The First Optimum Performance Home®

exterior and interior infrastructure part XIX

Architectural Illustration By Ronald Devesa

Gary Reber

synopsis

- SIPs and ICFs are superior structural components that provide resistance to earthquakes and hurricanes while being more fire-, mold- and water vapor diffusion-resistant and providing high levels of insulation, and in either case there is no air infiltration or thermal bridging.
- ISHN ThermaSAVE SIPs, unlike virtually all others, use fiber cement panels instead of sheets of OSB for both the interior and exterior portion of the panel with rigid EPS insulation foam sandwiched in between.
- What one needs to realize when deciding on a SIP manufacturer is that you will be dependent on that manufacturer to provide accurate working drawings and panel-cutting instructions.
- Installed on top of the Cosella-Dörken DELTA-FOXX and Battens Plus' BattenUP plastic battens was Trimline Building Products black composite Distinction Slate, which exhibits the rich, deep textured appearance of natural slate, with deep chiseled edges.
- Another major effort was the installation of the VELUX skylights, Wasco pyramid skylight, and Pella Windows and Doors.

Introduction

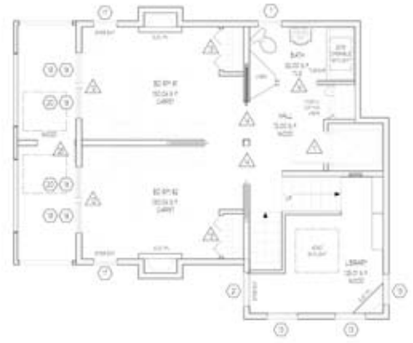
This is the nineteenth article in the series, documenting the design and construction of the first Optimum Performance Home®. The home has been under construction now for two years, after more than five years of design and plan development work. Construction financing is being provided by San Francisco-based New Resource Bank, a community bank chartered to fund "green" projects.

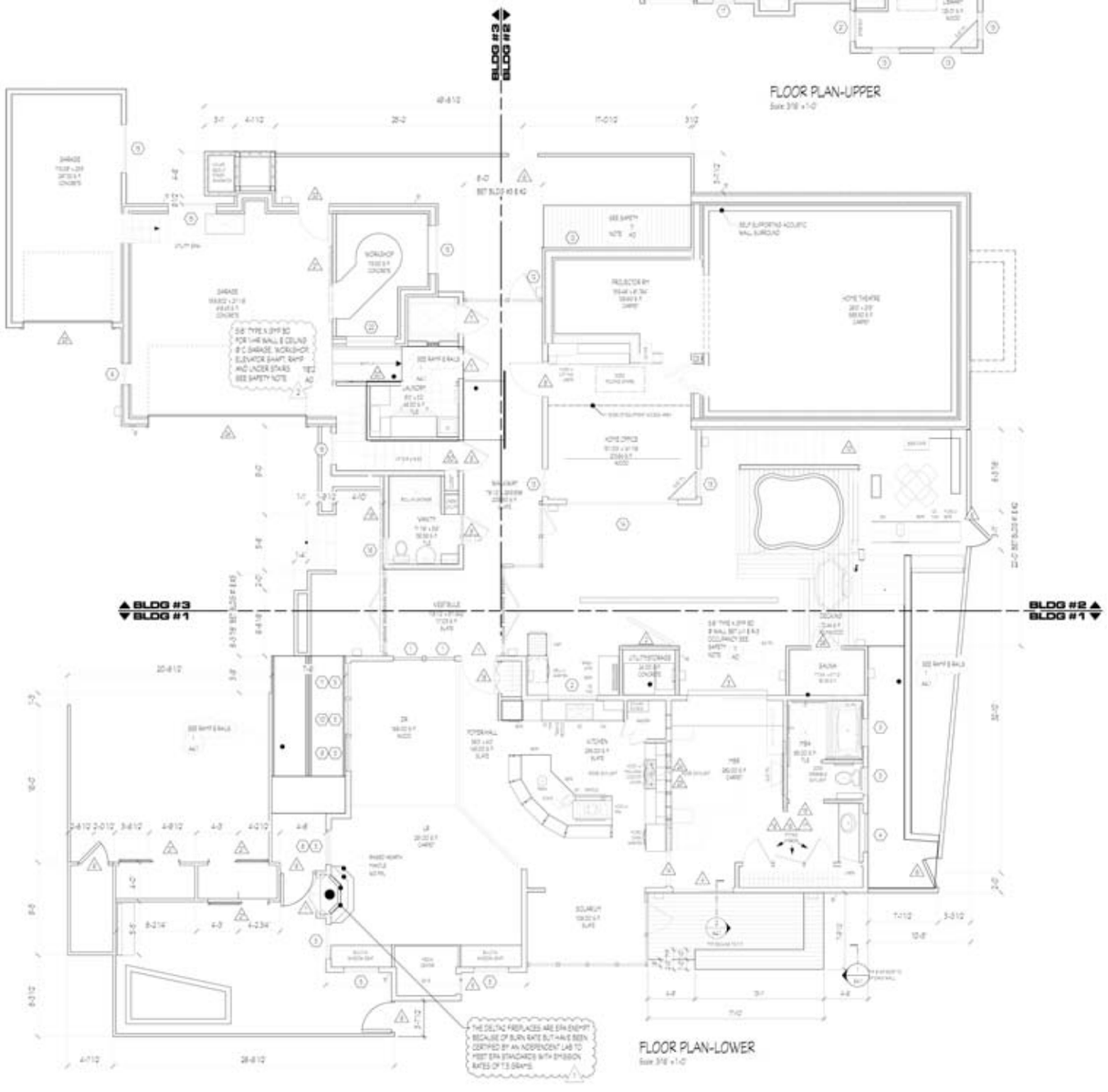
The project was selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, the nation's most challenging green build certification initiative, and the home is expected to exceed the credits required for Platinum certification.

The home is being built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean, approximately 110 miles north of San Francisco.

To document the day-to-day construction of the home, an iBeam Systems time-lapse construction camera is up and running. Visit www.ultimatehomedesign.com/oph.php and then click on the "Optimum Performance Home Build Cam" button. Photos are captured and automatically uploaded to iBeam's secure server every 15 minutes from 6:00 a.m. to 6:00 p.m. each day. The images can easily be e-mailed or printed to document job site conditions. To view time-lapse archive images, enter the user name ophsearanch and the password

The First Optimum Performance Home® At The Sea Ranch





The Sea Ranch, Sonoma County, California
Aerial Photo Courtesy Scott Simpson

ophsearanch. These monthly videos are comprised of the daily time-lapse images taken during each month the iBeam System has operated, dating back to April 2008.

Using iBeam's technology and an "always on" GetWireless AirLink Raven X EVDO V4221-VA and AirLink Dual-Band EVDO Antenna, our team is able to view a high-resolution photo archive of the entire project daily, including stunning 1920 x 1080p (progressive) high-definition time-lapse movies each month (see a standard-resolution version at www.ultimatehomedesign.com/oph-photos.php).

Upon completion, the entire construction photo archive will be featured as a 1080p high-definition time-lapse movie and will become part of a high-definition television program and educational documentary that Steve Michelson Productions and I are producing.

Ultimate Home Design® Concept

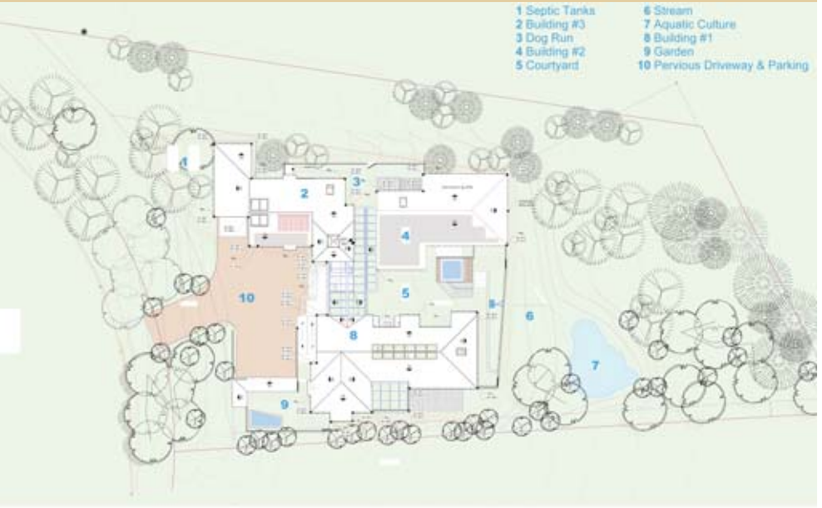
The showcase project is exemplary of the "Ultimate Home Design®" concept, which integrates age-friendly, universal design with the best sustainable building practices, while exerting minimal impact on the environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure; as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

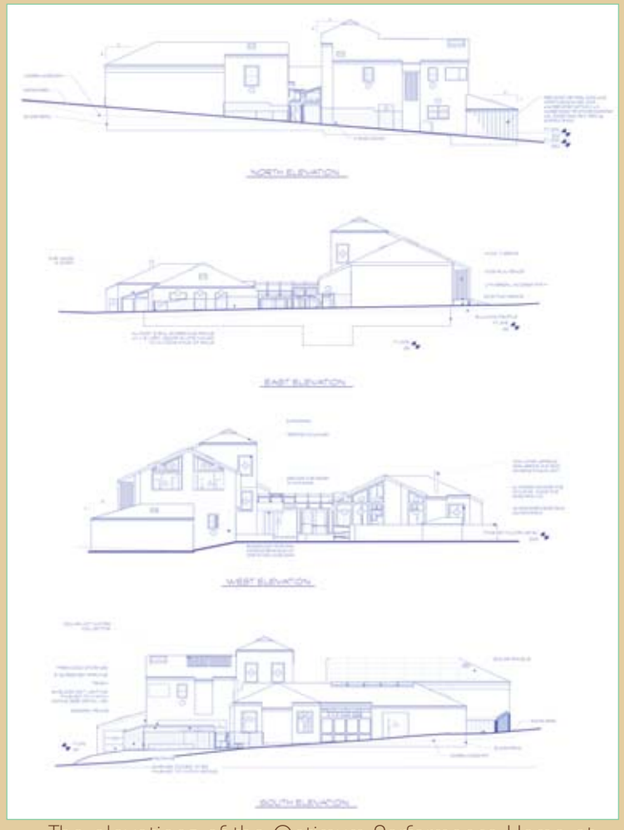
A building-science systems approach to home building is the cornerstone of the project, with emphasis on the relationship between the home's components and the envelope it creates. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners and the surrounding natural setting, and resource efficiency. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article covered the project scope. Thereafter, each issue has contained a part of the continuing series by working through site planning and preparation; Low-Impact Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee-approved architectural/structural and grading/drainage submittals, with conditions that translated to clarifications on certain building components and material finishes; particular aspects of the home's mechanical plan; structural aspects of foundations, structural walls incorporating Insulating Concrete Forms (ICFs), and Structural Insulated Panels (SIPs), as well as SIP roofing; the acoustical design of the dedicated Optimum Performance Home Theatre™ and rear-projection room; interior design approaches and materials; kitchen, bath, and home fixtures; universal design architecture; fire-risk mitigation; energy generation; and courtyard experience. "Breaking Ground" was the title of Part XIII, along with "Courtyard Experience." Part XIV and XV, respectively, covered the initial continuing phases of "Site And Foundation Preparation." Part XVI and Part XVII further expanded on the "Site and Foundation Preparation," as did Part XVIII.

The initial site grading, foundation, and mechanical, plumbing, electrical, and low-voltage infrastructure stages have been completed. This complex and leading-edge under-slab infrastructure work has been documented in the day-to-day time-lapse photography and archived photos on the *Ultimate Home Design* Web site. Following the installation of the Cosella-Dörken DELTA®-MS UNDERSLAB

> "A focus of the Optimum Performance Home's design is to stand as a showcase for the 'green' movement and demonstrate means of reducing a home's impact on the planet through the use of Low-Impact Development and environmentally responsible and sustainable building materials."





The elevations of the Optimum Performance Home at The Sea Ranch

vapor-retarding membrane and AFM Corporation R-Control® Perform Guard EPS foam slab insulation, the Uponor® AQUAPEX® radiant floor was installed and the engineered suspended concrete slab poured. Work is now complete on the erection of the Amvic® ICF walls and the Amvic AmDeck® ICF floor, to support the guest bedrooms and library/home theatre/surround music room, and the ISHN ThermaSAVE SIP walls and roofs.

Completion of the home was anticipated for April 2009 but due to the mortgage market collapse and the credit crunch, the project was impacted and its completion jeopardized. The project was impacted by the cold realities of the credit freeze. Construction was stopped at the end of January. Fortunately we were able to renegotiate two extensions of our construction loan with New Resource Bank, to enable the completion of the home, now anticipated to be May 2010. Other unforeseen obstacles and disruptive circumstances related to the SIP fabrication further delayed the project.

