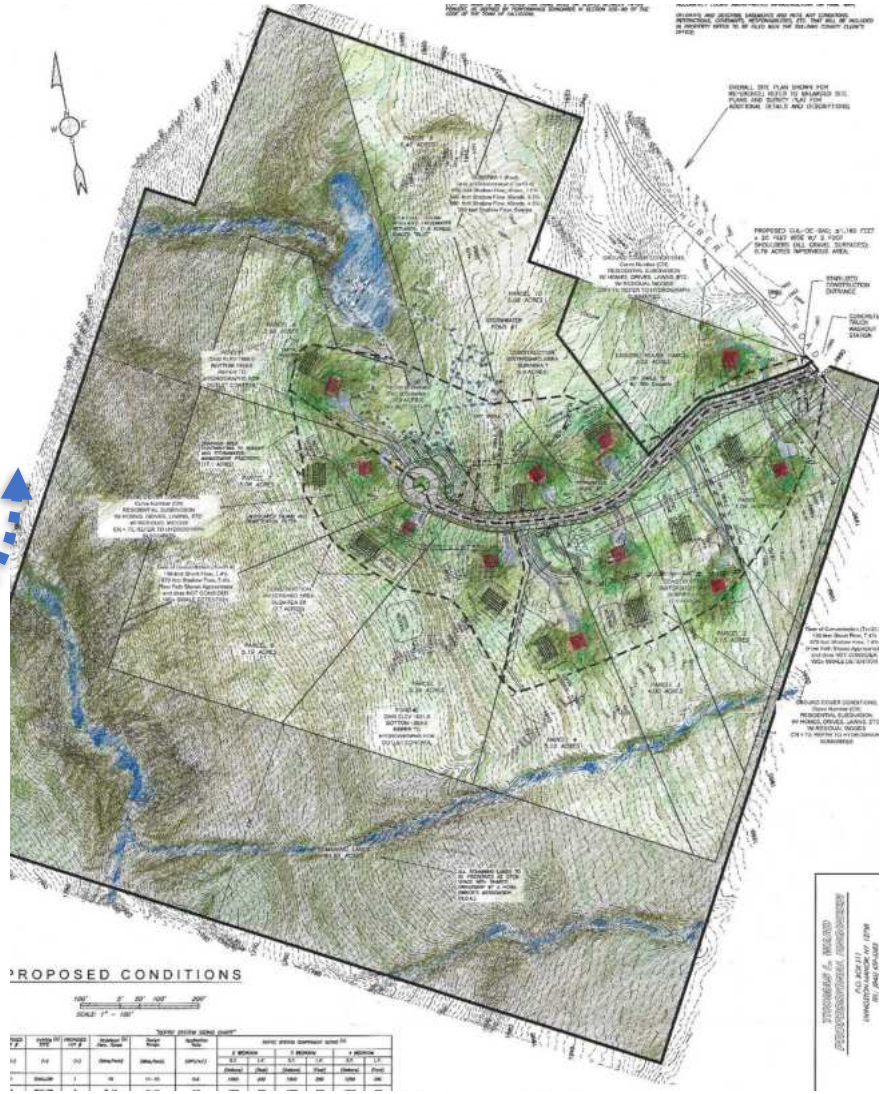
Clustered development

3-acre minimum lot size

Minimal land clearing, trees salvaged, milled, reused

Minimal land disturbance, respecting natural features and topography





HOA Regulations for Carbon-Neutrality

No fossil fuels permitted for space heating, hot water, cooking or clothes drying

All electric power from certified carbon-free sources (onsite solar panels or community solar subscription)

Propane and diesel generators only allowed as secondary to electric battery backup

Tree-clearing limitations

Fossil fuel-powered recreational vehicles prohibited for use on-site

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Model Designs




Overlook

2,283 GSF
3 bedrooms
3.5 bathrooms

Balsam

2,283 GSF
3 bedrooms
2.5 bathrooms

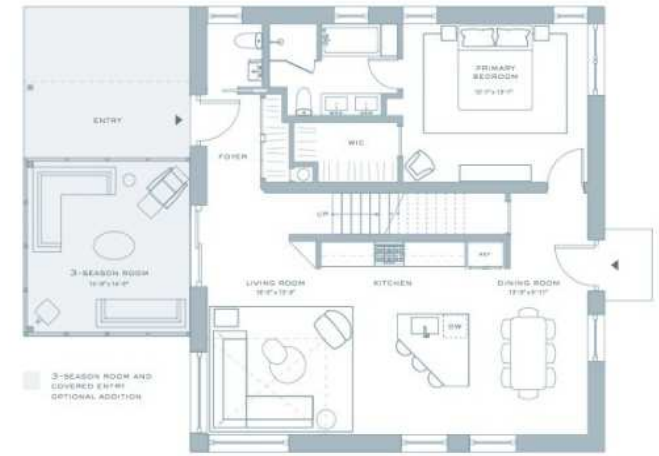
Tremper

1,916 GSF
2 bedrooms
2.5 bathrooms

Red Hill

1,783 GSF
3 bedrooms
2.5 bathrooms

The Balsam | Model House



Features

- 2 ½ story corner atrium: provides natural light (and thermal gain) for living room & 2nd floor lounge
- Indoor/outdoor living with two decks and patio / 3-season room
- 2-ton Fujitsu ASHP
- Zehnder ERV
- Expect PHI low-energy building certification in 2024
- **$69 / month average electric bill** for systems and appliances 11/21 - 11/23 (all systems on, but no full- time occupancy)
- Detached garage / accessory building option available

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The Red Hill

Features

- Design: farmhouse vernacular
- Pursuing PHIUS prescriptive path and DOE ZERH certifications
- 2-zone Mitsubishi ASHP
- Zehnder ERV
- Vaulted ceiling details
- Open kitchen / living / dining
- Upstairs lounge area
- Indoor / outdoor living w/ patios and available upper deck / 3 season room upgrade
  Carport and/or multi-functional Accessory Building available (e.g., garage, artist's studio, guest quarters, home office…)

