

Extreme Panel Columba House



Location: 181s 9200 E
Huntsville, UT 84317

Acres: 3.1

Zoned: AV-3

Construction System: Structural Insulated Panels (SIPs)

Purpose: Bank Financing & Planning Commission Review

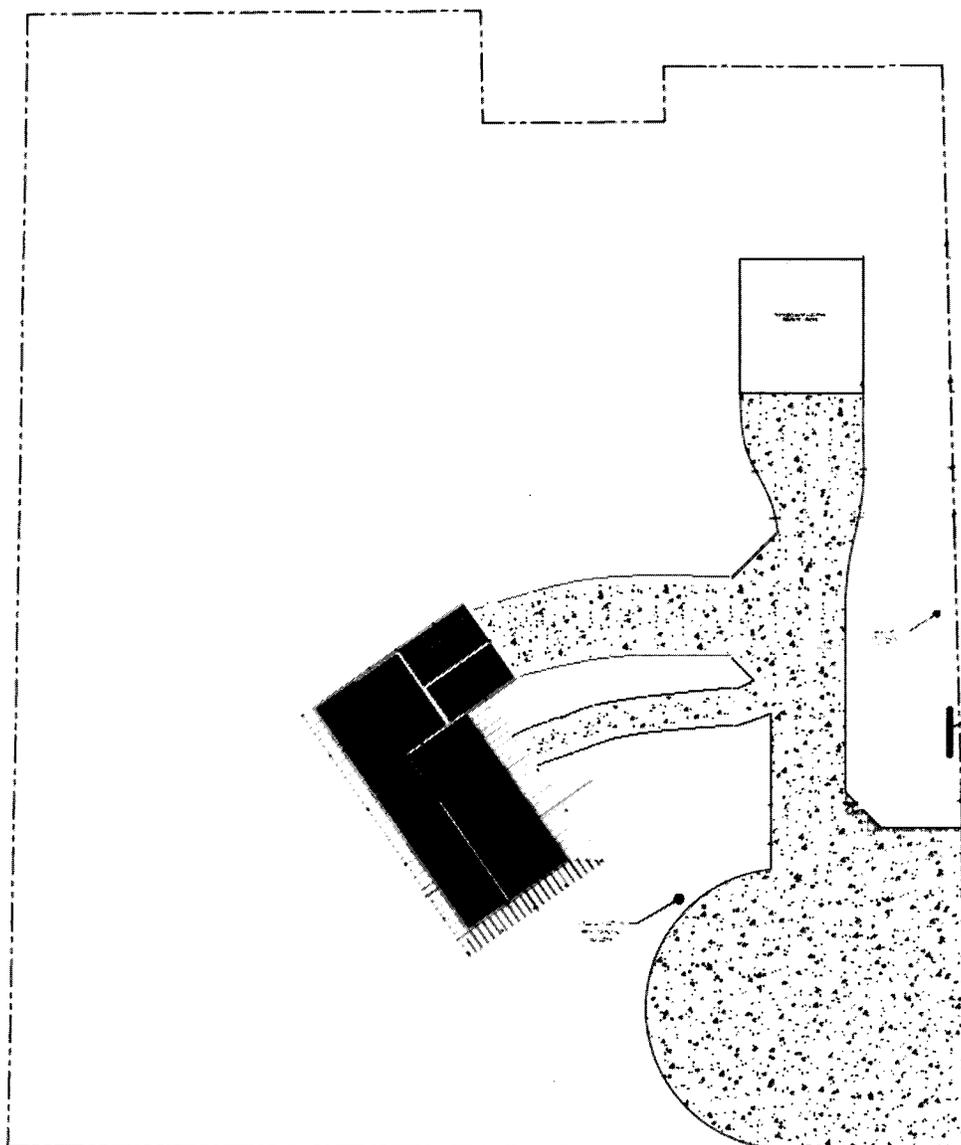
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1. Executive Summary

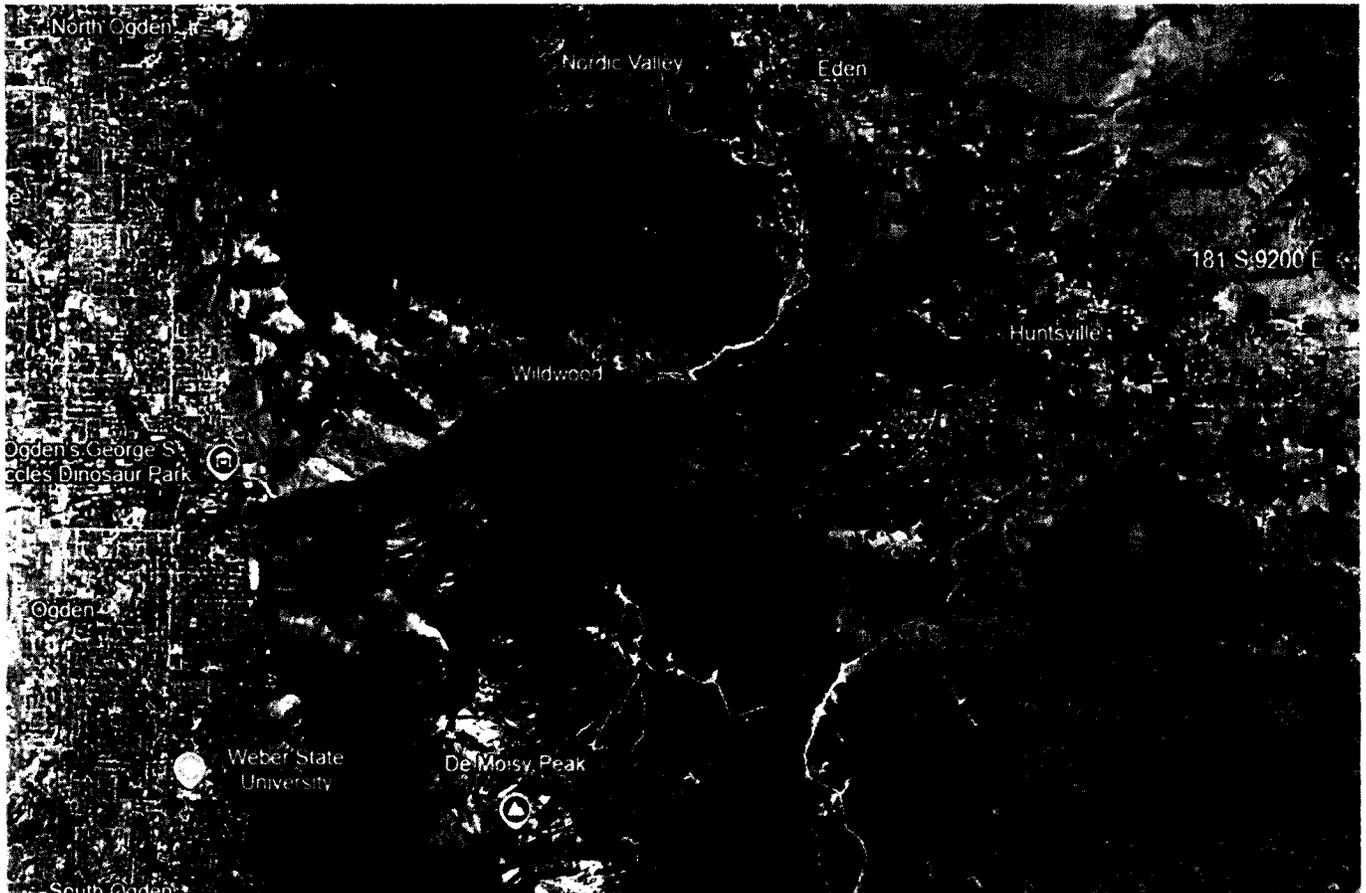
This Builder's Book presents the design intent, construction methodology, building science rationale, and code-compliance strategy for the Extreme Panel Columba House in Ogden Valley, Utah. The project utilizes SIP construction to achieve superior energy efficiency, durability, and constructability in a high-snow, cold-winter mountain climate. It also considers summer heat and passive heat management.

The Columba House is a compact, efficient, single-family residence designed for long-term performance, low operating costs, and resilience. SIP construction reduces thermal bridging, improves airtightness, and shortens construction timelines which are factors for lender risk reduction and jurisdictional approval.



