

Guiding Green Decisions:

Experiences of a Residential GC in Implementing Sustainable Design Specs

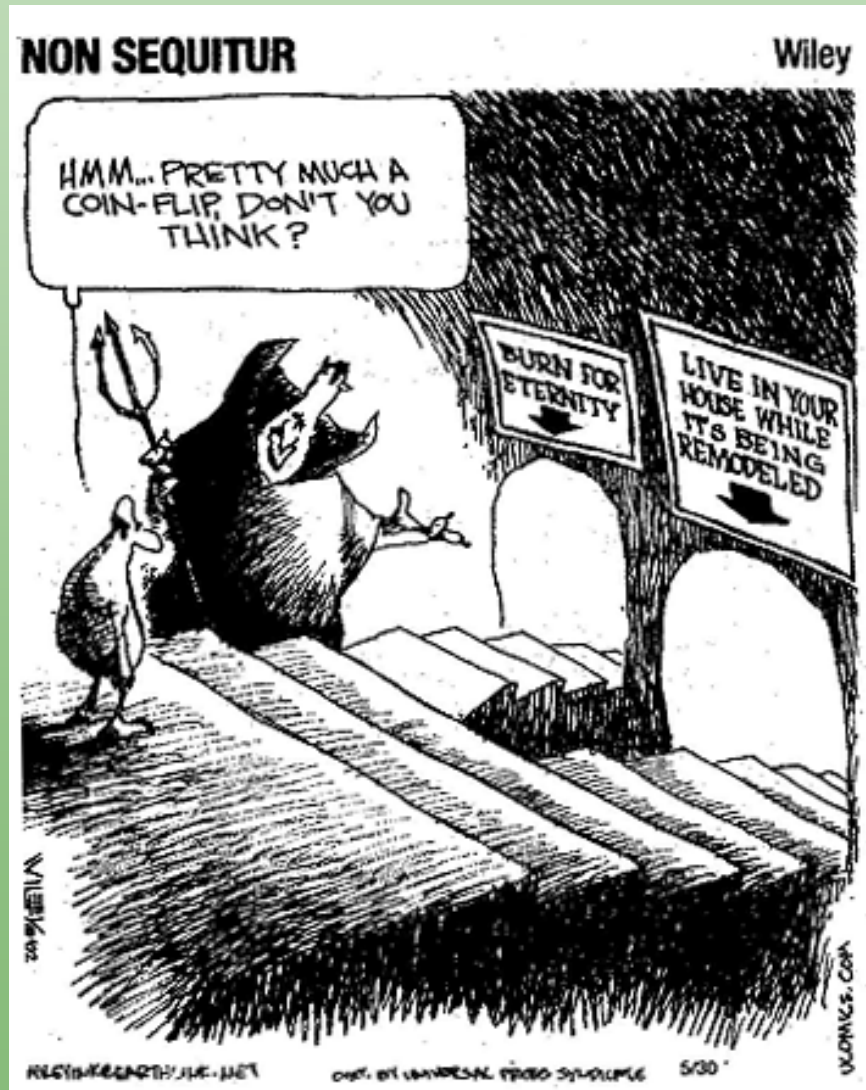


Eric Doub, President and Founder
Ecofutures Building Inc.
Boulder, Colorado
www.ecofuturesbuilding.com

**For ASID/USGBC focus group,
Sustainable Residential
Interiors Program**

Washington DC 4/8/2007

REMODELING & DESIGN: A MATTER OF PERSPECTIVE



REMODELING & DESIGN: A MATTER OF PERSPECTIVE

STARTING A GREEN REMODELING PROJECT...

WHAT CLIENTS CAN FEEL:

- ✦ Excited
- ✦ Overwhelmed
- ✦ Exhausted
- ✦ Confused
- ✦ Frustrated
- ✦ Ultimately, satisfied

WHAT WE CAN TELL THEM:

- ✦ Adding green & healthy materials takes slightly more effort yet provides enrichment and many benefits
- ✦ We are here to help

REMODEL SURVIVAL KIT

A good General Contractor and Design Team will:

1. outline the **process overview**
 - keep the project on schedule with the best materials available
2. Provide a **timeline and decisions guide**:
 - know when homework is due (Microsoft Project)
3. Provide **opportunities for clients to be involved in decision-making**
 - give clients research tasks, access to demonstration homes and showrooms to learn about materials
4. Adhere to monthly or weekly **work review sessions**
(budget, specs)



PROCESS OVERVIEW:

A clear roadmap of what's to be expected

Phase 1: Site meeting

- Healthy materials?
- Energy & Comfort Systems?
- How did you hear about Ecofutures?
- Other building and remodeling experience?
- Architect & plans?
- Size in SF
- Location?
- Timeframe?
- Financing?