Unfortunately, The Sea Ranch Association, which has been extremely difficult to work with during the design and construction stages, continues to fine our project each month due to non-completion within 12 months of the issuance of its permit. The Associations' Department of Design, Compliance & Environmental Management conducts automatic inspections every 30 days and fines our project as per the Board Violation Policy. The Sea Ranch Association has extended no support for the project. Our experience is true to the song, "It's Not Easy Being Green," with no encouragement or support from governing entities, even though this is an "extreme green" national showcase home that is slated to receive the prestigious Platinum certification under the LEED for Homes program of the U.S. Green Building Council. Then too, the project encountered, once again, severe rain storms in February and March of 2009, which further delayed recommencement of construction. Construction resumed in April 2009, but then severe rain storms in January and February 2010, again delayed construction.

It is our intent to produce a high-definition documentary for educational use by the U.S. Green Building Council, the organization who created the LEED for Homes rating and certification program, and for other "green" chartered organizations. Our presentation will reveal the step-by-step process for creating the first Optimum Performance Home—expected to be one of the highest-rated LEED for Homes Platinum projects in the world! Separately, we have produced an HD promo, which was requested by *Planet Green*, a network owned by the *Discovery Channel*. This promo will be promoted to secure national television distribution of a program on the home, which we have titled, the *Ultimate Home Series*. One can view the promo at www.ultimatehomedesign.com/oph-media.php. We are continuing our digital photography and high-definition video production efforts to document the construction of the home. Hundreds of still digital photos are available for viewing at www.ultimatehomedesign.com/oph-photos.php.

Construction Scheduling

Below is the breakdown of the initial site preparation, grading process, foundation work, engineered suspended slab, the Amvic ICF wall and AmDeck ICF floor construction, WaterFurnace® geothermal vertical fields, the large pond, the EcoRain™ underground water cistern and above-slab SIP walls and roofing. An outline will be provided in Part XX for the next stage of construction relating to the interior preparation and finishing.

DESIGN
optimum performance home

Pre-Construction Start Meetings
Site Work
- Clear Lot Vegetation
- Lay Out House Pad
- Install Curtain Drain Around Pad
- Excavate Optimum Performance Home Theatre, Alcove, and Wine Cellar
- Lay Out Footings
- Install Temporary Electrical Power
- Install iBeam Systems Time-Lapse Pro Construction Camera (See Part XIII)
- Install GetWireless and WildBlue Internet Transmission
- Activate Water Service
- Form Underground ICF Home Theatre, Alcove, and Wine Cellar Walls
- Verify Foundations' Site Placement/Inspection
- Rough Excavation Large Pond and Septic Trench to Designated Leech Field
- Install StormTech Infiltration Chambers (See Parts II, III, and IV)

Foundations
- Dig Initial Stage Foundation Footings and Install French Drain
- Pour First Stage Engineered Controlled Density Fill (CDF) Concrete with Portland Cement and Headwaters Resources Fly Ash (See Part VI)
- Set Forms; Tie Rebar Steel, Hold Downs, and Anchor Bolts
- Pour Final Stage Foundation Footing Concrete with Portland Cement, Headwaters Resources Fly Ash, Kryton's KIM Admixture, and Euclid Eucon Admixture (See Part VI)
- Run Spunstrand Acoustically Treated Air-Conditioning Duct for Home Theatre (See Part V)
- Conduit Trenching for Uponor AQUAPEX Plumbing (See Parts V and X)
- Run Armacell Insulated Uponor AQUAPEX Hot and Cold Water Tubing
- Run Plumbing Waste
- Run Wardflex Flexible Corrugated Stainless Steel Fuel Gas Tubing
- Run Underground Drain from Wine Cellar to StormTech Infiltrator Chambers Located Across the Property Frontage
- Install Gravel Around Plumbing
- Run Plumbing Conduit and Supply
- Run Electrical and Low-Voltage Conduit
- Lay Out NuTone Central Vacuum System (See Parts IX and X)
- Run WaterFurnace Geothermal Supply and Return Tubing
- Finalize Underslab Infrastructure
- Install EnergyEdge Insulated Form Around Perimeter of Slab
- Underslab Inspection
- Place Gravel and Sand Underslab
- Install Cosella-Dörken DELTA-MS UNDERSLAB
- Install AMF Corporation R-Control Perform Guard EPS Underslab Insulation
- Prepare for In-Floor D-Box™ Technologies Custom Motion Platform In the Home Theatre (See Part VII)
- Install Slab Rebar
- Install Uponor AQUAPEX Radiant Floor Tubing
- Pour Concrete Slab with Portland Cement, Headwaters Resources Fly Ash, Kryton's KIM Admixture, Euclid Eucon Admixture (See Part VI), and Forta Ferro (See Part XVI)
- Backfill Courtyard and Spa Area
- Install Zurn Flo-Thru Trench Drain
- Pour Concrete Slab with Portland Cement, Headwaters Resources Fly Ash, Kryton's KIM Admixture, Euclid Eucon Admixture (See Part VI), and Forta Ferro (See Part XVI)
- Install AMF Corporation R-Control Perform Guard EPS Around Perimeter of Slab Under EnergyEdge
- Waterproof Concrete Stem Walls with Carlisle BARRICOAT-R
- Backfill Foundation
- Treat Concrete Slab with Nisus Corporation Bora-Care Termite Barrier Pretreatment

Exterior
- Construct Amvic ICF Walls
- Construct Amvic AmDeck ICF Floor
- Pour Concrete Into Amvic ICFs and AmDeck
- Waterproof ICF Walls with Carlisle BARRICOAT-R
- Apply Cosella-Dörken DELTA-DRY Ventilated Rainscreen Air Barrier to ICF Walls
- Apply Fiber Cement MaxiPanel and MaxiTrim Cladding to ICF Walls
- Construct Firewood and Trash Shed
- Install Underground 500-Gallon Propane Tank
- Construct Owens Corning QuietZone Acoustic Wall Framing Studs
- Position Dimension One Amoré Bay Spa in Courtyard
- Install Kohler BodySpa Ten-Jet Tower Shower in Courtyard
- Dig Five 310-Feet Deep Bore Holes for WaterFurnace Geothermal System
- Pressure Test and Install WaterFurnace U-Bend Piping
- Fill Geothermal Bore Holes with Dynacrete Bentonite Grout
- Construct ThermaSAVE SIP Walls
- Apply Fiber Cement MaxiPanel and MaxiTrim Cladding to SIP Walls
- Install Roofing Structural Members
- Construct Optimum Performance Home Theatre Structural Ceiling
- Install ThermaSAVE SIP Walls

- Install ThermaSAVE SIP Roofing
- Install Cosella-Dörken DELTA-FOXX Class A Fire-Rated Roof Underlayment
- Install Batten Plus' BattenUP Corrugated Plastic Roof Battens
- Install Trimline Building Products Black Composite Distinction Slate on SIP Roofs
- Install Attic Breeze Solar Attic Fan
- Install Pella Windows and Doors Along with Fortifiber's FortiFlash Flashing
- Install VELUX Skylights
- Install Wasco Pinnacle Pyramid Skylight
- Seal Exterior with DOW FROTH-PAK Foam Insulation
- MoonDance Painting Application of L.M. Scofield's LITHOCHROME Tintura Dark Walnut Stain
- Instal EcoVantage's PerfikDek EcoPrem Wood Decking in Spa Area
- Instal EcoVantage's PerfikDek EcoPrem Wood Decking in Master Bedroom Deck Area

Interior
- Construct Interior Walls With Dietrich UltraSTEEL Framing Studs And Drywall Tracks
- Install Johnson Hardware Series 2000 Heavy Duty Pocket Door Kits
- Install PEARL (Permanent Escape And Resue Ladder) Fire Safety Ladders
- Treat Interior Wood Beams and Framing with No-Burn Fire Retardants
- Install RSF Wood-Burning Fireplaces' Delta 2 Fireplace
- Install Five Dimplex Electric Fireplaces
- Install Kohler Escale BubbleMassage Bath in Master Bedroom Suite Bathroom
- Install Sterling/Kohler OC-S-63 Series Rool-In Shower Modules in Guest Vanity Bathroom
- Install Sterling/Kohler Accord Barrier-Free Bathing Module in Second Floor Guest Bathroom
- Complete Rough Plumbing and Rough Electrical
- Install Acoustiblok Reinforced Dense Noise Isolating & Sound Proofing Membrane in Select Interior Walls and Ceilings

Wine Cellar
- Construct Underground Wine Cellar with Amvic ICFs
- Pour Concrete into Amvic ICFs
- Construct Concrete Roof to Support Earth Garden
- Waterproof Wine Cellar Walls with Carlisle Coatings
- Install Weston Solutions GreenGrid Living Herb Garden

Garages
- Construct West Amvic ICF Garage Wall
- Pour Concrete into Amvic ICFs
- Construct ThermaSAVE SIP Boat Garage

Propane System
- Install Underground 500-Gallon Propane Tank

Septic System
- Dig Septic Trench, Cut Road, Install Pipes, Backfill Trench, and Repair Road
- Install Roth MultiTank and FRALO Septic Tank Underground
- Equip Septic Tanks with Orenco Risers, Float Assemblies, In-Tank Filtration Systems, Effluent Pumping Systems and Electrical Controls
- install Sludgehammer Septic Tank Filter
- Dig and Install Septic Leach Field

Geothermal System
- Engage Weeks Drilling & Pump Company Drilling of Five 310-Feet Deep Geoexchange Bore Holes
- Install WaterFurnace Geothermal U-Bend Piping Lines
- Seal Bore Holes with Dynacrete Heat Transfer Sand and Bentonite Clay Grout
- Install WaterFurnace Envision Series Heat Pumps

Large Pond
- Complete Final Excavation of Large Pond
- Install CETCO Akwaseal Pond Liner Roll Imagetextile Bentonite Clay Liner
- Install Smart Drain Geotechnical Drains at Large Pond Location
- Install Agri Drain Inline Water Level Control Structure as Part of Large and Small Pond Systems
- Fill Pond with Spring And Rain Water
- Treat Pond with Seepage Control ESS-13 Environmental Soil Sealant

Small Pond
- Complete Final Excavation of Small Pond
- Install CETCO Akwaseal Pond Liner Roll Imagetextile Bentonite Clay Liner
- Fill Pond with Spring And Rain Water
- Treat Pond with Seepage Control ESS-13 Environmental Soil Sealant

Underground Water Cistern
- Install Stormwater Solutions EcoRain 2,400 Gallon Underground Water Cistern
- Install Firestone Specialty Products EPDM PondGuard Geomembrane Liner Over Water Cistern
- Install Resource Conservation Technologies Sediment Filter and High-Efficiency Pump as Part Of Water Cistern System

iBeam Time-Lapse Pro Construction Camera Perspective 2009-08-25

John Feeney, who owns Feeney Construction, our previous on-site supervising contractor and lead carpenter, completed the foundation work and did not return to the project. Roger Stevenson, our electrical contractor, who is also a fully licensed contractor, took over John's role in 2009 as our on-site supervising contractor and lead carpenter. Roger's companies are Sierra Pacific Builders and Stevenson Electric. For a six-month period his brother Dean, an architectural designer and builder, worked on the project and shared supervising duties with Roger. The current crew consists of Alain Bernal, Gabriel Bernal, and Aaron Davila Romero, who all stayed on, plus Richard Howard, a carpenter, and Axel Bernal. This crew, plus specialist sub-contractors, has been responsible for the remaining construction. Various specialist sub-contractors have also contributed to the project, including Travis Swithenbank and his specialist crew at QUALCON on the construction of the Amvic ICF walls, and Mic Carmichael of SIPBuilder, an extremely experienced specialist in SIP design and construction, on the modifications and erection of the ISHN ThermaSAVE SIP walls and roofs.

Matthew Jung, owner of 88HVAC, a Geothermal-Radiant-Solar company operating in Marin-San Francisco-Burlingame, California, installed the WaterFurnace geothermal supply and return tubing under the slab, and will work with our plumbers to complete the connections for the elaborate geothermal hot water system.

Sebastopol, California-based Weeks Drilling & Pump Company, under the direction of Chris Thompson, CEO, drilled the five 310-feet-deep geoexchange boreholes. This was an ardurous task that took two weeks to complete.

Don Bartlett of Bartlett Mechanical Services, along with Matthew Jung, were tasked with installing the WaterFurnace® geothermal system and

Weeks Drilling & Pump Company

- Weeks' drilling department can claim over 60 years experience and has completed over 20,000 well projects throughout Northern California and the West Coast, using sophisticated drilling methods to meet the demand for water supply wells, environmental, geothermal bore wells, and irrigation wells.

iBeam Time-Lapse Pro Construction Camera Perspective 2009-11-13

Uponor® AQUASAFE®

• Uponor's AQUASAFE® Looped Residential Fire Safety System integrates into a home's cold water system. Water circulates each time cold water is used and does not remain stagnant, as with competitive stand-alone fire sprinkler systems.

Aquacore® Whole-Home Hollow-Fiber Ultrafiltration System

• The Aquacore point-of-entry ultrafiltration system is capable of producing a steady flow of microbiologically pure water throughout the home.

Dryerbox®

• The Whirlpool® Duet® dryer will be connected to The Dryerbox® by In-O-Vate Technologies. The Dryerbox is a vent connection receptacle that saves space, saves energy, improves dryer efficiency, prevents the flex transition hose from getting "squished," and reduces a common household fire hazard.

