

# The First Optimum Performance Home®

## site work and infrastructure part XVIII



Architectural Illustration By Ronald Devesa

Gary Reber

### synopsis

California has a propensity for regulations, yet despite State authority for vertical loop geothermal regulation having been largely delegated to counties (resulting in inconsistent treatment across the state), the blind standard setback imposed by Sonoma County has resulted in effectively outlawing ground loops on sites with septic systems.

Drainage plays a critical role in the design and construction of below-grade applications to prevent groundwater seepage which may cause hydrostatic pressure and leakage, resulting in structural damage.

A 2,400-gallon EcoRain Stormwater Tank Modules' underground water cistern manufactured by Stormwater Solutions was installed to harvest the roof rainwater.

The cistern water is filtered by an in-ground Conservation Technology basket filter and withdrawn from the storage system for on-site irrigation using the company's fully automatic electronic submersible pump.

The two 1,500-gallon septic tanks manufactured by Roth Global Plastics are environmentally sound, watertight, and corrosion resistant.

### Introduction

This is the eighteenth article in the series, documenting the design and construction of the first Optimum Performance Home®. The home is now under construction, 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 has been 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 points 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](http://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 ophsearch and the password ophsearch.

Using iBeam's technology and an "always on" GetWireless AirLink Raven X EVDO V4221-VA and AirLink Dual-Band

Gas prices Skyrocket

No end in sight

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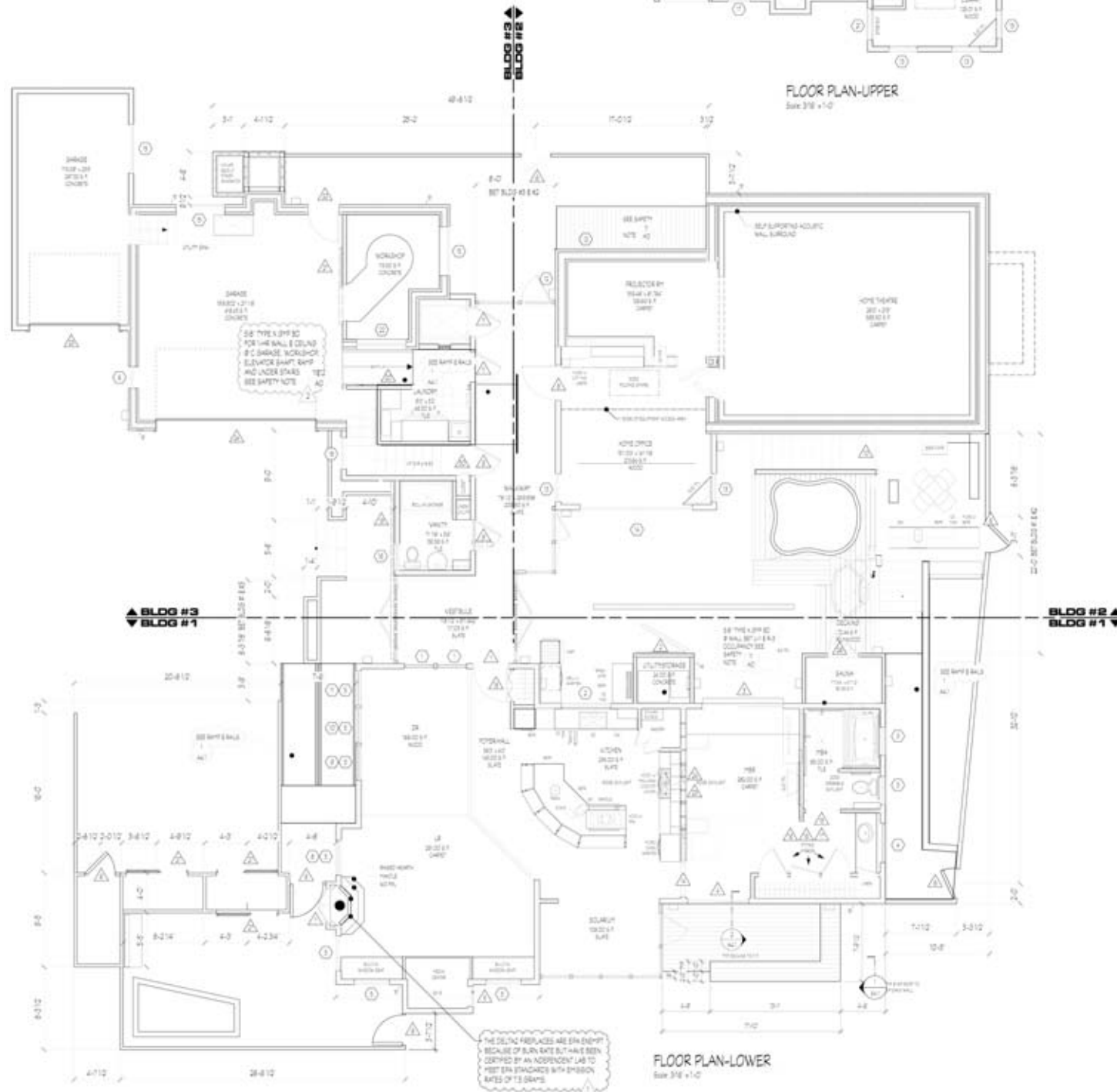
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# The First Optimum Performance Home® At The Sea Ranch



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

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](http://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 further expanded on the "Site and Foundation Preparation," as did Part XVII.