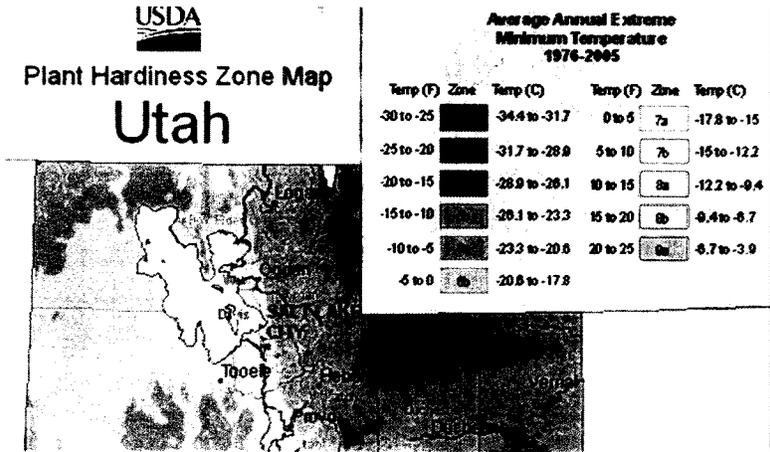
2. Project Overview

- **Project Type:** 3 bedrooms/ 3.5 bath, Single-family residential construction
- **Design:** Columba House (panelized SIP system)
- **Construction System:** Extreme Panel SIP shell
- **Climate Zone:** Climate Zone 6 (Cold / Mountain)
- **Primary Goals:**
 - Energy efficiency is well above code minimum
 - Predictable construction cost and schedule
 - Durable and efficient. Excels under snow load, wind, and freeze/ heat cycles
 - Simplified inspection and quality control
 - Main-level living designed for aging in place, ensuring lifetime accessibility



3. Site & Climate Considerations

Ogden Valley presents unique environmental challenges that inform the Columba House design. Winters are cold with extended sub-freezing periods, snow loads are high, and large diurnal temperature swings occur. The rural site requires consideration of septic and well systems. Located within the Intermountain Seismic Belt near the Wasatch Fault, the area has infrequent but potentially strong earthquakes, and regional wildfire risk is increasing due to drought, forested terrain, and wildland-urban interface conditions.



Seismic Context

Structures must prioritize lateral strength, continuous load paths, and reduced mass. SIP construction is ideal, providing a continuous diaphragm, reduced weight, superior racking strength, and ductility under cyclic lateral loading, often outperforming braced stud walls. SIPs are approved for all seismic zones in the International Residential Code.

Wildfire Context

Wildfire threats are driven primarily by embers and radiant heat. The tight SIP envelope reduces ember intrusion and flame spread compared with conventional cavity walls. Assemblies that minimize cavities, air leakage, and combustible detailing improve resilience in wildland-urban interface (WUI) areas.

Design Responses

- High-R SIP walls and roof for continuous insulation and minimal thermal bridging
- Simplified structural load paths using large-format SIP panels to enhance seismic resilience
- Airtight envelope to limit condensation, smoke intrusion, and ember entry
- Roof assemblies engineered for local snow loads and seismic forces
- Radiant floor heating is integrated for efficient cold-climate performance
- Non-combustible exterior finishes (metal roofing, fiber-cement, or concrete siding)

4. SIP Construction System Overview

4.1 What Is a Structural Insulated Panel (SIP)

A **Structural Insulated Panel (SIP)** is a high-performance building component consisting of an insulating foam core permanently laminated between two structural wood skins (typically OSB). SIPs function as structure, insulation, and air barrier in a single integrated assembly.

Unlike conventional stick-framed construction, where structural framing, insulation, and air-sealing are installed as separate site-built components, Structural Insulated Panels integrate all three functions into a single engineered assembly.

SIPs are manufactured in a controlled factory environment, allowing for precise tolerances, consistent material quality, and repeatable performance across the entire building envelope. This integrated approach significantly reduces on-site material waste, as panels are cut to design specifications and excess offcuts are minimized compared to traditional framing. The result is a more durable, energy-efficient, and predictable building system with less construction waste and reduced environmental impact.

4.2 How SIPs Are Constructed

- Two exterior-grade **borate treated OSB** panels act as structural skins
- A rigid expanded polystyrene (EPS) foam core provides continuous insulation
- Panels are bonded under controlled factory conditions
- Electrical chases are pre-routed within the foam core
- Window and door openings are precision-cut before delivery
- Once cured, each panel acts like a structural diaphragm, similar in principle to an I-beam, providing exceptional strength and stiffness.



4.3 Borate Treated OSB – Durability & Safety Benefits

The OSB skins used in Extreme Panel SIPs are treated with borate compounds (commonly referred to as borax treatment), which provide multiple long-term durability advantages:

- Insect resistance: Borate treatment deters termites, carpenter ants, and wood-boring insects
- Fungal resistance: Helps inhibit mold and decay organisms under elevated moisture conditions
- Fire performance support: Borates contribute to improved fire resistance characteristics when combined with gypsum interior finishes
- Long-term protection: Treatment remains effective for the life of the panel and does not off-gas or leach under normal service conditions

This treatment is particularly beneficial in rural and mountain environments where pest control access may be limited, and long-term durability is a priority.

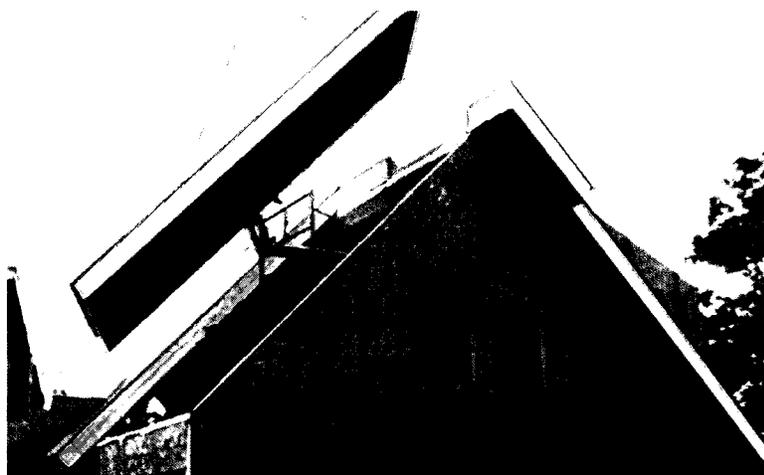
4.4 On-Site SIP Panel Assembly & Installation Process

Structural Insulated Panels for the Columba House are assembled on site using a crane-assisted installation process that ensures speed, precision, and structural integrity.

Panels are delivered to the site pre-cut and labeled according to engineered shop drawings. A crane is used to lift each panel into position, minimizing manual handling and reducing the risk of damage or misalignment.

Adjacent SIP panels are joined together using engineered splines, which may consist of insulated splines, dimensional lumber, or structural members- depending on load requirements. All joints are sealed with liquid flashing or acrylic tape, creating a continuous air and thermal barrier at every connection.

Panels are mechanically fastened using structural screws and fasteners at prescribed intervals, tying the system together into a rigid, monolithic assembly. Once secured, each wall and roof plane acts as a continuous diaphragm, providing exceptional strength, stiffness, and load transfer.



This crane-set, panelized approach allows the structure to be erected and dried in within days rather than weeks and significantly reduces on-site construction waste. Faster enclosure reduces weather exposure, improves construction quality, and significantly lowers risk.

5. Building Science Strategy

5.1 Insulation Value & Thermal Performance

SIP assemblies provide **continuous insulation** across the entire building envelope, virtually eliminating the thermal bridging inherent in conventional stud framing.

Typical effective R-values for Extreme Panel SIP assemblies used in this project:

- Exterior Wall Panels: 8 ¼ in. thick SIP walls with a whole-wall performance of approximately **R-29**
- Roof Panels: 12 ¼ in. thick SIP roof panels with a whole-assembly performance of approximately **R-49**

These R-values represent *effective* thermal performance, resulting in very minimal thermal bridging inherent in SIP construction. By comparison, a conventional 2x6 wall labeled as R-21 typically performs closer to R-13 to R-15 whole-wall once studs, plates, and penetrations are accounted for.

This higher *effective* R-value significantly reduces energy loss and ensures efficient heating and cooling.