SIP Fabrication & Modification On Site

complete the interface with the Spunstrand underground acoustically damped air-conditioning duct system for the Optimum Performance Home Theatre™. Don also oversaw the installation of Uponor AQUAPEX® radiant floor tubing. The Spunstrand system was constructed and installed by Jerry Feeney and John Feeney.

Russell Peffer and William "Willy" Spratt, who both own their own independent plumbing companies, Russell Peffer Plumbing and Spratt Plumbing respectively, have served as our plumbers throughout most of 2009 to the present. They have worked on every aspect of the rough plumbing, including the interior connections in the home, and installation of the Uponor AQUASAFE® Looped Residential Fire Safety System.

Unlike competitive stand-alone fire sprinkler systems, the Uponor AQUASAFE Looped Residential Fire Safety System integrates into a home's cold water plumbing. Water circulates each time cold water is used and does not remain stagnant (typically for years in conventional systems). As long as water is supplied to plumbing fixtures, water is supplied to the sprinklers. Uponor engineers designed the system for the Optimum Performance Home, and plumbers Peffer and Spratt are installing the system to Uponor specifications.

In addition to the work performed on the Uponor AQUAPEX plumbing system and AQUASAFE Looped Residential Fire Safety System, the plumbers installed in the laundry room an In-O-Vate Technologies' Dryerbox® as a vent connection receptacle in the stairway wall. This saves space and energy, improves dryer efficiency, prevents the flex transition hose from getting "squished," and reduces a common household fire hazard. The Dryerbox will allow the Whirlpool® Duet® clothes dryer to be pushed back against the wall of the laundry room without the fear of kinking the exhaust hose.

I mentioned previously that we have received no encouragement or support from governing entities for this "extreme green" project. I think that it is worthwhile to re-read in Part XVIII the frustrating encounter that occurred with the Sonoma County Building Department, in regards to our requirements for a geoexchange bore field location on the property. As reported, Sonoma County did not waver from their position, and required us to secure another location for our sealed

ground loop boreholes. Fortunately, we were able to locate one last area on the site that met the county's restrictions and staked out the new ground loop location. The county made a site visit and did some measuring. "The 'wells' [the county has no classification other than "wells" for ground loops] must be 25 feet or greater from our septic system tightline (currently they are <19 feet)." Thus, we had to further move the ground loop location approximately 6 feet from the tightline affluent pipe path and restake the location of the loopholes.

Upon another inspection, the county approved the relocation and issued us a new drilling permit. The new approved location has required additional engineering and an extended pipe run from the front of the home around the northern boundary to the far northeastern corner of the property, which has added to the project's expense and delays.

As stated previously, we had to wait for the ground to dry up enough to support the heavy Weeks Drilling rig that was used to drill the geoexchange holes. Weeks Drilling & Pump Company completed the drilling of the bore holes over the course of two weeks. The five bore holes are each 310 feet deep and sealed with 14,000 pounds/280 sacks heat transfer sand and 70 sacks of Bentonite clay grout with .88 conductivity/2,254 gallons of material in bore holes (305 cubic feet). This special material was provided by Dynacrete, based in Valley Springs, California. The special U-bend piping was provided by WaterFurnace and was pressure tested before the pipe was put in the ground and after the holes were backfilled with grout (reference IGSHPA Design Guidelines).

The exterior concrete roof of the wine cellar has yet to be protected with a BARRICOAT-R membrane manufactured by Carlisle Coatings & Waterproofing, Inc. Once completed, MiraDRAIN GR9200 will be applied

Dynacrete

• Dynacrete heat transfer sand and Bentonite clay grout used to seal geothermal bore holes.

WaterFurnace® Geothermal System

• The efficiency ratings of a geothermal system are up to five times higher than conventional heating and cooling systems. WaterFurnace® leads the industry with its ENERGY STAR®-qualified Envision Series, the first to achieve 500 percent efficiency in heating.

Carlisle® Coatings & Waterproofing

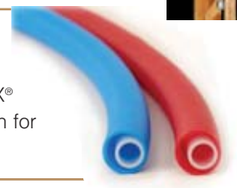
• BARRICOAT-R is a waterproofing and vapor barrier membrane designed for vertical surfaces, above or below ground. MiraDRAIN 6200 is a high-performance, high-strength drainage composite consisting of a three-dimensional, high-impact polystyrene core, and a nonwoven filter fabric.

Weeks Drilling Geoexchange Drilling Rig

Owens Corning QuietZone® Acoustic Wall Framing

• Owens Corning QuietZone® Acoustic Wall Framing studs are specially engineered with built-in, acoustically resilient, spring-loaded metal clips designed to significantly reduce the sound vibration path and allow the wallboard on the inside of the room to float and isolate sound wave vibrations.

Uponor® Pre-Sleeved Corrugated AQUAPEX®



• Uponor® 1/2- and 3/4-inch red and blue high-density polyethylene (HDPE) pre-sleeved corrugated AQUAPEX® tubing is designed for durability and provides protection for installation in the soil, allowing for easy removal.

EcoRain™ Stormwater Solutions

• EcoRain Stormwater Tank Modules for 2,400-gallon underground water cistern harvested from roof rainwater runoff.

Gutter Helmet®

• The Gutter Helmet® gutter protection system is a multi-patented, flow-limiting, ribbed design that slows and spreads water, causing it to flow easily into the gutters, while debris falls to the ground.

Oregon Shepherd

• Oregon Shepherd wool reacts to changes in temperature and atmospheric moisture, achieves impressive R-value thermal performance, absorbs and release water vapor, contains no permethrin, pyrethroids, or formaldehyde, does not burn, and reduces the level of environmental noise pollution considerably.

over the waterproof membrane. This sheeted membrane is designed specifically for green roofs, garden roofs, and large planter applications (in our case, an herb garden). Used with the BARRICOAT-R waterproofing, this drainage composite provides adequate water retention for sedums, grasses, and plant life, while providing a channel for excess water to drain.

Construction of the structural interior of the dedicated Optimum Performance Home Theatre has been completed, including the installation of the spring-loaded Owens Corning QuietZone Acoustic Wall Framing studs. (See Part VII for a description of the design of the Optimum Performance Home Theatre.) The initial electrical work has been completed and awaits Sonoma County inspection. Following approval, the Oregon Shepherd wool insulation batts will be installed and covered with two layers of Georgia Pacific wall board, to provide the finished wall and ceiling surfaces for final interior finishing and acoustical treatment.

The Uponor AQUAPEX-encased Amvic ICF AmDeck radiant floor is complete, along with the necessary AQUAPEX plumbing, for the second-story guest bathroom and kitchen alcove. This work was described in the previous Issue XVIII.

The Amvic ICF AmDeck Floor & Roof System is a modular, lightweight, stay-in-place form made of Expanded Polystyrene (EPS). We used this system to construct the second-story concrete floor over the two-car garage. The system provides structural strength through reinforced concrete and insulation through EPS. It utilizes 10-inch lightweight steel framing studs, which carry the temporary construction loads until the concrete gains its required strength, acting as furring strips to which interior finishes can be attached. This system perfectly compliments our ICF structure, and together they provide a complete energy-efficient structural and thermal building envelope for the second floor.

The EPS used in the green flooring system provides continuous insulation for the concrete floor with embedded Uponor plumbing and radiant floor AQUAPEX tubing. The R-value is 17.8, or more, depending on other materials used in conjunction with the system. In our application, the R-value is in excess of 40. The insulation is also highly effective at reducing the amount of noise that travels from one story to another, due to the sound transmission class (STC) rating of 50 plus.

Aqua Nueva's Terry McMains, based in Albuquerque, New Mexico, designed the site application of the EcoRain Stormwater Tank Modules' underground water cistern manufactured by Stormwater Solutions, LLC. The 2,400-gallon EcoRain cistern was installed in May. The cistern will retain roof runoff from Gutter Helmet® guttered interior roof areas (see Issue XVIII). Already the cistern is completely full of rainwater runoff from the roofs.

The large pond at the eastern rear of the site is intended to both celebrate and accommodate the excess presence of moisture moving across the site, contributed by several springs located on other properties surrounding the project site. The pond is designed to act as a

hydraulic stabilization feature by storing and managing excess moisture crossing the site, including some of the perched groundwater, and to create habitat value for native and migratory wildlife.

A "beach" with subsurface horizontal geotechnical drains (provided by Smart Drain, LLC) was installed at the "upper," or southeast corner of the pond, overlain by coarse sand and rock chips, to intercept seepage and runoff from the neighboring property and recharge the pond. The Smart Drain™ belting uses micro channels to move water by capillary and siphoning actions. Unlike ordinary perforated pipe, it doesn't clog! Moreover, the excess water is filtered, which reduces soil runoff. Nothing but clean water is drained. Smart Drain's capillary action literally sucks the water into its micro channels. The siphoning action provides additional water-drainage force, to whisk the water away from the drainage area. Once the soil is de-saturated, Smart Drain leaves just enough moisture to ensure optimum conditions for growth of grasses and trees.

A second, smaller pond, has also been installed at the front of the Optimum Performance Home as a feature of a small garden courtyard area adjacent to the living room and the exterior wood shed.

The excavated ponds are constructed as a dip in the topography, without any constructed berm or engineered containment. A CETCO Akwaseal Pond Liner Roll Imagetextile was installed at the ponds' surface bottoms. The liner is composed of Bentonite clay, sandwiched between two textiles, which are needle-punched together. The result is an easy-to-install, self-healing, self-seaming liner requiring little maintenance. The swelling properties of the Bentonite clay and cushioning of the textiles eliminate the need for seam welding and underlayments.

Now at the final stage, the ponds have filled with spring and rainwater

Smart Drain™

• The Smart Drain™ belting uses micro channels to move water by capillary and siphoning actions. Unlike ordinary perforated pipe, it doesn't clog. Moreover the excess water is filtered, which reduces soil runoff. Nothing but clean water is drained.

CETCO Akwaseal Pond Liner

• CETCO Akwaseal Pond Liner Roll Imagetextile is a bottom pond liner composed of Bentonite clay, sandwiched between two textiles, and needle-punched together.

Seepage Control®

• Seepage Control® manufactures the exclusive ESS-13 Environmental Soil Sealant formula, a non-toxic liquid vegetable oil polymer emulsion that is either poured into the water, or mixed with the soil and compacted to provide a leakproof pond bottom.

Weeks Drilling Geoexcange Bore Holes & SIP Wall/Roof Fabrication On Site

Agri Drain

• Agri Drain's Inline Water Level Control Structure is a rugged 1/2-inch PVC structure reinforced with stainless steel and anodized aluminum corner extrusions. It is a working part of the pond's hydraulic stabilization workings.

Roth MultiTank & FRALO Septech Septic Tanks

• Both a virgin HDPE Roth MultiTank and a FRALO Septech-branded blow-molded poly tank are used for the septic system.

Orenco® Systems

• The Roth MultiTank and FRALO septic tanks are equipped internally with Orenco® risers, float assemblies, in-tank filtration systems (effluent filters, pump vaults), effluent pumping systems, and the electrical controls to allow treated effluent to be returned harmlessly to the environment

runoff. Soon the ponds will be sealed with a vegetable oil polymer (provided by Seepage Control) that is completely non-toxic and used for this purpose.

As part of the pond hydraulic stabilization workings, an Agri Drain INLINE05X04P (WCS 5'x4" PVC) inline water level control structure, including slide Valterra valve and anti-seep collars, was installed. The rugged 1/2-inch PVC structure is reinforced with stainless steel and anodized aluminum corner extrusions.

The septic system has been installed, including the off-site leach drainfield. We opted to employ two 1,500-gallon septic tanks manufactured by Roth Global Plastics—a black Roth MultiTank and a blue FRALO Septech-branded Roth Tank. Internally, the Roth MultiTank and FRALO septic tanks are equipped with Orenco® risers, float assemblies, in-tank filtration systems (effluent filters, pump vaults), effluent pumping systems, and the electrical controls. These advanced products and systems were provided by Orenco Systems, Inc. for the project and allow treated effluent to be returned harmlessly to the environment via our off-site drainfield located approximately 1,500 feet away on The Sea Ranch commons.

Also installed is a 500-gallon underground propane tank at the western edge of the firewood and trash shed.

The courtyard and spa concrete slab pour has been completed. The Dimension One® Amoré Bay spa has been delivered and has been positioned in the courtyard, awaiting full connection. The spa is part of the courtyard entertainment area, which includes a custom Finnleo® Finnish sauna and a Kohler® 1000-H2-CP 10-Jet Tower BodySpa and Footbath that uses recirculated water.

Caption

This Issue

In this issue, the focus continues to be on the various construction elements related to site and above-foundation construction, the roof, and exterior and interior treatments.

As reported previously, the Amvic Insulated Concrete Form walls in Buildings 2 and 3 have been constructed. Unlike the SIP wall construction, the construction is extremely straight-forward and performed entirely on site. This is a real benefit in that minor adjustments can easily be made on site as required, unlike what is involved with SIP construction. The Amvic 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

While Structural Insulated Panels (SIP) can help build a strong, energy-efficient structure and provide high levels of insulation and air seal, we encountered problems. A tremendous amount of effort went into the on-site cutting and fitting of the custom SIP walls and roofs that our construction team installed. The licensed IHSN ThermaSAVE panel manufacturer, Chandler, Arizona-based Prostruct, turned out to be difficult to work with. Owned by Cameron Haddock, the son of ThermaSAVE's founder H.H. "Hoot"

Dimension One Spas® Amoré Bay

• A Dimension One Spas® Amoré Bay spa is featured in the courtyard area. The D1 Amoré Bay is the ultimate performance and comfort spa that is renown for energy efficiency and reliability.