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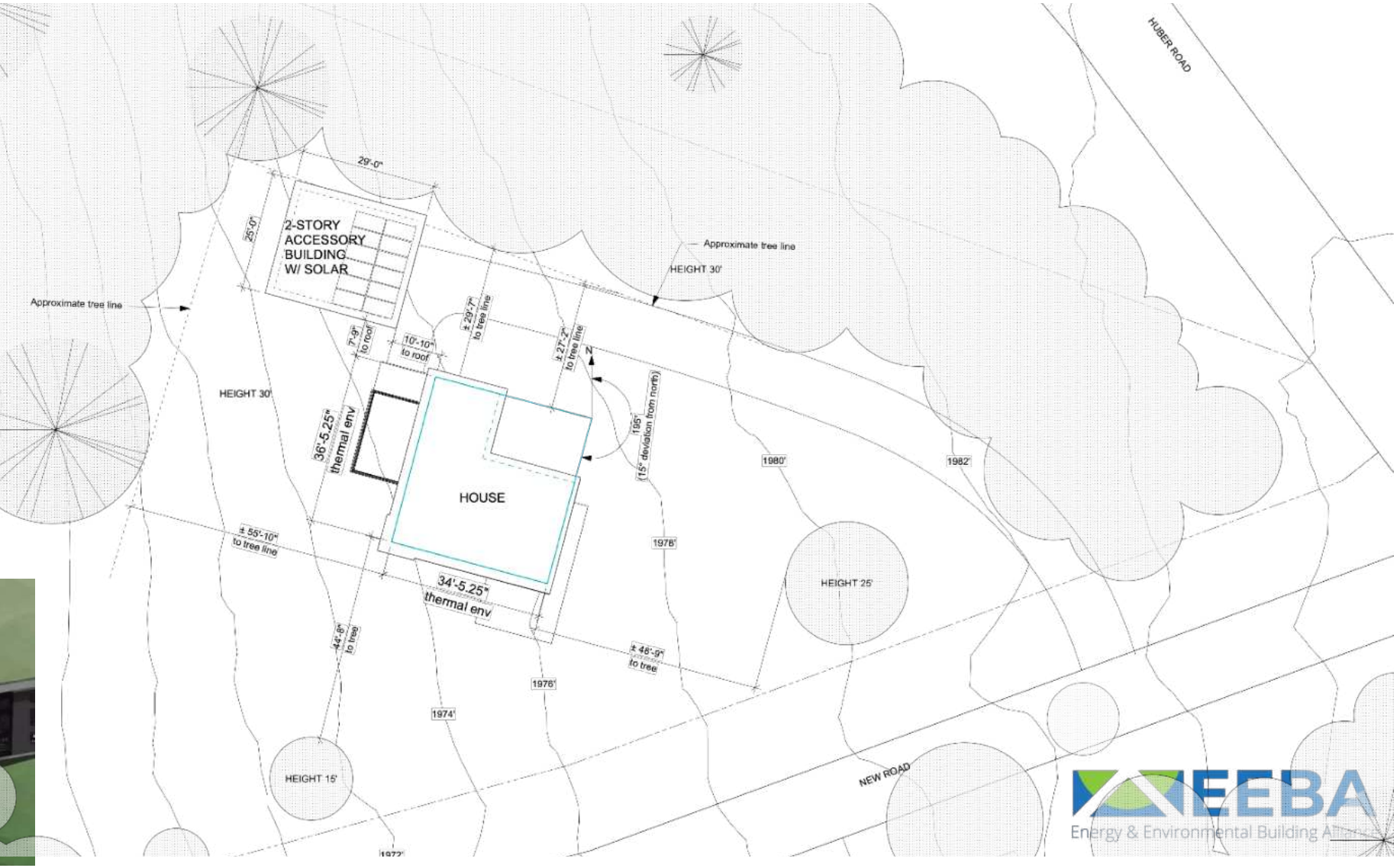
Site Planning

Optimizing for solar access & rooftop PV

PHPP, solar pathfinder, and 3D sun simulations used to optimize the building's location on-site for views, passive solar gains, shading, and roof-mounted photovoltaics at the Accessory Building.

House roof sheds to North
Accessory roof sheds to South



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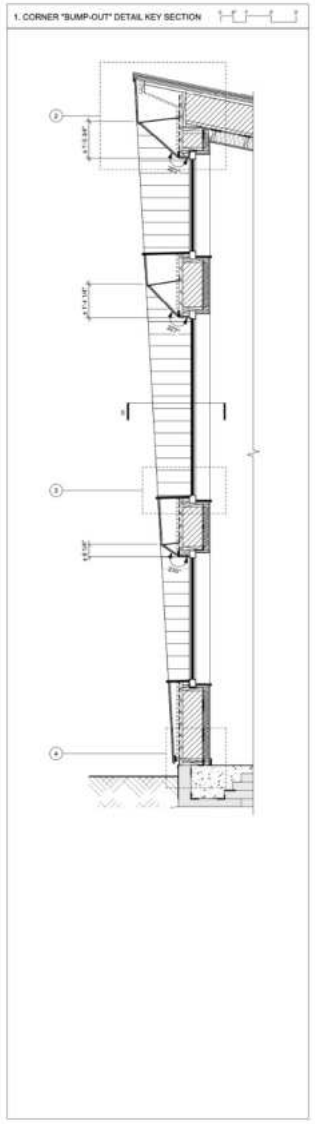
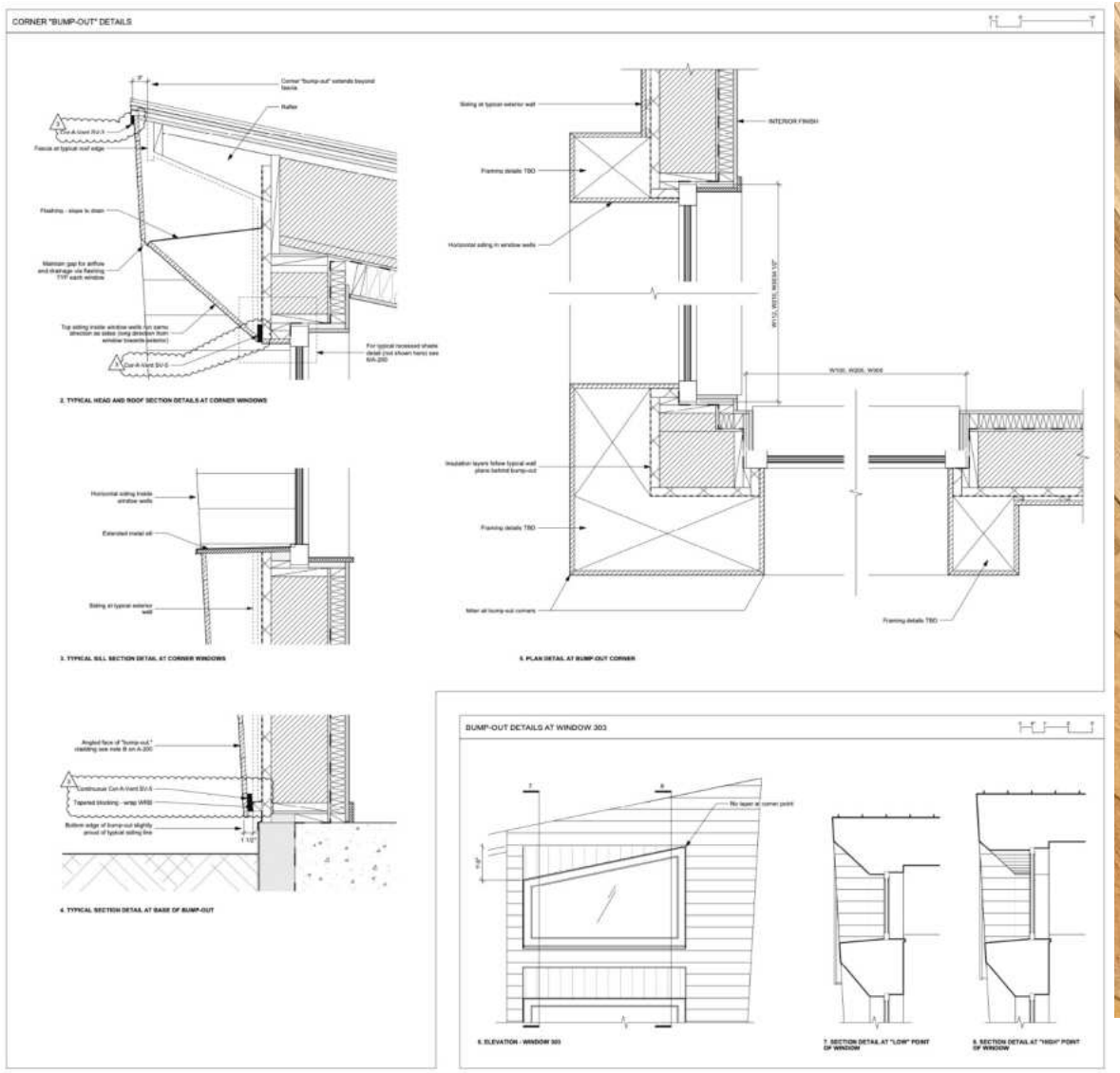
Passive Shading