Phase 4: Starting the project

- Client signs construction contract / allowances estimate & makes commitment payment (% and terms mutually agreed upon)
- Client hires **risk management consultant** for peer review of construction documents with focus on water incursion
- Timeline generated & project locked into Ecofutures schedule
- Value engineering as desired; further specifying & decision making by client, contractor & team, and architect
- Detailed estimating and bidding
- Apply for permit(s).
- (Remodels & existing home removals) Lead Education Pamphlet delivered & signed by homeowner; other environmental assessments performed (sometimes for new construction as well)

Project handed over to Project Manager

Phase 5: Construction

- Construction begins
- Weekly progress meetings begin with client, architect, Project Manager & Eric

Phase 2: Building value

- Review Ecofutures marketing materials and contact references; learn that Ecofutures building costs are competitive
- Walk through Ecofutures homes
- Learn about cost plus contracting: Paying only for products

To establish trust & confidence. 1. Our pricing is competitive; 2. We offer more (comfort, health, durability, & zero energy)

Phase 3: Allowances estimate

- Assign Project Manager
- Meeting to discuss Ecofutures best practices
 - Communication (contractor and client meet at least 10 minutes per week, more as necessary, by telephone or in person)
 - Accounting & Billing Statements; Payment Schedule
 - Timeline & Decisions Guide
 - Contracts
 - Multiple subcontractor bids
 - Warranty
- Obtain plans
- Client signs Design Development contract & pays retainer
- Produce allowances estimate and deliver to client
- Meeting to confirm budget & scope are compatible**

Phase 6: Wrap up

- Final walk-through and substantial completion agreement
- Final Payment
- Warranty program activated
- Punch list

ANOTHER PROCESS OVERVIEW

Decision Process for Remodel Projects

Project Manager

Client

GC

Plumbing

Establish project manager, plumber, electrician, & other necessary subcontractors

Client field trips to showrooms: #1 Great Indoors; #2 McGuckins

Have client send specifications to us

Price from Plumber

Price from Online Sources

Price from Vendors (see both phone list and Great Indoors, etc.)

Best price ordered
(per P.M. and Timeline)

Approve & let client order it
(Make sure it's ordered on time!)

Appliances

Client field trips to showrooms: #1 Boulder Valley Appliance; #2 Mountain High Appliance; #3 Great Indoors

Electrical

Arrange appointment between client and Mike at Front Range Lighting, walkthrough with Eric Doub
OR with Nancy Clanton & Associates (some jobs only)

Kitchens

Send kitchen features checklist to client

Create As-Built layout (including measuring pots, appliances and other odd objects)

Rough sketch labeled with Eric Doub & client

Send to Rick Stone (he then meets with clients RE: doors & drawer styles, hardware & features)

TIMELINE AND DECISIONS GUIDE

(Microsoft Project)