Finnleo® Custom-Cut Finnish Sauna

• An authentic Finnish Finnleo® Custom-Cut Sauna with a floor-standing Maxi 6 kW heater (FSO-60SC) has been specified, with 70 pounds of Finnish Vulcanite rock that provides traditional soft dry heat.

Kohler® BodySpa Ten-Jet Tower

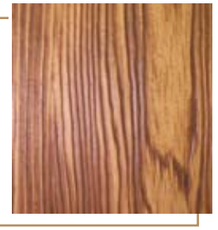
• The outdoor shower assembly will be the Kohler BodySpa Ten-Jet Tower (K-1000-H2) with separate Kohler MasterShower® Rite-Temp® valve trim with cylinder handle (K-T9492-7) and Kohler MasterShower Hotel Handshower Kit (K-8520).

SIP Wall Construction

IHSN ThermaSAVE®

• The IHSN ThermaSAVE® Structural Insulated Panel (SIP) Building System consists of a MaxiTile® (MaxiPanel®) inner and outer fiber-cement skin and a core of super-insulating expanded polystyrene (EPS) glued together with a special high-strength glue and dried under extreme pressure, resulting in a stressed-skin panel that has amazing capabilities.

MaxiTile®



• MaxiTile's® MaxiPanel® and MaxiTrim® fiber-cement products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air. And they are non-combustible.

Amvic® Insulated Concrete Forms

• The Amvic® ICF 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step. AmDeck is designed for floors.

Haddock, Prostruct used Hamilton, Alabama-based Green SIPS, Inc., a ThermaSAVE licensed manufacturing facility, to manufacture and cut the panels. A tremendous amount of time was wasted due to inaccuracies in ThermaSAVE's working drawings and Prostruct's panel manufacturing and cutting delays and errors. I organized and provided the actual raw material that comprised the fabrication of the SIPs—MixiPanel fiber-cement panels, AFM Corporation EPS foam insulation, Norbord FSC-certified OSB, and Ashland adhesive. Even though we spent countless hours, weeks, and eventually months correcting inaccuracies in the working drawings, when the factory-fabricated-and-cut panels finally arrived to the site, we found much of the work to be flawed and inaccurate. Mic Carmichael, the SIP Builder (not associated with ThermaSAVE), served as a subcontractor and consultant, and led our construction team in the on-site modification work. Mic has had extensive experience in erecting SIP panels. Much credit is due Mic because he was able to "re-work" the panel cuts and make the adjustments required in the construction of the home.

ThermaSAVE SIPs, unlike virtually all others, use fiber cement panels instead of sheets of OSB for both the interior and exterior portion of the panel, with rigid EPS insulation foam sandwiched in between. AFM Corporation manufactured the recycled and recycleable rigid super-insulating Foam-Control EPS with Perform Guard, an additive that effectively resists termites. The EPS used is fire retardant, with a flash point between 600 and 650 degrees Fahrenheit. The Class A fire-rated 7/16-inch thick fiber cement panels (MaxiPanel) are manufactured by MaxiTile® and the special high-strength ISOSET A-322 adhesive and catalyst is manufactured by Ashland Performance Materials.

Fiber-cement board used as SIP skins will not rot, burn, support toxic black mold (stachybotrus chartarum), or absorb moisture. No additional interior drywall or exterior sheathing is necessary. The exterior fiber cement panels are cedar grain in appearance, with the interior fiber cement panels finished smooth. They are pre-primed during manufacturing and require no additional primer prior to staining, plastering, or painting.

The inner and outer pre-primed fiber cement skins and termite-resistant treated EPS core were glued together and dried under extreme pressure, to create uniform stressed-skin panels with proven strength, durability, and thermal efficiency. The assembled SIPs were manufactured with factory-installed conduit or holes drilled through the foam, to provide raceways for wiring.

The ThermaSAVE patented spline connection system joins together four-foot-wide panels to build walls, floors, and roofs that are relatively lightweight, yet can withstand high wind loads (110 to 200 mph), earthquakes, and the twisting and flexing that slowly deteriorates conventional wood-framed buildings. There are no wood parts extended through the panels from face-to-face except at openings, corners, beams, and roof edges. Therefore, termites and vermin are not attracted to the panels, and mold will not grow in the panel system. The panels will not rot or warp and are manufactured using non-toxic products, and they do not create toxic wastes. According to ThermaSAVE, the structures in the home built with these panels will have up to 75 percent less heat loss or gain, compared to conventional wood structures.

Noteworthy is that ISHN ThermaSAVE's SIP building system is ICC (International Code Council) accredited. The State of California accepts the International Code Council, but also has its own requirements. California has high wind loads on the coast, high earthquake loads, and they have strict Quality Control Programs to enforce the code. The State of California also puts its own stamp on the panel. By accepting the ICC, the panels are stamped by the State of California, the ICC, the Quality Control Company, and ThermaSAVE.

As required by California law, the SIP panels were certified by a state-licensed inspector from an accredited Quality Control Company that the panels are quality constructed in accordance with the QC Manual and ES Report for California. Home builders should be aware that the inspection costs, including the PE engineer's seals required on the documents, can be substantial. In our case, the cost quote to inspect and certify 300 panels was approximately $4,000, including three inspections, with an additional California label fee of $5.00 per panel. No such fees are associated with ICFs.

The ThermaSAVE building system impressively passed the ICC fire containment test and demonstrated that the fiber cement panels during exposure to the high-intensity heat did not outgas noxious and poisonous fumes that could result in affixation, a common cause of death during residential home fires.

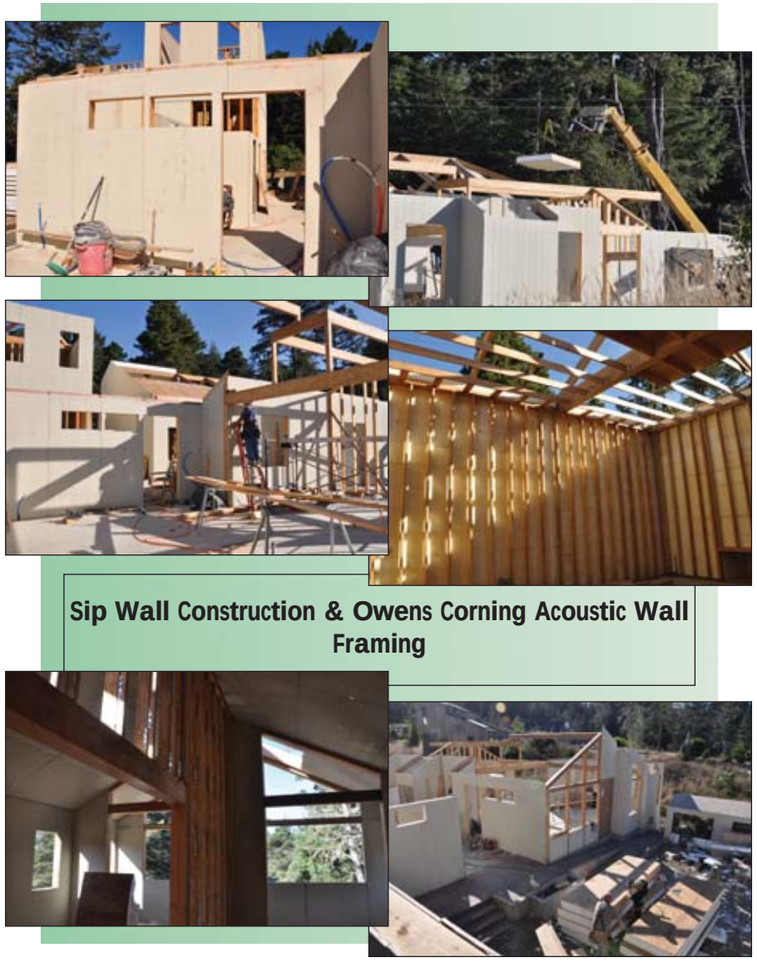
Also noteworthy is that ThermaSAVE is the building system choice of the Federation of American Scientists, which studied all building systems for two years with regards to mold, air quality, affordability, availability, ease of construction, wind and water resistance, and earthquake resistance.

As an alternative to traditional wood framing methods, SIPs are praised due to their advantage in being able to be installed more quickly, and of course, for their inherent more energy-efficient basic design. SIPs provide higher R-values, reduced air infiltration, less thermal bridging, and greater stability, compared to convention wood framing.

A critical element in the manufacturer of SIPs are accurate panel-cutting instructions that precisely match the CAD construction drawings with precise window and door openings, as well as roof angles. As noted, our architectural designer/CAD draftsman Ed Rose of Rosebud Studios, spent an enormous amount of time with the draftperson at ThermaSAVE to verify that the panel dimensions were accurate, in order to ensure that panel assembly on the job site would proceed quickly, reducing labor costs and waste and allowing our builders to dry-in without weather or labor delays. As it turned out, the ThermaSAVE people failed to "manufacture" a number of the SIPs accurately, and we ended up having to make extensive modifications on the job site. So much for the SIP industry promotion for reducing framing labor costs by using SIPs instead of traditional methods.

It is unfortunate that we found ourselves boxed in with no viable alternative at a critical time period in the construction of the Optimum Performance Home, because the ThermaSAVE SIP product itself has admirable merits and was selected by us for those merits during the home's design stage.

What one needs to realize when deciding on a SIP manufacturer is that you will be dependent on that manufacturer to provide accurate working drawings and panel-cutting instructions for the dimensional panel-cutting, and provide precise



Sip Wall Construction & Owens Corning Acoustic Wall Framing

Norbord

• Norbord TallWall rated structural panels are manufactured using Forest Stewardship Council-certified (FSC) wood strands and waterproof adhesives, and do not contain added urea-formaldehyde resins.

quality control. Any errors in working drawings, manufacturing, and cutting will be costly to correct once the panels are delivered to the construction site and the errors are discovered during erection. Unlike ICF construction, which is controlled on-site by your contractor/builder, once engaged with a SIP manufacturer your project is beholden to that manufacturer. In construction, capping costs and time expended during construction is paramount. I personally would not, based on our experience, recommend building with SIPs. Instead, I would recommend ICFs, which are extremely efficient and cost-effective to construct on-site and are even more energy-efficient and thermally dense, due to their inherent greater mass compared to SIPs. ICFs also provide the same protections from rot, mold, and fire that SIPs manufactured with fiber cement panels do. Amvic ICFs combine closed-celled EPS insulation and concrete thermal mass, which evens out temperature fluctuation by absorbing and storing heat. This prevents air movement in or around the cellular structure, creating an airtight seal around the entire perimeter of the building. Building with Amvic ICFs generated perhaps only one percent of construction waste on average. Our on-site SIP modification work generated substantially more waste, though that waste was recycled. Furthermore, Amvic uses steam and cold water to produce ICFs. No CFCs (Chlorofluorocarbons), HCFCs (Hydrochlorofluorrocarbon), formaldehyde, or any chemicals are used in Amvic's manufacturing process and no off-gassing is present. The impermeable walls prevent the entry of dust, pollens, and pollution.

Even though our unique SIP design used fiber cement panels instead of OSB, which resulted in the final exterior and interior wall structure, I prefer working with ICFs. In our unique SIP construction, we did save the additional cost of not having to sheath over the OSB SIP surfaces that are typically used by other SIP manufacturers. Also, the use of fiber cement board for the SIP skins eliminated the exposure to formaldehyde, a binder inherent in OSB.

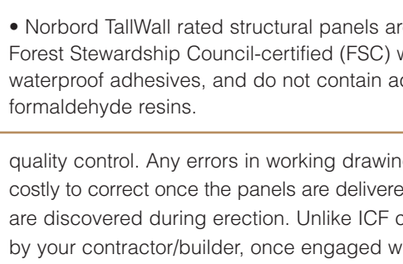
Our 6-1/2-inch thick SIP walls provide R-30 insulation and our 11-inch thick SIP roofs provide R-36 insulation. In certain applications, our SIP roof exteriors were manufactured with exterior-grade 4 x 12-feet Forest Stewardship Council (FSC)-certified TallWall OSB sourced from Norbord. TallWall rated structural panels are manufactured using wood strands and waterproof adhesives, and do not contain added urea-formaldehyde resins. The wood strands are arranged in cross-oriented layers, to provide strength and performance properties similar to an equivalent thickness of plywood. The result is a structural engineered wood panel that is consistent in quality with no core voids, which reduces wall air leakage up to 60 percent, for better indoor air quality.

While our experience with one particular SIP manufacturer proved costly, both in terms of added labor costs and damaging construction time delays, that is not to say that other SIP manufacturers are prone to error and delay. The question that needs to be posed, though, is how does one ascertain that their project will end up as represented by the SIP manufacturer? There is no way to know for sure until completion of SIP "manufacturing" and installation on the site—after considerable construction dollars have been spent. Should there be problems, labor and material costs escalate and time is lost, in order to "re-manufacture" or "re-cut," and finally re-erect. With ICFs the walls are constructed on site and are easily cut and positioned to exact requirements.