THE CATSKILL PROJECT BMA

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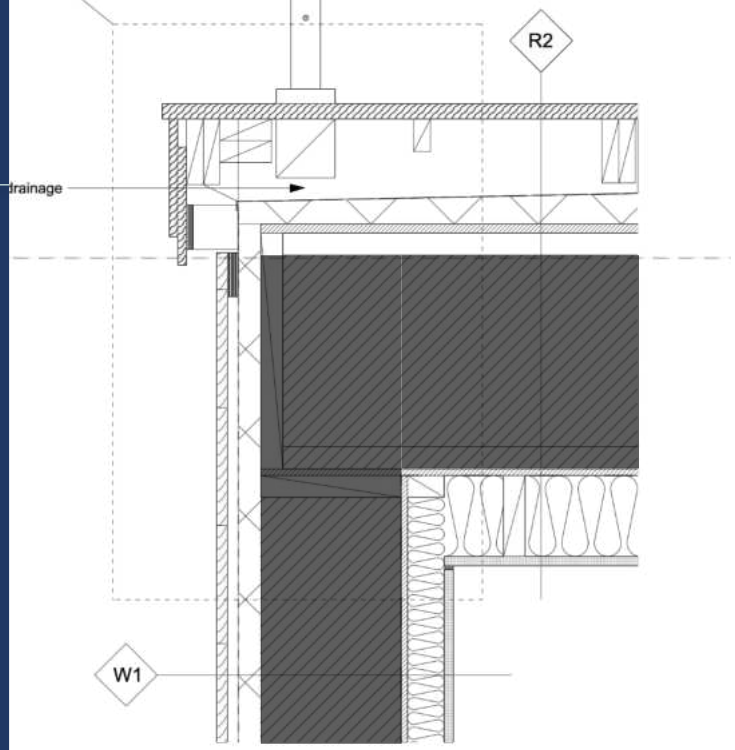
Building Shell

Wall (R-45)

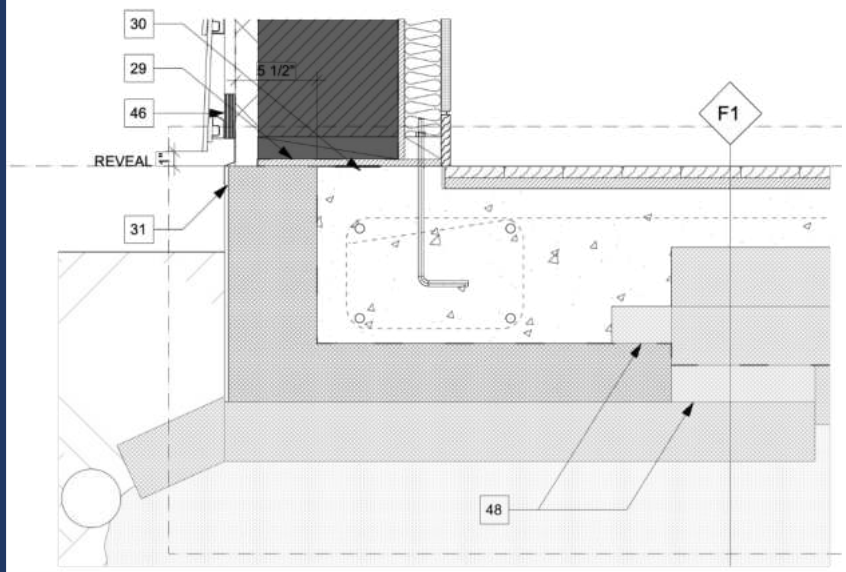
- 24” OC 2x10 infilled with dense-pack cellulose
- 40mm Steico fiberboard
- Siga Majvest WRB
- ¾” vertical furring
- Siding (site installed)
- 7/16” OSB and 10mil poly
- 2x3 insulated service cavity (Rockwool)

Roof (R-80)

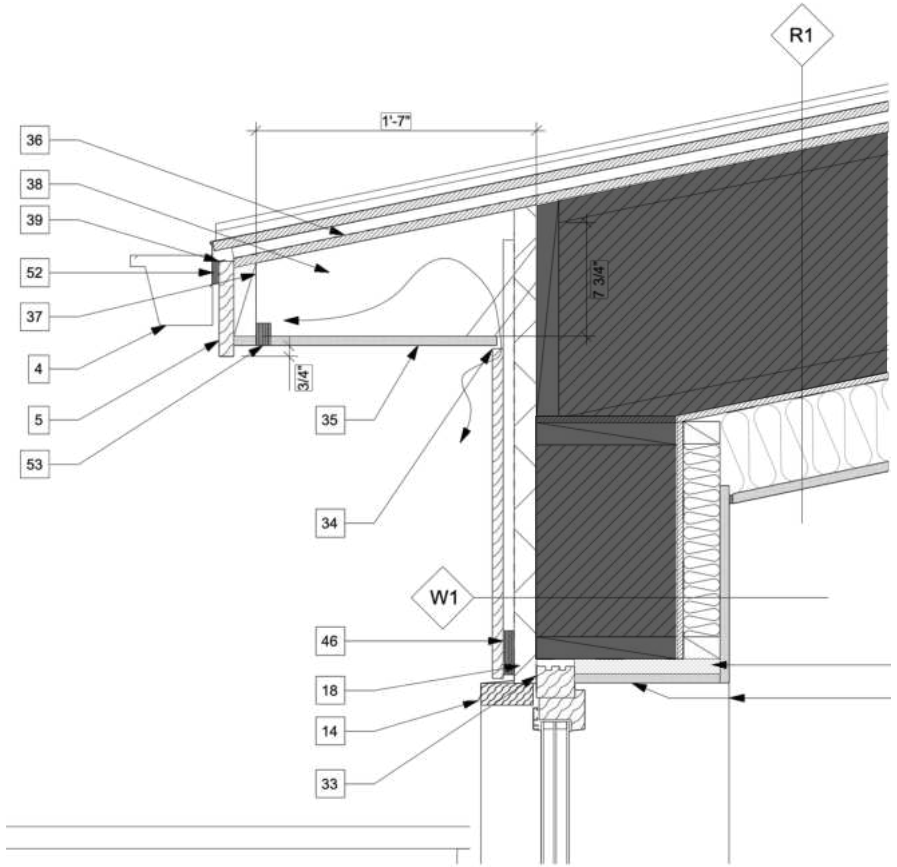
- 24” OC 16” TJI infilled with dense-pack cellulose
- 7/16” taped OSB
- 2x6 insulated service cavity
- 5/8" Zip WRB
- 2x4 strapping w/ metal roof
- EPS drainage plane on flat roof for R-96



5. DETAIL AT NORTH DECK EDGE



6. TYPICAL DETAIL EXT WALL AT FOUNDATION



7. HEAD DETAIL OF WINDOW 205.02 AND TYP DOWNSLOPE EAVE DETAIL

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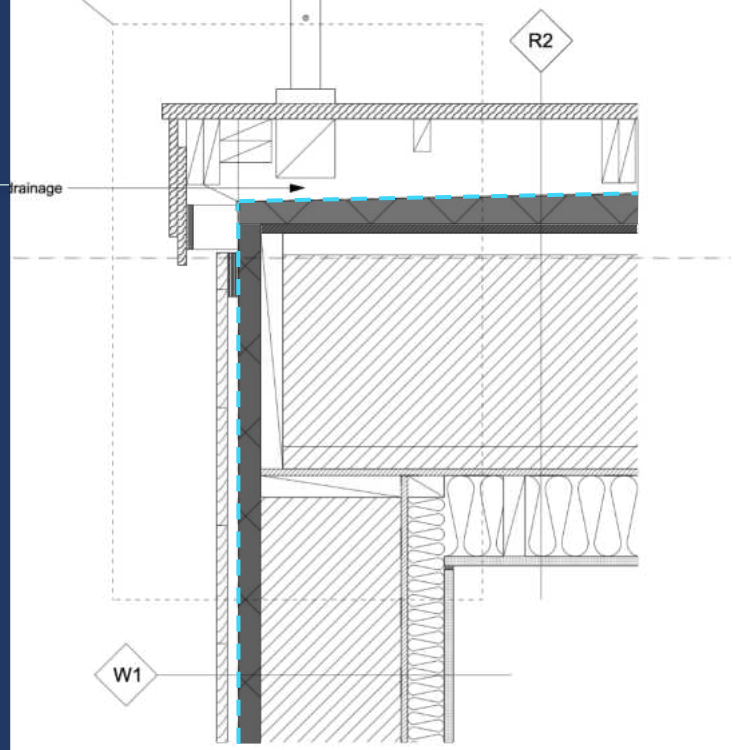