Sample Timeline & Decisions Guide: Remodel

ID	Task Name	Duration	Start	Finish	Specs & Decisions Finished By; Other Notes
55	Select door style, hardware	1 day	Fri 8/22/03	Fri 8/22/03	DECISION DATE: VISIT BOULDER DOOR
56	Front door--could be 8 weeks	40 days	Mon 8/25/03	Fri 10/17/03	Spec'd & ordered by mid August
57	Front door received, installed	1 day	Mon 10/20/03	Mon 10/20/03	
58	Door hardware ordered	25 days	Fri 9/12/03	Thu 10/16/03	Spec'd & ordered by mid September
59	Door hardware received, installed	1 day	Fri 10/17/03	Fri 10/17/03	
60	Garage doors: Overhead	5 days	Fri 8/22/03	Thu 8/28/03	If some windows are units salvaged from house
61					
62	Plumbing	65 days	Wed 7/23/03	Tue 10/21/03	
63	Select fixture style, type	1 day	Wed 7/23/03	Wed 7/23/03	DECISION DATE: PLUMBING FIXTURES
64	Baths & kitchen DWV & supply	7 days	Mon 10/13/03	Tue 10/21/03	And ext. hose bibs; laundry area?
65	MBA tub; shower valves	7 days	Mon 10/13/03	Tue 10/21/03	Spec'd & ordered by 7/23/03
66					
67	Mechanical	12 days	Mon 10/13/03	Tue 10/28/03	
68	Bathroom fans-- before radiant	1 day	Wed 10/22/03	Wed 10/22/03	Panasonic, ordered UPS'd to site from Pos. Energy
69	Radiant: baseboard, staple-up	4 days	Thu 10/23/03	Tue 10/28/03	
70	Evaporative cooler rough in; ducts as nec	2 days	Mon 10/13/03	Tue 10/14/03	
71	Humidifier water supply line	1 day	Mon 10/13/03	Mon 10/13/03	Unit spec'd at this time--"Norteck"?
72	Nat. gas BBQ (?), range rough ins	1 day	Mon 10/13/03	Mon 10/13/03	
73	Fireplace?	2 days	Mon 10/13/03	Tue 10/14/03	
74					
75					
76	Electrical	6 days	Wed 10/29/03	Wed 11/5/03	
77	Rough in	6 days	Wed 10/29/03	Wed 11/5/03	Walkthrough re locations and types (not models) of fxts.
78	Meter release; city inspection	3 days	Wed 10/29/03	Fri 10/31/03	
79	Temp power relocated	1 day	Mon 11/3/03	Mon 11/3/03	
80	Speaker wiring?	5 days	Wed 10/29/03	Tue 11/4/03	
81	Other low voltage? Alarm wiring?	5 days	Wed 10/29/03	Tue 11/4/03	
82					
83	Inspection Prep: Documentation & Testing	1 day	Thu 11/6/03	Thu 11/6/03	
84	Digital photos of framing & utilities	1 day	Thu 11/6/03	Thu 11/6/03	
85	Plumbing & mechanical gauges	1 day	Thu 11/6/03	Thu 11/6/03	

Assign dates, durations and locations for field visits and decisions

November 2003

Wednesday	Thursday	Friday	Saturday
3	4	5	6
Order windows, 22 days			
		Foundation forms stripped.	
10	11	12	13
Order windows, 22 days			
		Door hardware ordered, 25 days	
17	18	19	20
Order windows, 22 days			
Hardware ordered, 25 days			
21	22	23	24
		Hurd order ETA at SolarGlas Windows & doors received.	
Confirm and order windows, 22 days		Windows & doors installed, 3 days	
Front door--could be 8 weeks, 40 days			
Door hardware ordered, 25 days			
25	26	27	

IN RESIDENTIAL, THERE ISN'T ALWAYS A PROJECT MANUAL

Estimate with Proposal & Contract can serve as a guide

127				
128		9000 FINISHES		
129	9000	Drywall Hanging	\$2,500	To be bid by Celis
130	9100	Drywall Finishing: Patching & Matching Texture	\$5,000	To be bid by Celis
131	9200	Ceilings: New Tile	NA	
132	9300	Interior Trim		For sills, shelves, moldings etc. as nec.
133	9310	Labor	\$7,400	Base, Case, chair rail
134	9320	Materials	\$2,000	
135	9325	New Poplar Paint Grade Trim Through Out	\$0	
136	9350	Window sills		
137	9360	Labor	\$0	
138	9370	Materials	\$0	
139	9400	Siding: New cedar shakes		
140	9410	Labor	\$14,850	3 Carpenters, 3 weeks, Labor Intensive choice
141	9420	Materials	\$4,000	
142	9500	Exterior Trim		
143	9550	Awnings, Shutters, Trellises	\$0	
		Paint	\$5,500	Allowance
		er	\$0	
		Paint or Stain	\$3,500	Allowance
		Refinish all wood floors	\$4,034	Includes \$700 allowance for patching
		Underlayment	\$0	
		Hardwood Floors	\$2,860	Material and Labor for Addition. Heart Pine
		Heart Pine Treads with Painted Risers	\$2,875	Heart Pine to Match Floors
		Linoleum	\$1,600	
		Shower Pan	\$0	
153	9860	Tile: Bathroom Flooring	\$3,000	TBD not sure yet what material will go here
154	9861	Labor: Ecofutures Prep for floors & walls	\$0	
155	9862	Materials: Specific allowance	\$0	