Another drawback to SIPs that we encountered was installing electrical and plumbing assemblies, which necessitated at times cutting the interior surface of the SIP walls. Since our interior SIP skins are the actual fiber cement wall surfaces, not an OSB intermediate, this additional panel cutout work proved time consuming and frustrating. With ICFs such tasks are easily accomplished, and the cosmetic defacing work is covered with interior drywall.

SIPs and ICFs are superior structural components that provide resistance to earthquakes and hurricanes, while being more fire-, mold- and water-vapor diffusion-resistant and provide high levels of insulation. In either case there is no air infiltration or thermal bridging. This was an important consideration for construction in a coastal environment such as The Sea Ranch.

Once the SIP walls and roofs were constructed, the SIP roofs were covered with Cosella-Dörken DELTA®-FOXX, the most vapor permeable roof underlayment on the market. This extraordinary tough membrane has a very high water vapor permeability, which ensures excess moisture is quickly removed from the roof. A water-repellent dispersion coating makes DELTA-FOXX permanently and reliably waterproof. DELTA-FOXX is Class A fire-rated.



SIP Roof Fabrication & Installation

SIP Roof Installation & Deitrich UltraSTEEL® Framing

FortiFlash®, DOW FROTH-PAK™ Foam Insulation, DELTA®-FOXX, BattenUP®, Distinction® Slate & Akwaseal Pond Liner

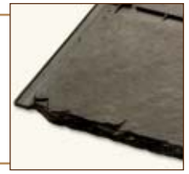
Cosella Dorken DELTA®-FOXX

• DELTA®-FOXX is a vapor permeable roof underlayment, which ensures excess moisture is quickly removed from the roof, making the roof permanently and reliably waterproof.

Batten Plus BattenUP

• Batten Plus' BattenUP is a corrugated plastic batten tested and approved by ICC for Class A tile roof systems. The fluted plastic battens solve many problems caused by the use of wood battens, which rot over time because they do not allow air circulation under the roof tile, which helps keep the underlayment dry.

Trimline® Distinction™ Slate



• Distinction™ Slate has the deep textured appearance of natural slate with deep chiseled edges, creating the most realistic composite slate available.

On top of the DELTA-FOXX roof underlayment was installed Batten Plus' BattenUP, a corrugated plastic batten tested and approved by ICC for Class A tile roof systems. The fluted plastic battens solve many problems caused by the use of wood battens. Wood battens rot over time because they do not allow air circulation under the roof tile, which helps keep the underlayment dry. The rotting of wood battens is also solved by the fluted plastic battens, by allowing water to drain through the large fluted channels and off the roof. They are not porous, as wood is, so they won't absorb moisture.

Finally, on top of the BattenUP plastic battens, Trimline® Building Products black composite Distinction™ Slate was installed on the roof by Richard Howard, a member of our construction team. Distinction Slate exhibits the rich, deep-textured appearance of natural slate with deep chiseled edges for the most realistic composite slate available. Distinction Slate is designed in a two-piece panel in two different natural slate surfaces. Distinction Slate is durable and a third of the weight of natural slate, meaning it can be installed on existing buildings without structural modifications. A primary reason for the selection of Distinction Slate is that it contributes to environmental sustainability in the following ways:

• Eco-friendly content is 58 percent—18 percent recycled post-industrial content of which 5 percent is cellulose material and 13 percent is fly ash. Distinction Slate uses 40 percent halogen-free fire retardant additives and is chemically non-reactive.

• Reclaimed landfilled waste—Distinction Slate utilizes a recycled cellulose material, along with a crystalline filler. Both of these ingredients would be landfilled if they were not reclaimed and reused.

• Manufacturing Process—Regrind plastic is used in 10 to 20 percent of new products. No in-process plastic from the Distinction manufacturing plant goes into landfills.

• Fuel Efficiency—Distinction Slate is 67 percent less weight than natural slate and concrete/clay tile, and the typical weight of shingles. Weight advantage means more square footage on a truckload, which requires less transportation per roof.

• Durable—Distinction Slate is warranted for 50 years and is 100 percent recyclable at the end of its life. Distinction Slate performs well under high UV light and low temperatures, can withstand a wide range of weather from sub-zero temperatures to relentless heat and sun exposure, and is nonfading.

Another aspect is the relationship to the home's rain catchment system. It is important to minimize any dirt, debris, or chemicals the water may pick up so there is less to filter later in the process. Distinction Slate provides a slicker surface than composite or other systems, so it does not collect as much dust and debris. It washes off much more quickly. It is one of the most effective, quickest, and most reliable solutions for efficient water catchment. With other types of systems, which are more porous such as slate and other clay and concrete tiles, grit, bird droppings, and other debris are harder to wash off, and hold and harbor a greater danger of bacterial growth that can leach toxins. Distinction Slate in this regard is preferable for potable water systems. In addition, the pores in other roofing material naturally absorb water, and porous catchment surfaces can experience as much as a 10 percent water loss, resulting from inefficient flow and evaporation.

Early on during the design phase of the Optimum Performance Home, we had favored natural slate. But after extensive research into the substantial material cost and the cost to retain specialized labor to install the natural slate, we decided to use instead our second choice, Distinction Slate, which turned out to be substantially more cost and labor saving and more eco-friendly.

The Amvic ICF walls have been cladded, first with a layer of Cosella-Dörken DELTA®-DRY, prior to screwing on the 7/16-inch thick MaxiPanel and 3/4-inch x 3-1/2-inch MaxiTrim (batons) Cedar grain fiber cement cladding. The batons were also screwed to the

exterior SIP panels, to create a board-and-batt style appearance.

DELTA-DRY is an innovative Ventilated Rainscreen that provides high-drainage capacity, a complete capillary break, and excellent moisture-protection characteristics. It features built-in drainage and ventilation layers, to provide reliable protection from moisture build-up. Preventing solar-driven moisture from the outside to migrate inwards is an essential requirement to keep wall systems dry. This is especially important for absorptive claddings like manufactured stone, fiber cement siding, or conventional stucco systems.

Even in difficult climates that only provide short drying periods for the building envelope, a rain-screen system offers outstanding protection for the structure, by allowing for drainage of water that makes its way behind the exterior cladding material.

As previously noted, the project overlooks the Pacific Ocean and is subject to consequential moisture exposure from the salt air and rain. Thus, an important consideration in the construction of the home was to use all PHEINOX™ hardened stainless steel and Climatek™ coated screws and fasteners, which are manufactured by GRK Canada Limited. Regarded worldwide as "The Industry's Toughest Screws," the GRK Fasteners' ÜberGrade stainless screws and fasteners used throughout the construction of the home—concrete screws, composite deck screws, ICF and SIP screws, fiber cement panel screws, wood screws, and the renown R4™ multi-purpose self-countersinking screw and RSS™ rugged structural screw—are guaranteed against staining and rusting. Additionally, the nails used in the construction of the home are premium-hardened stainless steel and coated for long-term durability.

During construction we are using exclusively caulks, sealants, and adhesives manufactured by OSI Sealants, Inc., part of the Dusseldorf, Germany-based Henkel Group's North American Consumer Adhesives Businesses. The company's Green Series low-VOC construction adhesives, caulks, and sealants were chosen to meet the LEED for Homes guidelines.

In the Optimum Performance Home, Frazee Paint's Envirokote Primer will be applied directly to new drywall and smooth fiber cement interior surfaces, providing a solid, bright white surface for the application of Frazee's Envirokote Flat paint and Tobias Stucco natural clay earth plaster. Frazee antimicrobial primers and paints are low-odor, zero-VOC formulations that eliminate the aromatic solvents, heavy metals, and formaldehyde preservatives found in the typical paint or sealer. The result is a non-polluting coating that also acts as a sealer to help reduce off-gassing from the surface below. Tobias Stucco is also a mold- and mildew-resistant and zero-VOC formulation.

Cosella Dorken DELTA®-DRY

• DELTA-DRY is an innovative Ventilated Rainscreen that provides high-drainage capacity, a complete capillary break, and excellent moisture protection characteristics.

GRK Fasteners

• GRK ÜberGrade stainless screws and fasteners are used throughout in the construction.

OSI Sealants, Inc.

• OSI Sealants' Green Series™ low-VOC construction adhesives, caulks, and sealants are used throughout in the construction.

Frazee Paint® Company

• Frazee antimicrobial primers and paints are low-odor, zero VOC formulations that eliminate the aromatic solvents, heavy metals, and formaldehyde preservatives found in the typical paint or sealer. The result is a non-polluting coating that also acts as a sealer to help reduce off-gassing from the surface below.

Tobias Stucco® Interior Wall Finish

• Tobias Stucco® Interior Wall Finish is an environmentally safe, non-VOC, mold-resistant, color-fast mixture that can be trowelled on walls and applied with various techniques to achieve a variety of textures.

Attic Breeze

• Attic Breeze Model AB-252A Solar Attic Fan is an all-black, solar-powered attic fan that uses a proprietary vent housing based on venturiflow technology, to maximize hot-air removal from the attic over the large home theatre.

Lindal SunRooms

• The Lindal solarium and vestibule entrance/walkway combine kiln-dried premium-grade Western red cedar with energy-efficient windows of the highest industry rating for their ability to prevent air and water infiltration under the toughest test conditions.

On the south-facing roof of the dedicated home theatre was installed an Attic Breeze Model AB-252A Solar Attic Fan. The all-black, solar-powered attic fan uses a proprietary vent housing based on venturiflow technology, to maximize hot air removal from the attic over the large home theatre. This ventilation technology combined with high-efficiency 14-inch fan blades, long-lasting variable speed motors, and powerful monocrystalline solar panels results in greater airflow delivery than other attic fans. The Model AB-252A 25-watt solar attic fan can move an incredible 1,550 CFM of airflow, capable of adequately ventilating an attic space of 2,300 square feet! Attic Breeze's all-metal vent housing construction uses corrosion-resistant zincalume alloy for superior performance in coastal climates and high-efficiency aluminum fan blades, featuring ultra-quiet operation. It is equipped with a thermal switch and rodent guard. The monocrystalline solar panels are industrial grade and are made with high-strength temperered glass and sturdy aluminum frames. The Attic Breeze fan is finished with a black, durable powder-coated finish and engineered to withstand extreme weather conditions and high winds. Attic Breeze provides a lifetime parts warranty on all their residential solar attic fan products.

A challenging aspect of the SIP roof construction was the positioning and installation of the elaborate Parallam parallel strand structural beams, which provide differing room heights and interior angles, to create interior character. The beams over the kitchen and master bedroom support the extensive array of VELUX skylights overhead. Off the kitchen main beam will be the Lindal Building Products solarium, which is in the final engineering stage and will soon be installed.

Another major effort was the installation of the VELUX skylights, Wasco pyramid skylight, and Pella Windows and Doors. Pella products are acknowledged as a leader in ENERGY STAR® efficiency. For the fourth consecutive year, the U.S. Environmental Protection Agency (EPA) and Department of Energy (DOE) announced that Pella Corporation has earned an ENERGY STAR Partner of the Year award for their commitment to manufacturing energy-efficient products and educating consumers about them. Additionally, for the second year in a row, Pella was honored with ENERGY STAR's most prestigious Sustained Excellence award, in recognition of their commitment to successfully managing energy use and promoting ENERGY STAR products and practices within the organization.

Pella windows and patio doors offer the warmth and beauty of wood interiors. In the case of the Optimum Performance Home, the wood is Pine, which can be painted or stained to match any decor. The exterior of Pella wood windows are protected by Pella's low-maintenance EnduraClad® Plus, an aluminum cladding system that doesn't need painting.

All Pella windows and doors throughout are triple pane and are constructed with energy-saving, low-E insulating glass. The triple-pane glass construction provides for between-the-glass blinds or fabric shades that can further increase energy savings and can even reduce outside noise. Both Pella Designer Series and Pella Architect Series windows and doors with triple-pane glass are used in the Optimum Performance Home. They are rated #1 for noise reduction when compared to top national brands with similar glazing.

A product's Solar Heat Gain Coefficient (SHGC) rating and U-Factor values gauge energy efficiency. The SHGC rating will tell you how effective the product is at blocking the heat caused by the sun (the lower the number, the less heat it allows in). The U-Factor value indicates how well the product keeps heat inside a home (the lower the number, the better it insulates). Pella's products offer some of the lowest U-Factor values in the industry. Most Pella products with low-E insulating glass meet or exceed ENERGY STAR guidelines in all 50 of the United States, with some that have U-Factor values that significantly exceed U.S. ENERGY STAR guidelines.

In our application, the Pella low-E InsulShield® argon gas-filled insulated glass windows are certified with a U-Factor of 0.27 (US/I-P) or 1.5 (Metric/SI) and a SHGC of 0.28! The Pella sliding French patio doors are certified with a U-Factor of 0.27 (US/I-P) or 1.5 (Metric/SI) and a SHGC of 0.22! The Pella exterior double and single French doors are certified at 0.32 and 0.24, respectively. The application of Pella's triple-pane windows and doors further reduces outside noise by up to 80 percent, for an extremely quiet interior environment, which is further enhanced with the effectively insulated ICF walls and SIP walls and roof.