5.2 Airtightness & Energy Control

SIPs naturally form a continuous air control layer. When properly sealed at panel joints:

- Air leakage is dramatically reduced
- Uncontrolled heat loss is minimized
- Drafts and cold spots are virtually eliminated

Lower air infiltration directly translates to:

- Reduced heating energy demand
- Smaller mechanical system sizing
- Improved occupant comfort

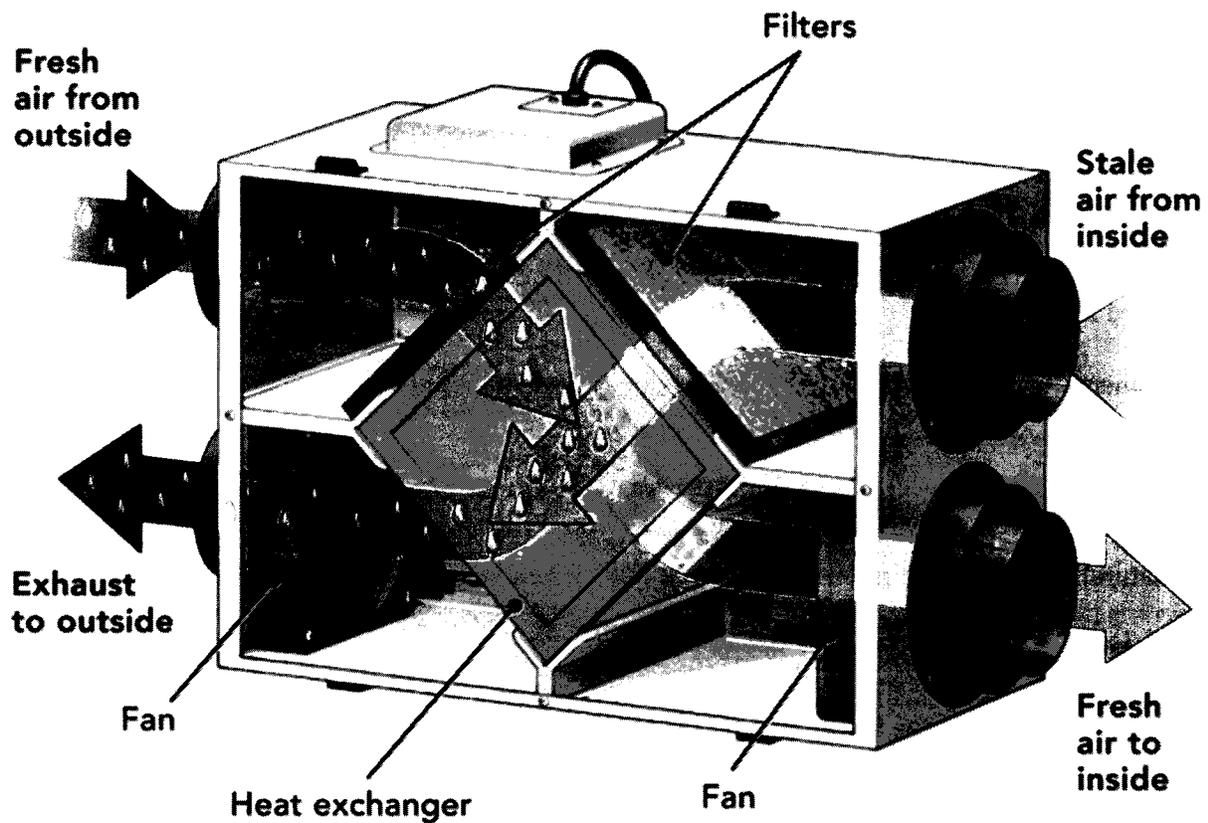
Code required blower door testing will be performed once the building envelope is fully enclosed to quantify airtightness. This test pressurizes and depressurizes the home to measure air leakage through gaps in the envelope. With the continuous SIP panels, careful sealing, and precision detailing, the Columba House is expected to achieve 1.0 or less air changes per hour at 50 Pa (ACH50). Utah code requires 3 ACH50. Achieving this confirms superior envelope performance, optimizes energy efficiency, enhances thermal comfort, and supports long-term durability and moisture control.

5.3 Moisture & Condensation Control

Because SIPs place insulation outside of the structural skins:

- Interior surfaces remain warmer in winter
- Condensation risk within wall assemblies is significantly reduced
- Moisture-driven degradation is minimized

Balanced mechanical ventilation (HRV or ERV) ensures healthy indoor air quality while maintaining envelope integrity.



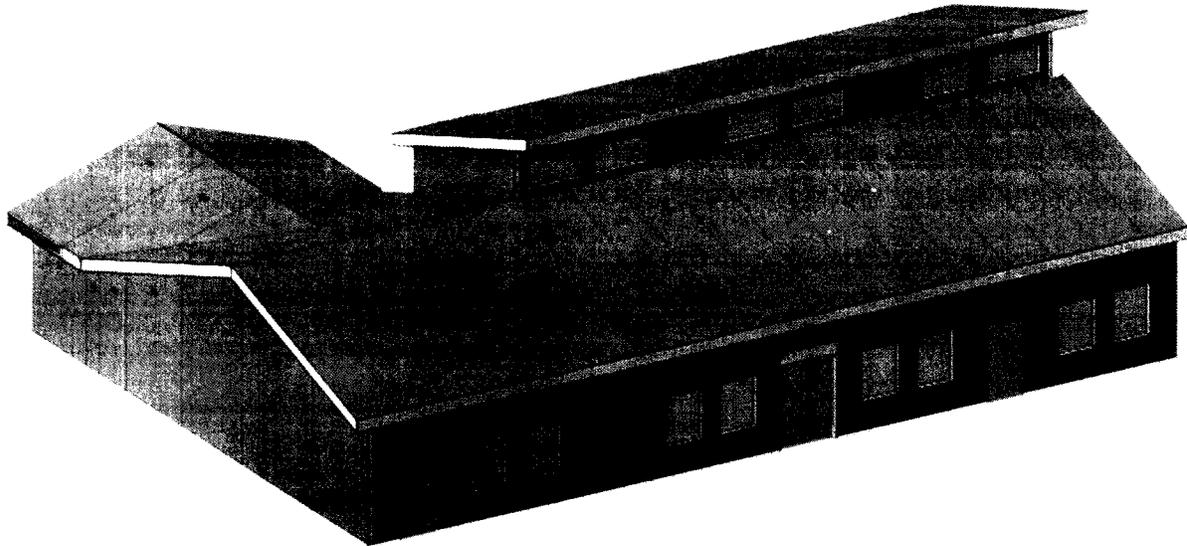
5.4 Energy Efficiency Benefits

- Heating energy demand is substantially lower than code-minimum homes
- More predictable monthly energy costs
- Reduced exposure to future energy price increases
- Improved long-term affordability for occupants

6. Structural Design & Engineering

SIPs act as engineered structural components, not just insulated walls. Roof SIPs for this project are engineered specifically for snow-load requirements, ensuring long-term structural reliability.

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6.1 Structural Strength

- Panels function as load-bearing elements
- High strength-to-weight ratio
- Excellent resistance to racking and deflection

6.2 Load Path Clarity

- Roof loads transfer directly through SIP walls to the foundation
- Simplified, continuous load paths reduce structural weak points
- Fewer framing connections compared to conventional construction