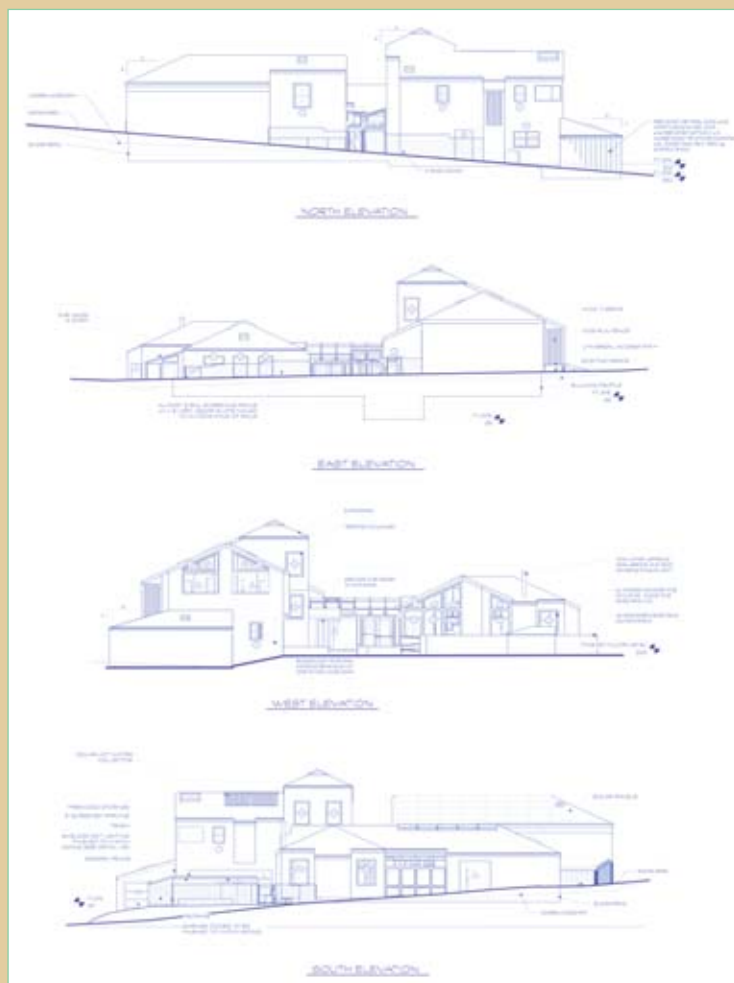
The initial site grading, foundation, and mechanical, plumbing, electrical, and low-voltage infrastructure stages have been completed. This complex and leading-edge under-slab infrastructure work has been documented in the day-to-day time-lapse photography and archived photos on the *Ultimate Home Design*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

**"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."**





LANDSCAPE/SITE PLAN



The elevations of the Optimum Performance Home at The Sea Ranch

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 an extension of our construction loan with New Resource Bank, to enable the completion of the home, now anticipated to be December 2009. 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. Then too, the project encountered, once again, severe rain storms in February and March, which further delayed recommencement of construction. Construction resumed in April.

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, if not the highest, LEED for Homes Platinum residential home 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/hdtv](http://www.ultimatehomedesign.com/hdtv). 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](http://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, and the EcoRain™ underground water cistern. An outline will be provided in Part XIX for the next stage of construction relating to the above slab IHSN ThermaSAVE® SIP walls and roofing.

#### 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 Waterline from Pond to the Boat Garage for Fire Hose Connection (See Part XI)
- 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
- 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
- Construct ThermaSAVE SIP Walls
- Install Roofing Structural Members
- Construct Optimum Performance Home Theatre Structural Ceiling
- Install ThermaSAVE SIP Roofing
- Treat Concrete Slab with Nisus Corporation Bora-Care Termite Barrier Pretreatment
- Install Trimline Building Products Black Composite Distinction Slate on SIP Roofs

#### 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 SIP Boat Garage

#### 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

#### 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 Pond System
- 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

John Feeney, our previous on-site supervising contractor and lead carpenter, did not return to the project. Roger Stevenson, our electrical contractor, who is also a fully licensed contractor, and his brother Dean, an architectural designer and builder, are now our on-site supervising contractors and lead carpenters. Their crew consists of Alain Bernal, Gabriel Bernal, and Aaron Davila Romero, who all stayed on. This crew, plus specialist sub-contractors, is 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.

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 complete the connections for the elaborate geothermal hot water system.