Pella has received the J.D. Power And Associates award for "Highest in Customer Satisfaction Among Window and Door Manufacturers" three years in a row.

The window selection includes Designer Series and Architectural Series fixed, angled, and double-hung designs. The Designer Series doors include double and single French and sliding French patio styles. All exterior cladding is low-maintenance aluminum for protection from the elements, with the added protection of Pella EnduraClad Plus finish. This finish is made with full 70 percent Kynar 500® resin, which ensures superior weatherability and longer-lasting protection against chalking, fading, corroding, and exposure to the sun's UV rays. Sash corners are joined three ways, for superior strength, using special metal fasteners, and to protect against salt air, high winds, driving rain, fog, and humidity—elements of The Sea Ranch environment. Additionally, Pella's Seacoast Exterior Paint Finish was applied to provide even greater performance over time.

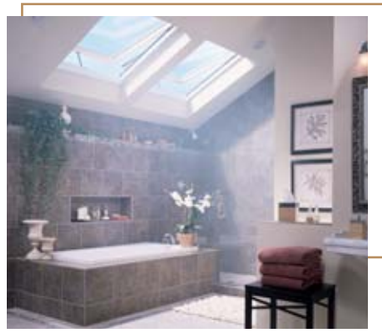
A major challenge in new home construction is water leaks, and the biggest cause of these leaks is water intrusion through windows, doors, and other exterior penetrations. To protect against water intrusion, all of the window and door openings are protected with FortiFlash®, a self-adhesive flexible flashing product developed by the Fortifiber Building Systems Group®. FortiFlash sets the industry standard for effectively protecting windows, doors, and other areas of penetration from water intrusion into wall systems. FortiFlash is engineered to deliver lasting protection against water intrusion in the most demanding environmental conditions. FortiFlash is reinforced by a strong cross-laminated high-density polyethylene film and a self-sealing rubberized asphalt core, which is designed to stay in place in the most punishing weather conditions.

FortiFiber® FortiFlash®

• FortiFlash® sets the industry standard for effectively protecting windows, doors, and other areas of penetration from water intrusion into wall systems.

Weston Solutions GreenGrid®

• The GreenGrid® green roof is composed of a series of preplanted modules made of recycled plastics that can easily be placed directly on a roof or other structure, with sufficient structural capacity.



VELUX® Skylights

• VELUX® skylights meet ENERGY STAR® approval guidelines for all U.S. climactic regions. VELUX remote-controlled venting electric skylights (VSE) are the ultimate skylight for natural daylighting, conrolled fresh air ventilation, and eliminating condensation.

The VELUX skylights throughout the Optimum Performance Home also meet relevant ENERGY STAR approval guidelines for energy efficiency in all climatic regions of the United States. Throughout the home VELUX skylights are employed for overhead, out-of-reach applications or for in-reach applications that do not require egress emergency escape capabilities.

The skylights are either fixed (FS), manually (VS), or electronically controlled (VCE), using an advanced RF remote. They are sized in a wide range and all are easily fitted with blinds. They feature an engineered, matched VELUX flashing system and energy efficient glass, to provide comfort on hot summer days and on cold winter nights.

The double-pane laminated glass construction with argon gas between low-E coated panes reduces external noise and won't discolor, leak, or allow drafts. The design is engineered to provide maximum protection from both heat gain and fading by controlling up to 83 percent of the sun's fade-causing rays. The U-Factor and SGHC ratings for the VELUX skylights in the home are 0.44 and 0.32, respectively.

The walkway of the custom Lindal vestibule entrance is designed with three large VELUX fixed FS606 curb mounted skylights. The kitchen and master bedroom suite employ 10 deck-mounted fixed FS601s. These installations, in particular, are unique design features in the Optimum Performance Home.

A specialized 14-inch, low-profile TRG VELUX Sun Tunnel™ tubular skylight will be installed in the underground wine cellar ceiling, with a highly reflective rigid tunnel perturbing out to the above-ground Weston Solutions GreenGrid roof garden. This will provide the brightest daylight capture from all angles.

Newer VELUX deck-mounted skylights are now available. They are designated The No Leak Skylight because they provide three layers of water protection and feature advanced LoE3 glass for better energy efficiency, higher visible light transmittance, and

Wasco® Products, Inc.

• A custom thermally-enhanced Wasco® aluminum-framed Pinnacle 300 pyramid skylight was designed and manufactured for the library/home theatre/surround music room.

Revere Copper Products, Inc. & CopperCraft

• Revere Copper Products, Inc. copper alloy sheets were fabricated into gutters by CopperCraft, an old world metalworking company.

DOW FROTH-PAK™ Foam Insulation

• Class-A Fire rated FROTH-PAK™ Foam Insulation is a two-component, quick-cure polyurethane foam that fills cavities, cracks, and expansion joints for insulation and air sealing.

Dietrich UltraSTEEL® Framing

• UltraSTEEL® Framing is a next-generation light-gauge roll-forming technology that significantly increases product performance, including greater load-carrying capacity, higher limiting heights, better acoustical and fire performance, and easier installation.

Johnson Hardware®

• Johnson Hardware® Series 2000 heavy-duty pocket door kits with ball bearing wheels will work with the finished interior doors.

improved solar heat gain performance. These units had not been introduced when we were under construction, but they are now available across the country and provide many new features and even better performance. They also carry an industry-first ten-year installation warranty, in addition to product warranties.

A custom 4- x 4-foot thermally-enhanced aluminum-framed Pinnacle 300 pyramid skylight was designed for the library/home theatre/surround music room and manufactured by Wasco® Products, Inc. The rugged, one-piece Permatherm® Vinyl Curb reduces thermal conductivity and condensation and features a built-in condensation channel to control indoor moisture in higher humidity areas. A co-extruded Weather Gasket ensures minimal air infiltration. The glazing is Performance Plus 2, a tempered low-E, argon gas-filled glazing, with a U-Factor of 0.23 and a SHGC of 0.47. The durable Quaker Bronze enamel Kynar® finish is engineered for long-lasting protection against the harshest environmental elements. As installed, this custom-configured structural skylight is visually stunning and sets off the home's unique tower structure architecture.

The extensive copper rain gutter system has been installed. The material for the all-copper rain gutters was sourced from Revere Copper Products, Inc. Founded in 1801 by Paul Revere, a prominent silversmith and maker of cast bronze bells and marine hardware, Revere Copper is one of the oldest, if not the oldest, manufacturing companies in the United States. Our architectural designer/draftsman, Ed Rose, provided The Sea Ranch-approved recessed gutter design and CopperCraft fabricated the gutter system. CopperCraft was established with the goal of preserving the high-quality and craftsmanship found in old world metalworking, while enhancing techniques with computerized layout, cutting, and forming. This insures quality, consistency, and competitive pricing. Once the gutters were delivered to the construction site, some additional copper metal work was performed by Chris Attchison's team at CNA Metalworks, Inc., which is located on The Sea Ranch. The rainwater is captured by the copper gutter system and deposited into the on-site underground water cistern for courtyard and garden irrigation use. The 2,400-gallon EcoRain cistern has completely filled from the captured roof's rainwater.

The Gutter Helmet gutter protection system has yet to be installed on all of the full-size copper rain gutters. The multi-patented, flow-limiting, ribbed design slows and spreads water, causing it to flow easily into the gutters. The simple physical law of surface tension forces water around the Gutter Helmet nose and into the gutters, while debris falls to the ground. A 2/8-inch horizontal gap handles the heaviest rains but keeps out animals and debris. Gutter Helmet's patented Perma-Life™ coating will not fade or chalk and is not affected by corrosive acid rain. A black Perma-Life coating has been chosen to complement the black Trimline Distinction Slate roofing.

Once the exterior building envelope was constructed, we sealed various crevasses, both on the exterior and interior, with DOW FROTH-PAK™ Foam Insulation, to insure an air-tight structure. FROTH-PAK Foam Insulation is a two-component, quick-cure polyurethane foam that fills cavities, cracks, and expansion joints for insulation and air sealing. It is Class-A fire rated.

The interior walls are constructed with UL® Classified and UL Fire Rated Dietrich UltraSTEEL® Framing studs and drywall tracks. Dietrich UltraSTEEL Framing is an internationally patented method of altering the characteristics of base strip steel, providing higher-strength capacity from lighter-gauge material. This next-generation light-gauge roll-forming technology significantly increases product performance, including greater load-carrying capacity, higher limiting heights, better acoustical and fire performance, and easier installation. The mechanical properties of UltraSTEEL are higher than traditional steel, which translates to an increase in stiffness and load-carrying capacity. Because steel has a significantly higher strength-to-weight ratio than wood, it thus has greater earthquake resistance. The unique dimpled surface of the framing components has been shown to reduce the levels of noise transmission through walls and ceilings. Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow. In addition, steel is recycled and recyclable.

As part of the Dietrich UltraSTEEL Framing, we installed six Johnson Hardware® Series 2000 heavy-duty pocket door kits with ball bearing wheels, to work with the finished interior doors. Johnson's quality heavy-duty pocket door system consists of:

• Heavy-duty precision-extruded aluminum jump-proof "I" beam track.

• Four-wheel heavy-duty ball bearing wheels, for smooth low-resistance rolling. The hanger features a unique "rocker" design that ensures constant four-wheel track/wheel contact and equal weight distribution. "Flip-of-a-clip" separates wheels from door plate for easy door installation/removal. All steel parts are zinc plated.

• Self-adjusting floor anchors. Long vertical fingers slide into split studs, allowing for floor settling without disturbing horizontal alignment of header and track.

• Steel-wrapped split studs with heavy-gage galvanized steel sides and backs for maximum rigidity, to protect the door cavity against accidental nail penetration.

DESIGN
optimum performance home

Pella® Windows, Dimplex® Electric Fireplace, VELUX® Skylights, ICF/SIP Construction, Distinction® Slate, & Dietrich UltraSTEEL® Framing

PEARL® Protected Permanent Escape & Rescue Ladder

• A PEARL® Protected Permanent Escape And Rescue Ladders provide the ultimate escape solution in the event of a fire or other home emergency.

RSF Wood-Burning Fireplaces' Delta 2

• The Delta 2 fireplace has a huge firebox, gently curving panoramic glass doors, and beautifully handmade firebricks, and utilizes RSF's patented clean burn technology, to achieve exceptionally low emissions.

Dimplex® Electric Fireplaces

• Dimplex® electric fireplaces are featured in the master bedroom suite, the guest bedrooms, and the home office. These extraordinary electric fireplaces feature the ultra-realistic Dimplex patented flame effect and the Purifire™ air treatment system that purifies indoor air.

Scofield LITHOCHROME® Tintura™ Stain, Distinction® Slate Roof, & Courtyard

We have yet to install four Johnson 2610F Wall Mount Door Hardware kits, which are surface mounted outside the wall. One will be installed for workshop access in the garage area and the other three on the outdoor shed. The aluminum track has a concave, one-point hanger channel for an unobstructed glide. Double wheel ball bearing hangers with swivel design hold nylon wheels evenly on track, are jump proof, and never need lubricating.

The next step, following Sonoma County Building Department inspection, will be to cover the interior ICF walls and Dietrich UltraSTEEL Framing studs with Serious Materials QuietRock® and Georgia Pacific (GP) ToughRock® drywall.

Three PEARL® (Permanent Escape And Rescue Ladders) fire safety ladders have been installed in the second story SIP walls. Two PEARLs are installed at the south and north SIP walls on the guest bedrooms' deck. The third is installed below the west facing Pella window in the library/home theatre/surround music room. The PEARL ladders provide the ultimate escape solution in the event of a fire or other home emergency for anyone on the second floor of the home. The ladders are ruggedly built using high-tech engineering and durable materials, including anti-slip rungs and standoffs, which can support up to 1,500 pounds. This ensures that the ladder is strong enough to support multiple people descending the ladder and stable enough for children to use. In addition, the PEARL ladder can easily support a firefighter in full gear performing rescue operations. The paint-grade cabinet door will be painted finished to blend seamlessly with the Tobias Stucco clay plaster décor.

The beautifully sculptured Delta 2 fireplace by RSF Wood-Burning Fireplaces has been installed in the living room. The Delta 2 has a huge firebox, gently curving panoramic glass doors, and beautifully handmade firebricks. It utilizes RSF's patented clean burn technology, to achieve exceptionally low emissions. Although the fireplace is environmentally sound, it is also capable of heating large areas, as is the case with the open-plan design of the home's main residence. The

L.M. Scofield

• L. M. Scofield's LITHOCHROME® Tintura™ Stain is a low VOC, environmentally friendly stain in Sea Ranch-approved Dark Walnut.

Delta 2's huge bay window offers an unequalled view of the fire from three different living spaces—the living room/kitchen, window seats, and dining room. The large 4.4-cubic-foot firebox has a handmade firebrick lining and easily holds 24-inch logs. An optional firescreen enables the Delta 2 to be burned with the glass door open, to mimic a traditional masonry fireplace with the crackle of a real wood fire. The Delta 2 was tested by a certified EPA facility to burn as clean as an EPA Phase II wood heater, at 3.548 grams per hour. On the exterior of the roof is Delta's sleek 8-inch diameter stainless steel EXCEL chimney, the most technologically advanced chimney available.