Project managers fill in line items with specifications & comments



THE DECISION-MAKING PROCESS: GETTING CLIENTS INVOLVED

By providing opportunities to experience green and healthy materials first hand:

Organize field trips to local vendors with showrooms

Visit demonstration homes & spaces

- Build new ones
- Foster good relationships with past clients



Participate in workshops and educational events

Give homework!

- Provide a wealth of literature and reading material, interesting catalogues and articles
- Unbiased reviews and advice from homeowners and professionals

DEMONSTRATION HOME: SOLAR HARVEST



Solar Harvest: Better than Net-Zero Energy



No wood burning appliances or fossil fuel-powered boiler, furnace or hot water heater
Highest Energy Star rating of any Colorado home to date: 97.7 out of 100 points
Possibly first U.S. home approved under code in a cold climate to have no "backup" heating system

Major Specifications

- Approved under modern code in a cold climate based on engineer's calculations that 68° F could be maintained indoors for 8 consecutive 21° F, winter days
- **Floorplan:** 4955 sq' heated, detached single-family dwelling with 5 bedrooms; 3 full baths; 2 half baths; living room; kitchen; & basement play and meeting space
- **Solar Electric:** 6.84 kW Sharp Photovoltaic: array, grid-tied, with half the panels on 20-degree roof and half on 40-degree roof
- **Natural gas** used only for range and clothes dryer, 1-2 therms per month usage
- **12 reclaimed Newnan 4x8' flat-plate collectors**, at 35 degrees, in a drainback system to 6000 gal solar storage tank
- **Passive gains:** 275 sq' of sunspace vertical glazing with distribution ducts and electro-actuated motor fans
- **Wall assembly:** super-insulated 2x6 walls with added indirect thermal mass
- **Design heat load:** 29,000 BTU/hr., for 4,700 square feet of conditioned space
- **Indoor air quality:** Extensive, engineered ERV (energy recovery ventilation) system with geothermal pre-heat/pre-cool fresh air intake. Direct exhaust to exterior only from kitchen, bathrooms exhaust through ERV. Natural ACH 0.1 or lower.
- **Health & safety:** Formaldehyde-free cabinets and carpet, A9H Saicofast paints and stains, low-odor floor finishes
- **Salvaged materials:** hardwood flooring, interior doors, 3 exterior swinging full-floor doors, cabinets, bathtubs, sinks, and windows in garage
- **FSC Certified** wall framing lumber, cabinet veneers, and Casework wood; Roseburg 1/2" joists for floors, engineered trusses for roof; Pau Rapa railing material, ACQ treated lumber for all plates and landscaping ties
- **Windows:** Fiberte Fiberglass frames with Argon HeatShield glazing. Overall unit U-Factor: U-values of 0.18 on the west and east, 0.12 on the north and extremely low air leakage ratings. (With outside temp of zero F and 15 mph wind, and indoor 70 deg F, the interior surface of double HeatShield is 64 deg F.)
- **Summer cooling:** Tamarack attic fans and natural "chimney effect" of air flow through operable high skylight
- **Electrical efficiency:** plug-type CFLs with occupancy sensors, Energy Star major appliances and electronics "kill switches" where possible
- **COST:** same as any custom residential home + 8%

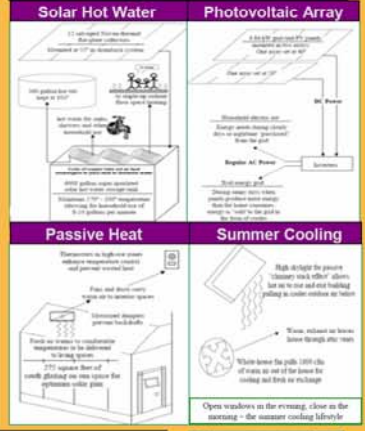
Solar Thermal

- **12 reclaimed Newnan** roof-mounted flat plate collectors form 6,000 gallon super-insulated tank located in the basement in a drainback system
- **Large tank** provides 100% of domestic hot water and the ability to heat 4700 square feet of living space to code, as well as 103° F water 24 hours a day, 7 days a week in the 360 gallon outdoor spa
- **When "fully charged"** at 100° F, the tank's potential energy is about 4 million BTUs. "Discharged" is considered 100° F.
- **Cost:** \$6,000-\$7,000 for tank and heat exchangers, additional \$6,000-\$8,000 for pumps, controls, labor and installation.