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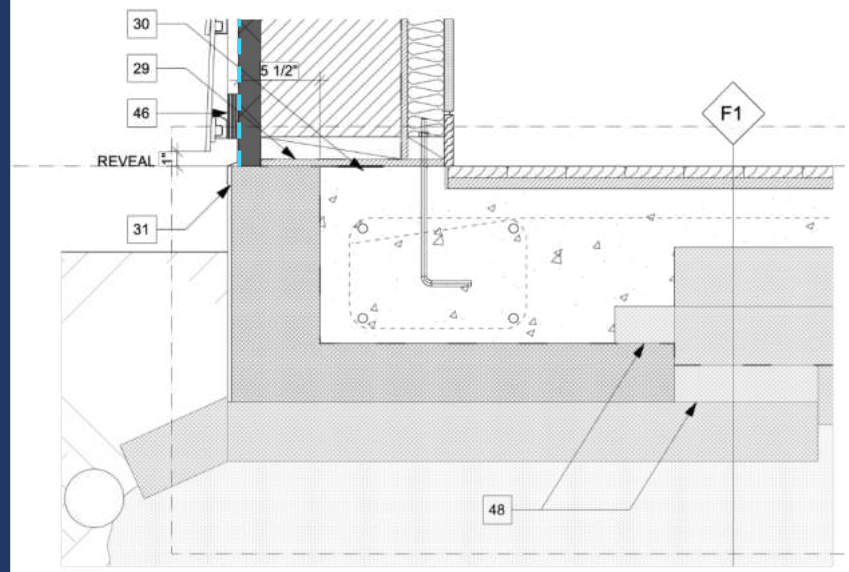

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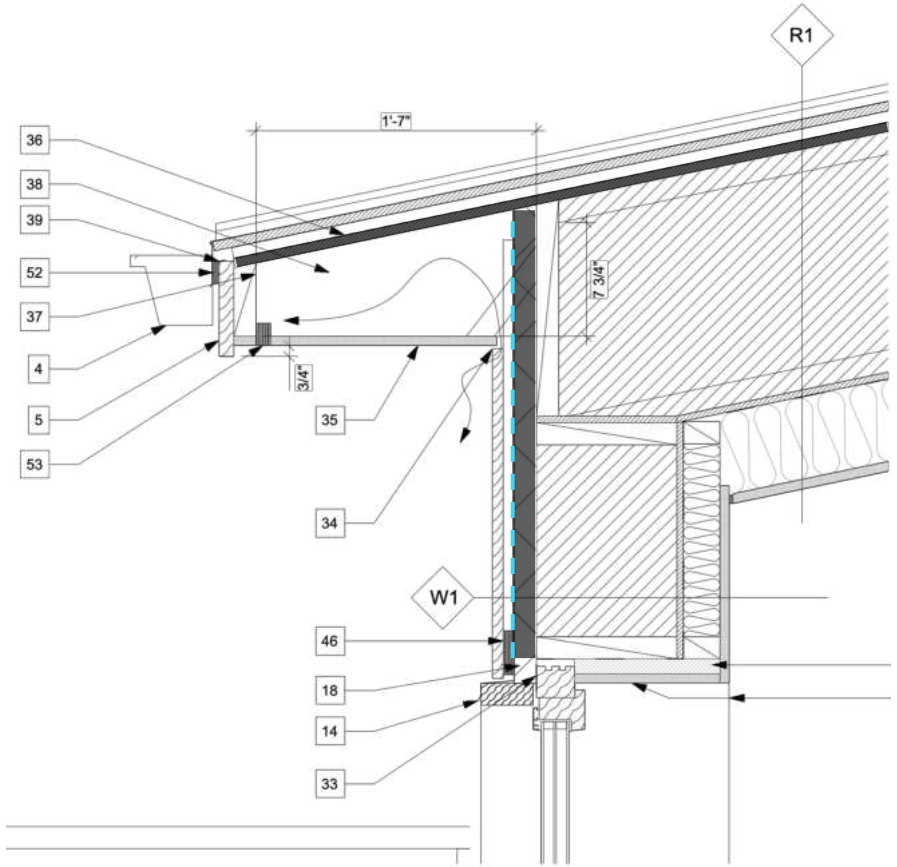

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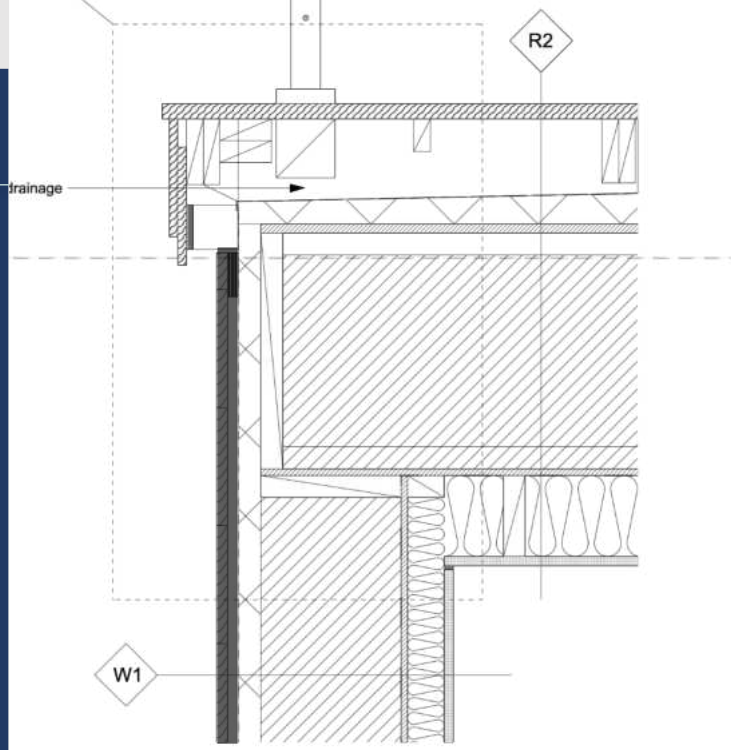