Sebastopol, California-based Weeks Drilling & Pump Company, under the direction of Chris Thompson, CEO, is scheduled to drill the five 310-foot-deep geothermal boreholes.

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

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.

I mentioned previously that we have received no encouragement or support from governing entities for this “extreme green” project. One frustrating encounter occurred with the Sonoma County Building Department, in regards to our requirements for a geexchange bore field location on the property. Early on, prior to the actual commencement of site excavation, we had secured a permit for the drilling of the five 310-foot-deep geothermal bore holes located at the front of the home, in the location of the guest parking area. In late November 2007 the permit expired and an extension was granted for 60 days. Unfortunately, due to wet ground conditions at the time, Weeks Drilling was unable to drill with the heavy equipment necessary for the job. When we sought a new extension in April 2009, the county informed us that they

wouldn't grant another extension, but said we could apply for another permit for the planned location. Then we received a discouraging e-mail from the county. We were informed that the neighboring property to the south was issued a septic system permit and installed a mound septic system in late 2008. The e-mail stated that our permit for the geexchange “wells” could not be issued. The county representative said the proposed “wells” were too close to a neighboring septic (mound).

Upon further research, we determined that apparently, the neighboring property was issued a septic permit on May 11, 2006 (which was for three years). Our geexchange “well” permit was issued on November 27, 2006 and expired on November 27, 2007, with a 60-day extension through January 27, 2008. I was unaware that our extension was limited to 60 days and assumed that we were permitted to drill when the weather cleared.

When I spoke to the county representative, I was told that the county

ordinance requires a 100-foot setback from a septic system. The county would not grant us a variance, leaving us no choice but to find another location on the property for the bore holes, a location that does not conflict with other septic systems elsewhere within 100 feet. We were faced with the situation that if we could not find a suitable area on site, then we would not be able to use the extremely energy-efficient geothermal system planned to heat the hot water for the home, primarily intended for the Uponor radiant heat floor system.

Unfortunately, we had already implanted in the concrete slab the necessary geothermal infrastructure piping that exited to the front of the house, as originally planned and drawn and described on our approved Sonoma County building plans.

Obviously, if the county had done its due diligence when we initially applied for our drilling permit, they would have realized that a prior septic permit was granted for the neighboring property,

which in our consultants' professional opinion should have never been granted, due to the extreme groundwater runoff conditions affecting our property and the surrounding properties, resulting from numerous underground springs in the immediate area. As such, there remains the possibility that this septic mound system could cause groundwater contamination problems.

John Geyer, a consultant, wrote us stating that: “State jurisdictions unanimously separate ground loops, public water supply wells, and septic systems. Variances can be allowed, pursuant to setbacks prescribed for sanitary control zones (usually spaced to protect public water supply wells). Washington Administrative Code 173-160-453(2), for instance, is as ‘geo friendly’ and reasonable as any to be found... but, it still requires a 50-foot setback of vertical bores from septic tanks and 100 feet from any approved septic drainfield. While logic fails for threats from a sealed borehole, the