Exterior Features

Energy Schematics



Wall Assembly

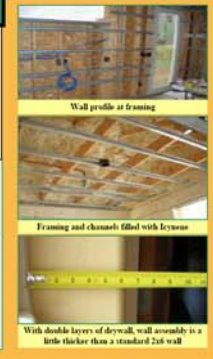
- **2x6 FSC-certified stud walls** with 1 1/2" resilient channels at 24" O.C.
- **1x2x4 spray-foam insulation** 7" in walls and 12" thick in ceilings
- **Double 1/2"** sheetrock for distributed indirect thermal mass
- **Exterior profile:** 1" rigid foam encased with 1/2" GraftCoat Stucco waterproof membrane
- **Wall assembly creates R-34** above-ground walls and **R-45** ceilings; Basement walls rate **R-30** with GreenBlock Insulated Concrete Forms

"Build tight, ventilate right!"
"If you want to fill a bathtub with hot water, first put in the drain plug."
(Lenny Lemons)



Geothermal Exchange

- **Geothermal pre-heat and pre-cooling system:** 260 feet of 6" PVC pipe buried 6 to 8 feet below ground
 - **With this system,** the ERV can achieve **95% heat recovery**, proven in Solar Harvest this winter: when exterior temperatures were 4° F, incoming air to ERV was maintained at 38° F
 - **This system ensures** that the ERV will continue running even with exterior temperatures below 20° F
- 6" PVC pipe for seasonal thermal pre-cooling & pre-warming of incoming fresh air
- Stale air exhaust to outdoors
- Fresh air supply to bedrooms



Project Team

Owners & Residents: Eric Dosh & Catherine Childs
General Contractor: EcoFutures Building, Inc.
Builder: CO 303.455.5014
Designer & Building Assistance: Richard Laine Systems, ACCOUNTING & Management Assistance by Margot Middle Construction
Project Managers: Eric Koller 303.249.0363 & Jeremy Marler 303.859.1437
The Amazing Exchange Center (Contributor): Sean Murphy, Doug McDonald, Don Lee, Ted Horton, Ryan Marler, Seth Marzby, Chad Fuller, Ben Lane, Mark Bradley, Ken Knead, Clayton Bryant, Karl Tompkins
Jan Elliot, Jeremy Schick, All Day