6.3 Seismic & Wind Performance

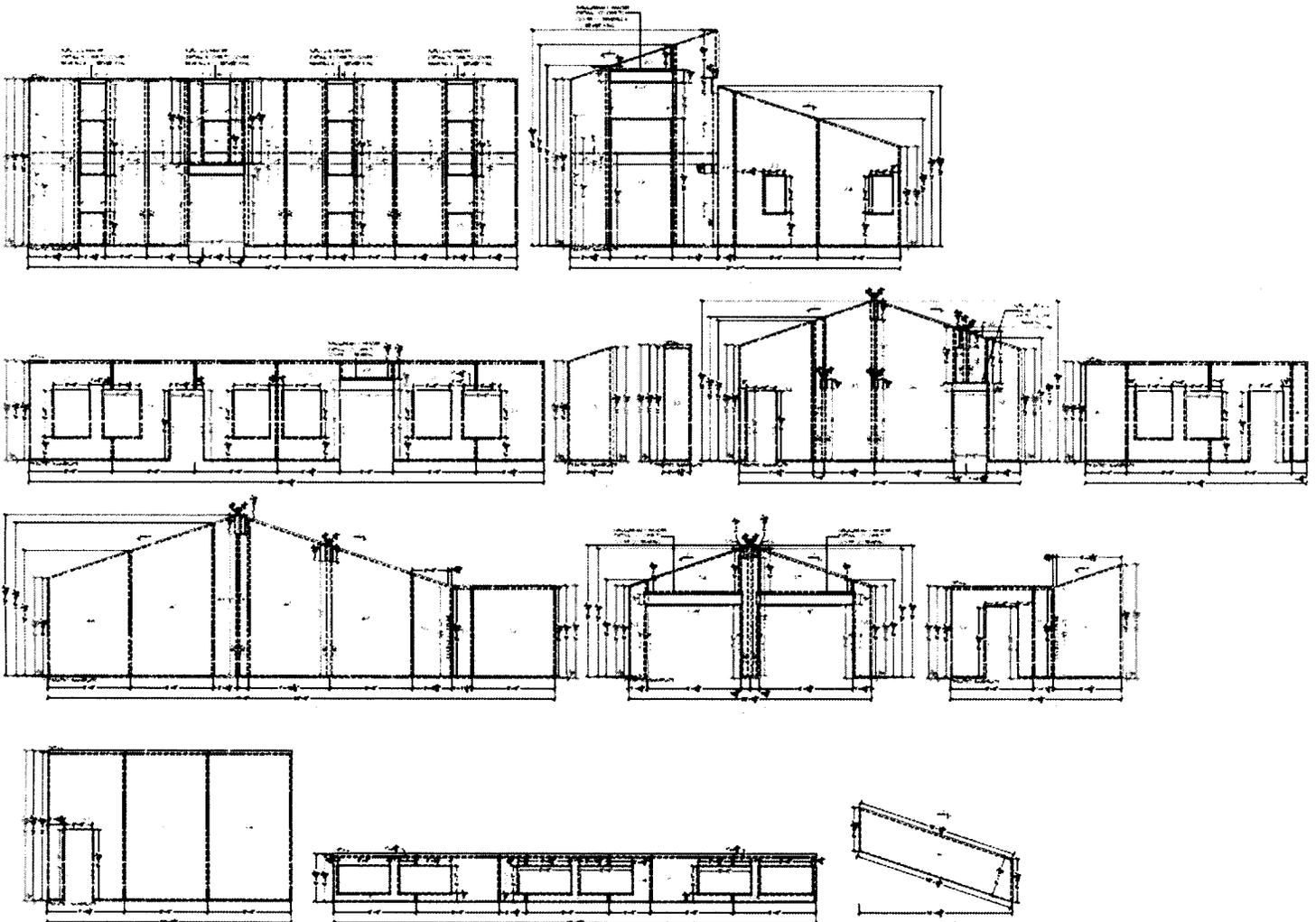
- Continuous panel diaphragms improve lateral stability
- Stronger connections between structural elements
- Proven performance in high-wind and seismic regions

6.4 Large Panel Size & Reduced Failure Points

- Lower risk of long-term movement or settling issues
- Fewer joints and seams, reducing air leakage pathways and reliance on sealants over time
- Improved structural continuity across walls and roof planes
- Maximum panel size of up to 8 ft by 24 ft, minimizing seams

6.5 Hold-Downs, Fasteners & Load Transfer Strategy

- Panels are joined using engineered splines, structural adhesive, and structural screws to create a continuous diaphragm.
- Wall panels are anchored to the foundation with embedded bolts or hold-down hardware at ends, corners, and shear-critical locations.
- Screw type, size, and spacing are determined per engineered drawings to resist uplift, overturning, and lateral loads from wind and seismic forces.



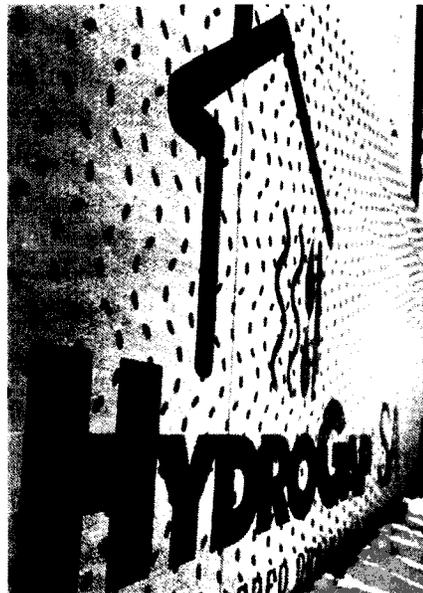
7. SIP Shell Scope & Building Envelope Components

7.1 Extreme Panel Columba House SIP Shell

The Extreme Panel Columba House SIP kit provides the primary structural and thermal enclosure of the home.

SIP Shell Includes:

- Exterior load-bearing SIP wall panels
- Roof SIP panels engineered for snow loads
- Gable and end-wall panels
- Factory-cut window and door openings
- Pre-routed electrical chases
- Insulated Headers

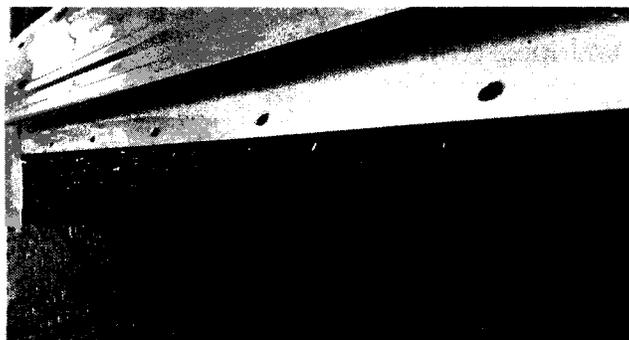


7.2 Weather-Resistant Barrier

The exterior of the SIP shell is protected with a weather-resistant barrier (WRB) to manage moisture and promote wall assembly drying. For this project, HydroGap® SA from Benjamin Obdyke is specified. This self-adhered WRB provides continuous drainage, protects the SIP panels from bulk water intrusion during construction and long-term service, and is compatible with the planned siding and cladding assemblies. It also allows for appropriate vapor permeability, helping to prevent moisture buildup within the SIP wall assembly.

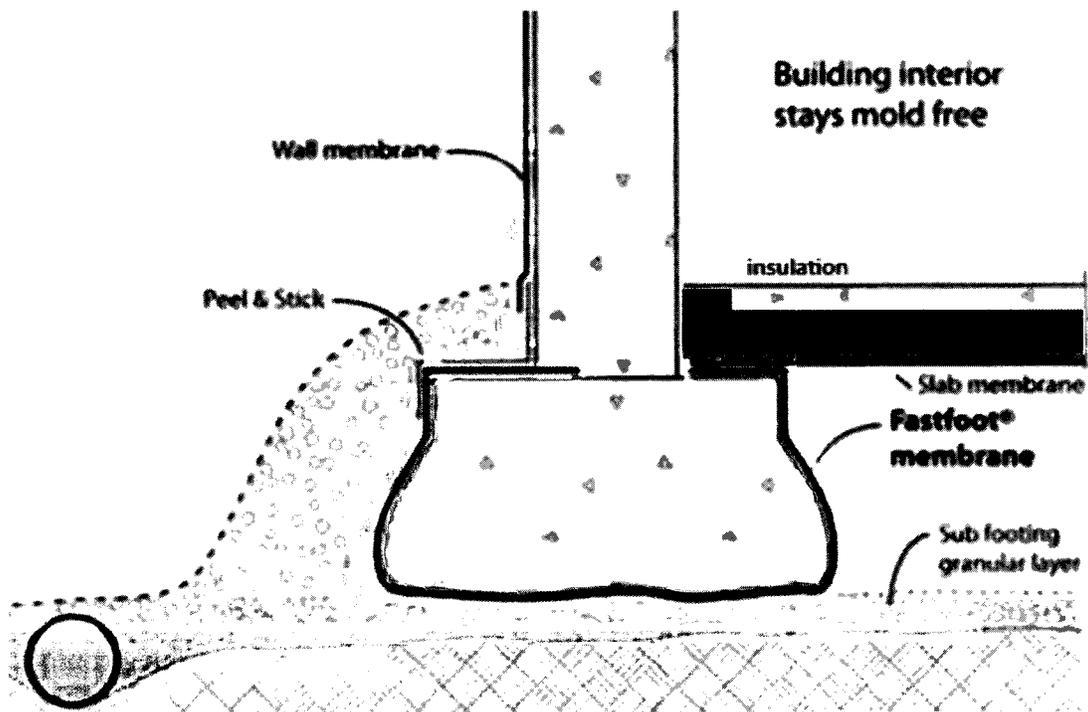
7.3 Window & Door Sealing

All window and door openings will be sealed using a combination of fluid-applied flashing and acrylic tape to ensure a continuous air and moisture barrier. Fluid-applied flashing conforms to irregular surfaces, bridging small gaps, while acrylic tape provides a durable, high-adhesion seal over joints and panel edges. This integrated approach enhances water resistance, minimizes air leakage, and maintains the high-performance envelope integrity of the SIP construction.