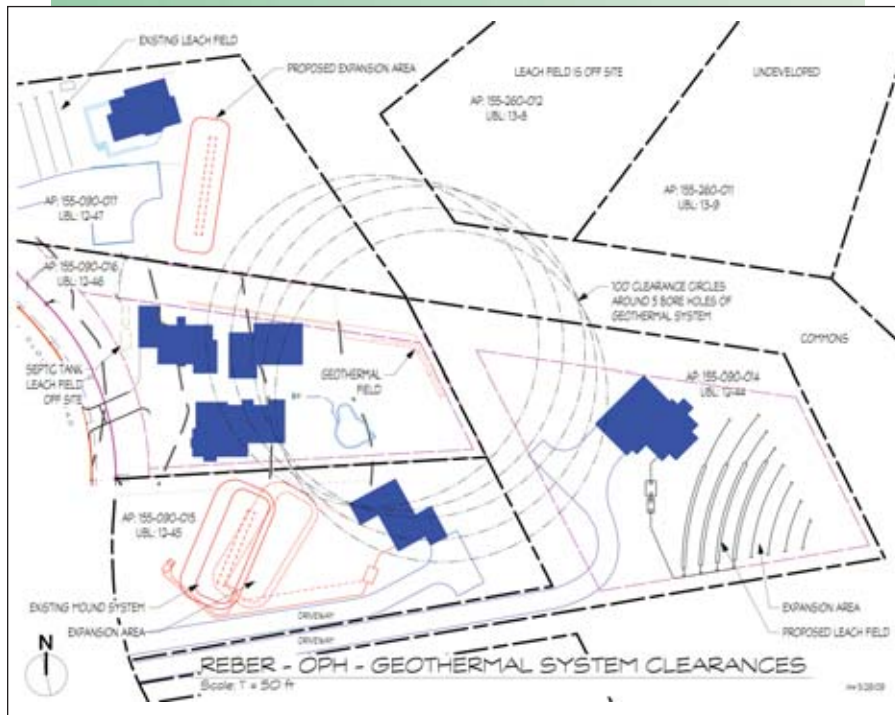


iBeam Time-Lapse Pro Construction Camera Perspective 2009-05-19

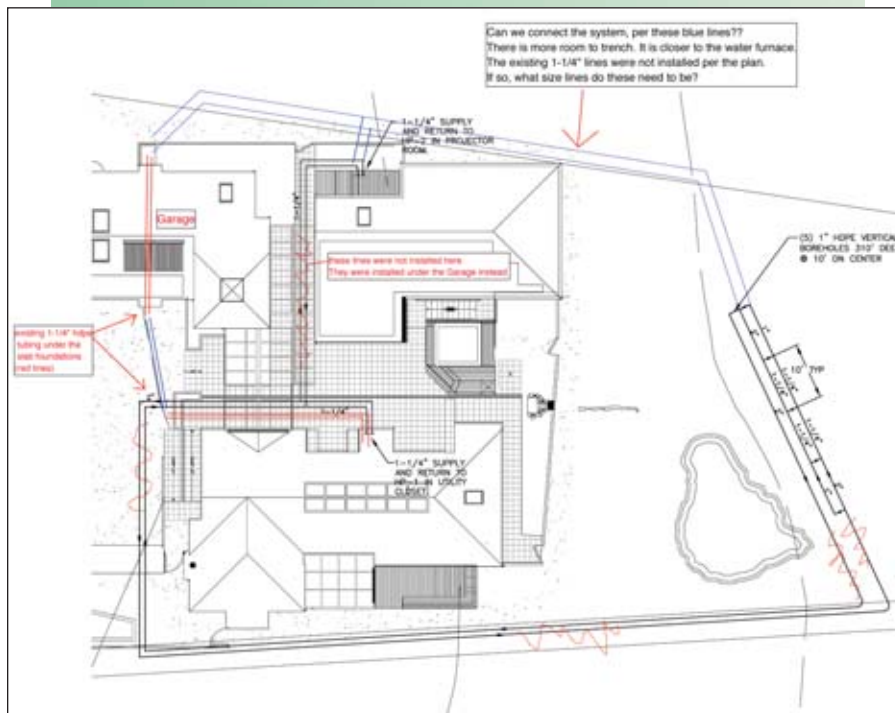


iBeam Time-Lapse Pro Construction Camera Perspective 2009-05-19





Above: Map Geothermal System Clearances  
Below: Map Geothermal Reroute



common treatment of ground loops and water wells seems uniform. Jurisdictions may compress setbacks to 50 feet, but that's likely to be as good as it gets.

"Formal regulations for horizontal loops near or under drainfields are less developed, but reality dictates that a hard-working horizontal loop capable of freezing ground has no place near a percolating drain field. Similarly, crushed rock common to drainfields have no thermal transfer capacity.

"Given California's propensity for regulations, and despite State authority for vertical loop regulation having been largely delegated to counties (resulting in inconsistent treatment across the state), I see little cause for optimism in this case. If a variance is sought, I know of no precedent for less than 50 feet separation from any regulated facility."

Bill Wilson, our environmental site management consultant, argued that the geo-bores are essentially like wells that have been properly sealed and abandoned, with "well" being somewhat of a misnomer. They are really more like deep narrow piles—cement in a borehole, with a pipe run in the center (a pipe loop, actually), and modeled more like a capped and abandoned well, but done even more thoroughly. If the setback is the blind standard, then the county has effectively outlawed ground loops on sites with septic. Also, it should be noted that there is no leach field (drainfield) on the site—it is remote to the site, with a pump up to it, and the FRALO and Roth septic tanks are absolutely water tight and sealed in every aspect.

We held the position that our drilling falls under the closed-loop system regulations of the American Water Works Association (AWWA). Our borehole "wells" are not agricultural wells, domestic wells, or ground monitoring wells. Nonetheless, Sonoma County did not waver from their position, claiming that the sealed boreholes could at

any time leak, allowing contaminated groundwater to seep down deep into the earth's aquifers.

In our attempt to secure another location for our sealed ground loop boreholes, Sonoma County required us to submit a location map showing a distance of at least 150 feet from every approved septic system (septic tanks and drain fields, both already in-ground and proposed expansions). Thus, the requirements of location were tightened further. (See Geothermal System Clearances and Reroute Maps.)

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 house around the northern boundary to the far northeastern corner of the property, which has added to the project's expense and delays.

Now, as stated, we are waiting for the ground to dry up enough to support the heavy drilling rig that will actually drill the geexchange holes. When complete, the bore holes will be 310 feet deep and sealed with 14,000 pounds/280 sacks heat transfer sand and 70 sacks of Bentonite grout with .88 conductivity/2,254 gallons of material in bore holes (305 cubic feet). This special material is being provided by Dynacrete, based in Valley Springs, California. The special U-bend piping



### 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.



### 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.

provided by WaterFurnace will be pressure tested before the pipe is put in the ground and after the holes are backfilled with grout (reference IGSHPA Design Guidelines).