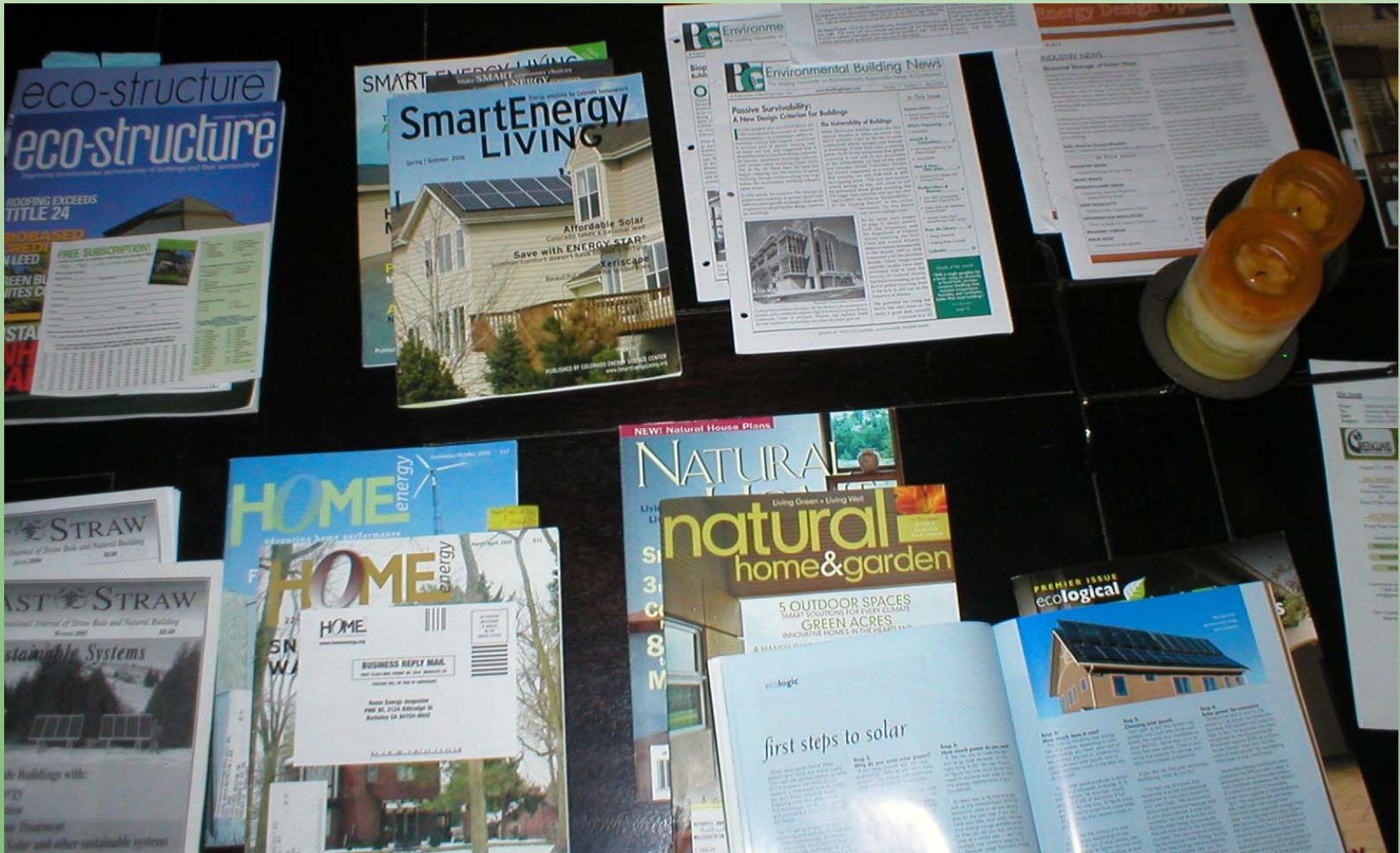
Engineers

John Anzell, P.E. - Gebas Engineering
Boulder, CO 303.444.8548 - janz@gebas.com
Ken May, Industrial Solar Technology
Golden, CO 303.279.8108 - kenmay@solartech.com
Peter D'Antonio, PE, PCD Engineering Services, Inc.
Longmont, CO 303.626.1108 - info@pcdesign.com
Michael Haggerty, Haggerty Integrated Engineering Consultants
Westminster, CO 303.656.5580 - mhaggerty@iecd.com
Gary Skowron, Western Soils, Inc. Lyons, CO 303.623.6862
Healthy Home Consulting, Peter Chandler, BRES, Living Space
Boulder, CO 303.442.1718 - Peter@hhcog.com

Other Contributors: TerraNova Construction, Inc., Tom's Painting, SC-VENTURE, SC-DRY & PAINT, and others.

For a 26-page technical specifications booklet, please visit:
<http://www.ecofuturesbuilding.com/pdfs/booklet.pdf>

NATIONAL PERIODICALS & JOURNALS



OTHER GOOD RESOURCES

- # **Internet:** research new and innovative materials
- # **Local experts** – call them!
- # **Vendors**
 - Accept mailings & solicitations, build yourself a library
- # **Conferences & Events**
- # **Local Organizations & Groups (BGBG)**
- # **Other Builders/Designers**
- # **Annual publications**
 - Green Building Products Guide

OUR FAVORITE INTERNET SITES FOR GREEN PRODUCT INFORMATION

www.buildinggreen.com

- GreenSpec Directory: 2,000 peer-reviewed accepted green products
- Environmental Building News



www.greenbuildingpages.com

- Award-winning green building network hub and green building material catalogue

www.greenguard.com

- Searchable index of products certified for healthy indoor air quality

COPING WITH “OSMs”: OWNER-SUPPLIED MATERIALS

- # Clients are increasingly purchasing online
- # This presents a challenge: less input by GC, architect and designer
- # Meet with clients to ensure they understand the tradeoffs:
 - Warranty issues
 - Genuinely green and healthy?
 - Delivered on time and on budget

Disclaimer of Responsibility for Owner-Supplied Materials

As a professional remodeling contractor, Mahoney Makeovers Inc. accepts full responsibility and liability for all materials and labor that we supply. Naturally, we cannot do this for materials that you choose to supply.