8. Foundation

The foundation and slab system provides a durable, code-compliant base. The house is raised one step above finished grade to improve drainage and reduce snow and moisture exposure at wall bases. Constructed as an insulated slab-on-grade system per City and site-specific soil requirements, continuous slab-edge insulation minimizes thermal bridging, and integrated radiant floor tubing delivers efficient, even heating. Interior load-bearing elements rest on independent footings that transfer concentrated loads directly to the soil. Seismic-rated hold-downs, anchor bolts, and a sealed sill plate create a continuous load path from the SIP walls, resisting uplift and lateral forces. Moisture management includes capillary breaks, sub-slab and footer vapor protection, and drainage detailing.



The wrap-around farm porch features a sloped stained concrete slab, while interior floors are polished concrete, leveraging thermal mass to enhance radiant heating efficiency, durability, and long-term performance.

9 Roof Assembly

9.1 Metal Roofing System

The roof assembly is designed for durability, snow shedding, and long service life.

- Standing seam metal roof, with hidden fasteners (final profile and color TBD)
- **Sharkskin® SA** self-adhered underlayment, or similar
- May use **AeroNet®** ventilated roof underlayment (Benjamin Obdyke)

This assembly:

- Provides secondary water protection
- Promotes drainage and drying beneath metal roofing
- Reduces condensation risk under snow cover



10. Wall Cladding & Exterior Finishes

10.1 Primary Siding System

- Metal or fiber-cement board-and-batten siding (final profile and color TBD)
- Installed over a drained and ventilated rainscreen
- **HydroGap® SA** self-adhered drainage membrane (Benjamin Obdyke)

This approach:

- Actively manages bulk water
- Promotes drying of wall assemblies
- Enhances long-term durability of SIP walls

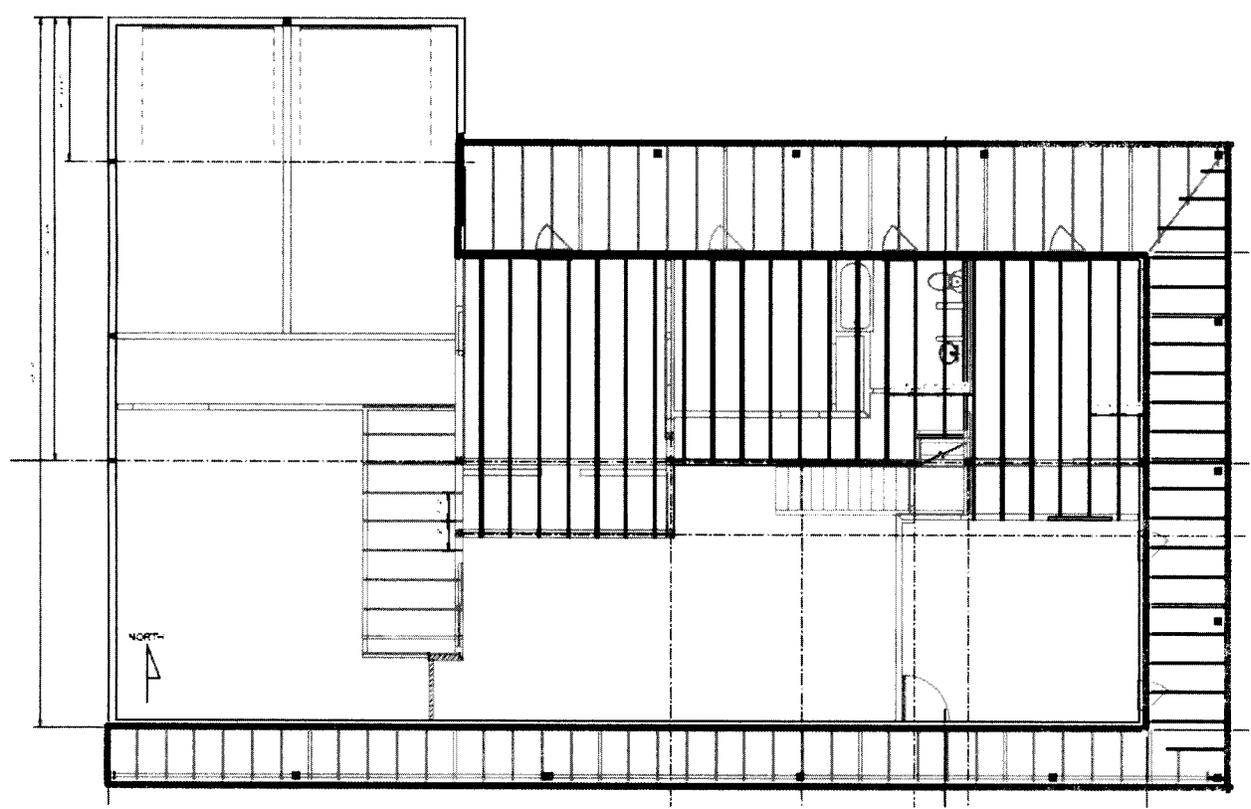
10.2 Accent Materials

- May use manufactured stone veneer (non-structural) (final profile and color TBD)
- **Evolve Stone®** (lightweight, adhered veneer)

Stone veneer will be detailed to maintain continuous drainage and drying behind the cladding.

10.3 Farm Porch

The Columba House includes a wrap around, farm-style covered porch designed to enhance durability, occupant comfort, and architectural character. The porch roof provides passive protection from snow, rain, and summer sun, reducing weather exposure at primary entry points and improving long-term performance of doors and exterior finishes.



The porch design works in conjunction with a rainscreen wall assembly, helping to keep exterior wall surfaces drier near grade. By shedding bulk water away from the foundation and allowing drainage and drying behind the cladding, the rainscreen reduces moisture exposure at the base of the walls, improves durability of siding materials, and extends the service life of the building envelope.

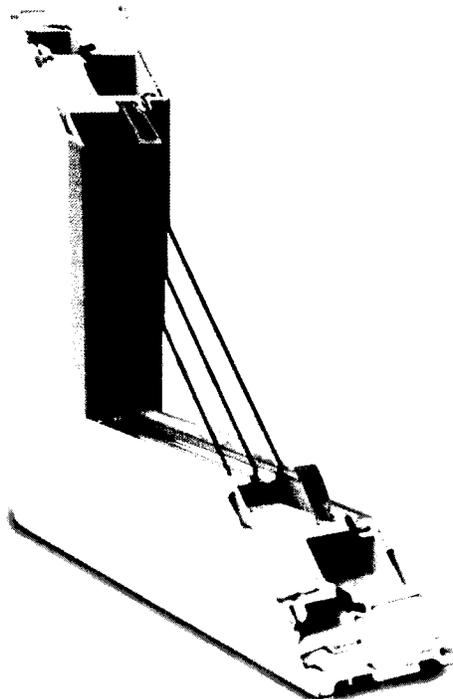
11. Windows & Doors

11.1 Window System and Slide Door

- **Enerlux** triple-glazed windows (final profile, type and color TBD)
- High-performance frames suitable for cold-climate installation
- Optimized glass packages for passive solar gain and winter heat retention

Proper glazing selection:

- Higher solar heat gain coefficient (SHGC) on south-facing elevations
- Lower SHGC on east, west, and north elevations to control overheating
- Improved interior surface temperatures to reduce condensation risk



11.2 Exterior Doors

- Door manufacturer to be selected (final profile, type and color TBD)
- Doors will meet or exceed energy performance requirements appropriate for Climate Zone 6

12. Mechanical, Electrical & Plumbing

12.1 Heating & Cooling

- Radiant floor heating system integrated into the slab and possibly 2nd floor wall.
- Air to water Heat pump, future update to include vacuum tube solar heater (final equipment TBD)
- Ductless mini-split system for shoulder-season cooling and heating by zone

Radiant Floor Heating Benefits:

- Even, low-temperature heat distribution ideal for cold climates
- Reduced energy consumption compared to forced-air systems
- Improved occupant comfort with minimal air movement
- Lower peak heating loads due to reduced heat loss

12.2 Ventilation

- Balanced mechanical ventilation system (HRV or ERV)
- Required due to airtight SIP envelope
- Calculated make up air for bath and kitchen exhaust
- Fresh air return to priority areas

12.3 Electrical

- Pre-planned chases within SIPs
- Reduced penetrations through the building envelope

12.4 Plumbing

- Interior plumbing runs to avoid freeze risk
- Manifold-style distribution for efficiency and serviceability
- Recirculation pump to minimize wasted hot water
- May pre plumb gas to kitchen and utility rooms

Septic System Overview:

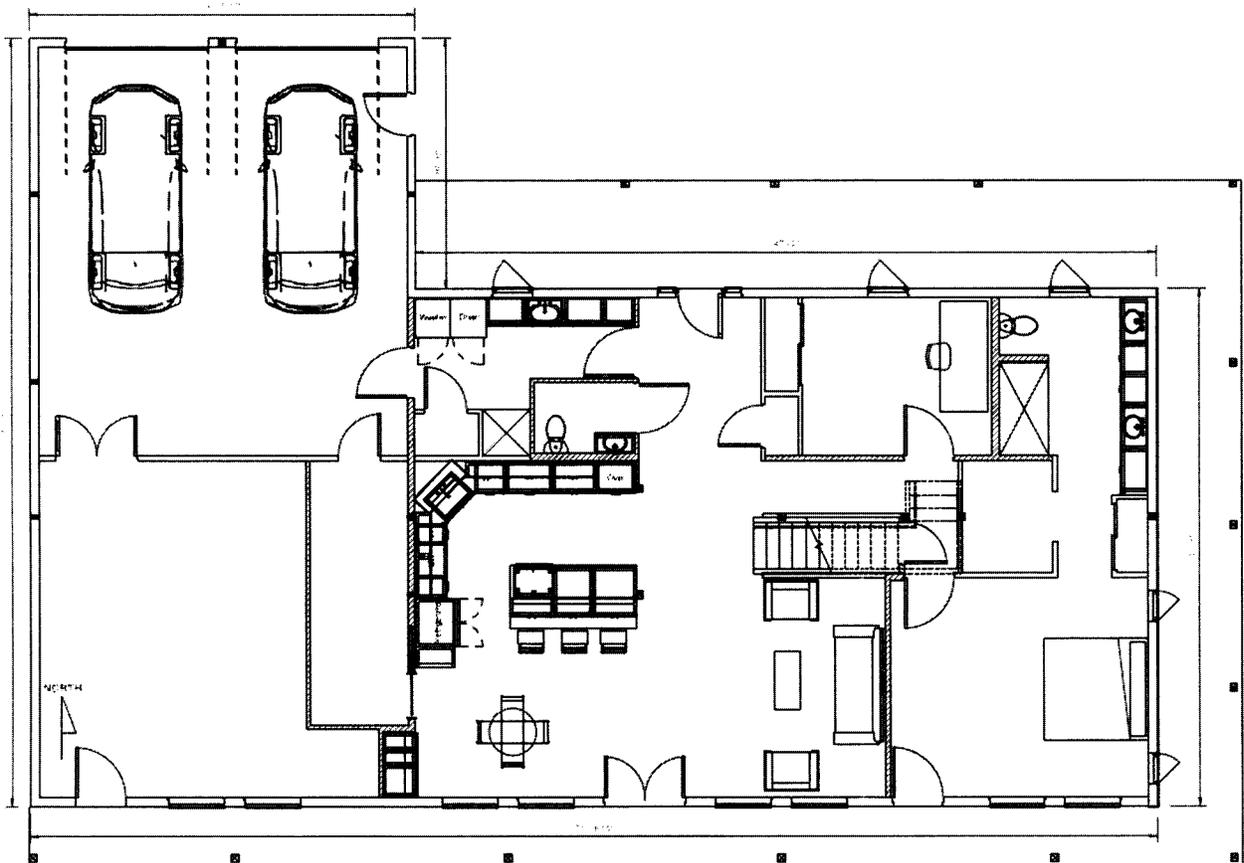
- Approved for conventional septic system by expired health department septic permit
- Engineered septic system sized for single-family residential use 3 bedroom house
- Designed by a licensed professional based on percolation rates and soil tests completed by the previous homeowner

13. Site Design and Interior Layout

The layout emphasizes main level living to support aging in place, while providing flexible, high-performance spaces for modern living. The house is oriented toward the southwest (235°), facing Mt. Ogden, optimizing daylight, passive solar gain, and views. The house will share the driveway with the existing barn, providing convenient access while minimizing site disturbance.

Key Spaces Include:

- Three bedrooms, each with a private ensuite bathroom, and a primary suite with walk-in closet
- Dedicated office space
- Mechanical and storage rooms, mud room with laundry and garage entry, and pantry accessible from both kitchen and garage.
- Main-level half bath for guest use
- Open floor plan connecting kitchen, dining, and living areas, ideal for entertaining and supporting universal design principles
- Dining area includes an integrated coffee nook/wet bar; kitchen features a five-piece layout with induction cooktop and hood vent



14. Conclusion

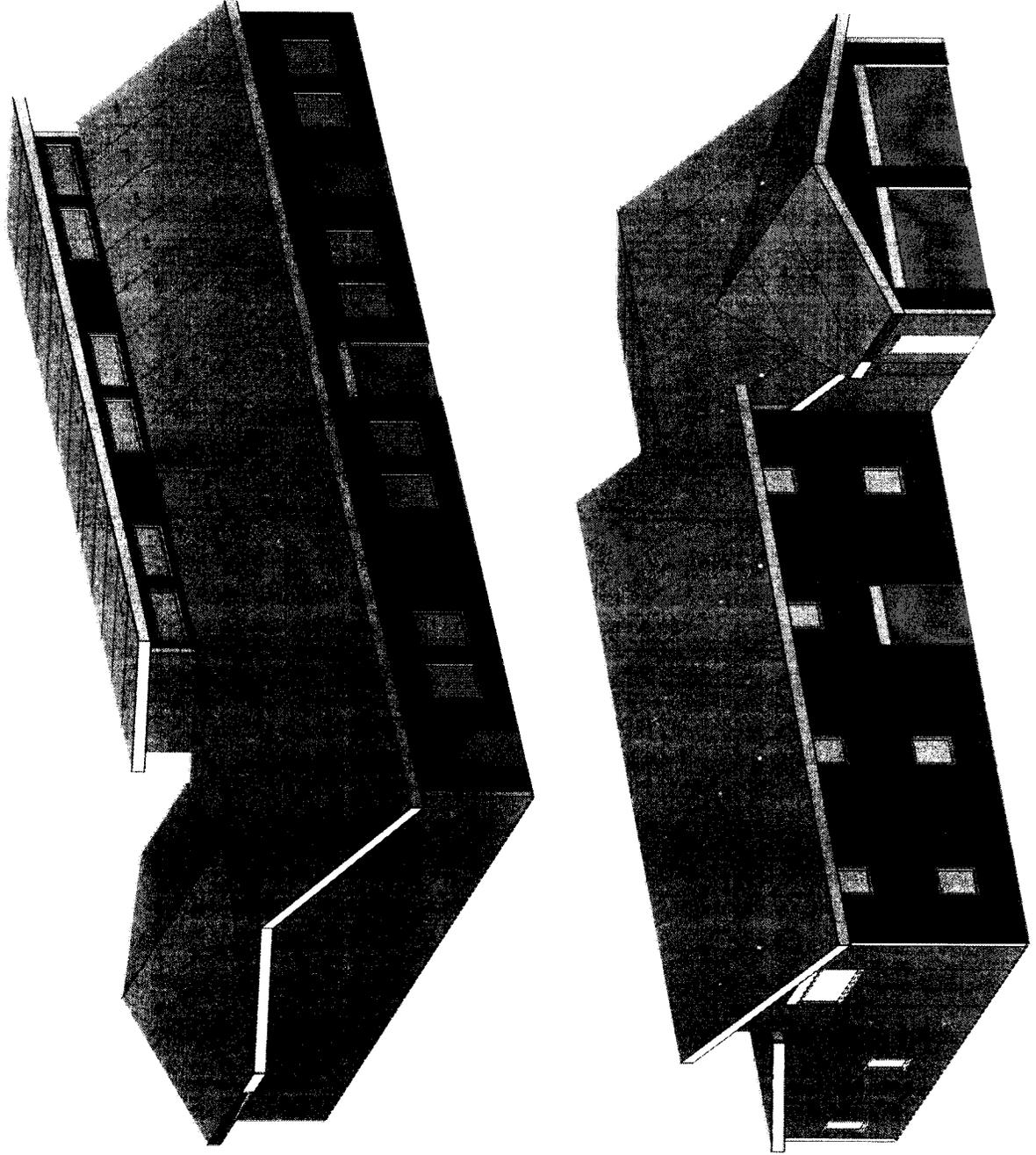
The Extreme Panel Columba House represents a durable, energy-efficient, and high-performance residential home. Its high-performance SIP envelope, continuous insulation, borate-treated OSB, and triple-glazed windows provide long-term durability while reducing heating demand and maximizing efficiency. Large-format panels and factory-controlled construction ensure predictable outcomes and rapid dry-in, minimizing weather exposure and construction risk.