### This Issue

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

In a previous issue, the site's soil conditions and the remedy (see Part XIV) were discussed. This resulted in Headwaters Resources' Doug Yeggy designing a specially engineered Controlled Density Fill (CDF) concrete mix to fill the voids and provide a strong, stabilized surface upon which to support the foundation footings. Headwaters Resources is the source of the extensive fly ash that we used in the concrete mixes designed for the project. The Portland Cement Association and the California Portland Cement Company are the sources of the cement used in the project. Delivery of the Portland Cement and fly ash to the concrete production facility was handled by Conti Materials. The local concrete production facility is Bed Rock Products, based in Point Arena (and Gualala), California. Bob Hay's Bed Rock Concrete Pumping is providing the concrete-pumping service for the project. The mix design for the Amvic ICFs was used once again for the ICF walls and the Amvic ICF AmDeck floor.

These mixes use Portland Cement, Kryton's KIM admixture, Euclid Eucon A+ admixture, and a minimum of 40 percent Headwaters Resources fly ash. The mix design for the standard foundation footings uses 324 pounds of Portland Cement, 216 pounds of fly ash (40 percent), 11 pounds of KIM admixture, and 16 ounces of Eucon A+ admixture per cubic yard. The suspended slab-on-grade mix design uses, per cubic yard, 360 pounds of Portland Cement and 240 pounds of fly ash (40 percent), 11 pounds of KIM admixture, 18 ounces of Eucon A+ admixture, and FORTA® FERRO®. The Amvic ICF concrete mix design used the mix design that was used for the standard foundation footings (see Part XVI).

For an in-depth presentation on the application of these mixes in the project, see Issue XV through XVII.

The engineered suspended slab on grade has been poured, as well as the wine cellar roof. Also poured are the slabs for the courtyard and master bedroom suite deck, and portions of the front porch and ramps at the front and back of the home. The wine cellar roof will feature a Weston Solutions GreenGrid® living herb garden planted around a VELUX® Sun Tunnel™ skylight.

## Owens Corning QuietZone® Acoustical 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.



The Amvic ICF structural elements of the underground wine cellar have been constructed. The stem and foundation walls exposed to the earth have been sealed and waterproofed. Carlisle® Coatings & Waterproofing BARRICOAT-R was used for this purpose. BARRICOAT-R is a waterproofing and vapor barrier membrane designed for vertical surfaces, above or below ground. This roller and/or brush-applied, water-based, asphalt emulsion is modified with a blend of synthetic rubbers and special additives, which cures to form a flexible, monolithic, waterproofing membrane. The membrane prevents lateral water migration. BARRICOAT-R is ideally suited for waterproofing on below-grade foundation walls, and other areas where a seamless elastomeric waterproofing is required.

Drainage plays a critical role in the design and construction of below-grade applications. Without proper drainage, groundwater seepage may cause hydrostatic pressure and leakage, resulting in structural damage. Good drainage is particularly critical to the success of this project, due to the adverse damp conditions contributed by underground springs.

Carlisle's MiraDRAIN's multi-directional flow design allows a continuous path for water discharge, eliminating the potential for hydrostatic pressure buildup. It allows water to pass freely into the drainage core, where it is gravity-fed into the site's drainage collection system.

The exterior earth-encased BARRICOAT-R membrane-protected Amvic ICF wine cellar walls, and the ICF walls that are earth-banked, are covered with MiraDRAIN 6200, high-performance, high-strength drainage composite, consisting of a three-dimensional, high-impact polystyrene core, and a non-woven filter fabric. MiraDRAIN 6200 has the added benefit of a polymeric sheet adhered to the back of the core, to prevent the drainage core from die-cutting the waterproofing membrane. The filter fabric is bonded to the dimpled polystyrene core, to minimize fabric intrusion. The fabric also prevents the passage of soil particles into the core, while allowing water to pass freely.

The exterior concrete roof of the wine cellar will be protected with a BARRICOAT-R membrane, and MiraDRAIN GR9200 will be applied over the waterproof membrane. This sheeted membrane is designed specifically for green roofs, garden roofs, and large planter applications. 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 interior of the dedicated Optimum Performance Home Theatre has commenced, 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 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 included installing the Uponor 1/2- and 3/4-inch red and blue pre-sleeved corrugated AQUAPEX tubing with outer Armacell® AP/Armaflex® pipe insulation, the NuTone® VX1000 central vacuum system, and the

complex electrical and low-voltage wiring system encased in conduit.

Uponor's AQUAPEX tubing provides protection for the installation in the soil and allows for removal and replacement of the tubing, if required. In addition, the red and blue color-coded sleeves easily identify hot and cold waterlines. AQUAPEX's flexibility and strength at temperatures ranging from below-freezing up to 200 degrees Fahrenheit makes it the ideal piping material for hot and cold water plumbing systems, trouble-free fire-sprinkler systems, and hydronic radiant floor-heating systems. PEX is a cross-linked polyethylene.