Five Dimplex® electric fireplaces also have been installed—in the master bedroom suite, the guest bedrooms, library/home theatre/surround music room, and the home office. These electric fireplaces feature the ultra-realistic Dimplex patented flame effect. The fireplaces are energy efficient and operate for pennies per day. Unlike some traditional fireplaces, electric fireplaces require no standing pilot and contribute no particulates or emissions, such as carbon monoxide, to inside or outside air. They reduce environmental impact by consuming no wood or fossil fuels and provide thermal comfort through efficient zone heating. All of the Dimplex BF33DXP electric fireplaces feature the built-in Purifire® Air Treatment System. Dimplex Purifire fireplaces are the world's first integral air-filtering electric fireplace. The high-efficiency washable allergen reduction filter operates with the heater or may be run with the air-circulating fan only to provide continuous, quiet cleaning. Based on a 12 x 14-foot room, the BF33DXP will circulate and clean the air four times per hour.

As part of completing the rough plumbing, the Kohler® Body Spa Ten-Jet Tower (K-1000-H2) shower assembly was installed in the courtyard spa area, along with separate Kohler Master-Shower Rite-Temp valve trim with cylinder handle (K-T9492-7), and Kohler MasterShower Hotel Handshower Kit (K-8520). In the master bedroom suite bathroom the Kohler Escale® BubbleMessage bath with chromotherapy (K-11343-GCR) was installed. The guest vanity bathroom off the Lindal vestibule was fitted with a Sterling®/Kohler OC-S-63 Series 6206 (62060103) ADA-compliant roll-in shower module in lightly textured swirl-gloss white. Made from solid Vikrell® material for strength, durability, and lasting beauty, the module is designed with a low-profile threshold for easy wheelchair access. A Sterling Accord™ barrier-free whirlpool bath with 15-inch apron (76141110-LH) and an Accord shower module in white solid Vikrell material with an integral Kohler showerhead (71144113) and Kohler diverter bath spout (K-389-CP) was installed in the second-floor guest bathroom. All of the Kohler bath/shower installations are compliant with ADA standards and meet the home's universal design and adaptability design requirements.

The staining of the Cedar-grained MaxiPanel fiber cement exterior of the home has been completed. After considerable comparative sample testing we chose L. M. Scofield's LITHOCHROME® Tintura™ Stain, a low VOC, environmentally friendly stain in Sea Ranch-approved Dark Walnut. The waterborne stain penetrates and bonds

Dryerbox® & Small Pond

with porous concrete or cementitious toppings for permanent, nonfading, predictable colors. Either a translucent or an opaque appearance can be achieved with this proprietary system. Our painters, MoonDance Painting, applied two coats, to increase color intensity, for a final installed appearance that exhibits the appearance of stained wood. MoonDance owner Steve Stiles specializes in using low- and no-VOC paints as well as environmentally friendly painting practices—minimizing wastes, using nontoxic cleaners and materials, and disposing of wastes properly.

The next installment in this series of case-study articles will cover the interior finishing of the home and continue to cover the actual work being done, to accomplish the tasks described, as well as the application of No-Burn®, a dual-action Class A fire reactant and black mold inhibitor, and Nisus Corporation's Bora-Care®, as well as the installation of the Lindal Building Products' solarium and vestibule entrance, Serious Materials' QuietRock® soundproof drywall and Georgia Pacific drywall, Acoustiblock® reinforced dense noise isolating material, EcoVantage's PerfikDek EcoPrem Wood decking, Carriage House Door garage doors, KraftMaid cabinetry, WaterFurnace geothermal system, QuietCool whole-house fans, Daltile Continental Slate™ flooring, Mapei® Opticolor™ epoxy grout, Oregon Shepherd wool insulation, Equi=Tech balanced power system, Monster Cable CAT6 infrastructure cable, and more.

In the meantime, photos and videos will be posted on the *Ultimate Home Design* Web site (www.ultimatehomedesign.com/oph.php), depicting progress in the construction of the first Optimum Performance Home.

Design Concept

As previously noted in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how modern building products and methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes concerns itself with building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated and holistic design, the house will serve as a durable residence that allows its occupants to age in place. The exceptionally solid structure should last decades, if not centuries, with minimal maintenance.

The high-performance building systems employed are designed to exceed California building code requirements and California Title 24 standards (nearly 38 percent above the minimum) and resist natural disasters more effectively than a code-minimum house, even with the new California code requirements that require use of non-combustible or fire ignition-resistant building materials. Constructed with stronger building materials and superior techniques, the home will be safer, allowing homeowners greater peace of mind. The Optimum Performance Home qualifies for the Fortified…For Safer Living® program of the Institute for Business & Home Safety (www.ibhs.org/business_protection). This program specifies construction, design, and landscaping guidelines to increase a new home's resistance to natural disaster.

In addition, the home will meet the guidelines and qualifications for the U.S. Department of Environmental Protection's ENERGY STAR, the EPA's (Environmental Protection Agency) WaterSense™, and the American Lung Association® Health House® programs. It also will meet the requirements of the National Association of Home Builders' (NAHB) National Green Building Standard, the Sustainable Buildings Industry Council (SBIC) Green Building Guidelines, and the "Green Points" program. Sonoma County and The Sea Ranch Association are now considering this program for adoption.

Furthermore, the home's design was the subject of a case study analysis presentation before the Custom Residential Architects Network (CRAN), Full Spectrum Practice Convention of the American Institute of Architects on October 20, 2007 in Chicago, Illinois.

The home is also a case study of the California Energy Commission in terms of energy-efficiency applications and an advanced water-saving plumbing system.

Finally, the home is a national showcase for the Custom Electronic Design & Installation Association (CEDIA), and is the subject of a series of articles on the design and installation of the electronic lifestyle components in the home. These articles are featured in CEDIA's *Electronic Lifestyles®* quarterly magazine. A presentation on the home's design was presented at the 2009 CEDIA Expo in Atlanta, Georgia.

The Setting

The Sea Ranch is an internationally renowned 5,000-acre environmentally protective residential development situated within a pastoral and forested coastal enclave and nature preserve approximately 110 miles north of San Francisco, California. This stunning development, now celebrating its 45th anniversary, straddles a 10-mile stretch of Highway 1 along a uniquely beautiful rugged coastline, ending at the northern tip of Sonoma County and the south bank of the Gualala River.

The Sea Ranch is widely regarded as a unique and remarkable residential development. During the 1960s and 1970s, The Sea Ranch was at the forefront of environmentally responsible development. It was conceived and designed by architects and landscape architects who wanted to provide a harmonious mixture of custom homes and pristine natural Northern California landscape in oceanfront, meadow, and forest environments. In fact, The Sea Ranch concept and its architecture are recognized in schools of architecture around the world, and it is frequently used for case studies in environmental and architectural design. The first condominium complex to be built on the southern coastal bluffs of The Sea Ranch is now a registered national architectural site.

Single-family development occupies approximately 2,500 acres, without borderline fences or other visible delineation of property lines. The remaining acres are permanent greenscape commons with 45 miles of nature trails for walkers, bicyclists, and equestrians. Each home is custom designed by an architect/architectural designer following site-specific design guidelines and is situated off a private road network without curbs, sidewalks, or streetlights. The Sea Ranch is a very unique residential development woven into a tapestry of buildings and nature and committed to environmental preservation. The development includes 2,288 lots for single-family custom homes, with 508 remaining to be developed (1,773 already developed and 7 under construction).

The Sea Ranch is managed by The Sea Ranch Association, a Common Interest Development (CID) with an elected volunteer Board of Directors, and supported by numerous volunteer committees. All development on The Sea Ranch is subject to design review and the approval of a Board-appointed autonomous Design Committee. The Design Committee is presently comprised of architects and landscape architects, though, it does not include anyone with experience in vegetation management or "green" sustainable building design. A legal set of Covenants, Conditions, and Restrictions (CC&Rs) govern the development and are designed to protect The Sea Ranch concept.

Distinction® Slate Roof, SIP Wall Scofield Tintura™ Stain, Large Pond & PEARL Protected Fire Safety Ladder

Scofield Tintura™ Stain, Reeve/CopperCraft Gutter, Distinction® Slate, Dimplex® Electric Fireplace & Attic Breeze Solar Attic Fan

The Home

The Sea Ranch Design Committee imposes upon designers architectural building blocks derived from the original rural structures found on the northern

Contractor Roger Stevenson Installing Reeve/CopperCraft Gutters

California coast. Designers are expected to apply their creativity to render various arrangements and deviations to arrive at a custom solution that specifically responds to the site. Successful proposals submitted to the Design Committee address the issues of passive solar positioning, wind, glazing (window) layout, privacy between neighbors, vegetation protection, view preservation, topography and grade changes, roof slopes, appropriate exterior materials and finishes, and other exterior design considerations—all within the building and site design.

A focus of the Optimum Performance Home's design is to stand as a showcase for the "green" movement and demonstrate means of reducing a home's impact on the planet through the use of Low-Impact Development and environmentally responsible and sustainable building materials. It is hoped that the home will become a case study for a "Green Points Program" suited to the scale of The Sea Ranch.

The home's 3,272-square-feet conditioned living space (4,441-square-feet total building "footprint," including garages, covered walkways, courtyard, and decks) is arranged in a three-building compound using a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency. This arrangement provides for an alcove courtyard protected from the prevailing northwest wind. The courtyard is only open to the east.

The home is designed with differing spatial experiences and destinations throughout, to encourage exploration. The home will display innovative interior design and be furnished in a contemporary Frank Lloyd Wright style appropriate to its dimensions. The home design connects the indoors and

iBeam Time-Lapse Pro Construction Camera Perspective 2009-12-23

the outdoors with glass-covered walkways, a courtyard, decks, and a garden to expand livable space, without requiring heating or air conditioning. The home is designed in accordance with biophilic design principles, with abundant and excellent use of natural light and natural indigenous landscaping planned. {For an in-depth analysis of the biophilic attributes of the home, please read "Biophilic Design," "Biophilic Design Attributes," and "The Interior Design Process, Part I: Synthesizing Sustainability, Universal Design, And Technology" authored by Julie Stewart-Pollack in Issue 3 (May/June 2006), Issue 4 (July/August 2006), and Issue 10 (July/August 2007), respectively.}

The main-floor living area is designed to accommodate the capabilities of all occupants without any challenging physical barriers, even for the elderly and disabled. The home design features a ground-level open plan for the living room, dining room, master bedroom suite, and spacious kitchen with solarium, exhibition cooktops, and home-management system.

The second building in the compound is designed to accommodate a large dedicated state-of-the-art Optimum Performance Home Theatre™ (otherwise known as the Reference Holosonic® Spherical Surround™ Home Theatre Laboratory) with integrated rear-screen projection room, front-projection, and a home office. This performance theatre is designed as a "black-out" environment with non-reflective black walls and ceiling and controlled lighting to provide maximum picture contrast and dimensionality, along with a 7.1-channel full-frequency spherical surround loudspeaker system capable of extraordinary dynamic range.

The third building will include a two-car plus boat garage, workshop, main-level guest vanity bathroom, and laundry room. The second level of this building will have two guest bedrooms, a bathroom, and a dedicated library/home theatre/surround music room distinguished by a high-tower feature. To insure universal access to this floor, the design provides for an Otis® Gen2 residential elevator, the most energy-efficient elevator available.

The entrance and walkways that connect the three buildings and the solarium will be enclosed with double-pane insulated- and solar-gain-reduced-tempered glass. There will be a seating area at the vestibule entrance to the home. The main entrance vestibule will serve as an oversized mudroom. The driveway, area around the garage, guest parking, and entrance to the home—as well as all paths around the home—are designed in accordance with The Sea Ranch guidelines, governing exterior hard-surfaced paths. All such surfaces are pervious to virtually eliminate water runoff. The surface will be packed with GraniteCrete permeable surface material, to enhance the natural appearance of the home's setting. There also will be a dedicated equipment/utility room off the courtyard, which accommodates the Uponor and WaterFurnace radiant-

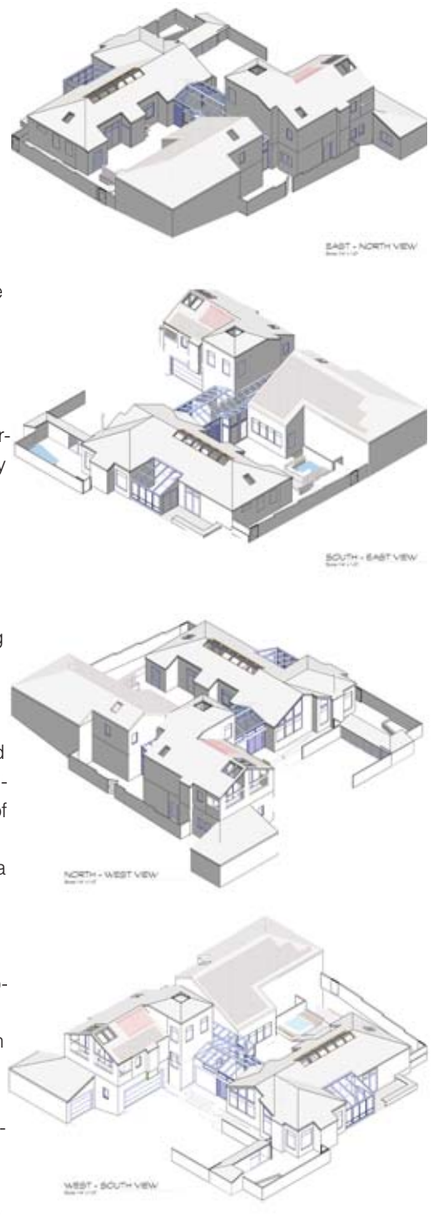
iBeam Time-Lapse Pro Construction Camera Perspective 2010-01-13

heating apparatus, Apricus® solar hot water storage tank, Navien®'s 98 percent condensing on-demand propane-fired tankless water heater, and other equipment. The backup Kohler generator will be housed within a separate weather-resistant structure located off the north wall of the two-car garage and guest bedroom. An upper level of this structure is designed to optimize the northwest wind performance of a future wind turbine system, under development.