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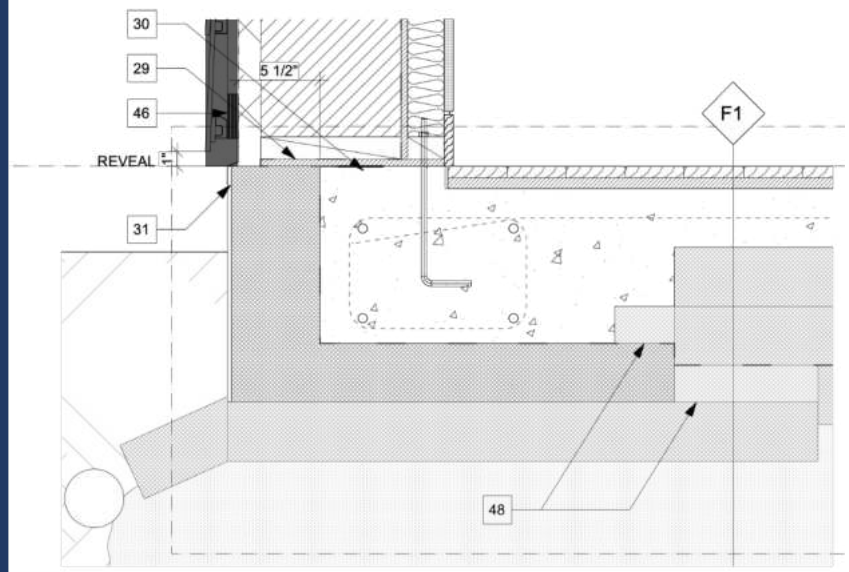

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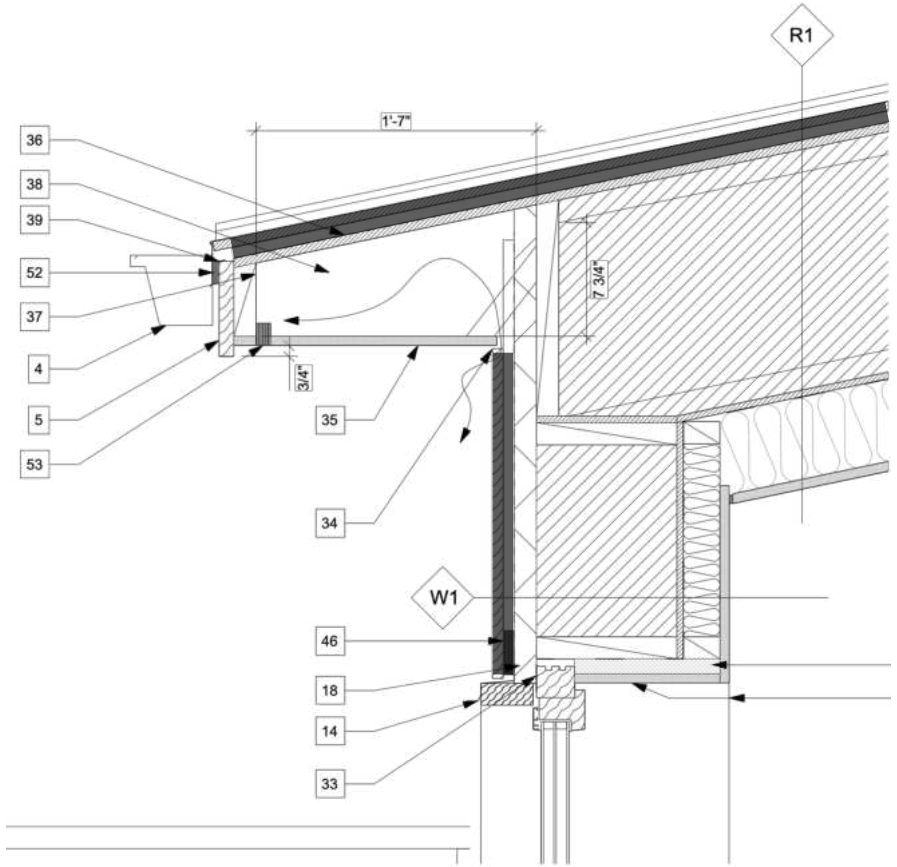

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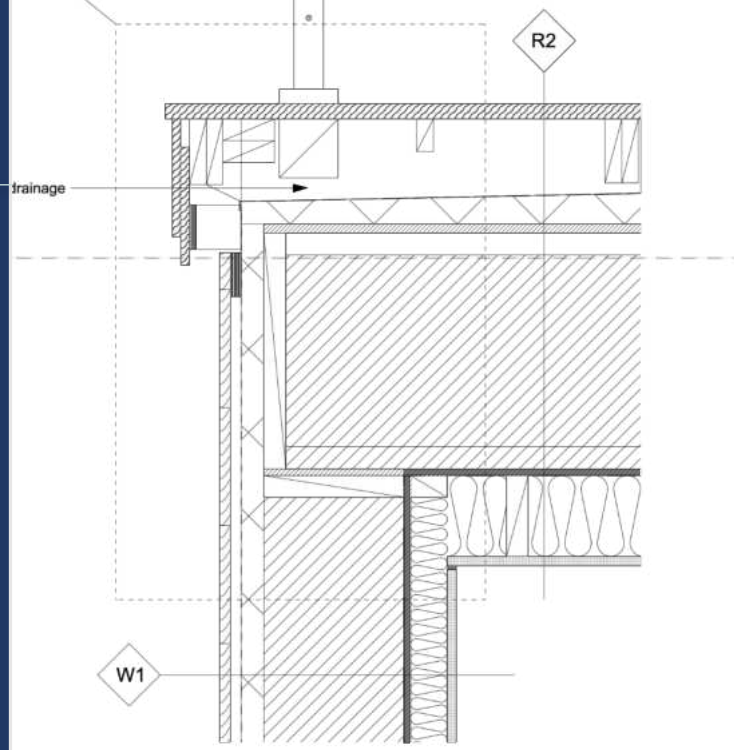

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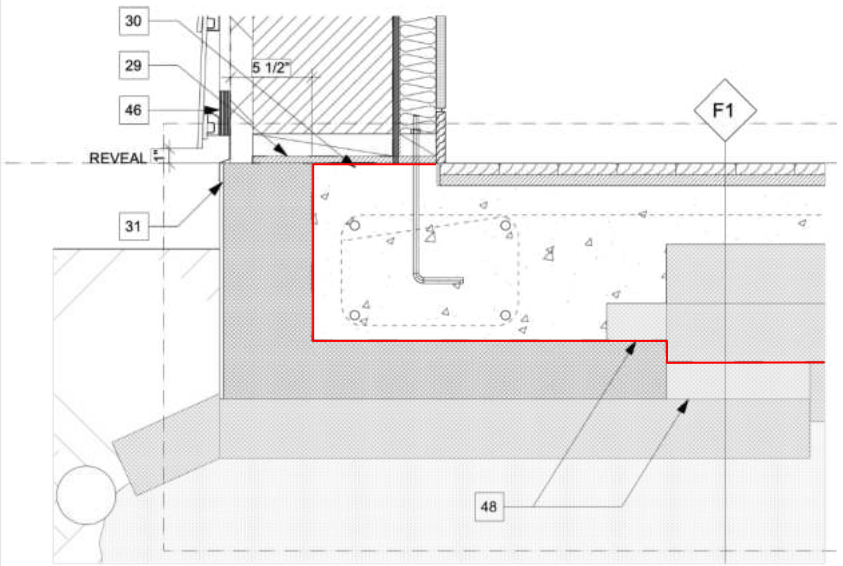