Armacell AP/Armaflex® pipe (tube) insulation was wrapped over the Uponor AQUAPEX tubing, to provide additional thermal insulation. The expanded closed-cell structure of AP/Armaflex pipe insulation makes it an efficient insulation for effectively reducing heat loss on the hot water plumbing, and heat gain on the cold water plumbing systems. It is formaldehyde free, low VOCs, fiber free, dust free, and resists mold and mildew, and is made with Microban® antimicrobial product protection, for added defense against mold on the insulation.

Jerry Moyles and his team at Mendocino Coast Plumbing did the installation of the Uponor plumbing system.

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. The insulation is also highly effective at reducing the amount of noise that travels from one story to another.

Bill Wilson Environmental Planning and Design, LLC is responsible for the on-site water-management systems, including the pond and drains.

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.

On other eaves, Rainhandler® grids are planned to shatter and re-suspend roof runoff, spraying it to the adjacent mulched landscape areas, to facilitate infiltration. Thus, all impervious roof surface areas that produce runoff are mitigated.

The Stormwater/EcoRain modular tanks can create any size underground void space. The modules are manufactured from 100 percent recycled polypropylene, with a tested weight load rating of H20. In our application we used 72 single modules, each measuring 1.34 feet wide (16.06 inches), 2.25 feet long (26.97 inches), and 1.48 feet high (17.72 inches). Each module has a tank volume capacity of 33.22 gallons. In addition, the system design employed EcoRain 2-inch heavy-duty drainage cells, which were positioned on top of the cistern, to protect the cistern from heavy loads above



## 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.

## Armacell AP/Armaflex® Pipe Insulation



- The expanded closed-cell structure of Armacell AP/Armaflex® pipe insulation makes it an efficient insulation for effectively reducing heat loss on the hot water plumbing and heat gain on the cold water plumbing systems.



## EcoRain™ Stormwater Solutions

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

ground. The compressive strength load rating of these cells is 405.3 pounds per square inch.

The EcoRain single modules were wrapped in a heavy-duty .6-mill-thick non-woven geotextile protection fabric liner. Finally a Firestone Specialty Products .45-mil thick EPDM PondGuard™ Geomembrane Liner was wrapped around the entire cistern assembly. Another EPDM PondGuard Geomembrane Liner will be used to construct a smaller pond in the front courtyard.

All of the rainwater deposited into the EcoRain underground cistern is filtered by an in-ground basket filter supplied by Conservation Technology. This is a high-rate, low-maintenance mechanical filter that removes all solid matter larger than 350 microns (1/72-inch). Pre-filtering the rainwater significantly improves water quality and reduces sedimentation in the storage system.

Water is withdrawn from the storage system for on-site irrigation of landscaping, using a fully automatic electronic submersible pump developed specifically for rainwater harvesting, also supplied by Conservation Technology. With this innovative pump there is no need for a pressure tank, a pressure switch, or dry-run protection, as would typically be required with other submersible pumps. The pump detects when a faucet or irrigation valve is opened and turns on automatically. When water is no longer needed, or when the storage system runs dry, the pump automatically turns itself off.

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.

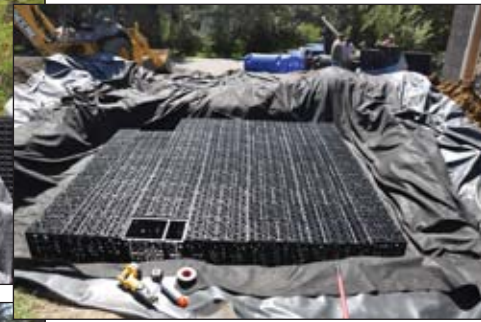
A "beach" with subsurface horizontal geotechnical drains (provided by Smart Drain, LLC) has been installed at the "upper," or southeast corner of the pond, overlain by coarse sand and rock chips, to intercept seepage and runoff from the





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.

The excavated pond is constructed as a dip in the topography, without any constructed berm or engineered containment. A CETCO Akwaseal Pond Liner Roll Imagetextile has been installed at the pond's surface bottom. 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



**Aqua Nueva's Terry McMains And Crew Installing Stormwater Solutions' EcoRain Stormwater Tank Modules' Underground 2,400-Gallon Water Cistern With Heavy Duty .6-Mill-Thick Non-Woven Geotextile Protection Fabric Liner And Firestone Specialty Products .45-Mill-Thick EPDM PondGuard™ Geomembrane**



requiring little maintenance. The swelling properties of the Bentonite clay and cushioning of the textiles eliminate the need for seam welding and underlayments.

At the final stage, when the pond is filled with spring and rainwater runoff, it 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.