Along with the wind turbine system, a large 33-unit high-performance premium photovoltaic Day4 Energy® 48MC module 6.27-kW solar PV system will be installed on the south-facing roof of the dedicated Optimum Performance Home Theatre (see Part XII, Issue 12, November/December 2007). The wind turbine and Day4 Energy systems' electricity will be supplied to the Pacific Gas & Electric power grid.

The home site is nestled on an almost-acre parcel at the edge of a forested area of the southern section overlooking the Pacific Ocean, offering distant water views. The orientation of the home on the site is designed to take advantage of natural lighting and passive solar heating and cooling. Good site and land planning will result in minimal land disturbance and preservation of natural features and environments.

Landscaping will consist of The Sea Ranch-approved indigenous vegetation, with low-water requirements and unique water conservation features, including two ponds and a stream supported by rainwater catchment and captured runoff. Site grading has been specifically planned to enhance the project's placement in the watershed, and the design incorporates the principles of Low-Impact Development to minimize runoff from impervious surfaces and mimic the natural hydrology in overall effect. The resultant water harvesting will then minimize the use of irrigation, and the increased infiltration and retention will passively support the native landscape. Additionally, a gray water system will be used for undersurface plant irrigation.



Four Perspective Views Of The Optimum Performance Home At The Sea Ranch

Next

This continuing series of articles will focus on the design elements, as they pertain to each stage of construction as the project progresses, and will include coverage of the technologies and building systems and the materials used and applied to construct the first Optimum Performance Home. UHD

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-In-Chief and Publisher of *Ultimate Home Design*®, The Green Build And Universal Design Resource™. He is also President of WSR Publishing, Inc, which publishes *Widescreen Review*®, The Essential Home Theatre Resource™. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics and architectural fields. Gary can be reached at 951 676 4914 or gary@ultimatehomedesign.com.

Product And Contact Information

- AFM Corporation, R-Control, 211 River Ridge Circle, Suite 102A, Burnsville, Minnesota 55337, 952 474 0809, www.r-control.com
- Agri Drain Corporation, 1462 340th Street, Adair, Iowa 50002, 800 232 4742, www.agridrain.com
- Amvic, Inc., 501 McNicoll Avenue, Toronto, Ontario, Canada M2H 2E2, 416 410 5674, www.amvicsystem.com
- Aquacore, 604 East North Street, Elburn, Illinois 60119, 888 657 7788, www.aquacore.com
- Aqua Nueva International, 3628 Greystone Ridge Court, Rio Rancho, New Mexico 87124, 505 975 5008, www.aquaharvestonline.com
- Armacell LLC, 7600 Oakwood Street Extension, Mebane, North Carolina 27302, 800 866 5638, www.armacell.com
- Ashland Performance Materials, 5200 Blazer Parkway, Dublin, Ohio 43017, 614 790 3818, www.ashland.com
- Bartlett Mechanical Services, Don Bartlett, 6755 Oak Street, Anderson, California 96007, 408 313 2486, www.bartlettmechanical.com
- Battens Plus, Inc., 530.620.5287, www.battensplus.com
- Bed Rock Concrete Pumping, P.O. Box 503, Point Arena, California 95468, 707 882 2637
- Bed Rock Products, Inc., 135 Hay Parkway, Point Arena, California 95468, 707 882 2323
- Bill Wilson Environmental Planning & Design, LLC, 71 Del Casa Drive, Mill Valley, California 94941, 415 383 2919, 805 689 7639
- California Portland Cement Company, 2025 East Financial Way, Glendora, California 91741, 800 272 9119, www.calportland.com
- Carlisle Coatings & Waterproofing, Inc., 900 Hensley Lane, Wylie, Texas 75098, 800 527 7092, www.carlisle-ccw.com, 707 785 3438, www.
- CETCO Lining Technologies, 2870 Forbs Avenue, Hoffman Estates, Illinois 60192, 800 527 9948, www.cetco.com

- CNA Metalworks, Inc., Chris Attchison, 35550 Verdant View, The Sea Ranch, California 95497, cnametalworks.com
- Conservation Technology, Inc., 2633 North Calvert Street, Baltimore, Maryland 21218, 800 477 7724, www.conservationtechnology.com
- CopperCraft, 404 E. Dallas Road, Grapevine, Texas 76051, 800 486 2723, www.coppercraft.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Beamsville, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- Dietrich Metal Framing/Dietrich Industries, 200 West Old Bridge Road, Columbus, Ohio 43085, www.dietrichmetalframing.com
- Dimension One Spas, 2611 Business Park Drive, Vista, California 92081, 800 345 7727, www.d1spas.com
- Dimplex North America Ltd., 1367 Industrial Road, Cambridge, Ontario, NIR 7GB Canada, 519 650 3630, www.dimplex.com
- DOW Chemical Company, 4847 Hopyard Road, Pleasanton, California 94588-2713, www.dow.com
- Dynacrete, 7343 Ricks Drive, Valley Springs, CA 95252, 209 938 0125, www.dynacrete.com
- 88HVAC, Matt Jung, 1760 Marion Avenue, Novato, California 94947, 415 215 0533, www.88hvac.com
- Euclid Chemical Company, 19218 Redwood Road, Cleveland, Ohio 44110, 800 321 7628, www.euclidchemical.com
- Feeney Construction, John Feeney, 14660 McCourtney Road, Grass Valley, California 95945, 530 477 7647, 530 263 0039
- Finnleo Sauna & Steam, 575 East Cokato Street, Cokato, Minnesota 55321, 800 346 6536, www.finnleo.com
- Firestone Specialty Products, 250 West 96th Street, Indianapolis, IN 46260, 317 791 3390, www.firestonesp.com
- FORTA Corporation, 100 Forta Drive, Grove City, Pennsylvania 16127-6399, 800 245 0306, www.fortacorp.com
- Fortifiber Building Systems Group, 300 Industrial Drive, Fernley, Nevada 89408, 775 333 6400, www.fortifiber.com
- Frazee Paint, 625 Miramar Road, San Diego, California 92121, 858 626 3600, www.frazee.com
- GetWireless LLC, 10901 Red Circle Drive, Suite 325, Minnetonka, Minnesota 55343, 800 990 9025, www.getwirelessllc.com
- GRK Canada Limited/GRK Fasteners, 1499 Rosslyn Road, Thunder Bay, Ontario P7E 6W1, Canada, 800 263 0463, www.grkfastenersys.com
- Gutter Helmet/Southeastern Metals (SEMCO), 1180 Industry Drive, Jacksonville, Florida 32218, 904 757 4200, www.gutterhelmet.com
- Headwaters Resources, 10653 South River Front Parkway, Suite 300, South Jordan, Utah 84095, 888 236 6236, www.flyash.com
- iBeam Systems, Inc., 280 North 8th Street, Suite 30, Boise, Idaho 83702, 800 403 0688, www.ibeamsystems.com
- In-O-Vate Technologies, Inc., 810 Saturn Street, Unit 21, Jupiter, Florida 33477, 888 44 DRYER, 561 743 8696, www.dryerbox.com
- Johnson Hardware/LE Johnson Products, Inc., 2100 Sterling Avenue, Elkhart, Indiana 46516, 800 837 5664, www.johnsonhardware.com
- Kohler Company, 444 Highland Drive, Kohler, Wisconsin 53044, 920 457 4441, www.kohler.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- L.M. Scofield Company, 1651 East Fourth Street, Unit 229, Santa Ana, California 92701, 714 568 1870, www.scofield.com
- MaxiTile Inc., 849 East Sandhill Avenue, Carson, CA 0746, 310 217 0316, www.maxitile.com
- Mendocino Coast Plumbing, Jerry Moyles, P.O. Box 41, Manchester, California 95459, 707 882 2628, 707 353 2628
- MoonDance Painting, Steve Stiles, 888 977 2468, 925 383 4537, www.moondancepainting.com
- Nisus Corporation, 100 Nisus Drive, Rockford, Tennessee 37853, 800 264 0870, www.nisuscorp.com
- No-Burn Inc., 1392 High Street, Suite 211, Wadsworth, Ohio 44281, 330 336 1500, www.noburn.com
- Norbord Industries Inc., 1 Toronto Street, Suite 600, Toronto, Canada M5C 2W4, 416 360 2236, www.norbord.com
- Oregon Shepherd LLC, 12589 Highway 30, Clatskanie, Oregon 97016, 503 728 2945, www.oregonshepherd.net
- Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, Oregon 97479, 800 348 9643, www.orenco.com
- OSI Sealants, Inc.,/Henkel Corporation, 32150 Just Imagine Drive, Avon, Ohio 44011, 800 499 3089, www.osisealants.com
- Owens Corning, 1 Owens Corning Parkway, Toledo, Ohio 43659, 800 438 7465, www.owenscorning.com
- PEARL Protected, 730 Peachtree Stree, NE Suite 850, Atlanta, Georgia 30308, 800 374 5737, www.pearlprotected.com

Russell Peffer Plumbing, P.O. Box 152, Hathaway Pines, California 95233, 209 768 4551

- Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, 847 966 6200, www.cement.org
- QUALCON, Travis Swithenbank, P.O. Box 566, 333 East Pine Street, Fort Bragg, California 95437, 707 964 5000
- Rainhandler/Savetime Corporation, 2710 North Avenue, Bridgeport, Connecticut 06604, 800 942 3004, www.rainhandler.com
- Revere Copper Products, Inc., One Revere Park, Rome, New York 13440-5561, 800 448 1776, www.reverecopper.com
- Roth Global Plastics/FRALO, P.O. Box 245, Syracuse, New York 13211, 866 943 7256, www.roth-global.net
- RSF Fireplaces/Industrial Chimney Company, 400 J-F Kennedy, St. Jerome, Quebec, J7Y 4B7 Canada, 450 565 6336, www.icc-rsf.com
- Seepage Control, 7301 West Boston Street, Chandler, Arizona 85226, 800 214 9640, www.seepagecontrol.com
- Serious Materials, 1250 Elko Drive, Sunnyvale, California 94089, 408 541 8102, www.seriousmaterials.com
- SipBuilder, Mic Carmichael, 13650 Empress Road, Nevada City, California 95959, 530 265 6027, 530 277 8847, www.sipbuilder.com
- Smart Drain, Drawer 2219, Columbia, Maryland 21045, 800 638 8582, www.smartdrain.com
- Spratt Plumbing, William "Willy" Spratt, P.O. Box 375, Avery, California 95224, 209 770 2139
- Steve Michelson Productions, Lobitos Creek Ranch, 2800 Lobitos Creek Road, Half Moon Bay, California 94019-2547, 650 726 2460, www.lobitoscreekranch.com
- Sierra Pacific Builders / Stevenson Electric, Roger Stevenson,1340 Highway 4, P.O. Box 2642, Arnold, California 95223, 209 768 2100
- StormTech, 20 Beaver Road, Suite 104, Wethersfield, Connecticut 06109, 888 892 2694, www.stormtech.com
- Stormwater Solutions, LLC / EcoRainSystems, Inc., 3940 Laurel Canyon Boulevard, Suite 856, Studio City, California 91604, 866 786 7690, www.stormh2osolutions.com
- ThermaSAVE/IHSN, Inc, 4002 Helton Drive, Florence, Alabama 35630, 256 766 3378, www.thermapanel.net
- Tobias Stucco, 2930 Dutton Avenue, Santa Rosa, California 95407, 707 577 8196, www.tobiasstucco.com
- Trimline Building Products, 5315 SW 53rd Court, Portland, Oregon 97221-1937, 503 320 1155, www.trimline-products.com
- Uponor North America, 5925 148th Street West, Apple Valley, Minnesota 85254, 800 321 4739, uponor-usa.com
- VELUX America, Inc., 104 Ben Cassey Drive, Forth Mill, South Carolina 29708, 888 838 3589, www.VELUX.com
- Wasco Products, Inc., 22 Pioneer Avenue, Sanford, Maine 04073, 800 388 0293, www.wascoproducts.com
- WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com, www.stormh2osolutions.com
- Weeks Drilling & Pump Company, Chris Thompson, 6100 Highway 12, Sebastopol, California 95472, 707 823 3184, www.weeksdrilling.com
- Weston Solutions, Inc., 750 Bunker Court, Suite 500, Vernon Hills, Illinois 60061, 847 918 4000, www.greengridroofs.com