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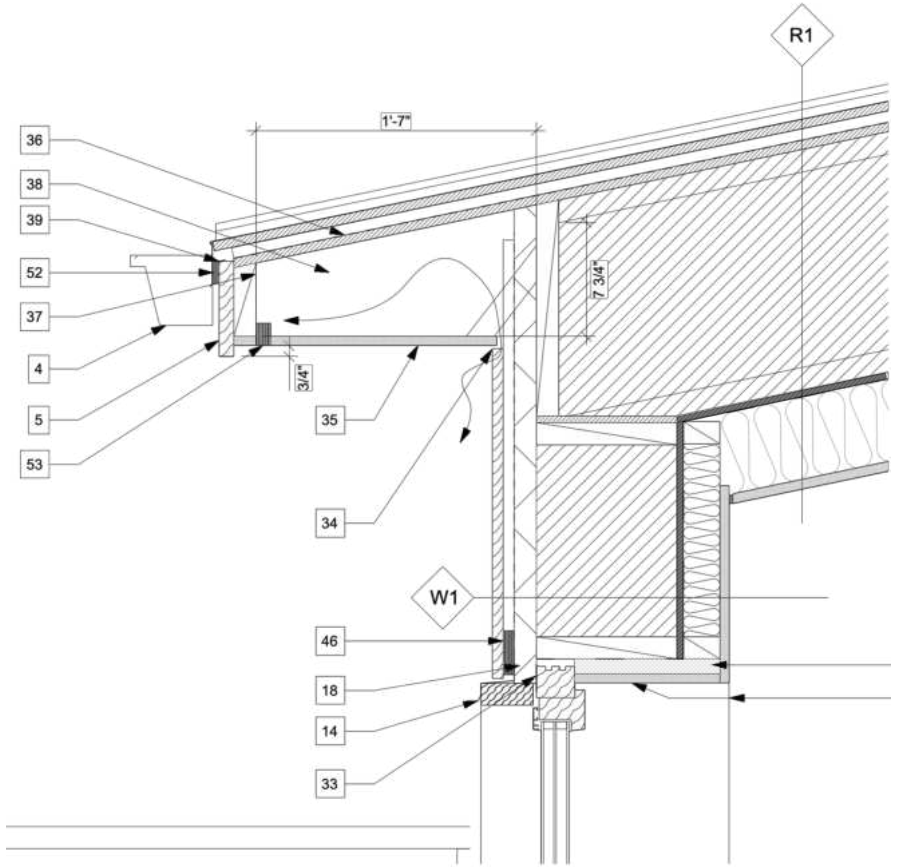

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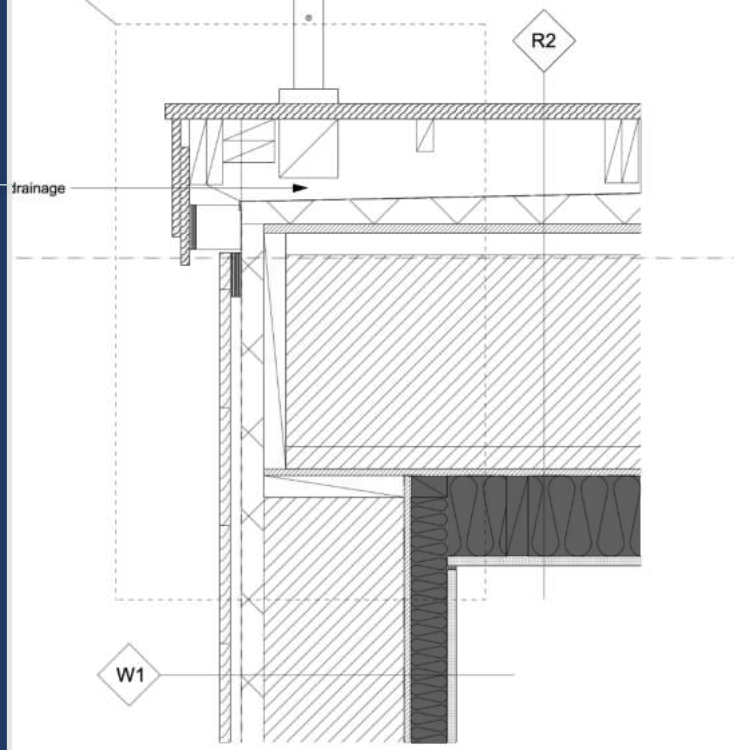

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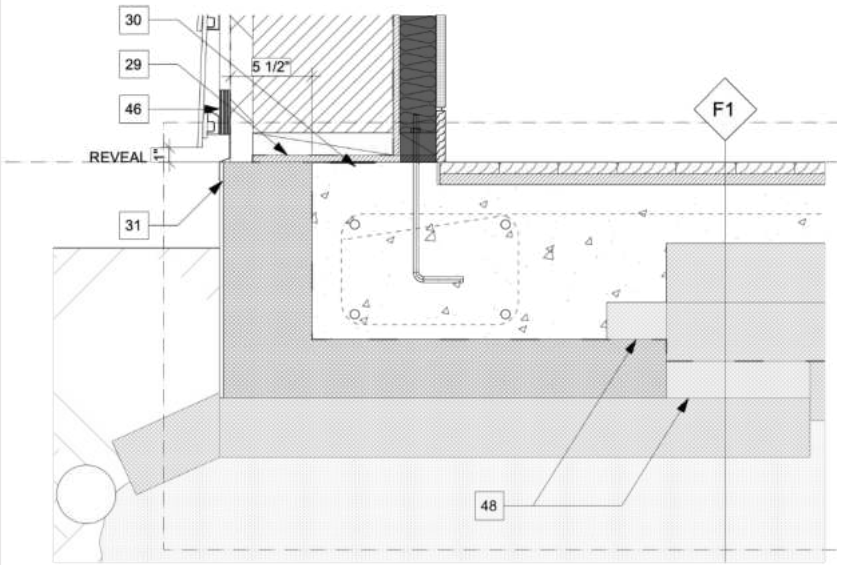

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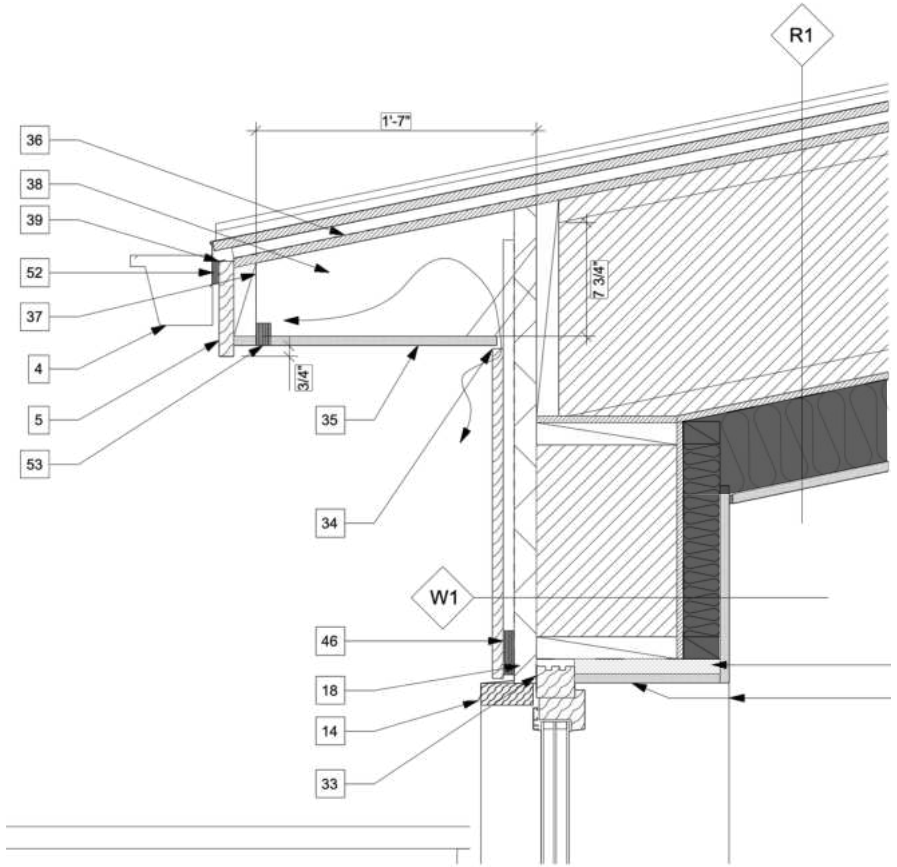