The black Roth MultiTank is the first tank of its kind. It can be used as a water cistern, pump, holding, rainwater, or septic tank. This is possible



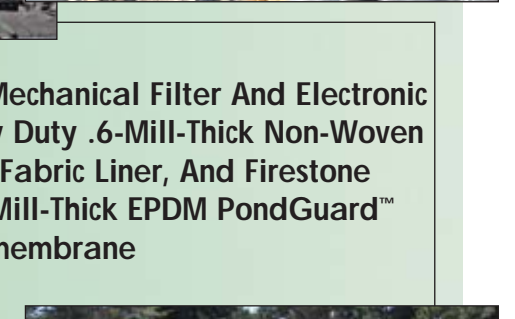
**Smart Drain™**

- 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.

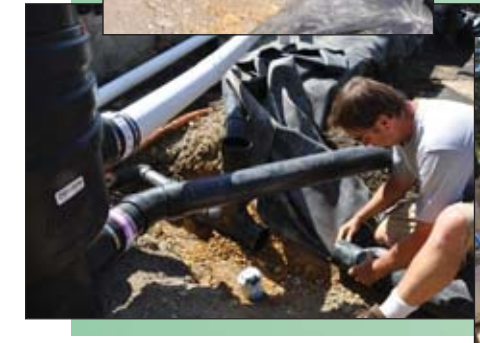


**Smart Drain™ Geotechnical Drains**

due to its special construction of an inner layer of FDA-approved virgin HDPE, two inside layers of PE for improved stability, plus one outer layer of black and UV-stabilized PE. The tank is environmentally sound, watertight, and corrosion resistant.



**Conservation Technology Mechanical Filter And Electronic Submersible Pump, Heavy Duty .6-Mill-Thick Non-Woven Geotextile Protection Fabric Liner, And Firestone Specialty Products .45-Mill-Thick EPDM PondGuard™ Geomembrane**





### 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.



### 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.



### Dimension One Spas® Amoré Bay

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



The blue FRALO Septech-branded Roth Tank is the first and only poly tank with the structural integrity to challenge concrete. It is the only blow-molded tank on the market and is renown for its watertight, seamless, and corrosion-proof construction. Roth's plastic process uses high-molecular-weight HDPE (HMW-HDPE), a superior raw material that results in the strongest, most durable poly tank on the market.

Both tanks carry the best warranty the industry has to offer: the Roth MultiTank has lifetime corrosion

protection and five years of labor insurance coverage, which includes the replacement and excavation of the tank, up to \$2,500. The FRALO tank carries a 50-year warranty from date of purchase against any manufacturing defects.

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.

Once the IHSM ThermaSAVE SIP walls and roofs are constructed, and the Trimline® Building Products black composite Distinction™ Slate is installed on the roof, the next phase of the infrastructure and the interior finishing of the home will commence.

The Amvic ICF walls have been clad, 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.

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.



### Alaine Bernal With Agri Drain Inline Water Level Control Structure



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.

Following the construction of the ICF and SIP walls, Nisus Corporation's Bora-Care® will be applied directly to the cured, finished surface slab and where the walls meet the slab, as a primary termite barrier pretreatment. Bora-Care creates a continuous barrier that termites cannot cross, eliminating their food source.

As the project overlooks the Pacific Ocean and is subject to consequential moisture exposure from the salt air and rain, 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



### Roth MultiTank And FRALO Septic Tanks



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.

The next installment in this series of case-study articles will continue to cover the actual work being done, to accomplish the tasks described, as well as the construction of the above-slab IHSN ThermaSAVE SIP wall and roof structure. The SIPs are being fabricated by Cameron Haddock of Prostruct, a licensee of IHSN, Inc. (ThermaSAVE Building Panels).

In the meantime, photos and videos will be posted on the *Ultimate Home Design* Web site ([www.ultimatehomedesign.com/oph.php](http://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



### 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).



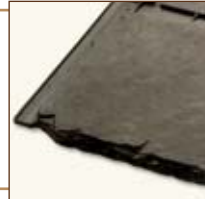
### Finnleo® Custom-Cut Finnish Sauna

- 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.



### Trimline® Distinction™ Slate

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



### 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.



### Bora-Care®

- Nisus Corporation's Bora-Care® is a primary termite barrier pretreatment that creates a continuous barrier that termites cannot cross, eliminating their food source.



### GRK Fasteners

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



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 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](http://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 44th 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



**Contractor Roger Stevenson, Brother Dean, And Crew Working With Uponor® AQUAPEX® Embedded Over Amvic® AmDeck® ICF Floor**



**More Uponor AQUAPEX®, AMVIC® ICF Home Theatre Walls, Structural Engineer Dan Del Carlo, The Stevensons, And Ralph**





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 green-scape 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 512 remaining to be developed (1,762 already developed and 14 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.