Construction is coordinated through engineered shop drawings, careful insulated foundation layout, and crane-assisted panel installation, followed by timely interior and exterior completion. Seismic-rated hold-downs, strategies for controlling moisture, high snow-load roofs, radiant floor heating, tight envelope design, and wildfire-resistant materials enhance climate-appropriate performance and resilience.

By building smart and building better, the Columba House demonstrates sustainable construction with less waste, optimized resource use, lower long-term costs, and high efficiency. The design combines superior insulation, airtightness, and durability to create a resilient home built to perform well today and for decades. Thoughtful material selection, energy-smart systems, and attention to lifecycle performance further enhance sustainability, comfort, and long-term value, making this home a model for efficient, responsible building.

This Builder's Book demonstrates that the home is not only code-compliant, but intentionally engineered for long-term performance, occupant comfort, and lender confidence.

COLUMBA



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 PHONE: 620-977-2225
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 WWW.EXTREMEPANEL.COM

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3D VIEWS

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

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ARCHITECT:	[Architect Name]
ENGINEER:	[Engineer Name]
DATE:	1/25/23

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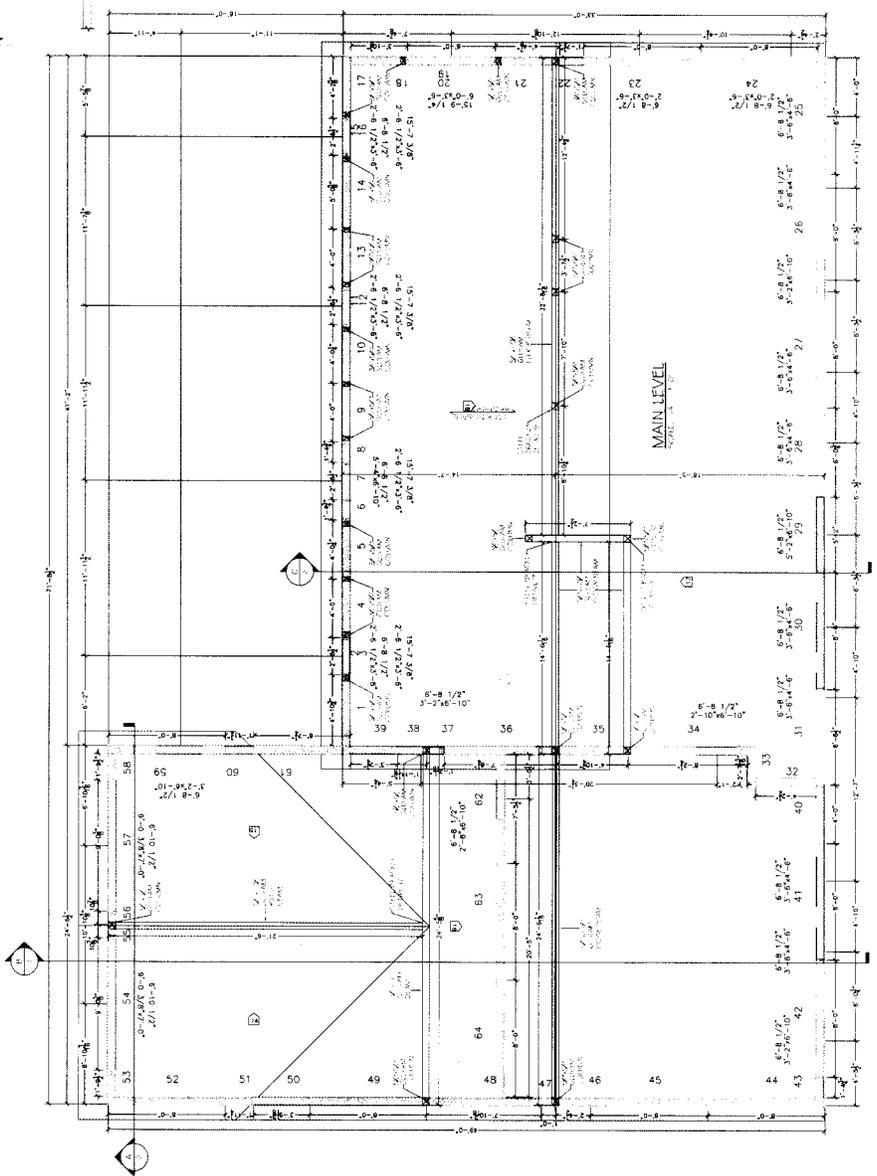
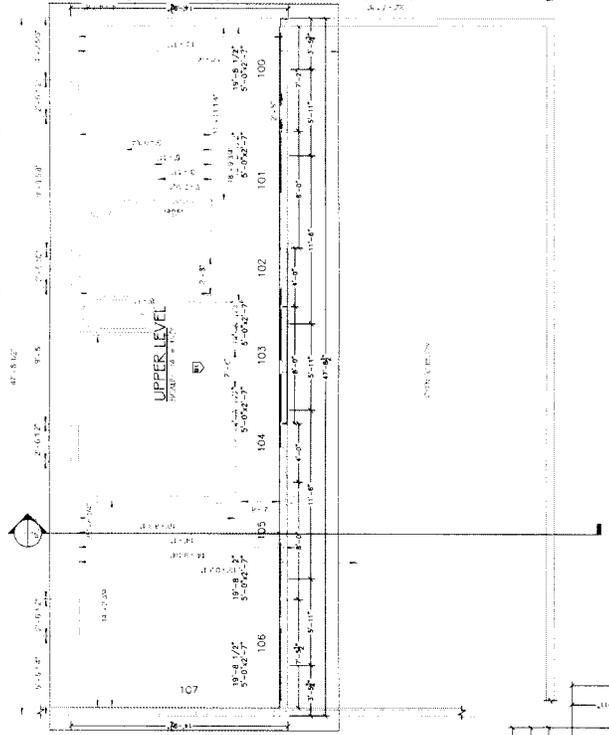
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PANEL LAYOUT
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2 / 6



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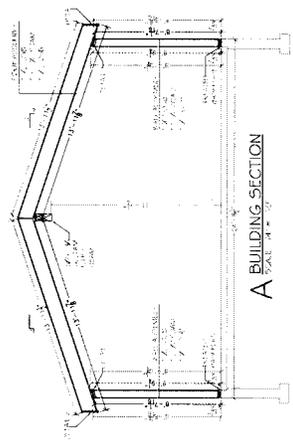
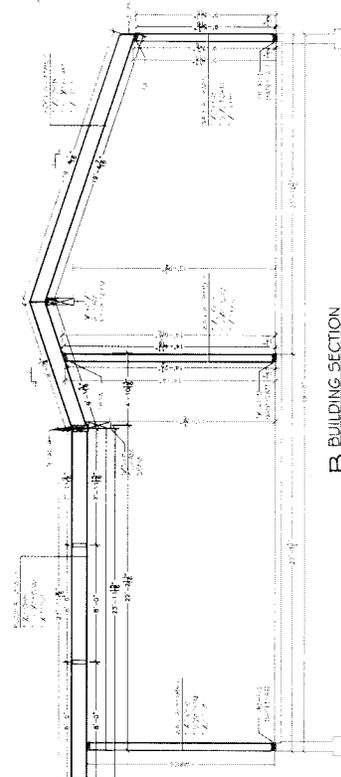
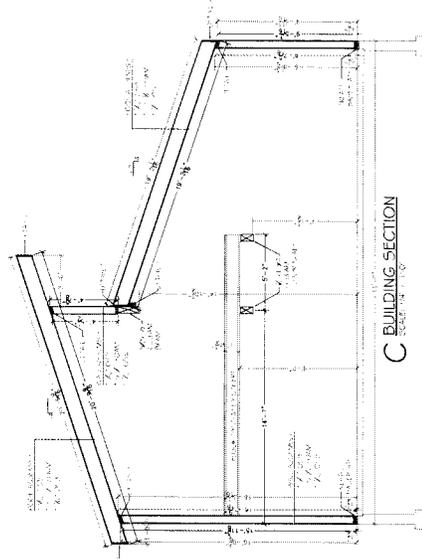
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BUILDING SECTIONS