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Panelized Construction

Integrative design process with Bensonwood / Tektoniks / Unity Homes

Wall & roof panels manufactured off-site at Bensonwood's factory in Keene, New Hampshire

Superior quality control

On-site assembly: 2-5 days

Blower door test delivery:
Lot 11 0.41 ACH @ 50Pa
Lot 4 0.36 ACH @ 50Pa
Lot 8 0.35 ACH @ 50Pa

Passive House Performance

CASE STUDY

PHI Low Energy Building Certification expected 2024

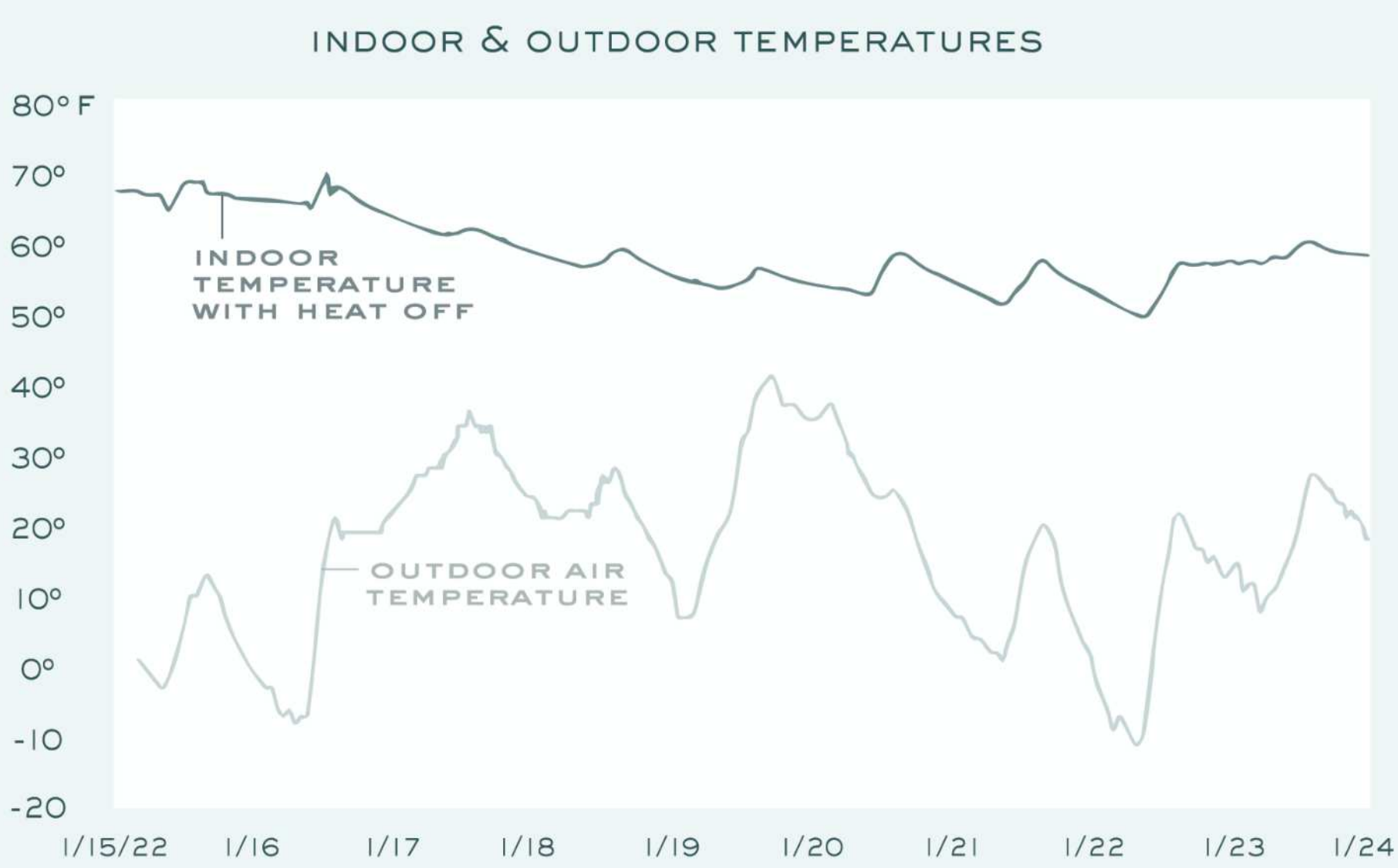
PHPP
Treated Floor Area: 1,713 SF

Heating Demand: 9.12 kBTU/ft²/yr
Cooling Demand: 6.42 kBTU/ft²/yr

Blower Door: 0.41 ACH @ 50Pa

Mechanical System
1.5-ton Fujitsu heat pump

Data recorded in 2022 case study at Lot 11 Balsam build. Study conducted by Baukraft Engineering PLLC.



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Specifying Site-Salvaged Trees

Deadfall, at-risk species (e.g., ash borer), and trees as minimally required for lot clearing, are salvaged & sent to mill at Labrador Lumber on the Southern tier of New York.

Ash, Maple, and Cherry boards of various sizes are then used for interior finishing by way of flooring, paneled ceilings, and trim work.

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Low GWP Specifications Outdoors

Green hemlock siding: no paint, stains, or preservatives. Natural carbon sequestration. No energy expended to kiln-dry.

Cupaclad siding: Non-combustible, waterproof, impact and stain resistant, maintenance-free. Completely modular and reusable. Hand-split natural material requiring no treatments or chemicals to produce.

Shou sugi ban siding: 2 kg carbon sequestered per 1kg lumber produced, zero required maintenance, 100-year lifespan

Limited use of concrete

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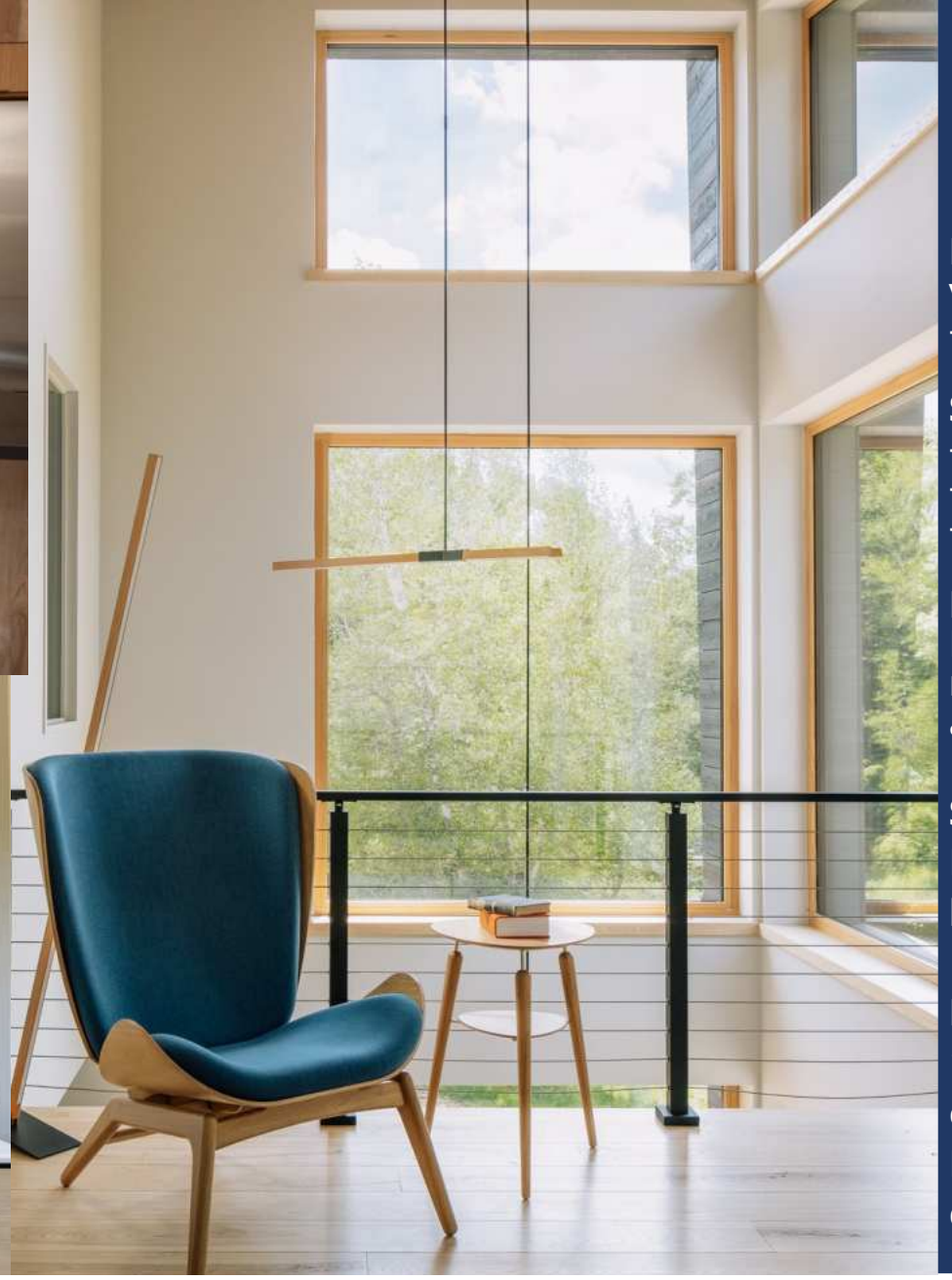