## The Home

The Sea Ranch Design Committee imposes upon designers architectural building blocks derived from the original rural structures found on the northern 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-foot living space (4,441-square-foot 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 home is designed with differing spatial experiences 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 the outdoors with 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 state-of-the-art Optimum Performance Home Theatre 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 and boat garage, workshop, main-level guest 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.



iBeam Time-Lapse Pro Construction Camera Perspective 2009-06-10



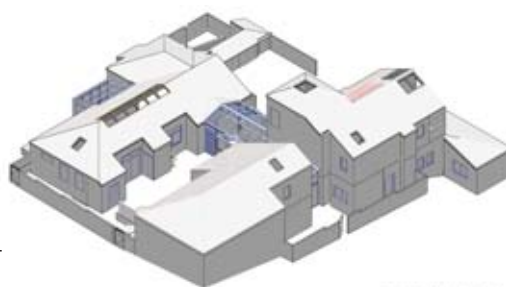
iBeam Time-Lapse Pro Construction Camera Perspective 2009-06-12



The entrance and walkways that connect the three buildings and the solarium will be enclosed with 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—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 decorative crushed rock, to enhance the natural appearance of the home's setting. There also will be a dedicated equipment room off the courtyard, which accommodates the Uponor and WaterFurnace radiant-heating apparatus, Apricus® solar hot water storage tanks, Navien®'s 98 percent condensing on-demand propane-fired tankless water heater, and other equipment. The backup Kohler generator is housed within a separate weather-resistant tower located off the north wall of the two-car garage and guest bedroom, within the fenced dog run. The upper level of this tower is designed to optimize the northwest wind performance of the double-stacked PacWind® Seahawk® vertical-axis wind turbines disguised within. An Enviro Energies generator will capture the wind power and distribute it to the GridPoint® Connect intelligent energy-management system (see Part XII, Issue 12, November/December 2007).

Along with the PacWind Seahawk/Enviro Energies system, a large high-performance premium photovoltaic Day4 Energy® 48MC module 8.7-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 Enviro Energies and Day4 Energy systems will be managed by a dual

GridPoint Connect intelligent energy-management system, providing hub connection to the Pacific Gas & Electric power grid and battery backup power.



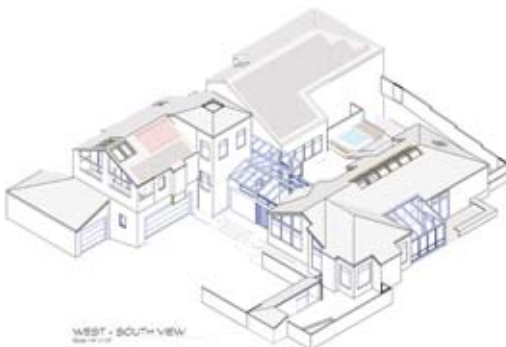
EAST-NORTH VIEW



SOUTH-EAST VIEW



NORTH-WEST VIEW



WEST-SOUTH VIEW

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

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.

## 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
- 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
- Bartlett Mechanical Services, 6755 Oak Street, Anderson, California 96007, 408 313 2486, www.bartlettmechanical.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
- CETCO Lining Technologies, 2870 Forbes Avenue, Hoffman Estates, Illinois 60192,
- Conservation Technology, Inc., 2633 North Calvert Street, Baltimore, Maryland 21218, 800 477 7724, www.conservationtechnology.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Beamsville, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- Dimension One Spas, 2611 Business Park Drive, Vista, California 92081, 800 345 7727, www.d1spas.com
- Euclid Chemical Company, 19218 Redwood Road, Cleveland, Ohio 44110, 800 321 7628,

www.euclidchemical.com

- 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
- 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
- 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
- Mendocino Coast Plumbing, P.O. Box 41, Manchester, California 95459, 707 882 2628, 707 353 2628
- Nisus Corporation, 100 Nisus Drive, Rockford, Tennessee 37853, 800 264 0870, www.nisuscop.com
- Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, Oregon 97479, 800 348 9643, www.orenco.com
- Owens Corning, 1 Owens Corning Parkway, Toledo, Ohio 43659, 800 438 7465, www.owenscorning.com
- Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, 847 966 6200, www.cement.org
- QUALCON, 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

- Roth Global Plastics/FRALO, P.O. Box 245, Syracuse, New York 13211, 866 943 7256, www.roth-global.net
- Seepage Control, 7301 West Boston Street, Chandler, Arizona 85226, 800 214 9640, www.seepagecontrol.com
- Smart Drain, Drawer 2219, Columbia, Maryland 21045, 800 638 8582, www.smartdrain.com
- Steve Michelson Productions, Lobitos Creek Ranch, 2800 Lobitos Creek Road, Half Moon Bay, California 94019-2547, 650 726 2460, www.lobitoscreekranch.com
- Stevenson Electric/Sierra Pacific Builders, 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
- 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
- WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com, www.stormh2osolutions.com
- Weeks Drilling & Pump Company, 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
- Zurn Flo-Thru Operation, 116 Molly Rex Lane, Mooresville, North Carolina 28117, 704 799 7087, www.zurn.com