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

3 / 6



EXTREME PANEL

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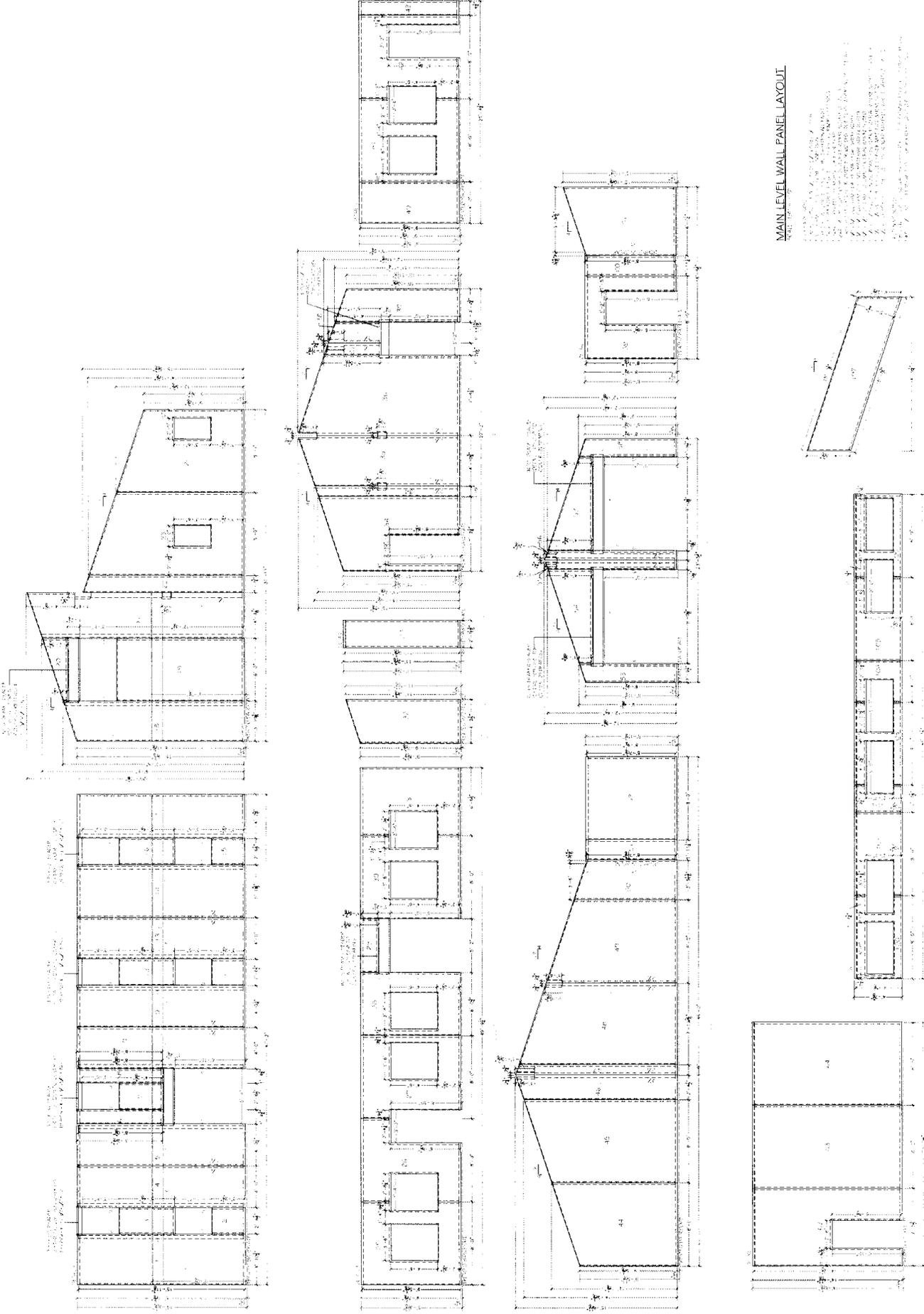
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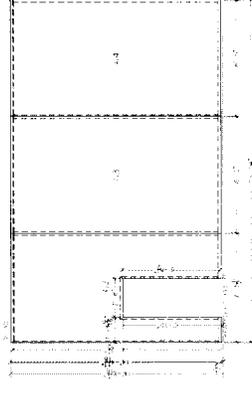
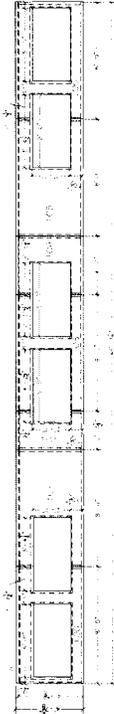
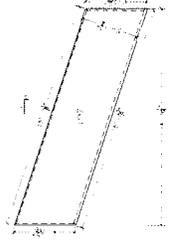
WALL PANEL DRAWINGS

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

4 / 6



MAIN LEVEL WALL PANEL LAYOUT



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ROOF PANEL
 DRAWINGS

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

5 / 6

ROOF PANEL NOTES

1. SEE SHEET 2 FOR PANEL 1 & 2. SEE SHEET 3 FOR PANEL 3.
2. SEE SHEET 4 FOR PANEL 4 & 5. SEE SHEET 5 FOR PANEL 6.
3. SEE SHEET 6 FOR PANEL 7 & 8. SEE SHEET 7 FOR PANEL 9.
4. SEE SHEET 8 FOR PANEL 10.
5. SEE SHEET 9 FOR PANEL 11 & 12. SEE SHEET 10 FOR PANEL 13.
6. SEE SHEET 11 FOR PANEL 14 & 15. SEE SHEET 12 FOR PANEL 16.
7. SEE SHEET 13 FOR PANEL 17 & 18. SEE SHEET 14 FOR PANEL 19.
8. SEE SHEET 15 FOR PANEL 20 & 21. SEE SHEET 16 FOR PANEL 22.
9. SEE SHEET 17 FOR PANEL 23 & 24. SEE SHEET 18 FOR PANEL 25.
10. SEE SHEET 19 FOR PANEL 26 & 27. SEE SHEET 20 FOR PANEL 28.
11. SEE SHEET 21 FOR PANEL 29 & 30. SEE SHEET 22 FOR PANEL 31.
12. SEE SHEET 23 FOR PANEL 32 & 33. SEE SHEET 24 FOR PANEL 34.
13. SEE SHEET 25 FOR PANEL 35 & 36. SEE SHEET 26 FOR PANEL 37.
14. SEE SHEET 27 FOR PANEL 38 & 39. SEE SHEET 28 FOR PANEL 40.
15. SEE SHEET 29 FOR PANEL 41 & 42. SEE SHEET 30 FOR PANEL 43.
16. SEE SHEET 31 FOR PANEL 44 & 45. SEE SHEET 32 FOR PANEL 46.
17. SEE SHEET 33 FOR PANEL 47 & 48. SEE SHEET 34 FOR PANEL 49.
18. SEE SHEET 35 FOR PANEL 50 & 51. SEE SHEET 36 FOR PANEL 52.
19. SEE SHEET 37 FOR PANEL 53 & 54. SEE SHEET 38 FOR PANEL 55.
20. SEE SHEET 39 FOR PANEL 56 & 57. SEE SHEET 40 FOR PANEL 58.
21. SEE SHEET 41 FOR PANEL 59 & 60. SEE SHEET 42 FOR PANEL 61.
22. SEE SHEET 43 FOR PANEL 62 & 63. SEE SHEET 44 FOR PANEL 64.
23. SEE SHEET 45 FOR PANEL 65 & 66. SEE SHEET 46 FOR PANEL 67.
24. SEE SHEET 47 FOR PANEL 68 & 69. SEE SHEET 48 FOR PANEL 70.
25. SEE SHEET 49 FOR PANEL 71 & 72. SEE SHEET 50 FOR PANEL 73.
26. SEE SHEET 51 FOR PANEL 74 & 75. SEE SHEET 52 FOR PANEL 76.
27. SEE SHEET 53 FOR PANEL 77 & 78. SEE SHEET 54 FOR PANEL 79.
28. SEE SHEET 55 FOR PANEL 80 & 81. SEE SHEET 56 FOR PANEL 82.
29. SEE SHEET 57 FOR PANEL 83 & 84. SEE SHEET 58 FOR PANEL 85.
30. SEE SHEET 59 FOR PANEL 86 & 87. SEE SHEET 60 FOR PANEL 88.
31. SEE SHEET 61 FOR PANEL 89 & 90. SEE SHEET 62 FOR PANEL 91.
32. SEE SHEET 63 FOR PANEL 92 & 93. SEE SHEET 64 FOR PANEL 94.
33. SEE SHEET 65 FOR PANEL 95 & 96. SEE SHEET 66 FOR PANEL 97.
34. SEE SHEET 67 FOR PANEL 98 & 99. SEE SHEET 68 FOR PANEL 100.