Low-GWP Specifications Indoors

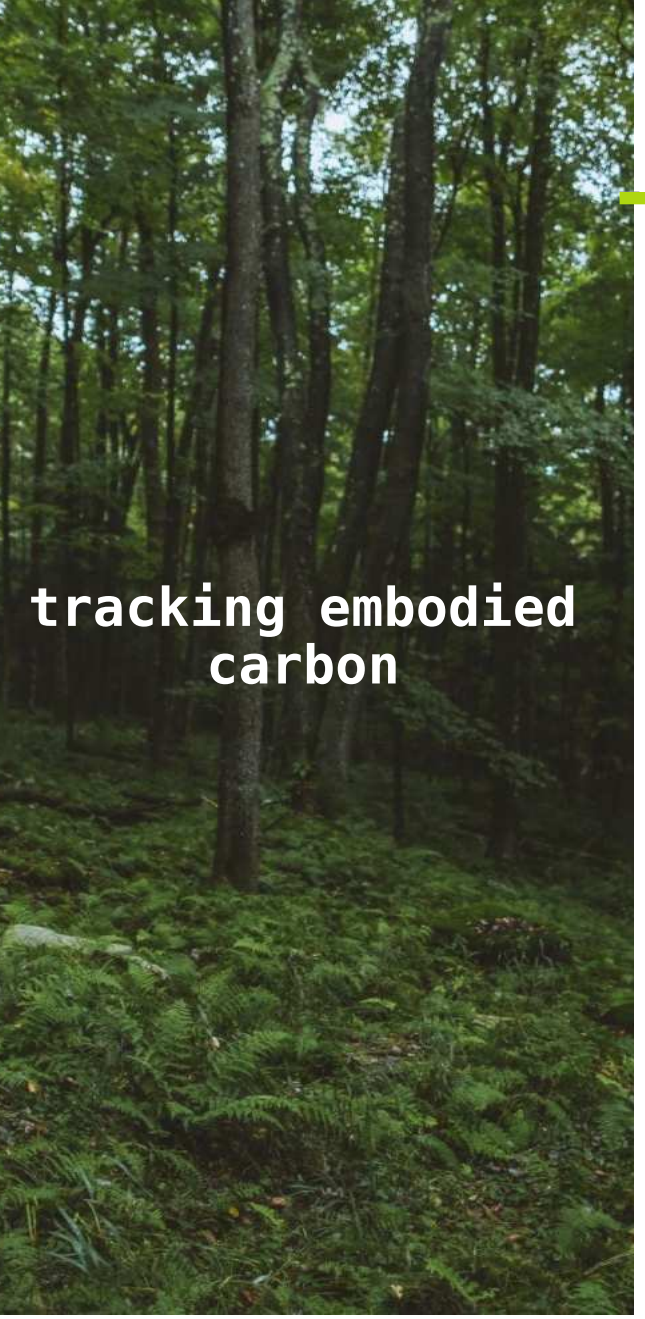
Densepack cellulose
vs high GWP foam insulation
-universal spec for Bensonwood

Site-harvested finish materials
- Cherry wood ceilings
- Soft maple wall finishes
- Ash flooring

Richlite counters
Resin-infused compressed paper, made from recycled wood pulp; FSC and Greenguard certified.

Stickbulb fixtures
LED lighting made from reclaimed heart pine.

Fireclay tile
100% renewable electricity factory, certified B-corp, Certified Climate Neutral, 90% production waste diversion



Estimated Embodied Carbon of Materials

Conservative tonnage: **167T**/building

Baseline number for the sleight of materials inputted; does not take into account specific EPDs; works off of current industry wide averages.

Realized tonnage: **117T**/building

Based on the specific data of materials inputted; EC3 states that this tonnage is a **91% reduction** from the baseline (the current carbon intensity of construction for similar buildings) set by the the Carbon Leadership Forum.

Achievable tonnage: **81T**/building

EC3's number for lowest possible carbon tonnage based on our sleight of materials, if we choose the least carbon intensive products possible.

actual → **< 117 T**
> 81 T

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Estimated Carbon Capture of Conservation Zone

iTree Canopy carbon capture estimations	Carbon (T)	CO2 Equivalent (T)	Value (USD)
Sequestered annually in trees	56.3	**206.4**	$9,600.00
Stored in trees (not an annual rate)	1413.7	5183.4	$241,100.00

Using iTree canopy, we calculated that the 41.5-acre conservation easement on Phase I will sequester approximately **206T of CO2 per year.**

CO2 sequestration of conservation easement = **206T/year**

Realized embodied carbon of construction = 117T x 11 builds = **1,287T**

Years to Zero = 1,287T / 206T = **6.25 years**

Assuming EC3's realized embodied carbon target of 117T, we estimate the embodied carbon of construction at Phase I, will be offset in **6.25 yrs.**

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Evolution of Current Builds / Future Considerations

Current Builds

* Aero-Aggregate under slab
* ICF frost walls vs warm-form slab on grade

Future Considerations

* gray water systems, rainwater collection
* low-GWP concrete & refrigerant
* full LCA / BEAM / PH Ribbon tool

Lessons Learned – Discussion

1. Property Selection
2. HVAC System: Equipment Sizing & Zoning
3. Heat Pump Water Heaters – for houses w/o basements
4. Site-Salvaged Hardwood Flooring
5. PH & Zero Energy Ready Home Certifications – Inspection Costs vs Incentives

Award-Winning Excellence in Sustainability

Green Builder Media's Green Home of the Year for Prefabricated Construction

Best Sustainable Real Estate Development 2024 Northeast USA

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Questions?

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Architect Buck Moorhead Architect

Developer Manor Falls Associates LLC

Project Team Greg Hale, Peter Malik, Buck Moorhead, Remy Moorhead, Christin Hale, Kaitlin Moody