In order to eliminate any potential misunderstandings, please be aware of the following obligations you assume when you choose to have us work with owner-supplied materials:

1. As the supplier of materials, you must assume full responsibility and liability for ordering correctly and on time, and for receiving and inspecting all of your materials. At the job site, you will also be responsible for moving your materials to the room in which they are to be installed.

2. In the event of missing or damaged parts, the wrong material being ordered or delivered, or any other problem concerning your supplied materials and products, you must assume full responsibility and liability for returning and exchanging them, as well as negotiating the terms of resolution with the seller.

3. As the supplier of materials, you must assume full responsibility and liability for

assuring that the products meet all applicable codes and ordinances.

4. As the supplier of materials, you must assume full responsibility and liability for assuring that all materials, including all “rough-in” items placed inside of walls in the early stages of the job, will be present at the job site and in good working order prior to the start of the project.

5. You must understand that missing or broken pieces or wrong materials may alter our work schedule and may result in additional time charges to you at regular hourly rates.

6. As the supplier of materials, you must assume full responsibility and liability for all guarantees and warranties pertaining to these materials. You shall hold the contractor harmless for any product or system malfunctions related to defective products purchased from other sources.

7. You must understand that the above conditions do not encompass all possible circumstances that could delay work or result in additional job costs stemming from owner-supplied materials.

I have read, and understand and agree to the above terms and conditions.

Property Owner Signature/Date

P.S.: If you prefer to have Mahoney Makeovers Inc. accept full responsibility and liability for the materials on your job, we would be happy to return any materials you may have already purchased from other suppliers and seek refunds, at no extra cost to you. Mahoney Makeovers will bill you, or grant you a credit, for the difference between our material prices and your former supplier's prices. Also, if you decide to purchase materials from your own outside supplier, we are available, for a modest fee, to consult with you beforehand to assure compliance with local codes and ordinances.

DESIGNER / BUILDER HOMEWORK

- # Stay on top of the latest products & developments
- # Review most recent testing, e.g. by Greenguard
- # Grill your vendors – avoid greenwashing
- # Assemble your team of trusted tilers, electricians, painters, flooring subs, cabinet suppliers: know that they will do it right!
- # Show off specs honoring comfort, health & safety, durability, value & environmental stewardship on Parade of Homes and other tours
- # Grill your HBA – avoid greenwashing
- # Work with building officials, with a spirit of mutual dedication to your community's health and well-being, on establishing and enforcing high-performing home requirements

SHARING FINDINGS

Interior Finishes

Quick Specs:

- Formaldehyde-free cabinets and carpet and low-odor wood finishes
- Low-toxic, water-based floor finish
- Low-solvent construction adhesives
- Salvaged and environmentally preferable flooring
- Interior materials & color by Catherine Childs with Charlotte Hansen, color consultant



Painting and Staining by Tom's Painting, Boulder, CO 303-776-2063

- All paints & sill/railing varnishes by **AFM Safecoat Paints and Oils**, purchased from Planetary Solutions in Boulder, CO 303-442-6228
- Zero-VOC, solvent-free, food-safe polymerized linseed oil finish on all cabinets and built-ins by **Tried and True Varnish Oil** Truemensburg, NY 607-387-9280 www.triedandtruewoodfinish.com

Stairwell mural by local artist Sarah Spencer 303-661-9767

Doors All but a few are salvaged/seconds from Habitat for Humanity Outlet, Denver 303-722-5863, including interior full-lite units

Tubs are salvaged/seconds from Bud's Warehouse, Denver 303-296-3990

Flooring: High-Density Bamboo prefinished flooring from Four Winds Bamboo Boulder, CO 303-447-2389 www.fourwindsbamboo.com
Now available unfinished (lower upstream health and safety costs) from Sustainable Flooring, Boulder CO. www.sustainableflooring.com

Salvaged Oak flooring from a Boulder home demolished in early 2005, finished with Traffic by BonaKemi (800) 872-5515 www.bonakemi.com

Installation/finish of bamboo & oak by Bldr Valley Hardwoods 303-859-0970

Marmoleum linoleum in mudroom

EarthWeave all-natural wool carpeting with Hemp/Cotton Backing supplied by Eco-Products 303-449-1876

- No dyes, pesticides or stain protections – therefore no VOCs contributing to harmful indoor air conditions; biodegradable
- Hardy hemp fibers used as backing are naturally mold resistant and contribute to the its ability to naturally biodegrade

Consultant & mfr rep: EcoBuild, David Adamson, Boulder, 303-545-6255

Hypo-allergenic/non-offgassing carpet pad - by Healthier Choice Foam, supplied by Eco-Products: 303-449-1876

Interior Finishes

Cabinets & Built Ins:

Cabinet design & specifications by Rick Stone of R. Chase Design, Inc. Lafayette, CO 303-604-0177

Cabinet features include EarthSource FSC-certified Maple and Cherry wood species treated with 2 coats VOC-free Linseed oil finish; maple and cherry veneers are FSC; "WOODSTALK" hard rock Maple print 2-sided Melamine, ¾" & ¼"; drawers prefinished with "Valspar Enviroplus" VOC-free waterborne finish www.earthsourcewood.com

Art case designed by Catherine Childs & Mark Bradley

Built by Mark Bradley of Ecofutures Building

Countertops:

Hanstone kitchen countertops by Hanwha, Inc.,

by Top Shop, Denver, CO 303-421-4377

<http://www.hanstoneusa.com>

Engineered quartz countertops selected for aesthetic and durability.

Unlike granite, e.g., Hanstone requires no sealant.

Avonite countertops in bathrooms, by Top Shop

<http://www.avonite.com>

Composed of reclaimed and recycled solid surfaces, contributing to a zero-waste manufacturing facility

Window sills & stair railings are "Lyptus" – plantation-grown Brazilian hardwood (30 years of sustainable Lyptus forestry to date). Sunspace sill is FSC-certified Pau Lope, from Boulder Lumber.

Drywall Hanging by Eloy Miramontes, 720-350-2185

Drywall Finishing by Francisco Martinez, 720-333-6159

Porcelain, Ceramic and Stone Tiles and Recycled Glass Grout:

Design and Supply by Capco Tile & Stone by Kim Smith 303-545-5295

Installed by Bob & Don's Tile, Don DeBacker, Boulder, CO 303-444-5394, and Fit to Be Tiled, Kris Campbell 303-588-9393 (foyer, sunroom, master bath); and Justin Snow 303-898-2125 (kids' baths, kitchen)



NETWORKING

- # Use new and innovative products and communicate your findings
 - Internet sites (buildinggreen.com)
 - Newsletters (BGBG, COSBA, USGBC)
 - Periodicals and publications – write to them!

- # And, more importantly – read them!
 - Read and listen to what other people have done, and learn from it

Don't be afraid to try something new & fail as long as you tell someone about it; only by trying new products and technologies can we find new and better solutions

BUT, DESPITE OUR BEST EFFORTS...

(to end on a cheery note)

■ Clients can later add all sorts of toxins to the home, affecting IEQ:

- Housecleaning products & laundry detergents & spot removers
- Personal care products (e.g. hair sprays etc.)
- Electronics (e.g. Comcast box or UPS for computer, giving off brominated flame retardant fumes, DecaDBE and TBBP-A)
- Repainting or restaining with toxic products
- Furniture with formaldehyde; and window treatments, bedding, and linens with PVC and other offgassing chemicals...
- Candles with Dirty Oil (common); kerosene portable heaters; ionizing “air cleaners”
- Plug-in air fresheners; fragrances – unregulated, known toxins
- Pesticides & herbicides, int. & ext. – tracked in; IEQ & health problems

■ And clients can add energy-hog end uses:

- Hot tubs
- Incandescent bulbs where screw-base CFs were used to start
- A second fridge, put in a hot garage, which wipes out the savings generated in specifying all the home’s other Energy Star appliances

The Bottom Line

It’s whole-systems thinking that counts.